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HSU, JENNIFER RYAN

THE DEVELOPMENT OF STRUCTURAL PRINCIPLES RELATED TO
COMPLEMENT SUBJECT INTERPRETATION

City University of New York

PH.D. 1981

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THE DEVELOPMENT OF STRUCTURAL PRINCIPLES RELATED TO
COMPLEMENT SUBJECT INTERPRETATION

by

JENNIFER RYAN HSU

A dissertation submitted to the Graduate Faculty
in Linguistics in partial fulfillment of the re-
quirements for the degree of Doctor of Philosophy,
The City University of New York.

1981

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

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Abstract

THE DEVELOPMENT OF STRUCTURAL PRINCIPLES RELATED TO
COMPLEMENT SUBJECT INTERPRETATION

by

Jennifer Ryan Hsu

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This study investigated children's ability to understand sentences containing missing complement subjects. The study attempted to determine (1) the structural analyses which children assign multiple clause sentences and (2) the rules that children use to identify the controller of missing complement subjects.

Several competing theories have been proposed concerning the rules that children use to interpret missing complement subjects. Chomsky (1969) proposed the minimal distance principle, Tavakolian (1977) the conjoined clause analysis, and Goodluck (1978) the c-command constraint. Tavakolian's and Goodluck's theories included competing hypotheses concerning children's structural analysis of multiple clause sentences. According to Tavakolian, children analyze multiple clause sentences as conjoined simplex sentences which are attached to $\bar{S}$. In contrast, Goodluck claims that children attach complements to the VP. The present study reconciled the competing theories by postulating that they represent separate developmental stages.

In addition, a review of the literature on children's interpretation of complex sentences suggested additional developmental stages in children's structural analysis of multiple clause sentences.

Sixty four children ranging from three to eight years of age were interviewed on four separate occasions. During the first interview a spontaneous language sample was collected from each child. The samples were analyzed using Lee's (1974) Developmental Sentence Scoring Analysis and a DSS score was obtained for each child. During the second and third interviews, each child was asked to act out a total of forty-five complex sentences. These interviews, which constituted the main comprehension task, were conducted in a manner described by Chomsky (1969) (Re: promise/tell task). Fifty of the children were asked to return for a fourth interview which included an acting out task and a judgement task.

It was predicted that children's knowledge of the structure of multiple clause sentences could be described in terms of five grammar types: (1) subject oriented, (2) object oriented, (3) mixed subject-object, (4) approaching adult, and (5) adult. It was also predicted that the grammar types develop in the following order: (1), (2), (3), (4), and (5). The pattern of control observed on selected constructions was used to classify each child according to grammar type. The hypothesis of the five grammar types and

their sequential development was supported by the fact that the children belonging to the different grammar types differed significantly with respect to age and DSS scores, and that all the means were in the predicted direction. These results confirmed the prediction concerning the sequence in development of grammar type.

Several independent lines of evidence supported the claim that the five grammar types represented a valid description of children's knowledge of the structure of multiple clause sentences. The independent tests involved (1) performance on the non-classificatory sentences, (2) ability to identify semantically deviant sentences, (3) reliability of response patterns across interviews, and (4) interpretation of the order of events in multiple clause sentences. In general, response patterns on these independent tests corresponded to the patterns predicted for each grammar type. However, the small sample size of the subject oriented group and some inconsistencies in their response patterns suggested that the definition of that grammar type needed some modification.

With respect to the rules used to determine control, the study investigated the hypothesis that children obey the c-command constraint in conjunction with the minimal distance principle. Significant differences in the number of subject responses on complements following locative prepositional phrases as compared to those following direct

objects supported this hypothesis. In addition, the study investigated four proposals concerning the operation of the c-command constraint: (1) immediate operation, (2) delayed operation, (3) overgeneralization, and (4) inviolability. The results supported the delayed operations, and the inviolability hypotheses. It was concluded that children's grammars include an adult form of the constraint, and that the delay in operation of the constraint is due to the structural misanalysis of prepositional phrases. This conclusion is compatible with recent theories of universal grammar which postulate that universals are innately specified in the child's language acquisition device.

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CHAPTER I

INTRODUCTION

1. Goals of Language Acquisition Research

A fundamental question in language acquisition research is "how does a child learn language?". In order to answer this question, it is necessary to determine what a child knows about the structure of language both during and at the end of the acquisition process. Of course, the outcome of this process is adult competence. Descriptions of adult competence vary depending on the theoretical model of language that is adopted. Assuming that adult competence is best described by Chomsky's model (1965, 1971, 1973, 1980a, 1980b, and in press), the end product of the acquisition process consists, in part, of tacit knowledge of phrase structure rules, transformational rules and sub-categorization rules, as well as tacit knowledge of principles which limit the form and application of these rules. Given the end product, it seems reasonable to assume that at some point during the acquisition process the child is developing knowledge of these rules and conditions. This assumption has been supported by findings from a variety of studies. For example, research on errors found in children's speech (Mayer, Erreich, and Valian, 1978; and Erreich, Valian, and Winzemer, 1980) provides evidence for children's early use of transformational rules. Evidence for transformational

rules has also been reported by Menyuk (1969) and Klima and Bellugi (1973). In addition, Goodluck (1978), Solan (1978), Solan and Roper (1978), and Otsu (1981), report findings suggesting that constraints on rule application are also present in the grammars of young children.

Studies on the early stages of language acquisition have led some researchers (Miller and Ervin, 1964; Brown and Fraser, 1964; McNeill, 1966 and 1970; and Bloom, 1970) to propose that syntactic rules underlie the two-word stage of language development. However, as pointed out by de Villiers and de Villiers (1978) there is considerable controversy as to whether children's knowledge at the two-word stage is best described in terms of tacit knowledge of syntactic rules and basic grammatical relations or in terms of semantic rules for expressing concepts such as agent, action, and object. Debate over the nature of children's rule systems at the two-word stage presuppose, without argument, a particular conception of what syntax and semantics are. In view of the debate over the nature of children's knowledge at the two word stage, it is necessary to specify the point in the acquisition process when children's grammars include syntactic rules and conditions related to the form and application of those rules.

Following the two-word stage, children's productions show increasing evidence of both phrase structure rules and transformational rules (Menyuk, 1969; Klima and Bellugi, 1973;

Ingram, 1977; Hsu, 1977; Mayer et al, 1978; and Erreich et al, 1980). The evidence also suggests that the early rule systems differ considerably from those characterizing adult grammar. Thus, a description of children's knowledge must specify not only the form of the early rule systems but also how the rules eventually change and develop into adult competence.

2. Performance Strategies versus Knowledge of the Grammar

Descriptions of children's knowledge at the various stages of language acquisition have been based on productive output or on performance in various types of comprehension tasks. Production data have been used to construct comprehensive grammars for the initial stages of language acquisition (Miller and Ervin, 1964; Brown and Fraser, 1964; McNeill, 1966 and 1970; Bloom 1970; and Ingram, 1977). Production data have also been used to investigate children's knowledge of specific aspects of language such as question production and negation (Klima and Bellugi, 1973). Comprehension data have been primarily used to investigate hypotheses concerning rules and restrictions related to specific constructions (Chomsky, 1969; Tavakolian, 1977; Goodluck, 1978; Solan, 1978; Solan and Roeper, 1978; Otsu, 1981). It is important to note that the rules postulated for children have been tested on different types of data than those describing adult competence. The rules that are postulated for

adults are tested by eliciting judgements concerning grammaticality, synonymy, ambiguity, and sentence meaning. It is assumed that metalinguistic judgements of this type provide crucial data which enable researchers to confirm or reject hypotheses concerning the nature of adult competence. Theories of children's grammars, on the other hand, have not been based on metalinguistic judgements. Instead the theories have been evaluated on the basis of production and comprehension.

Productive language samples and performance on comprehension tasks may not provide an accurate picture of a child's linguistic competence. Performance factors operate in both production and comprehension just as they do in adult intuitions. The influence of performance factors may lead investigators to either over- or under- estimate a child's knowledge of the grammar. Chomsky (1964) points out that memory span and lapses of attention may limit a child's productions. In addition, language samples often fail to reflect all the structures that a child has mastered. As a result, theories based on productive language samples may underestimate children's linguistic competence. Alternatively, children may produce forms that have been learned as rote routines. This appears to be the case in the early use of the copula and irregular past tense (Menyuk, 1969) and in the early use of can't and don't (Klima and Bellugi, 1973). Postulating knowledge of syntactic rules when a form is being used as a rote routine would overestimate children's

linguistic competence.

Performance on comprehension tasks may also lead to either an over- or under- estimation of children's linguistic knowledge. This is largely due to the fact that children use comprehension strategies to interpret sentences. There seem to be two general types of comprehension strategies: one, extralinguistic strategies which involve the systematic use of environmental cues and knowledge of the world in the interpretation of sentences; and two, linguistically based strategies which seem to involve the use of some grammatical concepts to guide sentence interpretation. Huttenlocher and Strauss (1968), Huttenlocher, Eisenberg, and Strauss (1968), Bever (1970), Clark (1974), Wilcox and Palermo (1975), and more recently Bridges (1980) report evidence suggesting that extralinguistic cues such as the relative proximity, mobility, or position of referents may guide a child's interpretation of sentences. Perceptual preferences or behavioral preferences due to differences in motor difficulty of alternatives in the task may also constitute extralinguistic cues that influence performance on a comprehension task (Huttenlocher, 1974). Bever (1970) and Strohner and Nelson (1974) have shown that knowledge of habitual relations such as event probability and event plausibility guide children's interpretation of sentences. Finally, Chapman and Miller (1973) report findings which suggest that animacy of noun phrases influence young children's selection of the subject and

object of a sentence. Adults may also use extralinguistic cues to interpret the meaning of a sentence. In the case of adults, the cues operate in conjunction with syntactic information; whereas in the case of children the cues may either override or operate in place of syntactic information.

In contrast to extralinguistic cues, linguistically based strategies involve some grammatical concepts. Bever (1970) reports results in which children interpreted reversible passives as if they were active sentences. These results have been interpreted as supporting the hypothesis that children use a strategy (termed the N-V-N strategy) which specifies that any noun-verb-noun (NVN) sequence is interpreted as corresponding to "actor-action-object". Researchers have observed a decline in performance on reversible passives (Bever, 1970; de Villiers and de Villiers, 1973; and Maratsos, 1974) and on cleft sentences (Bever, 1970) at around four years of age. These findings indicate that the N-V-N strategy becomes operational at that age. Smith (1974) and de Villiers, Tager-Flusberg, Hakuta and Cohen (1979) argue that the N-V-N strategy is also used by children to interpret relative clause sentences. Use of the N-V-N strategy entails that children have developed notions of grammatical classes and that they can distinguish among the classes. Cromer (1970) identifies a primitive rule that children use to interpret easy to see sentences. The rule identifies the deep subject as being the surface subject. Cromer's

primitive rule seems closely related to the N-V-N strategy in that the first noun in both instances is assumed to be the agent of the verb. Thus, there does not seem to be a clear distinction between the term 'rule' as used by Cromer and the term 'strategy' as it is used by researchers such as Bever, Smith, or de Villiers and de Villiers. In general, the term strategy seems to be used to describe interpretive rules. Other examples of linguistically based strategies (or interpretive rules) include Clark's (1971) order-of-mention strategy, and Amidon and Carey's (1972) main-clause-first strategy. (See section 1.2, chapter II, for a discussion of these strategies.)

Unlike the processing strategies used by adults, the strategies used by children apply to a range of sentence types without regard to the syntactic structure of the individual constructions. For example, the N-V-N strategy is used to interpret passives, clefts, and relative clauses. Children are unable to recognize inappropriate application of a strategy to particular construction types. As a result, they fail to detect errors in interpretation. Adults, on the other hand, are able to detect errors and generally react to those errors by reprocessing the sentence.

Strategies may result in the correct interpretation of sentences that are not generated by the child's grammar. For example, children have been observed to interpret non-reversible passives correctly (Bever, 1970; and Baldie, 1976). Considering these sentences alone may lead to the conclusion

that children understand the passive construction. However, at the same time that children comprehend nonreversible passives they have difficulty in interpreting reversible passives (Slobin, 1966; Bever, 1970, Baldie, 1976). The evidence from reversible passives suggests that children do not understand passives and that event probability is guiding the child's interpretation of nonreversible passives. Thus, conclusions based on children's interpretation of nonreversible passives alone would overestimate the child's knowledge of the grammar.

On the other hand, children's use of comprehension strategies may result in underestimation of a child's competence. Strohner and Nelson (1974) report evidence that manipulation of the context may sway a child's interpretation of a sentence. In their study, the use of strategies among four year olds appeared to override knowledge of the grammar. The susceptibility of active sentences to the use of a non-linguistic strategy (viz. event probability) is surprising since productive samples suggest that active sentences are generated by children's grammars very early in the developmental sequence. More recently, Goodluck and Tavakolian (1979) report that an increase in the number of animate noun phrases in a sentence resulted in a significant decrease in children's ability to interpret sentences containing OS relative clauses. Goodluck and Tavakolian conclude that increased processing load may result in the use of a strategy

even though the construction may be generated by the child's grammar.

In summary, children's use of strategies (or interpretive rules) pose a serious problem for investigations which attempt to describe children's knowledge of linguistic structure. A child's behavior is ambiguous as to whether it reflects the use of a strategy or knowledge of the syntactic structure of a particular construction type. Neither errors nor correct responses can be interpreted with certainty. As stated by Strohner and Nelson (1974) in their concluding remarks

The findings of the present studies demonstrate important influences of nonverbal contexts and event probabilities upon sentence comprehension in the young child. Given such influences it seems perilous indeed to try to infer the child's knowledge of syntactic structures from his performance in only one situation. (p. 575).

The present research investigated children's interpretation of multiple clause sentences. In particular, the study investigated children's ability to understand sentences containing missing complement subjects. The research is concerned with determining (1) the rules that children use to identify the controller of missing complement subjects and (2) the structural analyses which children assign multiple clause sentences. In light of the introductory statements concerning the goals of language acquisition research, the present study attempts to specify the point in the acquisition process when these rules develop or begin to operate.

It also attempts to characterize the initial form of the rules and subsequent changes in the rules as the child's grammar develops toward adult competence. In some respects the methodology is parallel to historical linguistics.

In the present study, hypotheses concerning children's knowledge of syntactic rules were tested on the basis of performance on comprehension tasks. Specifically, the study required children to act out sentences using small animals. As pointed out in the preceding paragraphs, performance on a comprehension task may not necessarily reflect children's underlying competence due to their use of extralinguistic cues or linguistically based strategies. In view of this problem, the present study is designed to control for children's use of event probability and/or plausibility strategies (see sections 2.2, 2.3, 3, and 4, chapter IV). Furthermore, the situational context is planned to control for strategies related to proximity, mobility, or position of objects as well as perceptual or behavioral preferences (see sections 2.2, 2.3, 3, and 4, chapter IV). The number of animate nouns in each sentence was limited to two in order to control for possible effects of processing load. Thus, the study is designed to control for the influence of extralinguistic strategies.

The problem of controlling for linguistically based strategies reduces to one of providing independent motivation for claims concerning the child's structural knowledge. In 1964, Chomsky suggested a general solution to the problem:

only experimentation of a fairly indirect and ingenious sort can provide evidence that is at all critical for formulating a true account of the child's grammar (as in the case of investigation of any other real system). Consequently, I would hope that some of the research in this area would be diverted from recording of texts toward attempting to tap the child's underlying abilities to use and comprehend sentences, to detect deviance and compensate for it, to apply rules in new situations, to form highly specific concepts from scattered bits of evidence, and so on. (p. 39)

The design of a study conducted by Goodluck and Tavakolian (1979) provides an example of the "ingenious and indirect evidence" suggested by Chomsky. In particular, they test claims concerning attachment of relative clauses by comparing performance on crucial construction types. In a similar manner, the present study plans to test claims concerning children's knowledge of complement sentences by including crucial construction types. Linguistically based strategies used by children tend to apply across construction types. Therefore, differences in performance on two or more constructions, which control for semantic variables, should indicate sensitivity to the syntactic structure of the sentence. In order to assess this sensitivity, the present study compares individual children's performance on a wide range of construction types. Also included is a task involving deviancy judgements. Comparison of performance on this task to performance on the acting out tasks is expected to provide additional evidence of children's knowledge of the syntactic structure of multiple clause sentences.

Finally, language samples, which were scored using Lee's (1974) Developmental Sentence Scoring, were also obtained from each child. These data were used to relate performance on a comprehension task to performance on a production task. A major goal of this study was to provide independent motivation for claims concerning children's knowledge of complement constructions (i.e. claims concerning their structural analyses of these constructions and rules for complement subject interpretation). Although children's performance may not be a clear reflection of their competence, the use of a variety of construction types as well as a variety of tasks such as judgements of deviance and production data should reduce the problems of disentangling the relative influence of strategies as opposed to structural knowledge.

3. The Role of Linguistic Universals in Children's Grammars

Recently, it has been proposed (Goodluck, 1978) that the rules used by children to interpret sentences containing missing complement subjects involve knowledge of linguistic universals. This hypothesis is based on a theory of universal grammar (UG) which claims that children approach the acquisition process with a set of innately specified principles. These principles, which constitute the language acquisition device (LAD), restrict the class of attainable grammars and narrowly constrain their form. In early versions of this theory

(Chomsky, 1965; McNeill, 1966; Fodor, 1966; Mayer, Erreich, and Valian, 1978; Erreich, Valian, and Winzemer, 1980; Goodluck, 1978; and Roeper, 1978) LAD enables children to formulate hypotheses concerning the structure of the language which they hear. According to this theory, termed the hypothesis testing model (HTM) of language acquisition, universals function to guide and limit the range of possible hypotheses formulated by the child. LAD also provides a means of evaluating each hypothesis and selecting the particular hypothesis that was compatible with the data. However, the mechanism for evaluation and selection was not clearly specified. More recent versions of the theory of UG (Chomsky, 1980a, 1980b, in press; Phinney, 1981; and Otsu, 1981) postulate that the innately specified principles in LAD are characterized by a system of parameters which are fixed by experience. Fixing the parameters results in one of a finite set of core grammars. The theory accounts for the diversity among languages by postulating that the consequences of one set of choices differ from the consequences of another set of choices. Considerations of markedness are also a part of the theory in that parametric settings may be either marked or unmarked. Direct evidence is required for marked settings, otherwise, the unmarked setting will occur.

Chomsky (1965) distinguishes between two types of universals: substantive and formal universals. Substantive universals make specific claims about the content of any

particular language such as the proposal that a language must draw from a specific set of phonological features and not include others, or that it may draw from a specific set of syntactic categories such as nouns and verbs. Formal universals, on the other hand, are abstract conditions on the form of grammars which include conditions on the form and application of rules. Conditions restricting the application of transformational rules such as those proposed by Chomsky (1973) constitute examples of possible formal universals.

The claim that universals are part of the information that is innately specified has led researchers to search for evidence that universals exist in the grammars of young children. For example, McNeill (1966) argues that substantive universals such as basic grammatical categories are part of children's earliest grammars. In support of his claim he attempted to show that classes of words found at the two-word stage of language acquisition are gradually differentiated into adult grammatical categories. McNeill also argued that the earliest sentences of children contain basic grammatical relations. Subsequent research (Brown 1973) has not supported the idea of an innate hierarchy of grammatical categories. Furthermore, as argued by de Villiers and de Villiers (1978) there is little support for the claim that children have knowledge of basic grammatical relations at the two-word stage of language development. Mayer et al. (1978) and Erreich et al. (1980) report evidence suggesting the existence of the basic

operations underlying transformational rules. They claim that linguistic universals provide a stock of operations which are incorporated into the transformational rules of a particular language. These operations would constitute substantive universals.

Recently, researchers have begun to investigate the presence of constraints on the form and application of rules that operate in the grammars of young children. Solan and Roeper (1978) report evidence suggesting that the "no tangle constraint" is operational in the grammars of young children. The "no tangle constraint" is a restriction that prohibits lines on a phrase marker from crossing. In an investigation of children's interpretation of missing complement subjects, Goodluck (1978) reports evidence that c-command and the c-command constraint on control operate in children's early grammars. Solan (1978) also reports evidence that c-command operates in the grammars of young children. It has been proposed (Reinhart, 1976) that c-command constitutes a general restriction on the application of sentence level linguistic rules. (See section 2.1, chapter II for a detailed discussion.) Reinhart argues that c-command restricts the domain of anaphora as well as the domain of movement rules. In addition, Goodluck (1978) has proposed that c-command governs the interpretation of missing complement subjects. (See section 2.2, chapter II for a detailed discussion.) The "no tangle constraint" and c-command are considered to be candi-

dates for formal language universals. Evidence that these principles operate in the grammars of young children is consistent with the theory of UG.

A common assumption in studies on the operation of formal universals in children's grammars is that universals which have been identified in adult grammar are fully specified and operational from the beginning stages of the language acquisition process. Furthermore, it is claimed that children obey the universals at all stages of language acquisition, and that behavior which seems to violate the universals results from incorrect structural analyses. The assumption of inviolability is often used to motivate hypotheses concerning children's knowledge of syntactic structure. For those who assume that this model is correct, one task of language acquisition research is to provide evidence confirming the existence of putative universals in the grammars of young children. Developmental psycholinguistics is, according to this view, regarded as a testing ground for claims concerning adult language.

There is, however, no a priori reason for anticipating that formal universals are immediately operational in children's grammars. It is logically possible that universal principles are maturationally conditioned and, therefore, will appear later in development.¹ Furthermore, the theory of parameters suggests that some aspects of an innately specified principle (viz. marked settings) appear only after

the child encounters positive evidence. Thus, universal principles which do operate in a child's grammar may undergo apparent changes as the various parametric settings are fixed by experience. For example, Chomsky (1973, 1980b) has proposed a universal (the Subjacency Condition) which is a condition on movement. The parameters of the condition involve the possible nodes of a phrase marker which block application of movement rules such as wh-movement. In some languages $\bar{S}$, S, and NP are bounding nodes, while in other languages (viz. Italian) only $\bar{S}$ and NP are bounding nodes (Chomsky, (1980b)).² Assuming that, initially, children treat all three nodes as bounding nodes, then a child learning Italian will appear to be following a principle which differs from the adult version. Once the child encounters evidence that S is not a bounding node, the principle will undergo an apparent change as the marked parameter is fixed.

There appears to be two ways in which the operation of universals in children's grammars may differ from their operation in adult grammar. One, children's structural analysis of various constructions may differ from adults in such a way as to affect the application of the principle. In other words, a child may initially misanalyze constructions such that the principle does not apply. As the child develops the correct analysis of the constructions, the principle will apply to an increasing range of construction types. Secondly,

operation of a universal may differ between adults and children as a result of differences in the form of the rule. One possible type of difference would involve development of the unmarked parameters on the part of the child. In cases where the adult rule is characterized by the marked parameters, the child's grammar would differ from an adult's grammar until the marked parameters are fixed by experience. The rule would undergo a developmental change when the child encounters the relevant positive evidence. In this case, the universal may be initially described as a sub-adult rule which is gradually modified as the child's grammar develops. The term "sub-adult" refers to a form of the rule which differs from the adult version of the rule for the particular language which the child is learning. It is possible that the sub-adult version in one language may correspond to the adult version in another language.³ In summary, each of the two general factors which may influence the operation of universals in children's grammar can be viewed as binary conditions. That is, the form of the universal in a child's grammar may either be the adult version or a sub-adult version. In addition, the structures which are in the domain of the rule in adult grammar may be either correctly or incorrectly analyzed by the child. In view of this, there are at least four logical possibilities which describe the operation of universals in children's grammars:

(1)

- (A) A sub-adult rule + incorrect structural analyses
- (B) A sub-adult rule + correct structural analyses
- (C) An adult rule + incorrect structural analyses
- (D) An adult rule + correct structural analyses

The alternatives A, B, and C predict that differences will exist in the operation of a universal principle in children's grammar as compared to adult grammars. These alternatives (A, B, and C) will be referred to as the delayed operation hypothesis. Alternative D, on the other hand, predicts that, initially, a child has (1) tacit knowledge of the adult form of the rule and (2) the correct structural analyses of the constructions which fall within the domain of the principle. Condition D, which will be termed the immediate operation hypothesis, predicts that from the beginning stages of language acquisition universals will operate in the same manner in children's grammars as in adult grammars.

The delayed operation hypothesis raises the possibility that during the period when children are acquiring language, they may manifest behaviors either in language comprehension or production which violate universals existing in adult grammar. Furthermore, within the context of the delayed operation hypothesis, the task of research becomes more complicated. Researchers will need to determine which of the

alternatives listed in (1) describe a child's knowledge. Furthermore, they will need to identify the initial forms of the sub-adult rules as well as determine how the rules are altered, given experience, into adult competence.

... In view of the alternatives concerning the operation of universals in children's grammars, the present study investigated whether a putative universal (viz. the c-command constraint) is present from the beginning stages of children's comprehension of multiple clause sentences and whether the rule applies uniformly across construction types. The study also tested the inviolability hypothesis as it relates to the operation of the c-command constraint. Thus, both the delayed operation hypothesis and the immediate operation hypothesis were evaluated in the present research. (See section 2, chapter III, section 6, chapter V, and section 2, chapter VI for a discussion of the specific predictions and the results.)

This dissertation contains seven chapters. Chapter II is devoted to a review of the literature. It reviews the major studies and theories related to the development of comprehension of the construction types used in the present research. It also reviews the literature on the development of the ability to interpret missing complement subjects. Finally, chapter II outlines five developmental stages in children's structural analyses of multiple clause sentences. Chapter III summarizes the construction types included in the comprehension task, outlines the specific predictions that were tested, and

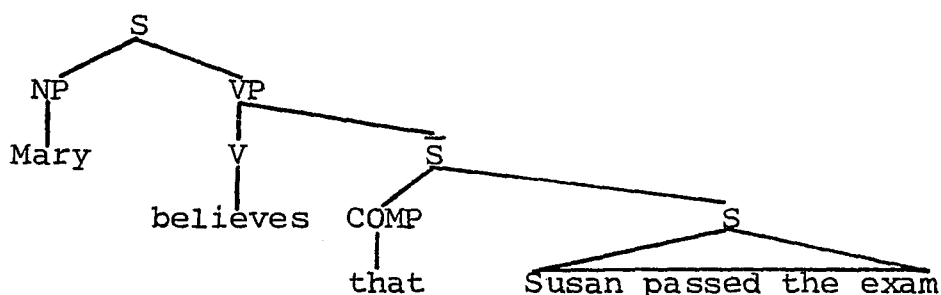
discusses the relationship between the predictions and each construction type. Chapter IV describes the method and materials which were used to test the predictions. As outlined in chapter IV, this study involved four separate interviews. The first interview was devoted to taking a productive language sample, whereas the second and third interviews constituted the main comprehension task. The fourth interview included a comprehension task and a section which required deviancy judgements. Chapter V presents the results of tests evaluating the predictions. Chapter VI discusses the results and chapter VII summarizes the principle findings and conclusions.

FOOTNOTES

¹This point is also made by Otsu (1981).

² $\bar{S}$ refers to embedded structures containing a complementizer and an S. Thus, $\bar{S}$ is represented by the phrase structure rule $\bar{S} \rightarrow \text{COMP} + \text{S}$. For example, the sentence Mary believes that Susan passed the exam is represented as follows:

(i)



In (i) $\bar{S}$ includes the complementizer that and the embedded S, Susan passed the exam.

³This is predicted by parametric theory which states that the unmarked parameters of a principle will automatically develop unless positive evidence is provided for the marked setting (Phinney, 1981). With respect to Subjacency, if the unmarked parameter of the principle is the case in which all three nodes, $\bar{S}$, S, and NP are bounding nodes, then, for a child learning Italian, the sub-adult version of Subjacency would correspond to the adult version of Subjacency in English.

CHAPTER II

PREVIOUS RESEARCH

As stated in the introduction, the present study used comprehension tasks and deviancy judgements to investigate (1) the rules children use to identify the controller of missing complement subjects and (2) the structural analyses which children assign multiple clause sentences. In order to relate the present research to previous work in the field, this chapter reviews some of the major studies and theories connected with the construction types used in the comprehension tasks. In particular, the chapter surveys research on relative clauses, adverbial clauses, and infinitive constructions. This historical overview is followed by a review of the literature related to the interpretation of missing complement subjects.

Recent research (Goodluck, 1978) suggests that c-command and the c-command constraint on control play an important role in guiding children's interpretation of missing complement structures. In order to clarify some of the issues related to the operation of these principles, this chapter includes an explanation of how they function in adult grammar. Finally, the chapter concludes with an outline of five grammar types which are predicted to constitute stages in children's structural analyses of multiple clause sentences.

1. Historical Overview of Research on Complex Sentences

1.1 Relative Clauses

1.1.1 Systems for Classifying Sentences Containing Relative Clauses. Studies investigating the development of relative clauses in children's grammars have described the sentences in a variety of ways. As a result, it will be necessary to review the classification systems in order to introduce terminology that is needed to describe the acquisition data.

Sentences containing relative clauses have been described in terms of embeddedness and focus (Brown, 1971; Bowerman, 1979; and de Villiers, Tager-Flusberg, Hakuta, and Cohen, 1979). The term embeddedness has been used to refer to the grammatical role of the noun in the matrix clause which is modified by the relative clause. The role of the noun (subject, direct object or indirect object) determines the position of the relative clause. For example, if the modified noun is the subject of the main clause, then the relative clause will directly follow the subject NP. Sentences of this type (sentence 1) are designated subject sentences, or center-embedded (CE) sentences. (See Table 1 for additional examples.)

Subject Sentences (Center-embedded (CE) sentences)

(1) The lion that hit the bear kissed the elephant
On the other hand, if the modified noun is the object of the

TABLE 1

Summary of Classification Systems of Sentence Containing Relative Clauses

Embeddedness	Focus	Abbreviations		Function	Surface Descriptions
Subject	Subject	SS	CE	parallel	The lion that hit the bear kissed the elephant N_1 that $V_1 N_2 V_2 N_3$ // S(S-V-C)-V-C
Subject	Object	SO	CE	nonparallel	The lion that the bear hit kissed the elephant N_1 that $N_2 V_1 V_2 N_3$ // S(C-S-V)-V-C
Subject	Indirect Object	SI	CE	nonparallel	The lion that the bear yelled to kissed the elephant N_1 that $N_2 V_1 V_2 N_3$ // S(C-S-V)-V-C
Object	Subject	OS	RB	nonparallel	The lion hit the bear that kissed the elephant $N_1 V_1 N_2$ that $V_2 N_3$ // S-V-C(S-V-C)
Object	Object	OO	RB	parallel	The lion hit the bear that the elephant kissed $N_1 V_1 N_2$ that $N_3 V_2$ // S-V-C(C-S-V)
Object	Indirect Object	OI	RB	nonparallel	The lion hit the bear that the elephant yelled to $N_1 V_1 N_2$ that $N_3 V_2$ // S-V-C(C-S-V)
Indirect Object	Subject	IS	RB	nonparallel	The lion yelled to the bear that kissed the elephant $N_1 V_1 N_2$ that $V_2 N_3$ // S-V-C(S-V-C)
Indirect Object	Object	IO	RB	nonparallel	The lion yelled to the bear that the elephant kissed $N_1 V_1 N_2$ that $N_3 V_2$ // S-V-C(C-S-C)
Indirect Object	Indirect Object	II	RB	parallel	The lion whispered to the bear that the elephant yelled at $N_1 V_1 N_2$ that $N_3 V_2$ // S-V-C(C-S-V)

main clause, then the relative clause will directly follow the object NP. Sentences of this type (sentence 2) are designated object sentences or right branching (RB) sentences. (See Table 1 for additional examples.)

Object Sentences (Right-branching (RB) sentences)

(2) The lion hit the bear that kissed the elephant

The term focus refers to the grammatical role of the missing NP in the relative clause. Sentences in which the missing NP functions as subject of the relative clause are termed subject focus, whereas sentences in which the missing NP function as the object of the relative clause are termed object focus.

Subject Focus

(3) The lion that Δ hit the bear kissed the elephant

(4) The lion hit the bear that Δ kissed the elephant

Object Focus

(5) The lion that the bear hit Δ kissed the elephant

(6) The lion hit the bear that the elephant kissed Δ

Classification based on embeddedness and focus can be summarized by an abbreviation system in which the first letter designates embeddedness and the second letter designates focus. For example, sentence (3) is designated SS due to the

fact that the matrix subject noun the lion is modified by the relative clause, and the missing NP in the relative clause is in subject position. Sentence (4), on the other hand, is designated OS due to the fact that the matrix object noun, the bear is the modified noun and the missing NP in the relative clause is in subject position. (See Table 1 for additional examples.)

Sheldon (1974) introduced another system which classified relative clause sentences in terms of parallel function and nonparallel function. Parallel function refers to sentences in which the relativized NP and the missing NP have the same grammatical functions in their respective clauses. SS and OO sentences are examples of this type. Nonparallel function refers to sentences in which the relativized NP and the missing NP have different grammatical functions. SO and OS sentences are examples of nonparallel functions. (See Table 1 for examples of both parallel and nonparallel function sentences.)

In addition, sentences with relative clauses have been described in terms of the ordering of subject, verb, and complement within each of the clauses (Brown, 1971) and in terms of the surface order of nouns, verbs, and relative pronouns (Tavakolian, 1977; and de Villiers et al., 1979). Both of these descriptive systems are illustrated in Table 1. (See Surface Descriptions.) De Villiers et al. (1979) investigated relative clause sentences involving indirect object

constructions. Table 1 classifies these sentences using both the system of abbreviations for embeddedness and focus and the surface structure descriptions of the ordering of nouns, verbs, and relative pronouns.

1.1.2 Studies on the Acquisition of Relative Clauses.

Studies on the acquisition of relative clauses have primarily investigated hypotheses concerning how children process these sentences. As outlined in Sheldon (1974) two early hypotheses concerning the processing of relative clauses were "the interruption hypothesis" and the "word order hypothesis". The interruption hypothesis states that self embedding contributes to complexity, whereas the word order hypothesis states that violation of underlying word order contributes to complexity. Studies of production (Menyuk, 1969; Gaer, 1969; and Limber, 1973) and studies involving elicited imitation (Brogan, 1969; and Slobin and Welsh, 1973) supported the interruption hypothesis in that center-embedded relative clauses were found to be more difficult to produce than right branching relative clauses.

Studies on the development of children's comprehension of relative clauses, however, have yielded results that conflict with the production data and the interruption hypothesis. Using a picture-cued comprehension task, Gaer (1969) reported that children's comprehension of right branching sentences did not differ significantly from center-embedded sentences.

This study has been criticized by both Sheldon (1974) and de Villiers et al. (1979) for lack of control of crucial variables as well as failure to detect a wide range of processing errors. Brown (1971) conducted a better controlled study. Like Gaer, Brown used a picture-cued comprehension task. However, in Brown's study, the child was presented with a choice of only two pictures to match to the sentence. In terms of the mean number of correct responses, Brown obtained the following order of difficulty: (< means easier) SS<OS<OO<SO. This ordering conflicts with the interruption hypothesis. However, it is consistent with the word order hypothesis, since the easier relative clauses (SS and OS sentences) conform to the S-V-C word order whereas the more difficult relative clauses (OO and SO sentences) violate the word order. Sheldon (1974) points out, however, that the word order hypothesis fails to account for the large difference in the mean number of correct interpretations of OO and SO sentences that was obtained by Brown. As noted by Sheldon (1974) the word order hypothesis predicts that these sentences would be interpreted in roughly the same way.

Sheldon (1974) proposed the parallel function hypothesis which led her to formulate predictions that conflicted with both the "interruption hypothesis" and the "word order hypothesis". According to the "parallel function hypothesis" complex sentences, in which coreferential NP's have the same grammatical function in their respective clauses, will be

easier to process than ones in which the coreferential NP's have different grammatical functions. Based on this hypothesis, Sheldon (1974) predicted that sentences with relative clauses in which the relativized NP and the missing NP have the same grammatical function (SS and OO sentences) would be easier to process than sentences in which the two NP's have different grammatical functions (OS and SO sentences). Sheldon (1974) tested these predictions by asking children ranging from 3 to 5 years of age to act out a set of sentences using toy animals. Sheldon's data were consistent with her predictions. The mean number of correct responses revealed the following order of difficulty: $SS < OO < OS < SO$. Sheldon (1974) argues that the parallel function hypothesis can explain approximately two-thirds of the mistakes on both subject and object relatives. However, parallel function is not sufficient to explain all the errors. Sheldon notes that most of the remaining errors involved interpreting the relative clause as modifying the subject. Sheldon proposes that this error can be explained by assuming that children are over-relying on an Extraposition rule.¹

Using an acting out task similar to Sheldon's, Lahey (1974) investigated 4 and 5 year old children's comprehension of coordinate constructions and center-embedded (SS only) and right-branching (OS only) relative clause sentences. Lahey was primarily interested in the relative importance of prosody and syntactic markers on comprehension. She concluded from

her results that word order is the critical factor in comprehending these sentences. Similar to Sheldon, Lahey found that overall center-embedded sentences (SS) were easier than right-branching sentences (OS). Lahey also reports the same pattern of errors noted by Sheldon. That is, children tended to select the first noun of the sentence to carry out the action in both clauses.

The error patterns that were noted by Sheldon and Lahey were also obtained by Tavakolian (1977) in a study of children's comprehension of relative clauses and other types of complex sentences. Like Sheldon, Tavakolian used an acting-out task to investigate 3 to 5 year olds comprehension of SS, OO, SO, and OS relatives. Tavakolian obtained results similar to Sheldon's except that there was one more correct response to SO relatives than to OS relatives. Thus, Tavakolian obtained the following order of difficulty: $SS < OO < SO = OS$. Tavakolian criticized Sheldon's "extraposition analysis" of errors noting that it leads to the prediction that children will correctly interpret SO relatives, when, in fact, they are frequently misunderstood. As an alternative to both the "extraposition argument" and the "parallel function hypothesis", Tavakolian proposed the conjoined clause analysis. Tavakolian argues that the conjoined clause analysis accounts for both the error patterns observed in children as well as the relative difficulty of the four sentence types. According to Tavakolian's proposal, a child's initial hypothesis about

the structure of a multiple clause sentence is that the sentence consists of conjoined simplex sentences. Thus, children will parse multiple clause sentences as if they consisted of two conjoined clauses. Tavakolian also proposes that the conjoined clause analysis includes a rule which leads children to select the first NP as subject of both the first and second verb of a multiple clause sentence. With respect to relative clauses, the conjoined clause analyses predicts that children will correctly interpret SS sentences and systematically misinterpret OS sentences. This prediction was confirmed by the data. In addition, the predominant error pattern on the OS sentences was selection of the subject of the matrix clause as subject of the embedded clause. Tavakolian's subjects exhibited more variable error patterns on the OO and SO sentences than on the SS and OS sentences. Tavakolian argues that these sentences are more difficult to process by the conjoined clause analysis due to the fact that the linear order of NP's and V's do not parallel the linear order of NP's and V's in conjoined sentences in which the second subject is missing. According to Tavakolian, the dissimilarity in the structures forces children to abandon the conjoined clause analysis early and adopt an adult interpretation. This hypothesis is consistent with the variability in error patterns on OO and SO sentences and the greater number of correct responses on these sentence types as compared to OS sentences. However, it is important to note that the percentage of correct re-

sponses to SO sentences did not differ significantly from OS sentences. With respect to Tavakolian's data, the "conjoined clause hypothesis" is consistent with (1) the ordering of relative clause sentences in terms of difficulty (2) the predominant error pattern of selecting the first NP as subject of both the first and second verb, and (3) the greater variability of error patterns in response to OO and SO relatives as compared to SS and OS relatives. Tavakolian points out that the conjoined clause hypothesis enables reconciliation of the production and comprehension data where SS sentences appear to be understood long before they are produced. The correct interpretation of SS sentences may not be due to adult parsing but to the use of the conjoined clause analysis.

In a recent study, de Villiers et al. (1979) rejected both the "parallel function hypothesis" and Tavakolian's proposal. De Villiers et al. used an acting-out task to test 3 to 7 year olds comprehension of the nine types of relative clauses listed in Table 1. Thus, the study included indirect object relatives as well as subject and direct object relatives. Based on mean number correct, de Villiers et al. obtained the following ordering of difficulty: $OS=SS<OO=IS=OI<IO=II<SO<SI$. The findings conflict with the "parallel function hypothesis" since the parallel sentences (SS, OO, and II) were not consistently easier than the nonparallel sentences. The findings also conflict with the "conjoined

clause hypothesis" since the OS and SS sentences are interpreted equally well. In addition, it is important to note that the conjoined clause hypothesis leads to the prediction that children will interpret IS sentences in the same way they interpret OS sentences. Thus, there should be a greater number of errors on IS than on SO sentences.² However, the sequence obtained by de Villiers et al. is just the reverse. Furthermore, in contrast to Tavakolian, de Villiers et al. report that the error patterns did not indicate systematic selection of the subject of the matrix clause as subject of the embedded clause. De Villiers et al. conclude that children use the N-V-N strategy to interpret relative clauses. The N-V-N strategy, which de Villiers et al. term a type of processing heuristic, gives a correct interpretation of OS relatives ($N_1 V_1 N_2$ that $V_2 N_3$) where N_2 is interpreted as the object of V_1 and the subject of V_2 . The processing heuristic should give incorrect interpretations of SS sentences. This prediction, however, is not supported by the data.

The results of research on children's ability to comprehend relative clauses is summarized in Table 2.

Table 2

Summary of Results of Studies Investigating Children's
Ability to Interpret Sentences Containing
Relative Clauses

Researchers	Ordering of Relative Clauses	Experimental Method
Brown (1971)	SS<OS<OO<SO	Picture Selection
Sheldon (1974)	SS<OO<OS<SO	Acting out
Lahey (1974)	SS<OS	Acting out
Tavakolian (1977)	SS<OO<SO=OS	Acting out
deVilliers et al. (1979)	OS=SS<OO=IS=OI<IO=II<SO<SI	Acting out

Focussing on SS, OO, OS, and SO sentences, the comprehension studies reveal consistent data with respect to children's ability to interpret SS and SO sentences. In general, performance on SS sentences is consistently superior to performance on OO and OS sentences, and performance on SO sentences is consistently poor. Furthermore, the relative ordering of OO sentences is roughly the same across all studies. The major disagreement concerns the ability of children to interpret OS relatives. Sheldon and Tavakolian report comparatively poorer performance on OS sentences, whereas both Brown and de Villiers et al. report OS sentences to be interpreted better than OO and SO sentences. In addition, de Villiers et al. report OS relatives to be interpreted as well as SS relatives.

Solan and Roeper (1978) and Goodluck and Tavakolian (1979) have conducted studies which provide additional data on children's interpretation of OS relatives. Using an acting out task, Solan and Roeper (1978) investigated 3 to 5 year olds comprehension of OS and OO relatives. They report that 80 percent of the responses were correct. This finding conflicts with Tavakolian's (1977) study in which 19 percent of the responses were correct. Goodluck and Tavakolian (1979) used an acting out task to investigate 4 and 5 year olds comprehension of OS relatives following active and passive matrix sentences. They found that in 60 percent of the responses children interpreted the relatives correctly. Goodluck and Tavakolian's study included both adverbial temporal complements following active and passive matrix clauses (sentences 7 and 8) and relative clauses following active and passive matrix clauses (sentences 9 and 10).

Adverbial temporal complements

- (7) The boy hits the girl after jumping over the fence
- (8) The boy is hit by the girl after jumping over the fence

Relative clauses

- (9) The boy hits the girl that jumps over the fence
- (10) The boy is hit by the girl that jumps over the fence

In comparing performance on sentences 7 and 8, there was an increase in the number of subject responses on sentence 8, which Goodluck and Tavakolian attribute to the presence of the passive by phrase. However, this shift was not observed for the relative clauses. Furthermore, there was a significant difference in the number of subject responses to sentence 8 as compared to sentence 10. Based on this evidence, Goodluck and Tavakolian argue that young children have developed recursion in the NP and that they are capable of parsing relatives as constituents of the NP node.

Goodluck and Tavakolian attribute previous findings (Tavakolian, 1977; Sheldon, 1974) in which children failed to interpret OS relatives correctly, to a processing overload. This hypothesis is based on the observation that in their own research, where children successfully interpreted OS relatives, the object of the relative clause was inanimate (as illustrated in sentences 9 and 10) whereas in the studies in which children did poorly the object of the relative clause was animate (e.g. The lion stands on the duck that bumps into the pig, Tavakolian, 1977). In light of this observation, Goodluck and Tavakolian investigated 4 and 5 year olds comprehension of OS sentences in which the relative clause contained either an animate object (sentence 11), an inanimate object (sentence 12) or an intransitive verb (sentence 13).

- (11) The dog kicks the horse that knocks over
the sheep

(12) The dog kicks the horse that knocks over the
fence

(13) The dog kicks the horse that jumps up and
down

Goodluck and Tavakolian report that there was a significantly greater percentage of correct responses on sentences containing inanimate objects or intransitive verbs than on those containing three animate objects.³ They also report that the most frequent error was selection of the matrix subject as agent of the verb in the relative clause. Thus, they conclude that addition of a third animate NP increases the processing load, resulting in the use of the conjoined clause analysis. The conjoined clause analysis appears to be a strategy that is used to interpret either sentences that the child's grammar fails to generate or sentences that are difficult for the child to process.

Adopting Goodluck and Tavakolian's theory enables reconciliation of the conflicting results on children's interpretation of OS relatives. Initially, children may use the conjoined clause analysis due to the fact that their grammars fail to generate these sentences. The analysis results in incorrect responses which predominately involve selection of the matrix subject as the missing noun phrase of the relative clause. The conjoined clause analysis is abandoned when the child's grammar generates these sentences. At this time, the child exhibits correct responses. However, sentences which

increase processing difficulty may result in continued use of the conjoined clause analysis. The question remains why children were successful in interpreting the OS sentences in the de Villiers et al. study, since this study used sentences containing animate NP's. It should be noted that the de Villier's et al. study reports only overall means rather than means for individual age groups. Unlike previous research, their study included 6 year old children. Sheldon (1974) reports that children ranging in age from 5 to 5;6 exhibited improvement in their interpretation of OS sentences as compared to 3 year old children. Tavakolian's data shows a similar increase in correct responses among 5 year olds. This improvement would be expected to continue in older children. Thus, it is likely that by including children between the ages of 5;6 to 7, de Villiers obtained results reflecting the more developed grammars of older children.⁴

In summary, researchers have proposed a variety of hypotheses concerning how children process relative clauses. Although each researcher reported data supporting his or her theory, subsequent studies generally have yielded conflicting results for many of the theories. The survey of the data suggests the following general account of children's interpretation of relative clause sentences. Production data (Menyuk, 1969; Limber, 1973; and Bloom and Lahey, 1978) suggests that relative clauses are acquired after the child has established basic sentence structure. The production data

also suggests that right branching relative clauses are the first type to be generated by the child's grammar. Goodluck and Tavakolian's data supports this claim with evidence from a comprehension task which suggests that OS relatives are analyzed as constituents of the NP node by 4 and 5 year old children.⁵ When children are confronted by sentences which are not generated by their grammar or have an increased processing load, they appear to use strategies (or interpretive rules) to understand the sentences.⁶ Evidence from the comprehension studies suggests that children have a variety of processing strategies at their disposal. The availability of more than one strategy could account for the conflicting results in children's ability to interpret relative clause sentences. A child's use of any particular strategy may be influenced by either the task or the complexity of the sentence. However, two consistent patterns across a number of the studies suggests that the conjoined clause analysis constitutes a strategy that is frequently used by children. One consistent pattern is the superior performance on SS relatives in all the studies summarized in Table 2. The second pattern involves the nature of children's errors. There is a tendency for the relative clause to be interpreted as modifying the matrix subject. This pattern is reported by Lahey (1974), Sheldon (1974), Tavakolian (1977) and Goodluck and Tavakolian (1979). The fact that this pattern is not reported by de Villiers et al. (1979) suggests that the conjoined clause

analysis is an early strategy, which is abandoned as knowledge of the grammar and the N-V-N strategy begins to guide children's interpretation of sentences.

1.2 Adverbial Clauses. The comprehension tasks used in the present research included adverbial clauses introduced by the subordinating conjunction after. This section reviews studies which have investigated how children interpret sentences with adverbial clauses introduced by before and after.

Research on the acquisition of adverbial clauses reveals some interesting parallels to the findings on the acquisition of relative clauses. Adverbial clauses are similar to relative clauses, in that they are difficult for children to interpret (Clark, 1971, Amidon and Carey, 1972; Amidon, 1976; Johnson, 1975; French and Brown, 1977; and Coker, 1978). Adult competence with respect to a wide range of adverbial clauses may not develop until nine years of age (Amidon, 1976). As a result, children appear to use a variety of strategies to interpret these sentences (Johnson, 1975; and Coker, 1978) just as they do with relative clauses. The use of any one strategy seems to be a function of sentence type (Johnson, 1975; French and Brown, 1977; and Coker, 1978), the nature of the task (Johnson, 1975; and Coker, 1978), and the level of grammatical development (Amidon and Carey, 1972; and Amidon, 1976). Of particular interest are the studies by Amidon and Carey (1972) and Amidon (1976) which report findings suggesting the children are gradually developing a

knowledge of the grammar underlying sentences containing adverbial clauses and that this knowledge in conjunction with strategies guide their interpretation.

Three principal hypotheses have been proposed to account for children's interpretation of sentences containing adverbial clauses introduced by before and after. Clark (1971) proposed the semantic feature hypothesis and the order-of-mention strategy, whereas Amidon and Carey (1972) proposed the main-clause-first strategy. A series of studies which followed Clark's and Amidon and Carey's pioneering work, have focussed on evaluating their hypotheses. In general, the findings suggests that both the order-of-mention and the main-clause-first strategies are used by children (Johnson, 1975; French and Brown, 1977; and Coker, 1978). However, the former strategy may be characteristic of younger children, whereas the latter may be characteristic of five year old children. Clark's semantic feature hypothesis has received less support in the literature.

Clark (1971) attributed children's difficulty in interpreting adverbial clauses introduced by before and after to lack of knowledge of the meaning of the subordinating conjunctions. In order to account for development of children's ability to interpret these sentences, Clark (1971) proposed the semantic feature hypothesis.

This hypothesis is predicated on a semantic theory which claims that the meaning of words can be represented in

terms of features or components which have a hierarchical arrangement. The semantic feature hypothesis postulates that children learn the meaning of words by gradually acquiring knowledge of the meaning components. According to the hypothesis, the learning process is guided by two principles: (1) general features are acquired before specific features, and (2) the positive value of a feature will be acquired before the negative value. As illustrated in Table 3, Clark (1971) analyzed the meaning of when, before, and after in terms of the features of $\pm$ Time, $\pm$ Simultaneous, and $\pm$ Prior.

Table 3

Clark's (1971) Analysis of the Meaning of
When, Before, and After

Terms	Features
when	+Time +Simultaneous
before	+Time -Simultaneous +Prior
after	+Time -Simultaneous -Prior

The features are arranged hierarchically such that the feature Time dominates Simultaneity, which in turn dominates Priority. This analysis in conjunction with the semantic feature hypothesis led Clark to predict that when would be acquired first;

before, second; and after, third. Since knowledge of these temporal conjunctions develops gradually, there will be a period when children do not understand them or only have partial knowledge of their meaning. Clark (1971) proposed that in the absence of complete semantic knowledge of the conjunctions, children would use the order-of-mention strategy to interpret the sentences. According to this strategy, sentences in which the order-of-mention corresponds to the actual order of occurrence will be easier to interpret than sentences in which this is not the case. Table 4 summarizes the patterns of correct and incorrect responses on before and after sentences which are expected to be associated with the interpretive strategies postulated by various researchers. Children using Clark's order-of-mention strategy should correctly interpret sentences (14) and (16), while making errors on sentences (15) and (17).

Table 4
Strategies and Predicted Response Patterns to
Adverbial Clause Sentences

Sentence Types	Order of Mention	Strategies
		<u>After</u> means <u>Before</u> or Main Clause First
14. He jumped the gate before he patted the dog (Before ₂)	+	+
15. Before he patted the dog, he jumped the gate (Before ₁)	-	+
16. After he jumped the gate, he patted the dog (After ₁)	+	-
17. He patted the dog, after he jumped the gate (after ₂)	-	-

Note. Coker (1978) originally summarized the predictions in this manner.
+ = correct; - = incorrect

Clark (1971) tested the semantic feature hypothesis and the order-of-mention theory by asking 3;0 to 5;0 year olds to act out sentences such as 14 - 17. The results supported both hypotheses. Children produced significantly fewer errors on the combined before sentences than on the after sentences. In addition, they made significantly fewer errors on sentences 14 and 16 than on 15 and 17. Furthermore, the errors on 15 and 17 were reversals of the actual order of action. Based

on these results, Clark (1971) proposed a three stage sequence in the development of the ability to interpret adverbial clauses introduced by before and after. In the first stage, children understand neither before nor after, and use the order-of-mention strategy to interpret complex sentences. During the second stage children understand before but not after. There are two subperiods to this stage. In the first subperiod, the order-of-mention strategy is used to interpret after sentences, whereas in the second period, after is interpreted as if it meant before. Finally, children learn the meaning of both words. Thus, according to Clark, development of the ability to interpret before and after adverbial clauses is a matter of acquiring semantic knowledge.

The order-of-mention strategy has received considerable support in the literature. Johnson (1975), Barrie-Blackley (1973), French and Brown (1977), Flores d'Arcais (1978) and Coker (1978) all report evidence that sentences in which the order-of-mention parallels the order of action (preserve sentences) are easier to interpret than sentences in which the order-of-mention does not parallel the order of action (violate sentences). However, several studies have failed to replicate Clark's findings. In an early study, Amidon and Carey (1972) presented children ranging from 5;4 to 6;3 years of age with an acting-out task involving command sentences such as 18 - 23.

- (18) Move a blue plane before you move a red
plane (Before₂)

- (19) Before you move a red plane, move a blue plane (Before₁)
- (20) After you move a blue plane, move a red plane (After₁)
- (21) Move a red plane after you move a blue plane (After₂)
- (22) Move a blue plane first; move a red plane last
- (23) Move a blue plane last, move a red plane first

Amidon and Carey report that in terms of the number of errors there was no significant difference on the before and after sentences, nor was there a significant difference on sentences which preserved or violated the order of occurrence. The children in Amidon and Carey's study did make errors on sentences 18 - 21. However, the errors involved failure to act out the subordinate clause (omissions) rather than reversals of the action. Children who were given feedback on their performance improved rapidly. This improvement as well as the nature of the errors, and the ease of understanding first and last, led Amidon and Carey to propose that the initial poor performance was due to the main-clause-first strategy rather than failure to understand before and after. In contrast to Clark, Amidon and Carey (1972) argue that the difficulty of sentences 18 - 21 is due to the syntax of subordinate constructions. Amidon (1976) reports evidence that supports this view. She investigated 5, 7, and 9 year olds ability to act out command sentences with the connectives when, as

soon as, before, after, if, if not, unless, and unless-not. Following the acting-out task, Amidon asked when and what questions. The when question referred to the relation between the event in the main clause and the event in the subordinate clause, whereas the what question referred only to the event in the main clause. In the acting out task, 5 year olds made significantly more errors in which they disregarded information in the subordinate clause than did 7 or 9 year olds. These errors were independent of the type of connective. In addition, there was no difference in the errors on the main clauses for the three age groups. With respect to the questions, the 5 year olds exhibited significantly more errors in recalling the content of the subordinate clause than did the 7 or 9 year olds. Although there was a significant difference between the 5 and 7 year olds ability to recall the content of the subordinate clause there was no difference in their recall of the content of the main clause. Amidon (1976) concludes that 5 year olds, in contrast to 7 and 9 year olds, exhibit greater difficulty in retaining and expressing information about events described in the subordinate clause. This difficulty is not observed in their ability to act out or answer questions related to the main clause, nor is the difficulty related to the type of connective. Thus, Amidon's results support the hypothesis that syntactic factors contribute to the difficulty of subordinate clauses and that 5 year old children may use a main-clause-

first strategy in interpreting complex sentences. Amidon analyzed her data to determine whether the order of mentioned events affected performance. She found that at all ages, performance on sentences in which the order-of-mention corresponded to the order of occurrence did not differ significantly from performance on sentences in which the order of mention violated the order of occurrence.

Coker (1978) reports results which reconcile the apparent discrepancy between children's use of the order-of-mention and main-clause-first strategies. Coker used three tasks to investigate children's comprehension of sentences with before and after. In two of the tasks before and after functioned as prepositions whereas in the third task they functioned as subordinating conjunctions. In the prepositional tasks, children were given three pictures in a predetermined sequence. Presentation was followed by questions concerning the order in which the pictures were seen. The first task (Task 1) involved questions of the form: what did I show you before/after the X. The second task (Task 2) involved yes/no questions of the form: Did I show you the X before the Y/after the Y. The children were required to memorize the sequence of presentation prior to answering the questions. The third task (Task 3) was a comprehension task in which the children acted out sentences similar to those in Clark's experiment. (See Table 4.) The children in Coker's study ranged in age from 5;3 to 7;7.

(See Table 5 for ages of children in Clark's study.) Coker reports significant differences in the difficulty of the tasks where task 1 was the easiest and task 3 was the most difficult. In task 3, Coker classified children according to whether they exhibited the order-of-mention strategy or the main-clause-first strategy. Table 4 lists the predicted response patterns for each strategy. Children who exhibited the patterns at a greater than chance level were then classified as exhibiting the respective strategy. Overall, Coker found that among those children who failed task 3, eighteen percent exhibited the order-of-mention strategy whereas sixteen percent exhibited the main-clause-first strategy. Thus, there was evidence for the use of both strategies on the comprehension task originally used by Clark (1971). Coker (1978) reports additional findings which suggest that some of the children in Clark's original study may have been using the main-clause-first strategy. Coker noticed that Clark's theory of semantic development which claims after is equated with before makes the same predictions as the main-clause-first strategy (see Table 4). The inclusion of the preposition tasks, however, enabled Coker to choose between the two theories. Coker found that among those children who used the main-clause-first strategy, approximately half succeeded on the preposition tasks indicating that they knew the meaning of before and after. The remaining half used a strategy (the next-event-in-time) indicating that they did not know the meaning

of the terms. Coker points out that if the children interpreted after to mean before, as Clark suggests, they would have responded with the previous event in time. Coker's results indicate that children use both the main-clause-first and the order-of-mention strategies regardless of whether they have developed knowledge of the meaning of the subordinate conjunctions. Coker reconciles Clark's findings with those of Amidon and Carey's by showing that the main-clause-first strategy can account for the response pattern in which before sentences are interpreted correctly and after sentences incorrectly. Given this reinterpretation, Clark's results also indicate that children use both strategies. Furthermore, in a recent study, French and Brown (1977) report evidence that both strategies are used. The frequency of use of either strategy seems to be a function of the nature of the task (Johnson, 1975). When children are made aware of both clauses, the order-of-mention strategy predominates; whereas if there are no cues to pay attention to both clauses, the main-clause-first strategy predominates.

Table 5 summarizes the results of studies investigating children's interpretation of adverbial clauses. The studies are listed according to the ages of the children tested. As indicated in Table 5, the order-of-mention strategy is used by children ranging from 3;0 years of age (Clark, 1971) to as old as 7;7 years of age (Coker, 1978). The order-of-mention strategy is similar to Tavakolian's (1977) conjoined clause

Table 5

Summary of Results of Studies Investigating Children's Ability
to Interpret Sentences Containing Adverbial Clauses

Studies	Semantic Feature Hypothesis	Hypotheses Order-of- Mention Strategy	Main-Clause- First Strategy
Clark (1971) Ages: 3;0 - 5;0 Task: Acting out Sentence Types: 14 - 17	+	+	- ^a
French and Brown (1977) Ages: 3;5 - 5;1 Task: Acting out Sentence Types: Nonreversible & Reversible (14 - 17)	-	+ ^b	+ ^b
Johnson (1975) Ages: 4;2 - 5;2 Task: Acting out Sentence Types: 14 - 17 18 - 23 (Commands)	+	+	+
Amidon and Carey (1972) Ages: 5;4 - 6;3 Task: Acting out Sentence Types: 18 - 23 (Commands)	-	-	+
Coker (1978) Ages: 5;3 - 7;7 Task: Answering Questions & Acting out Sentence Types: <u>Wh</u> questions with <u>before</u> & <u>after</u> <u>Yes/no</u> questions with <u>before</u> & <u>after</u> 14 - 17	-	+	+

Table 5 (continued)

Studies	Semantic Feature Hypothesis	Hypotheses Order-of- Mention Strategy	Main-Clause- First Strategy
Amidon (1976) Ages: 5, 7, & 9 Task: Acting out & Answering Questions Sentence Types: 18 - 21 (Commands) with 8 connectives <u>What</u> and <u>When</u> questions	-	-	+

Note. + = confirmed; - = not confirmed; Under sentence types numbers refer to illustrations in the text.

^aCoker's (1978) reinterpretation changes this to a plus for three of Clark's subjects between 4;0 and 4;5 years of age.

^bWeak group trends for reversible sentences only.

analysis (see section 1.1, this chapter for an explanation of this strategy). Both strategies are used by younger children and both represent a similar analysis of multiple clause sentences. According to the conjoined clause analysis, multiple clause sentences are parsed as two independent clauses. The order-of-mention strategy, in which the order of action of the two clauses is independent of syntactic or semantic information, implies that sentences with adverbial clauses are also analyzed as two independent clauses. Thus, both strategies could be summarized as follows:

- (24) Treat any multiple clause sentence as conjoined independent clauses. If there is a noun missing assume that the first noun is the agent of the verb (conjoined clause analysis). Assume that the first clause describes the first event, and that the second clause describes the second event (the order-of-mention strategy).

Treating multiple clause sentences as conjoined independent clause suggests that the child's early grammar lacks structures in which embedded clauses are attached to a VP or NP node. This view is supported by Ingram (1977). It is also consistent with the outline of the development of relative clauses that is presented in section 1.1 (this chapter). However, both the conjoined clause analysis and the order-of-mention strategy are used by five and six year old children. Limber's study (1973) as well as the relative clause literature suggest that children begin to develop recursive grammars during the third year. Thus, these strategies

appear to be used after the development of recursion in VP or NP nodes. As noted in section 1.1 (this chapter), Goodluck and Tavakolian (1979) account for older children's use of the conjoined clause analysis by arguing that the strategy is also used in response to an increased processing load. Regression under pressure is also true for adult's (viz. by-passing the syntactic component when confronted with multiply embedded sentences). Older children's use of the order-of-mention strategy could also reflect a response to an increased processing load.

The main-clause first strategy is not used by very young children (see Table 5). Amidon and Carey (1972) and Amidon (1976) argue that the main-clause-first strategy is a five year old strategy. Their position is shared by Coker (1978). However, results reported by Johnson (1975) and a reinterpretation of Clark's data suggests that the main-clause-first strategy may be used by children as young as four years of age. The results of French and Brown (1977) suggests that it may appear even earlier. The use of the main-clause-first strategy demonstrates that children are able to distinguish between main and subordinate clauses. This view is supported by the fact that the location of the subordinate clause does not have a significant effect on children's interpretation of adverbial clause sentences (Clark, 1971; Amidon and Carey, 1972; and Coker, 1978). In addition, the fact that children use the strategy regardless

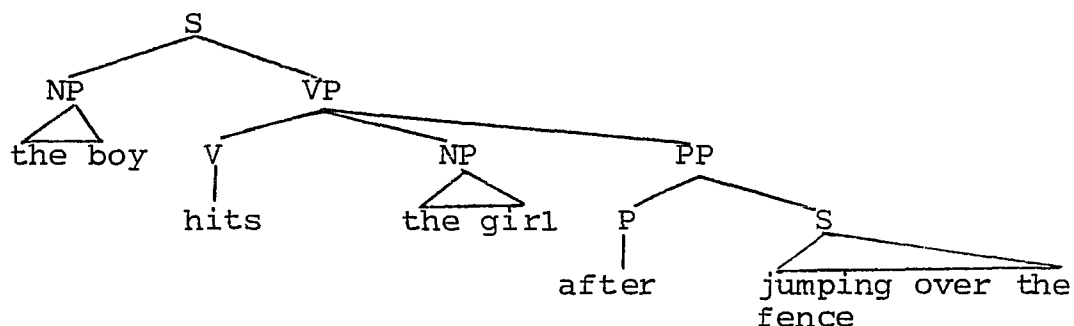
of whether they know the meaning of the conjunctions, suggests that the distinction is made on the basis of syntactic information. A study by Goodluck (1978) provides support for this view. Goodluck's research suggests that four and five year old children have developed recursion in the VP (i.e. embedded clauses are attached to the VP node). It is important to note that the ages of Goodluck's subjects parallel the ages of the children who manifest the main-clause-first strategy. Goodluck (1978) investigated children's ability to interpret missing complement subjects in sentences such as the following:

- (25) The boy hits the girl after jumping over
the fence
- (26) The boy stands near the girl after jumping
over the fence
- (27) The boy is hit by the girl after jumping
over the fence
- (28) After jumping over the fence the boy hits
the girl

The purpose of Goodluck's study was to determine which noun phrase in the main clause would be selected to carry out the action specified in the subordinate clause. Goodluck found that children tended to select the object noun phrase in sentences (25) and (28) whereas they tended to select the subject noun phrase in sentences (26) and (27). The pattern of responses on sentences (25) and (28) led Goodluck to postulate that children four and five years of age attach the embedded clause after jumping over the fence to the VP

node as illustrated in (29). (Goodluck's research and conclusions are explained in detail in section 1.3 of this chapter.)

(29)



Development of recursion in the VP at four and five years of age supports the claim that the main-clause-first strategy is based on syntactic knowledge. Attachment of embedded clauses to the VP would allow children to distinguish between main and subordinate clauses. Amidon and Carey (1972) and Amidon (1976) claim that the main-clause-first strategy reflects the difficulty of subordinate constructions. The fact that recursion in the VP is newly developed and that it is incorrect in terms of adult grammar (see section 2.2.1, this chapter) could explain the complexity of subordinate clauses. This added complexity apparently results in (1) a tendency to omit the subordinate clause in acting-out tasks and (2) difficulty in recalling information specified in the clause.

In contrast to the data on strategies, the data on the semantic feature hypothesis is much less conclusive. The studies summarized in Table 5 as well as other studies yield

conflicting results on the order of acquisition of before and after. Clark (1971), Johnson (1975), and Flores d'Arcais (1978) report that in comprehension tasks performance on before is better than on after. However, Amidon and Carey (1972), Amidon (1976), French and Brown (1977), Coker (1978) and Kavanaugh (1979) report no difference in performance on before and after. Barrie-Blackley (1973) reports that performance on after is better than on before and Cairns and Hsu (1978) report that children use after prior to before in formulating answers to when questions. Harner (1976) reports that for children ranging from 2 - 4 years of age, before is understood better than after when the words function as subordinating conjunctions; whereas the reverse is true when they occur in other contexts. The conflicting results argue against the semantic feature hypothesis as it was outlined by Clark (1971). However, Amidon (1976) reports results on the acquisition of eight connectives which suggests that children's difficulty in interpreting adverbial clause sentences may in some cases reflect lack of knowledge of word meaning. Amidon reports that following order of acquisition of the eight connectives: when, as soon as and if were acquired first; before, after, and if not, second; and unless and unless-not, last. The sequence in development follows the semantic feature hypothesis for the general categories of $\pm$ Simultaneity (temporal order vs. simultaneity) and $\pm$ affirmative conditional

(negative vs. affirmative conditional). Amidon's results do not support the feature of $\pm$ priority. The present study will not be concerned with resolving the issues related to the semantic feature hypothesis. It is sufficient to point out that the subordinating conjunction contributes to the complexity of the sentence.

In conclusion, there are two factors which account for children's difficulty in interpreting adverbial clause sentences: (1) the syntactic complexity of the subordinate clause and (2) the semantic complexity of the subordinating conjunction. Adult competence with respect to the semantic and syntactic rules underlying these sentences develops between five and nine years of age. As a result, young children rely on strategies to interpret these sentences. Two principal strategies have been identified: (1) the order-of-mention strategy and (2) the main-clause-first strategy. Both strategies are used by children to interpret sentences with adverbial clauses, and there seems to be a developmental sequence in the appearance of the strategies. The order-of-mention strategy appears first. The initial appearance occurs during the period when children's grammars lack recursion in the VP or NP nodes. The main-clause-first strategy, which appears after the order-of-mention strategy, is associated with the development of recursion such that embedded structures are either attached to the VP, as is the case with adverbial temporal complements (Goodluck,

1978) or to the object NP as is the case of OS relatives (Goodluck and Tavakolian, 1979). Children are now able to distinguish between main and subordinate clauses. Both the order-of-mention and main-clause-first strategies are used until the child has developed adult competence with respect to the semantic analyses of subordinating conjunctions, and structural analyses of multiple clause sentences.⁷

1.3 Missing Complement Subjects. A review of the literature on the acquisition of relative clauses and adverbial clauses reveals independent data which supports the hypothesis that children initially view multiple clause sentences as a series of independent clauses. This implies a grammar which initially lacks recursion in VP and NP nodes. Data from the acquisition of relative clauses and adverbial clauses also suggests that recursion in these nodes develops at around four years of age. The relative clause literature, in particular, suggests that the object NP is a recursive node for children at this age. Subject NP's do not become recursive nodes until later. Children's interpretation of missing complement subjects suggests that recursion also occurs in the VP node at this age. This conclusion is based on Goodluck's (1978) research, which investigated children's interpretation of missing subjects in infinitival complements and adverbial temporal complements. Goodluck's study extended research on children's ability to interpret missing complement subjects, which began in 1969 with Carol

Chomsky's pioneering work on the acquisition of syntactic structures between the ages of five and ten. Chomsky (1969) investigated children's ability to interpret a variety of syntactic structures. Among these were infinitival complements following the verbs tell, ask, and promise. Acquisition of these constructions have been investigated in a variety of subsequent studies (Kessel, 1970; Kramer, Koff, and Luria, 1972; Maratsos, 1974; Tavakolian, 1977; Goodluck, 1978; and Gowie and Powers, 1979). Many of these researchers included additional construction types in an effort to evaluate competing theories.

The purpose of the present section is to review these studies on children's interpretation of missing complement subjects. This section is particularly concerned with evaluating Goodluck's hypotheses concerning (1) the structural principles which guide children's interpretation of missing complement subjects and (2) the structural analyses which are assigned to multiple clause sentences by young children. The latter hypothesis relates to the development of recursion in children's grammars.

1.3.1 Introduction to Terminology Related to Sentences Containing Missing Complement Subjects. Prior to discussing the acquisition data, it will be necessary to define some of the terms that have been used in research on missing complement subjects. Sections 1.1 and 1.2 discussed two types of embedded structures: relative clauses and

adverbial clauses. The term complement is also used to refer to embedded structures. Both relativization and subordination have been referred to as a type of complementation (Rosenbaum, 1965, p. 21). Rosenbaum argues, however, that relativization and subordination differ from what he terms predicate complementation. Within the acquisition literature, the terms relative clause, adverbial clause and complement structures have not been adequately distinguished. Recently, Bowerman (1978) identified two types of embedded structures: (1) the embedded sentence fills in an empty slot in the matrix sentence and functions in a syntactic role such as subject, object, or indirect object and (2) the embedded sentence modifies a constituent of the matrix sentence. Complements are examples of the first type and relative clauses are examples of the second type. Bowerman claims that adverbial clauses introduced by subordinating conjunctions fall within the latter type of embedded structure. However, Williams (1977) argues that adverbial clauses are attached directly to the S. If this is the case, then they cannot be considered examples of the latter type of embedding. In order to avoid confusion in reviewing the acquisition literature, the same terms as those used by the original investigator will be adopted in describing the findings.

Structures introduced by complementizers have been consistently termed complements. These include that, for-to,

and poss-ing complements (sentences (30), (31), and (32), respectively).

(30) That Pat won the race surprised everybody

(31) For Pat to win the race surprised everybody

(32) Pat's winning the race surprised everybody

The embedded structures in the above examples function as subjects of the sentence. Infinitival clauses such as the clause underlined in sentence (33) are also termed complement constructions.

(33) John tried to go to the store

The infinitival clause in (33) functions as the object of the main clause. The phrase to go to the store has no overt subject and is termed a reduced complement (Akmajian and Heny, 1975). However, the infinitive is interpreted as if a subject were associated with the verb of the complement. In sentence (33) it is John who will be going to the store. Sentence (33) cannot be paraphrased with any complement subject other than John or a pronoun which is coreferential with John. The unspecified subject in sentence (33) is referred to as the missing complement subject. Since it is John who will be carrying out the action in the complement, the missing complement subject is coreferential with the subject of the main clause. Sentences of this type are referred to as subject controlled. In addition, there are sentences such as (34) - (36) in which the object of the main clause is coreferential with the missing complement subject.

(34) John told Mary to go to the store

(35) John ordered Mary to go to the store

(36) John commanded Mary to go to the store

In sentences (34) - (36), the object noun phrase Mary will carry out the action specified in the complement. Sentences of this type are termed object controlled.⁸ In general, a matrix verb which has a direct object assigns object control of the missing complement subject whereas one which lacks an object assigns subject control. There are, however, exceptions to this rule. In sentences with the verb promise, the complement is subject controlled even though it may be immediately preceded by the direct object of the main clause. For example, in sentence (37) the main clause subject Bill carries out the action specified in the complement.

(37) Bill promised Mary to go to the store

The verb ask also constitutes an exception in that it allows subject control in sentences such as (38) and object control in sentences such as (39).

(38) Bill asked to go to the store

(39) Bill asked Mary to go to the store

In particular, sentences such as (39) are ambiguous. That is, they allow both subject and object control. This is illustrated in sentence (40) in which the interpretation is biased towards subject control.

(40) Bill asked the teacher to go to the bathroom

The verb beg is similar to ask in that it also allows either

subject or object control, (when the direct object of the main clause directly precedes the infinitival complement). Chomsky (1969) termed verbs, such as ask and beg, request verbs.

There are a variety of constructions other than infinitival complements which contain missing subjects. Two such constructions are illustrated in sentences (41) and (42).

(41) The boy hits the girl after jumping over
the fence

(42) The boy pulls the girl in order to win the
race

Goodluck (1978) refers to sentences (41) and (42) as complement structures. Although this conflicts with Bowerman's definition, Goodluck's terminology will be used to facilitate discussion of her results. The embedded clauses are introduced by after and in order to, and in each case the subject of the embedded verb is missing. Both sentences (41) and (42) are subject controlled. In sentence (41) the boy jumps over the fence and in (42) the boy wins the race. The grammatical principles which govern control in sentences of this type will be discussed in section 2 of this chapter.

1.3.2 Development of the Ability to Interpret Missing Complement Subjects: Previous Research. Chomsky (1969) investigated four construction types: Easy to see, promise, ask/tell and pronominalization. All four aspects of her study have generated further research. However, only those parts of her study investigating children's inter-

pretation of promise, ask, and tell sentences involve interpretation of missing complement subjects. Thus, only these aspects of her study will be discussed.

Chomsky proposed that children use the minimal distance principle (MDP) to determine the controllers of infinitival complements. MDP specifies that the noun phrase closest to the complement will be the controller of the missing complement subject.⁹ According to Chomsky, MDP applies generally in English. It applies to sentences in which the direct object precedes the infinitival complement (see sentences (34) - (36)), and it applies to sentences with only one main clause NP (see sentence (33)). MDP captures the fact that in almost all cases the missing subject of an infinitival complement is the main clause NP which is closest to it. That is, object control is obligatory for most verbs when the direct object of the main clause precedes the complement, and subject control occurs in cases where the main clause lacks an object. As pointed out in section 1.3.1, there are exceptions to this rule. The exceptions involve the verbs promise (sentence 37), ask (sentence 40), and beg. It follows that these constructions constitute exceptions to the minimal distance principle.

Maratsos (1974) points out that Chomsky's formulation of the minimal distance principle discusses control in terms of both surface structure distance relations and underlying constituent structures such as deep structure subject

and object (p. 701). Maratsos also notes that subsequent literature on language development refers only to the surface structure distance account of MDP. This seems to be true although none of the investigators make the distinction between the surface structure principle as opposed to a principle that operates on underlying constituent structure. Chomsky's account implied that both the surface structure or a deep structure MDP would give equivalent results. Although this is true for the constructions tested in her study, it may not be true for other constructions. For example, missing complement subjects following passive clauses (assuming the passive is derived transformationally rather than generated directly in the base) do not conform to a surface structure minimal distance principle, but do conform to an underlying minimal distance principle. This is illustrated in the following sentence.

(43) John is told by Mary to go to the store

In (43) the surface structure subject, John, is the controller of the missing complement subject. Since John is not the NP closest to the complement, the sentence violates a surface structure MDP. However, if the passive is derived transformationally, then John is the deep structure object of the main clause. Assuming the transformational account and a deep structure MDP, the sentence does not violate the principle. In view of these facts, the present research

distinguishes between a surface structure MDP as opposed to a deep structure MDP.

Chomsky postulated that an exceptionless MDP guides children's interpretation of missing complement subjects. She investigated this proposal by asking children ranging from five to ten years of age to act out sentences such as (44) and (45) using small animals.

(44) Bozo tells Donald to do a somersault.
Make him do it.

(45) Bozo promises Donald to do a somersault.
Make him do it.

Based on the hypothesis that children use an exceptionless MDP, Chomsky predicted that they would correctly interpret complements following tell and incorrectly interpret complements following promise. The results confirmed her prediction. A group of children manifested object control on both the promise and tell sentences. In addition, several children exhibited mixed subject and object control on both the tell and promise sentences, whereas others manifested object control on the tell sentences and mixed control on the promise sentences. Chomsky postulated that these groups represented successive stages in the development of children's comprehension of missing complement subjects.

Chomsky (1969) also investigated five to ten year olds interpretation of ask sentences such as (46).

(46) Ask Mary what to feed the doll

As discussed in section 1.3.1 of this chapter, ask optionally

allows either subject or object control of complements which are directly preceded by a direct object (see sentences (39) and (40)). However, in sentences such as (46) subject control is obligatory. The hypothesis that children use MDP to determine the controller of missing complement subjects, predicts that children will incorrectly interpret sentences such as (46). Chomsky found that initially children interpreted ask as tell. However, children, who distinguished between the two verbs semantically, continued to assign the incorrect subject to the complement verb. That is, they manifested object control of the missing subject. These results also support the hypothesis that MDP governs the interpretation of missing complement subjects. Other researchers (Kessel, 1970; and Kramer, Koff, and Luria, 1972) who have investigated children's interpretation of missing complement subjects following the verb ask, also report results consistent with MDP.

Additional studies (Maratsos, 1974; Goodluck, 1978; Tavakolian, 1977; and Gowie and Powers, 1979) have investigated children's interpretation of missing complement subjects following matrix clauses containing the verbs tell and promise. With respect to sentences containing active matrix clauses, the studies replicated Chomsky's findings. That is, children generally exhibited object control of complements following both verbs. It is important to note that younger children in Tavakolian's study exhibited subject

control of both sentence types. This result is discussed later in this section. In general, children beyond four years of age exhibit a consistent pattern of object control of infinitival complements following active matrix clauses. Object control occurs in constructions where it is required (tell sentences) and in exceptional cases where subject control is required (promise and ask X what to do sentences). This pattern is consistent with the theory that children obey the surface and deep structure principle MDP in determining the controller of missing complement subjects.

Maratsos (1974), Tavakolian (1977), and Goodluck (1978) also report evidence which is inconsistent with the hypothesis that children use a surface structure MDP to interpret missing complement subjects. Maratsos (1974) noted that passive sentences which are followed by infinitival complements constitute an exception to the surface structure MDP. As illustrated in sentence (47) infinitival complements in passive sentences are subject controlled.

(47) Mary was told by John to go

The NP Mary is the subject of the infinitive to go. The surface structure MDP predicts that John, the NP closest to the infinitival complement, will be selected as the missing complement subject. Thus, if children are using the surface MDP to determine the controller of infinitival complements, they will incorrectly select the object of the preposition as subject of the complement in sentences such as (47).

Using an acting out task, Maratsos investigated 4 and 5 year olds interpretation of infinitival complements following active and passive sentences. Sentences (48) - (53) are examples of the constructions used in the study.

Infinitival complements following active matrix clauses

- (48) The turtle tells the elephant to get out
- (49) The girl asks the boy to sit down
- (50) The monkey promises the dog to jump off
- (51) Mary promises John to go away

Infinitival complements following passive matrix clauses

- (52) The bear is told by the elephant to get on
- (53) The daddy is asked by the mommy to get in

The complements in sentences (48) and (49) are object controlled whereas the complements in sentence (50) and (51) are subject controlled due to the main verb promise. The complements in sentences (52) and (53) are also subject controlled due to the passive matrix clause. Maratsos reports that sentences (48) and (49) were interpreted correctly. That is, the children manifested object control. In contrast, sentences (50) and (51) (promise sentences) were interpreted incorrectly in accordance with MDP. However, among those children who interpreted the passive matrix clause correctly (i.e. no reversals), the majority correctly picked the subject as the controller of the infinitival

complement. This was true for both sentences (52) and (53). Most of the control errors occurred among children who interpreted the passive matrix clause incorrectly. The fact that children manifest subject control of complements following passive matrix clauses constitutes strong evidence against the claim that children use a surface structure MDP to determine the controller of missing complement subjects. As noted previously, this does not constitute evidence against a deep structure MDP, unless the passive is assumed to be generated directly in the base.

As an alternative to the surface structure MDP, Maratsos proposed that children rely on a semantic rule to interpret missing complement subjects. According to Maratsos' proposal the receiver of an order (the goal) is identified as the subject of an infinitival complement following verbs of speaking. For example, in sentences (54) and (55) an order comes from John, the source, and goes to Bill, the goal.

(54) John told Bill to leave

(55) Bill was told by John to leave

As argued by Maratsos, in both cases, it is Bill, the goal of the order, who is the controller of the missing complement subject. This is true despite the difference in surface structure. It is also true for most verbs of speaking such as tell, advise, request, beg, order, command, and persuade (Maratsos, 1974). Therefore, the semantic rule predicts correct performance on passives such as (52) and (53) as

well as active ask and tell sentences such as (48) and (49). According to Maratsos, promise constitutes an exception to the semantic rule just as it does to MDP. Maratsos (1974) argues that in promise sentences, the source of the promise rather than the goal supplies the complement subject reference. Thus, incorrect performance on promise sentences would be explained by overgeneralization of the semantic rule.

Tavakolian (1977) also investigated children's interpretation of infinitival complements following the verbs tell and promise. (Tavakolian refers to the constructions as verbal complements.) Tavakolian's study involved children ranging in age from 3;0 to 5;6. The children were divided into three age groups: 3.0-3.6; 4.0-4.6; and 5.0-5.6. Tavakolian used an acting out task similar to Chomsky's in which the children were asked to manipulate small animals. The following sentences are examples of Tavakolian's experimental sentences:

Infinitival complements following active matrix clauses

(56) The lion tells the pig to stand on the horse

(57) The pig promises the rabbit to jump over the duck

It is important to note that there were three exemplars of each construction type. All three promise sentences used the verb promise. However, the three tell sentences used tell, yells at and whispers to. Tavakolian found that three and

four year olds tended to interpret promise and tell sentences in the same way. That is, if they exhibited object control on one, they also exhibited object control on the other. Of particular interest is the fact that there was a tendency for younger children to exhibit subject control on both construction types. Thus, the younger children who exhibited subject control on the tell sentences also exhibited subject control on the promise sentences. The relationship between performance on the complements following promise and tell was significant ($p < .05$). At 5 years of age, however, there was a significant difference between the two complements. Five year olds tended to exhibit object control in the tell sentences and subject control on the promise sentences. There was also evidence of object control on both constructions. Evidence of subject control on tell and promise sentences conflicts with both the surface structure minimal distance principle and Maratsos' semantic rule. However, evidence of subject control on these constructions supports Tavakolian's theory that children use the conjoined clause analysis to interpret multiple clause sentences. The conjoined clause analysis was explained in section 1.1.2 of this chapter. Briefly, it states that children parse multiple clause sentences as conjoined simplex sentences. Furthermore, in accordance with the analysis, children assign subject status to the missing noun phrase in a string and interpret it as being coreferential with the subject of the first clause. As pointed out in section 1.1.2 the conjoined

clause analysis is consistent with the fact that children interpret SS relatives correctly. It is also consistent with the fact that the predominant error pattern on other types of relative clauses is selection of the first NP in the sentence as the relativized noun. (Subject control of verbal complements provides further support for Tavakolian's theory.)

Tavakolian's study also included in order to complements, sentential subject sentences, and conjoined clauses.¹⁰ Examples of the construction types are listed below:

'In order to' complements

- (58) The lion jumped over the pig to stand on
the horse

Conjoined sentences with missing subjects

- (59) The duck jumps over the horse and stands
on the rabbit

Sentential subjects

- (60) To kiss the lion would make the duck happy

As argued by Tavakolian, overgeneralization of rules is a common phenomenon in the grammars of young children. Thus, it seems likely that MDP would be overgeneralized to constructions like (58) and (59). Overgeneralization of MDP means that children would manifest object control on sentences such as (58) and (59). However, the children in all three age groups exhibited a consistent pattern of subject control on sentences (58) and (59). Thus, MDP was not overgeneralized. In response to sentence (60), children tended

to pick an outside NP (i.e. an animal not mentioned in the sentence) to carry out the complement action. (This result is discussed in section 4.4, this chapter and sections 1.2.3 and 2.2, chapter III). Tavakolian's results reveal a consistent pattern of subject control across a wide variety of construction types, which provides strong support for the conjoined clause analysis.¹¹ Tavakolian suggests that her data are compatible with Chomsky's due to the fact that she tested three to five year olds, whereas Chomsky tested five to ten year olds. Based on the fact that three and four year olds have more incorrect responses on tell sentences than five year olds, Tavakolian argues that the conjoined clause analysis is developmentally prior to MDP.

In a recent study, Goodluck (1978) investigated children's interpretation of missing complement subjects in a variety of construction types. Her results conflict with Chomsky's surface structure minimal distance principle, Maratsos' semantic rule, and Tavakolian's conjoined clause analysis. Goodluck's study included three experiments. In the first experiment, Goodluck used an acting out task in which children were asked to manipulate small dolls. Goodluck tested children ranging from four to six years of age. She grouped the children into three age groups: four, five and six year olds. The following construction types were tested in the first experiment:

Active matrix clause with the main verbs 'tell' or 'ask' preceding an infinitival complement

- (61) The boy tells the girl to jump over the fence

Active matrix clause with a direct object NP preceding an adverbial temporal complement

- (62) The boy hits the girl after jumping over the fence

Active matrix clause with a locative preposition phrase preceding an adverbial temporal complement

- (63) The boy stands near the girl after jumping over the fence

Passive matrix clause with the main verb 'hit' preceding an adverbial temporal complement

- (64) The boy is hit by the girl after jumping over the fence

Passive matrix clause with the main verbs 'tell' or 'ask' preceding an infinitival complement

- (65) The boy is told by the girl to jump over the fence

Preposed adverbial temporal complement followed by an active matrix clause

- (66) After jumping over the fence the boy hits the girl

Goodluck's results are similar to Chomsky's in that the children manifested a consistent pattern of object control on sentence (61), the active tell construction. There was a slight drop from 97.5 percent for the five year olds to 82.5 percent for the six year olds (see Table 6). The drop reflects mixed control which was also reported by Chomsky. In addition, the children in Goodluck's study manifested subject control of missing complement subjects following passive main clauses with either the matrix speaking verb

tell (65) or the matrix action verb hit (64). They also manifested subject control of complements following locative prepositional phrases (63). The response pattern to the passive sentences constitutes evidence against the surface structure minimal distance principle, whereas the response pattern to the locative sentences constitutes evidence against a deep structure MDP.

The pattern of control on sentences (63), (64) and (65) also constitutes evidence against Maratsos' semantic rule. With respect to sentence (65) (passive tell), Goodluck's results replicate those reported by Maratsos. However, the fact that subject control is also manifested on sentences (63) and (64) suggests that a more general rule is operating than the semantic rule proposed by Maratsos. Furthermore, the controllers in both sentences (63) and (64) cannot be viewed as the goal of an order.

An important finding in Goodluck's study is that children exhibited a significantly greater percentage of subject control on (63) (locative sentences) than on (62) (direct object sentences) ($p = .001$). It is clear from this difference that children have not yet developed adult grammars with respect to control of missing complement subjects. That is, they are manifesting object control of sentences that are subject controlled in adult grammar. The four year olds in Goodluck's study manifested a predominant pattern of object control on sentences such as (62). A similar

pattern of object responses was also observed on preposed adverbial temporal complements such as (66). The pattern of object control on sentences (61), (62), and (66) conflict with Tavakolian's theory that young children use the conjoined clause analysis to interpret all multiple clause sentences.

Table 6 summarizes the results of the four major studies on children's interpretation of missing complement subjects. In each study there were at least two types of responses to each construction type. Subject or object control were the predominant response types although a few children manifested other patterns. The table reports the type of control observed in the largest percentage of the children's responses. Both types of control are indicated in cases of ties. Conclusions suggested by Goodluck's data seem to be supported by general patterns of responses reported in Table 6. That is, patterns of subject control reported by Tavakolian and Maratsos as well as Goodluck argue against Chomsky's minimal distance principle. In addition, subject control occurs across a wide variety of construction types including in order to complements tested by Tavakolian (1977). This supports the claim that Maratsos' semantic rule fails to capture a significant generalization concerning the grammars of young children. Finally, as noted in the discussion of Goodluck's data, patterns of object control, which are evident in the responses of four year

Table 6
Summary of Results on Children's Interpretation of Missing Complement Subjects

Construction Types	Ages:	Chomsky ^a	Patterns of Control					Goodluck		
		(1969) 5 - 10	Maratsos (1974) 4 5		Tavakolian (1977) 3 4 5			(1978) 4 5 6		
Active Promise + Infinitival Comp. (45) (50) (51) (57)	o/s		o 82	o 75	s 50	o 54	s 58			
Active Tell ^b + Infinitival Comp. (44) (48) (49) (56) (61)	o/s		o 98	o 98	s/o 46/46	o 58	o 71	o 95.0	o 97.5	o 82.5
Active Main Clause with Direct Object + Adv. Temp. Comp. (62)								o 55.0	s 60.8	s 67.5
Preposed Adv. Temp. Comp. + Active Main Clause (66)								o ^d 52.5	s ^d 52.5	s 65.8
Passive Tell ^b + Infinitival Comp. (52) (53) (65)			s ^c 98	s ^c 98				s 86.7	s 91.7	s 90.0
Passive Hit + Adv. Temp. Comp. (64)								s 86.7	s 83.3	s 91.7
Active Main Clause with PP + Adv. Temp. Comp. (63)								s 67.5	s 80.8	s 85.0
Active Main Clause with PP + <u>in order to</u> Comp. (58)					s 79	s 92	s 96			

Note. Examples of construction types are indicated by numbers in parentheses. adv. = adverbial; temp. = temporal; comp. = complement; PP = prepositional phrase; s = subject control and o = object control; Percentage of responses are indicated by numbers under type of control.

^aChomsky's data was reported in terms of number of children exhibiting a particular response pattern. The patterns did not correlate with age.

^bThis construction type includes (1) ask sentences tested by Maratsos and Goodluck, and (2) yells at and whispers to sentences tested by Tavakolian.

^cThe control patterns and percentages pertain to only those children who correctly acted out the passive main clause.

^dOutside NP responses = 8.3 percent for 4 year olds and 8.5 percent for 5 year olds.

olds on three construction types, argue against Tavakolian's conjoined clause analysis.

As an alternative, Goodluck proposes that control of missing complement subjects is determined by the c-command principle and a corollary of this principle, the c-command constraint on control. These principles are consistent with an important pattern that has emerged from the results on children's interpretation of missing complement subjects. Subject control is manifested in sentences in which the complement is preceded by a prepositional phrase. Thus, subject control is manifested when complements are preceded by (1) passive main clauses and (2) locative prepositional phrases in active main clauses. In contrast, object control is manifested when the complement is preceded by the direct object of the main clause.¹² These patterns occur in sentences involving verbs of speaking as well as other action verbs. They are also manifested in sentences involving a variety of complement types. These facts suggest that structural principles rather than surface structure strategies or semantic principles are guiding children's interpretation of missing complement subjects.

The final section of this chapter describes five grammar types which reconcile the theories proposed by Goodluck, Tavakolian, and Chomsky. The proposed grammar types are believed to represent stages in the development of children's knowledge of the structure of multiple clause

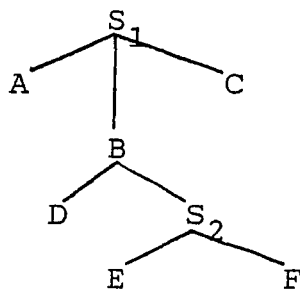
sentences. Before discussing the grammar types it will be necessary to explain the c-command principle and its corollary the c-command constraint on control.

2. C-Command and the C-Command Constraint:

Adult Grammar

2.1 Command and C-Command. The notion of command was introduced by Langacker (1969) in his work on pronominalization. He proposed a restriction on pronominalization which stated that a pronoun cannot both precede and command its antecedent. Langacker (1969) defined the relation of command as follows: "a node A 'commands' another node B if (1) neither A nor B dominates the other; and (2) the S-node that most immediately dominates A also dominates B (p. 167)". The relation of command is illustrated below.¹³

(67)



1. Node A commands nodes B, C, D, S₂, E, and F
2. Node B commands nodes A and C
3. Node C commands nodes A, B, D, S₂, E, and F
4. Node D commands nodes A, C, S₂, E, and F
5. Node E commands node F
6. Node F commands node E

In (67), node A commands all remaining nodes due to the fact that it is immediately dominated by an S-node which also dominates the other nodes, and node A does not dominate any of the other nodes. Node B, on the other hand, is immediately dominated by S_1 which only dominates nodes A and C. Thus node B commands only nodes A and C.

Several researchers (Jackendoff, 1972; Lasnik, 1976; and Reinhart, 1976) found that the precede and command restriction proposed by Langacker failed to account for all of the facts concerning pronominalization. Jackendoff (1972) suggested a modification of the notation which replaced S with the term cyclic node. Reinhart (1976) proposed an alternative rule governing restrictions on anaphora which stated that "two NP's cannot be coreferential if one is in the syntactic domain of the other and is not a pronoun (where the domain is defined by the c-command relation) (p. 125)".

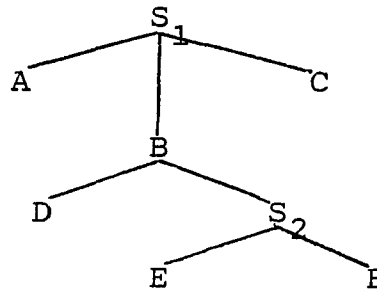
C-command is a term derived from constituent command.

Reinhart (1976) defined the relation of c-command as follows:

- (68) Node A c(constituent)-commands node B, if neither A nor B dominates the other, and the first branching node which dominates A dominates B (p. 32)

C-command can be illustrated with the tree in (67) which is repeated here as (69).

(69)



<u>Command</u>	<u>C-Command</u>
1. Node A commands nodes B, C, D, S ₂ , E and F	1. Node A c-commands nodes B, C, D, S ₂ , E and F
2. Node B commands nodes A and C	2. Node B c-commands nodes A and C
3. Node C commands nodes A, B, D, S ₂ , E and F	3. Node C c-commands nodes A, B, D, S ₂ , E and F
4. Node D commands nodes A, C, S ₂ , E and F	4. Node D c-commands S ₂ , E and F
5. Node E commands node F	5. Node E c-commands node F
6. Node F commands node E	6. Node F c-commands node E

As pointed out by Reinhart, command and c-command differ in that command (using Jackendoff's definition) makes reference to cyclic nodes whereas c-command does not. Thus, all branching nodes are relevant to the determination of c-command relations whereas only cyclic nodes (or S nodes) are relevant to command relations. Comparing relations defined by command and c-command reveals that nodes A and C both command and c-command all the remaining nodes in (69). However, command and c-command define different relations for node D. Node D commands nodes A and C since D is dominated by S (a cyclic node), which also dominates A and C. Node D

does not c-command either A or C, since the first branching node dominating D, namely B, does not dominate A or C. Node D c-commands S_2 , E and F, since these nodes are dominated by B, the first branching node dominating D.

C-command, according to Reinhart, constitutes a general restriction on the application of sentence level linguistic rules. She terms this proposal the minimal domain hypothesis which is stated as follows: "major linguistic rules may operate on two nodes α and β only if α and β are within a minimal domain (p. 183)". The minimal domain is defined by the c-command relation. Reinhart (1976) argues that in addition to defining the restriction on anaphora, c-command also restricts a variety of movement rules such as those which (1) move material out of subject position (extraposition), (2) attach constituents to an S-node (e.g. preposing), (3) move material into COMP (e.g. wh-movement) and (4) raise elements. In general these movement rules are restricted such that elements may only be moved within c-command domains (Reinhart, 1976). Reinhart also argues that rules which determine relative scope may also apply only within c-command domains. Thus, as Reinhart suggests the minimal domain hypothesis (the c-command relation) seems to be a strong candidate as a general condition on linguistic rules.

2.2' C-Command and the C-Command Constraint. Goodluck (1978) argues that c-command governs interpretation of missing complement subjects. That is, c-command determines the possible controllers of a missing subject NP. In addition, Goodluck claims that the principle operates in both children's and adult's grammars. In order to explain Goodluck's proposal it will be necessary to review the structural analyses of sentences with missing complement subjects.

2.2.1 Structural Analyses of Sentences with Missing Complement Subjects. A variety of structures contain missing complement subjects. The present research is primarily concerned with infinitival complements such as (70); in order to complements such as (71); and adverbial temporal complements such as (72).

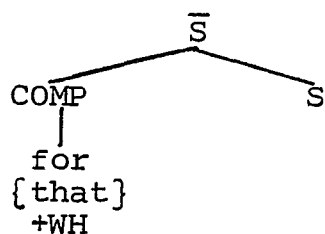
(70) Bill told Mary to get the keys

(71) Bill grabbed Mary in order to get the keys

(72) Bill grabbed Mary after getting the keys

The syntactic structure of infinitival complements depends on the verb in the matrix clause. Verbs have been classified (Rosenbaum, 1967) according to the type of complements they allow (e.g. for-to, poss-ing, or that complements). Adopting Bresnan's (1972) analysis, embedded structures which follow a complementizer have the structure illustrated in (73).¹⁴

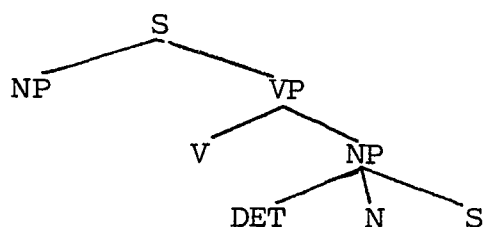
(73)



There are a class of verbs similar to want (e.g. prefer, hate, like, hope, desire, love) which allow for-to complements. Therefore, these verbs allow embedded constructions of the type illustrated in (73).

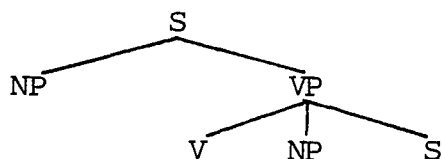
Complements differ with respect to the level of attachment. Rosenbaum (1967) identified two types of complements: verb phrase and noun phrase complements. Noun phrase complements are those which are embedded in noun phrases as illustrated in (74).

(74)



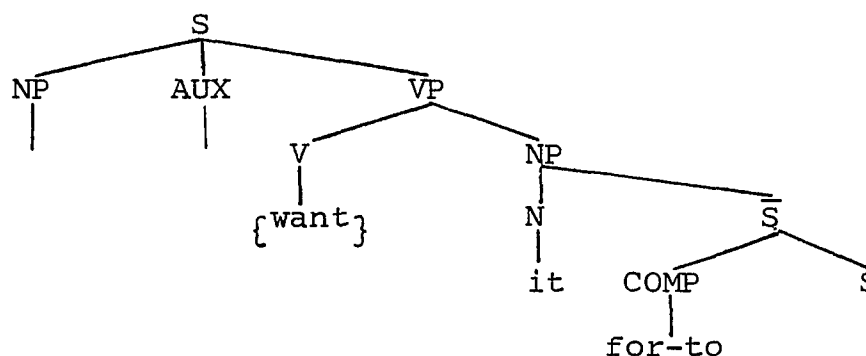
A noun phrase complement can occur in either subject or object position. Verb phrase complements are those which are embedded in the verb phrase as illustrated in (75).

(75)



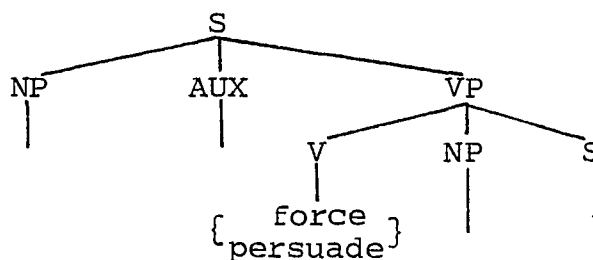
In view of the distinction between noun phrase and verb phrase complements, matrix verbs have also been classified on the basis of the level of attachment of the embedded structure. Infinitival complements following verbs such as want have been assumed (Akmajian and Heny, 1975) to attach to an NP as illustrated in (76).

(76)



Using Rosenbaum's (1967) terminology, verbs such as want take noun phrase complements. In contrast, complements following verbs such as persuade (e.g. force, allow, coax, help, order, permit, make) have been assumed (Akmajian and Heny, 1975) to attach to the VP as illustrated in (77).

(77)



Thus, verbs such as persuade would be described as taking verb phrase complements.

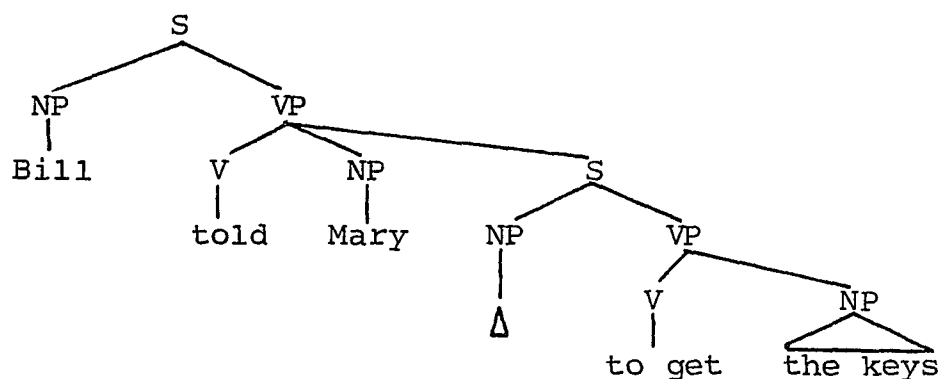
Recently, Chomsky and Lasnik (1977) and Chomsky

(1980a) have argued that infinitival complements following verbs such as persuade are base generated in the form illustrated in (73). This analysis requires that COMP must be expanded to include a null complementizer.¹⁵ According to Chomsky and Lasnik (1977) and Chomsky (1980a), verbs such as persuade are control verbs, whereas verbs such as want are noncontrol verbs. This has implications for the internal structure of the embedded S. For control verbs, the missing complement subject is represented by PRO. On the other hand, infinitive constructions following noncontrol verbs such as want may have lexical NP's. In cases where the infinitival subject is identical with the matrix subject, a rule (Equi NP Deletion) deletes the subject of the infinitive generating sentences such as (78).

(78) John wants to go

The verb tell is classified as a control verb by Chomsky and Lasnik (1977). Following their analysis of persuade, the present study assumes that the verb tell takes verb phrase complements. Choosing between an S versus $\bar{S}$ analysis of control verbs is not crucial for the present study.¹⁶ Thus, infinitival sentences such as (70) will be assumed to have the structure illustrated in (79).

(79)



This analysis, which is adopted by Goodluck (1978), assumes that the complement is generated directly with the empty subject.¹⁷

Williams (1977) argues that in order to complements are attached to the S node rather than the VP, as are clauses introduced by after, before, during, while and because. Goodluck (1978) adopts Williams' analysis of in order to complements and after clauses (termed adverbial temporal complements by Goodluck). She argues that Williams' analysis is supported by several lines of evidence. First, Williams (1975) observed that there is a natural order of constituents such that complements assumed to attach to the S follow those that attach to the VP constituent. This would explain the difference in acceptability of sentences such as (80) and (81).

(80) John told Mary to grab the keys after getting into the car

(81) ?John told Mary after getting into the car to grab the keys

In (81), the after clause, which is an S constituent, pre-

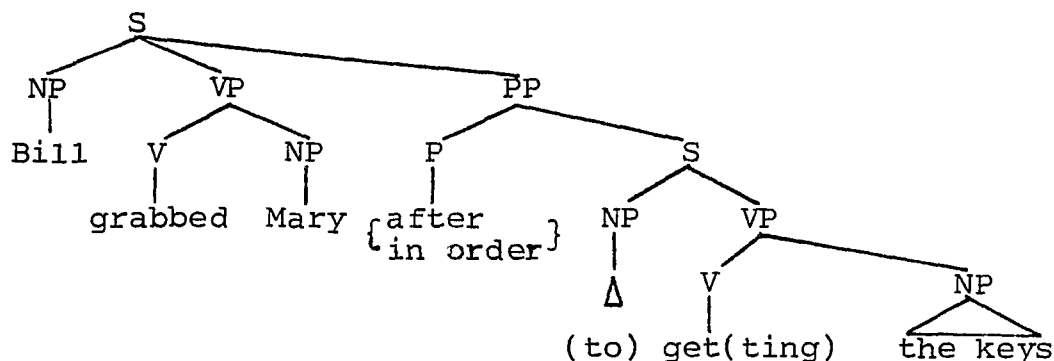
cedes the infinitival complement, which is a VP. Secondly, Williams argues that in order to clauses are never subject to subcategorical restrictions. Infinitival complements, on the other hand, can only occur with a restricted set of matrix verbs. This difference can be accounted for by the fact that subcategorization restricts only the occurrence of constituents that are sister to the matrix verb (Goodluck, 1978). That is, subcategorization restrictions apply only to VP constituents. Finally, Goodluck cites Williams' (1977) observation that in order to complements differ from infinitival complements with respect to preposability. Williams (1975, 1977) claims that differences in preposability can be accounted for by differences in level of attachment. Elements which attach to the highest constituents on a tree, such as S constituents, are the most naturally preposable, whereas elements which attach to lower constituents are less preposable. As a result, in order to complements which attach to the S may prepose as in (82).

(82) In order to get the keys, Bill grabbed Mary
However, as illustrated in (83), infinitival complements, which are attached to the VP (see (79)), may not prepose.¹⁸

(83) *To get the keys, Bill told Mary
The behavior of adverbial temporal complements is similar to that of in order to complements. Thus, the present research assumes, along with Goodluck, that in order to and adverbial temporal complements are attached to the S. According to

this analysis sentences (71) and (72) have the structure illustrated in (84).

(84)



In (84), the missing NP is assumed to be generated directly in the base.

2.2.2 Complement Subject Interpretation. This section explains Goodluck's proposal that c-command governs the interpretation of missing complement subjects. It is important to note that there have been a variety of proposals concerning the rules which determine the subject of a complement clause (e.g. Rosenbaum 1967, 1970; Jackendoff, 1972; Stockwell, Schacter and Partee, 1973; Solan, 1977; Chomsky and Lasnik, 1977; Bresnan, 1978; and Chomsky, 1980a). Early approaches to the problem of control, such as Rosenbaum (1967, 1970), proposed that a transformational rule deleted the complement subject NP under identity with the controlling NP. Rosenbaum originally termed the rule the identity erasure transformation. The rule is now more generally known as Equi NP Deletion. In contrast, Goodluck (1978), following Chomsky (1980a), assumes that "control is specified

by a rule that coindexes the (lexically unfilled) complement subject NP with the controlling NP (p. 17)". Chomsky and Lasnik (1977) argue that rules of control are obligatory and they apply only to anaphoric elements. Thus, Chomsky and Lasnik distinguish between Equi NP Deletion which applies to noncontrol verbs such as want, and obligatory control which applies to control verbs such as persuade, tell or promise. The present section will not attempt to evaluate the alternative approaches to the problem of control. The discussion will be limited to Goodluck's proposal.

Sentences (70), (71), and (72), which are repeated here as (85), (86), and (87), differ with respect to control.

(85) Bill told Mary to get the keys

(86) Bill grabbed Mary in order to get the keys

(87) Bill grabbed Mary after getting the keys

Sentence (85) is object controlled, whereas sentences (86) and (87) are subject controlled. Goodluck (1978) argues that this contrast can be explained by the following restriction on control:

(88) A controller must c-command the missing subject position (p. 18).

Goodluck terms this the c-command constraint on control. As pointed out in section 2.1 (this chapter), c-command was a concept introduced by Reinhart (1976) which specifies a syntactic domain that restricts rules of pronominalization. Reinhart's (1976) definition, which was quoted in (68), is repeated here as (89).

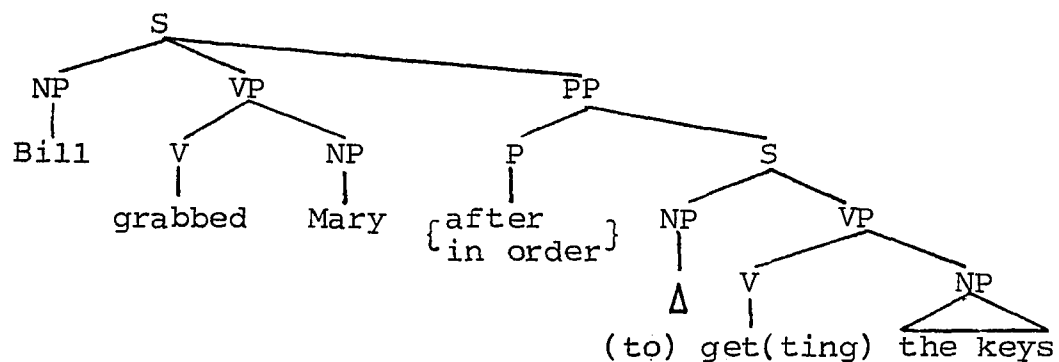
- (89) Node A c(constituent)-commands node B, if neither A nor B dominates the other, and the first branching node which dominates A dominates B (p. 32)

Following Reinhart's definition of c-command, the c-command constraint on control can be restated as follows:

- (90) A noun phrase (node A) is a possible controller of a missing NP position (node B) if the first branching node which dominates A also dominates B; and neither A nor B dominates the other.

The c-command constraint specifies that the missing NP in in order to and adverbial temporal complements must be controlled by the matrix subject. In order to illustrate this, consider sentence (91).

(91)



The subject NP, Bill, is a possible controller since it is immediately dominated by a branching node, S, which also dominates the missing NP position. Furthermore, neither the NP, Bill, nor the missing NP dominate each other. The c-command constraint blocks the object NP, Mary, from being a possible controller. This is due to the fact that the NP, Mary, is dominated by a branching node, VP, which does not dominate the missing NP position. Thus, the c-command con-

constraint (in conjunction with the assumption of S attachment of the complement) is consistent with Williams' (1977) observation that in order to and adverbial temporal complements are subject controlled.

It is important to note that the c-command constraint on control has two functions: (1) it specifies the noun phrases that are possible controllers (i.e. the noun phrases that c-command the missing NP), and (2) it blocks noun phrases which do not c-command the missing NP from being selected as controllers. The second function can be viewed as a corollary of the c-command constraint on control. In view of the two functions, the c-command constraint on control (90) may be restated as two principles: the c-command control principle (92) and the c-command restriction on control (93).

(92) The C-Command Control Principle

A noun phrase (node A) is a possible controller of a missing NP position (node B), if the first branching node which dominates A also dominates B; and neither A nor B dominates the other

(93) The C-Command Restriction on Control (A Corollary of The C-Command Control Principle)

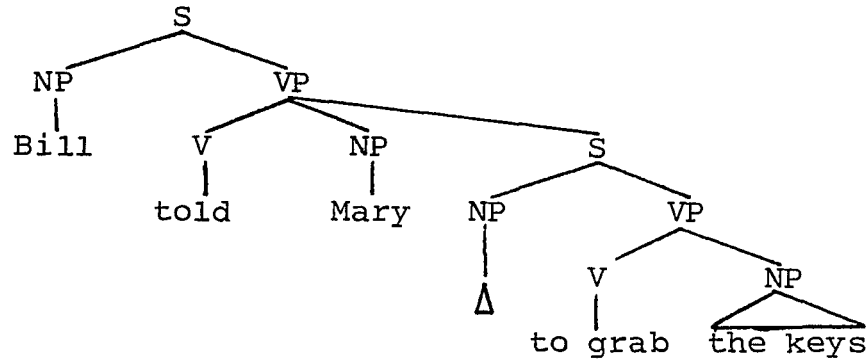
A noun phrase which does not c-command the missing NP position will be blocked from controlling the missing NP

The principles stated in (92) and (93) will be referred to, collectively, as the c-command constraint on control.

Section 2.2.1 stated that infinitival complements

following the verb tell are assumed to attach to the VP as illustrated in (79). Sentence (79) is repeated here as (94).

(94)



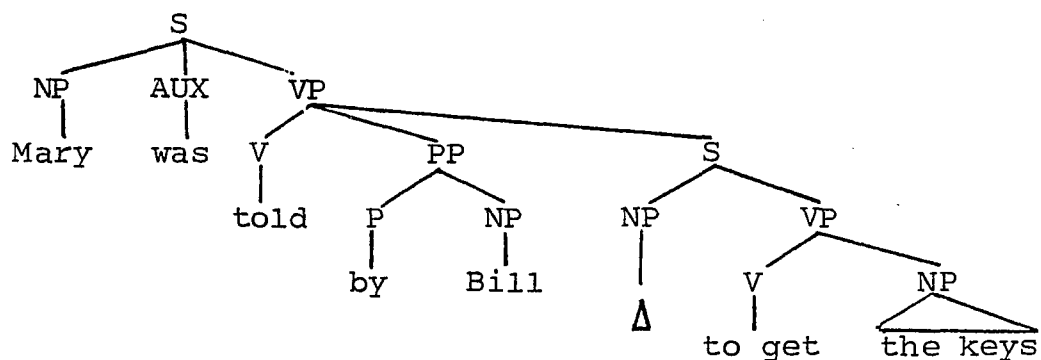
According to the c-command control principle stated in (92) either the subject NP, Bill, or the object NP, Mary, are possible controllers of the missing complement subject since both the S and VP are branching nodes which dominate the missing NP position. Thus, the c-command constraint ambiguously allows either Bill or Mary to control the missing NP position. These sentences, however, are object controlled. Thus, an additional rule is needed to specify that the object NP, Mary, is the controller of the missing complement subject. Goodluck (1978) also notices that the c-command constraint is ambiguous with respect to the controller of infinitival complements which are attached to the VP. Furthermore, she acknowledges that an additional principle is necessary to account for the fact that infinitival complements are generally object controlled. Goodluck observes that there are a number of proposals such as Rosenbaum's minimal distance principle, which could operate in conjunction with the

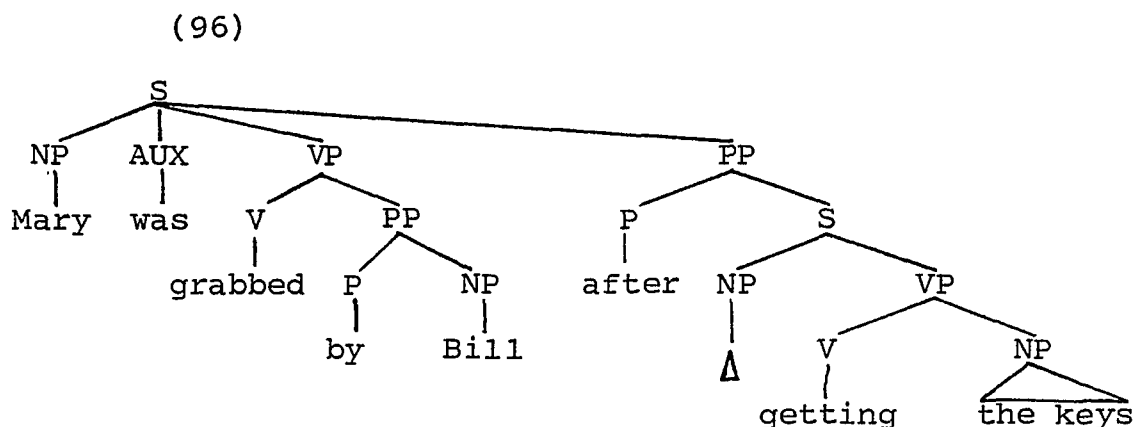
c-command constraint. MDP counts the number of intervening branching nodes and selects the closest NP to the missing NP position as the controller. Goodluck does not choose between the various proposals (e.g. Rosenbaum, 1967, 1970; Solan, 1977; Bresnan, 1978; and Chomsky, 1980a). In general, the c-command constraint is consistent with Williams' (1975) observation that a complement must attach to the VP in order for it to be object controlled. Goodluck concludes that

the c-command constraint accounts for the range of possible controllers in all but a few cases, and.... that it is a general principle governing control for constructions such as (85) - (87) (p. 25).¹⁹

2.2.3 The C-Command Constraint and Passive Constructions. The c-command constraint is consistent with the observation that complements following a passive matrix clause are subject controlled. Consider the passive sentences (95) and (96):²⁰

(95)

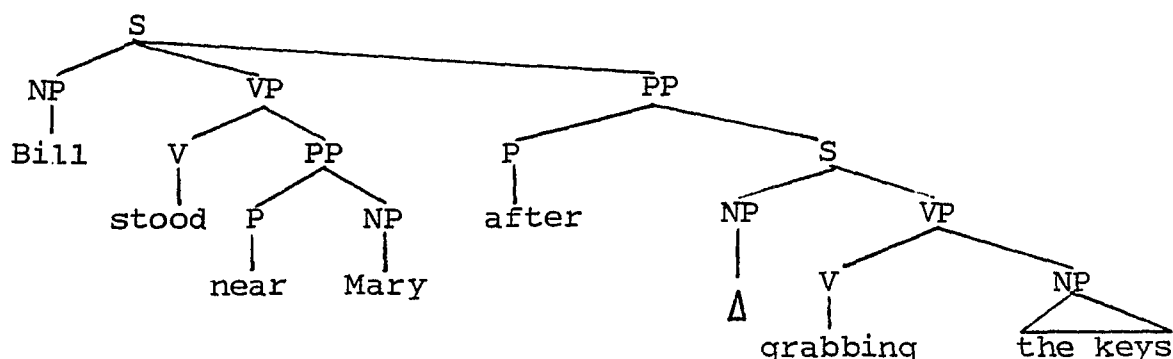




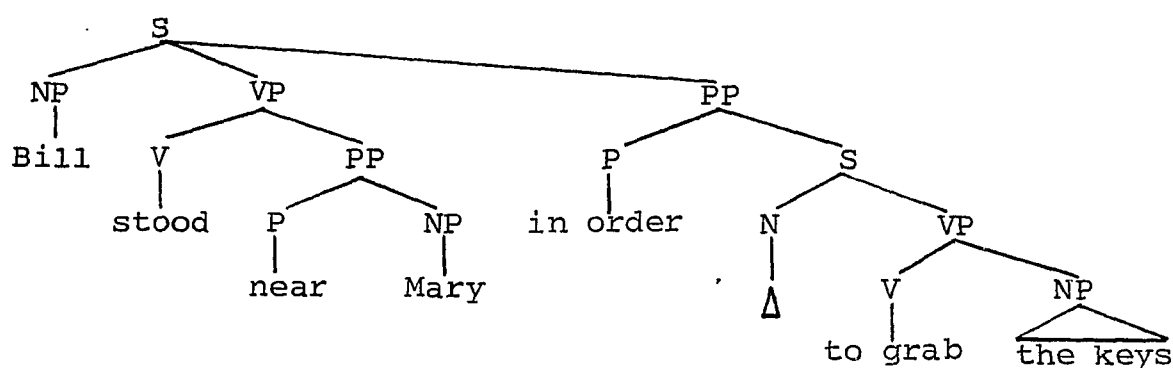
The complement is attached to the VP in (95) and to the S in (96). In both sentences the c-command control principle specifies that the subject NP, Mary, is a possible controller. This is due to the fact that the subject NP is immediately dominated by S which also dominates the missing NP position. On the other hand, the c-command restriction blocks control by the object NP, Bill. This is due to the fact that in both (95) and (96) the NP, Bill, is dominated by a branching node, PP, which does not dominate the missing NP position. Thus, the subject NP, Mary, must be selected as the controller.

As pointed out by Goodluck (1978), the c-command restriction blocks control by any noun phrase which is the object of a prepositional phrase in the matrix clause. Thus, the c-command restriction blocks control of missing complement subjects by the object noun phrase in sentences such as (97) and (98).

(97)



(98)



In sentences (97) and (98), the NP, Mary, is the object of a locative PP. Thus, Mary is blocked as a controller due to the fact that it is dominated by a branching PP node which does not dominate the missing NP position. As a result, the subject NP, Bill, which c-commands the missing NP position, is selected as the controller in (97) and (98). Thus, complements which are preceded by either a passive by phrase or any other type of prepositional phrase are subject controlled. As Goodluck notes, although blocking of control by objects of a preposition seems to be generally correct for English, there are some exceptions. These exceptions will be discussed below (see section 2.2.5, this chapter).

2.2.4 The C-Command Constraint, Preposed Constructions, and the Level of Complement Subject Interpretation.

An important fact of the grammar, is that both preposed adverbial temporal complements such as (99) and preposed and in order to complements such as (100) are subject controlled.

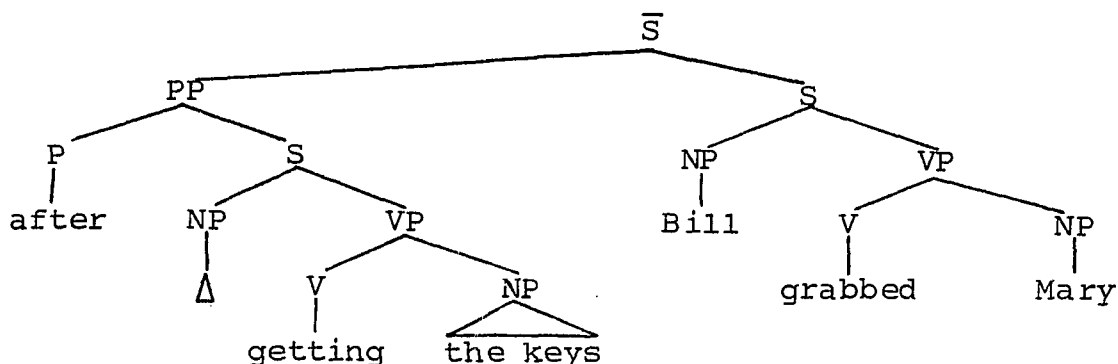
(99) After getting the keys, Bill grabbed Mary

(100) In order to get the keys, Bill grabbed Mary

Thus, subject control occurs in sentences with either preposed and non-preposed complement structures which are considered to be S constituents. Preposed complement structures play an important role in hypotheses concerning the level of interpretation of missing complement subjects. This is due to the fact that the attachment of the preposed complement may result in a structure in which the matrix subject NP does not c-command the missing NP position. This occurs in the analysis of preposed complements proposed by Goodluck (1978). As a result, Goodluck argues that complement subject interpretation must occur prior to preposing. There is however, an alternative analysis which would allow complement subject interpretation to occur at the level of surface structure. The following discussion explains (1) the two analyses, (2) the arguments in favor of each, and (3) the implications for the level of interpretation of missing complement subjects.

Goodluck (1978) argues that preposed complements are attached to $\bar{S}$ or a higher node as illustrated in (101).

(101)



Goodluck motivates her analysis with the following arguments. First, she notes that some constituents can be preposed as illustrated in (101), whereas others cannot as illustrated in (102).

(102) *To grab the jewels, John told Bill

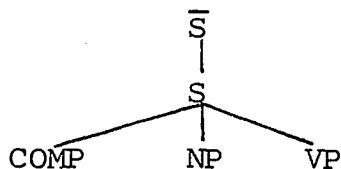
Goodluck adopts William's (1977) proposal that the difference in grammaticality of sentences (101) and (102) is accounted for by the fact that, in general, complements which attach to the S node can be preposed, while those attached to the VP node cannot be preposed. However, Goodluck observes that some VP constituents can be preposed as illustrated in (103).

(103) In the cupboard, John put the bread

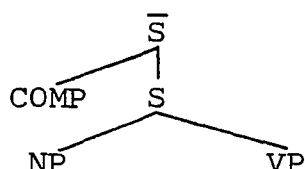
Sentences such as (103) are stylistically marked. According to Goodluck, the difference in acceptability of (103) as compared to (101) is due to differences in the underlying syntactic structure. Complements preposed from S attach to $\bar{S}$ as illustrated in (101), whereas complements preposed from the VP attach to the matrix S. Goodluck's analysis follows from Reinhart's (1976) proposal that only constituents which

are preposed from the VP move into COMP. Goodluck assumes, along with Reinhart, that COMP is attached to S as in (104) rather than to $\bar{S}$ as in (105).

(104)



(105)



It is important to note that the latter structure follows from the phrase structure rule $\bar{S} \rightarrow \text{COMP} + S$ which was proposed by Bresnan (1972). The structure represented in (105) has been adopted as the standard analysis by authors such as Chomsky and Lasnik (1977) and Chomsky (1980a). In summary, Goodluck argues that preposed VP constituents attach to S due to the fact that they move into COMP, while preposed S constituents attach to $\bar{S}$. Goodluck claims that the following contrast provides further support for her proposal.

(106) After grabbing the jewels, who did John hit?

(107) *In the cupboard what did John put?

Assuming VP constituents move into COMP and S constituents do not, the ungrammaticality of (107) can be explained by the fact that COMP is filled by the WH word, which makes preposing impossible (Goodluck, 1978). It is important to note

that if the standard phrase structure rule, $\bar{S} \rightarrow \text{COMP} + S$, is adopted, then Goodluck's proposal would not account for the difference in grammaticality between (106) and (107), since COMP would be filled by the WH word in both sentences. The sentences selected by Goodluck, which provide the crucial contrasts for her arguments, involve the verb put. This verb is unusual in that it is strictly subcategorized to take a prepositional phrase. In contrast, sentences (108 - 111) seem more acceptable than either (103) or (107).

(108) ?In the cupboard, John saw some bread

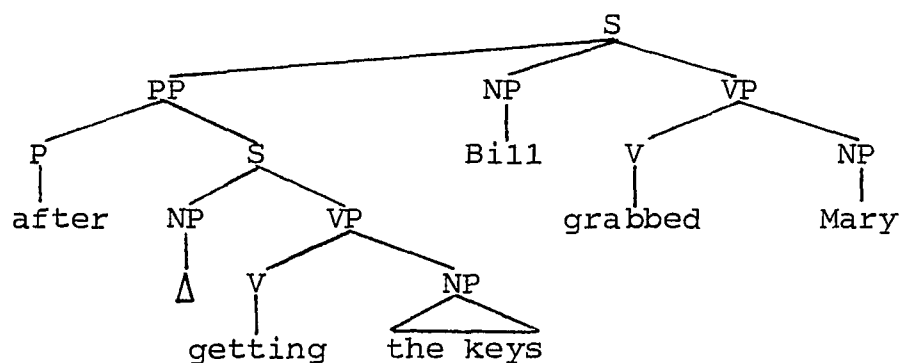
(109) ?In the cupboard, John found some bread

(110) ?In the cupboard, what did John see?

(111) ?In the cupboard, what did John find?

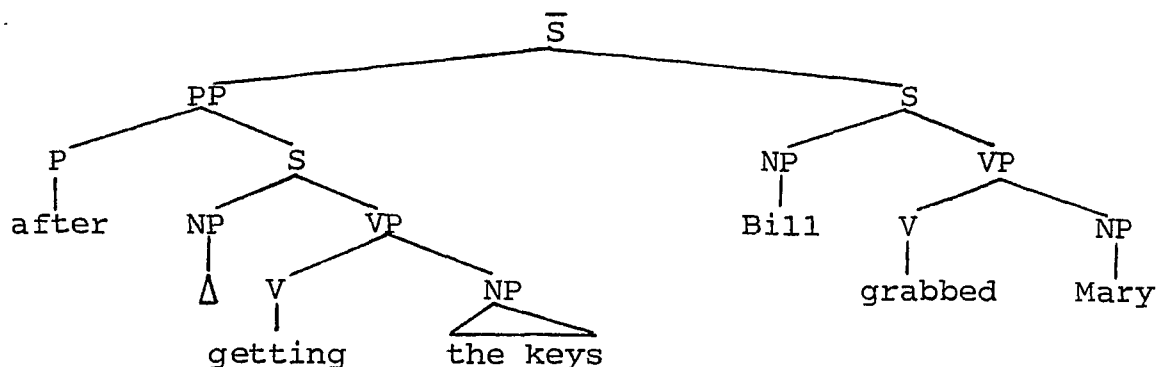
Thus, the difference in grammaticality between (106) and (107) may not be attributable to a structural difference.²¹ In view of this, it seems equally plausible that preposed S complements are attached to the matrix S. This alternative analysis of preposed complements is illustrated in (112).

(112)



Goodluck's analysis in which the preposed complement is attached to $\bar{S}$ is repeated in (113) for convenience (see also (101)).

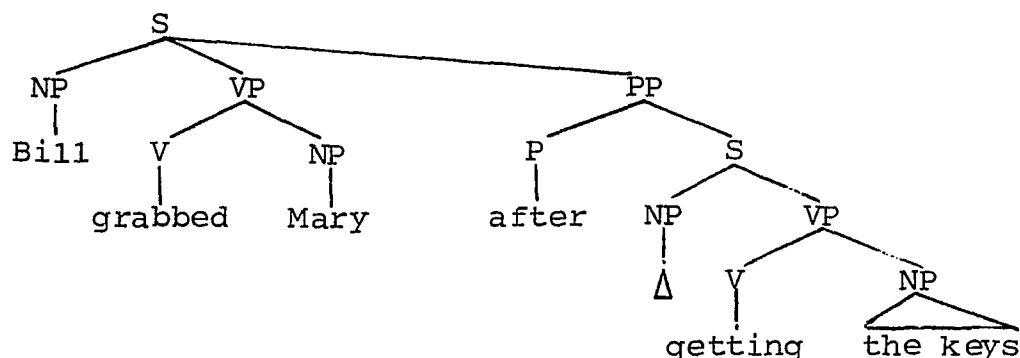
(113)



The analysis of preposed structures bears on the issue of the level of interpretation of missing complement subjects. In (113) either subject or object control would violate the c-command principle if control is determined at the level of surface structure. This is due to the fact that neither the subject nor object NP of the matrix clause c-commands the missing NP position (i.e. both are immediately dominated by a branching node which does not dominate the missing NP position). Thus, the subject and object NP's of the matrix clause should be blocked as possible controllers of the missing NP position by the c-command constraint. Goodluck explains the fact that preposed complements are subject controlled by proposing that missing complement subjects are interpreted at a level other than surface structure. That is, missing complement subjects are interpreted prior to preposing. As explained in section 2.2.2, this chapter, the

c-command constraint determines that non-preposed structures such as (84) (repeated here as (114)) are subject controlled.

(114)



According to Goodluck, subject control of preposed complements results from the fact that interpretation occurs on the non-preposed structure.

The alternative analysis of preposed complements in which the complement is attached to the matrix S rather than $\bar{S}$ (see (112)) does not entail that control be determined prior to preposing. This is due to the fact that subject control in structures such as (112) does not violate the c-command constraint. In (112), the subject NP, Bill, c-commands the missing NP position. Therefore, Bill is a possible controller, whereas the object NP, Mary is not. Thus, the structure proposed in (112) permits interpretation of missing complement subjects at a level of surface structure. If this structure characterizes adult grammar, then subject control is ambiguous with respect to the issue of the level of interpretation of missing complement subjects. However, young children may manifest response patterns which

are unambiguous with respect to this issue due to differences in their analysis of non-preposed complements as compared to that of adults. The grammars of young children are explained in section 4, this chapter, and a method of evaluating Goodluck's hypothesis concerning the level of interpretation of missing complement subjects is described in section 3, chapter III.

2.2.5 Exceptions to the C-Command Constraint.

Goodluck (1978) notes that there are several exceptions to the c-command constraint such as complements of the verb rely on (115) and complements of dative PP constructions (116).

(115) Bill relied on Mary to get the keys

(116) Bill shouted to Mary to get the keys

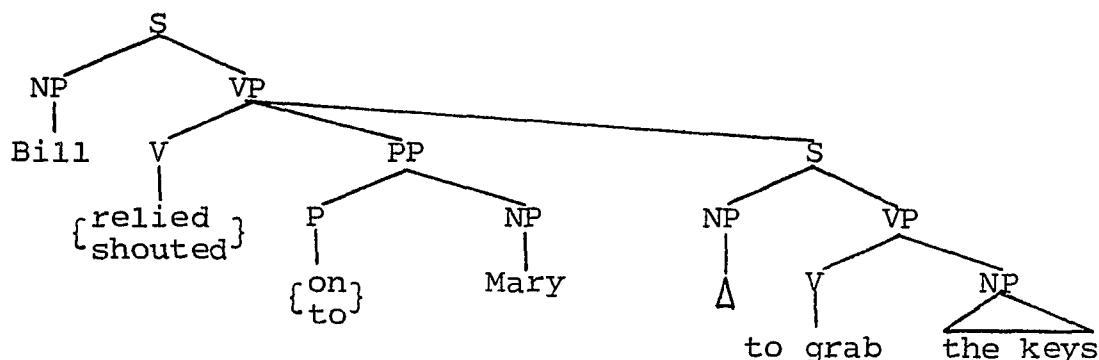
In addition, sentential subject sentences such as (117) may also be considered to be an exception.

(117) To get the keys would please Mary

The purpose of this discussion is to show why these constructions are considered to be exceptions to the c-command constraint.

The complements of rely on and dative PP sentences are object controlled. That is, Mary is the subject of the complement in both sentences (115) and (116). As illustrated in (118), object control violates the c-command constraint due to the fact that the NP, Mary, is dominated by the branching node, PP, which does not dominate the missing NP position.

(118)



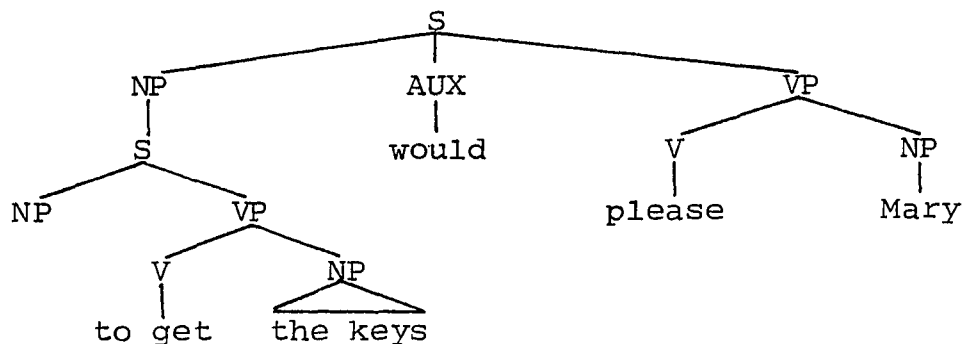
One solution to the rely on sentences is to treat the preposition as part of the verb. The object NP would then c-command the missing NP. Goodluck points out, however, that Wh movement demonstrates that on Mary is a syntactic unit.²²

(119) On whom did Bill rely to grab the keys?

Goodluck surveys other proposals (Solan, 1977; and Bresnan, 1978) which attempt to develop a semantic account of control phenomena. These semantic accounts may ultimately offer a unified theory of exceptions involving the verb rely. For the present, complements of rely on are problematic for the c-command constraint.

Sentential subject sentences, which are generated directly in the base, have the structure illustrated in (120).

(120)



In (120), the object NP, Mary, does not c-command the missing NP position. Thus, it should be blocked as a possible controller. However, for many speakers, Mary is the subject of the complement. Thus, these sentences also seem to violate the c-command constraint.

Goodluck (1978) argues that dative PP sentences and sentential subject sentences do not constitute exceptions due to the fact that they are free control complements which are not subject to the c-command constraint. Free control complements allow control by an NP not mentioned in the sentence, whereas obligatory control complements require that an NP in the matrix clause control the missing complement subject. According to Goodluck, the c-command constraint applies only to obligatory control complements. Some adult speakers permit outside NP's to control dative PP complements. If the distinction between free and obligatory control complements is adopted, then the dative sentences would not constitute an exception to the c-command constraint. However, as stated by Goodluck, (1978)

Dialects in which control by the dative object in sentences such as (115) and (116) is obligatory present a problem....which we will leave unresolved (p. 25).

There seems to be general agreement that sentential subject sentences such as (117) allow either control by the matrix object NP, Mary, or an outside NP. Thus, these sentences may also be classified as free control complements. Children's interpretation of both dative PP constructions and sentential

subject sentences is investigated in the present research. In particular, the study tests the hypothesis that the c-command constraint is overgeneralized to these constructions (see section 4.4, this chapter, and sections 1.2.3, 1.2.5, and 2.2, chapter III).

3. C-Command and the C-Command Constraint on

Control: Children's Grammar

The following section explains Goodluck's claims concerning the operation of the c-command constraint in the grammars of young children. The c-command principle which was defined in (68), and the c-command constraint on control which was defined in (88) are repeated below for convenience.

(121) The C-Command Principle (Reinhart, 1976)

Node A c(constituent)-commands node B, if neither A nor B dominates the other, and the first branching node which dominates A dominates B (p. 32)

(122) The C-Command Constraint on Control (Goodluck, 1978)

A controller must c-command the missing subject position. (p. 18)

Section 2 restated the c-command constraint on control as two principles: (1) the c-command control principle and (2) the c-command restriction on control. These principles are referred to, collectively, as the c-command constraint on control. The definitions of these principles, (92) and (93), respectively, are repeated below for convenience.

(123) The C-Command Control Principle

A noun phrase (node A) is a possible controller of a missing NP position (node B), if the first branching node which dominates A also dominates B; and neither A nor B dominates the other

(124) The C-Command Restriction on Control (A Corollary of the C-Command Control Principle)

A noun phrase which does not c-command the missing NP position will be blocked from controlling the missing NP

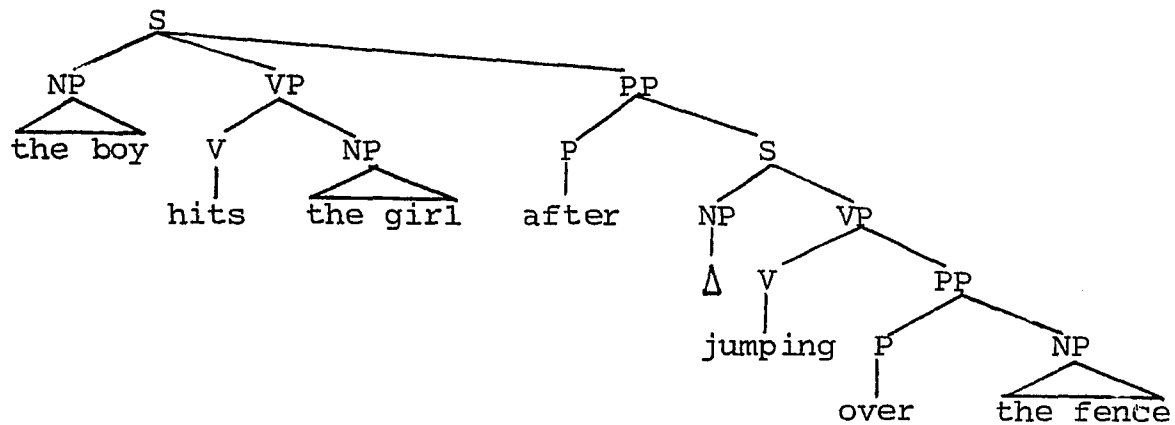
As described in section 1.3.2, this chapter, Goodluck (1978) proposes that the c-command constraint guides children's interpretation of missing complement subjects. Based on the assumption that the constraint is a universal, Goodluck argues that it is inviolable and that it is fully specified and operational from the beginning stages of language acquisition. These assumptions provide crucial motivation for hypotheses concerning children's analyses of the structure of multiple clause sentences.

Table 6 indicates that young children exhibit a pattern of object control of sentences such as (61) (repeated below as (125)) in which adverbial temporal complements follow a matrix direct object.

(125) The boy hits the girl after jumping over the fence

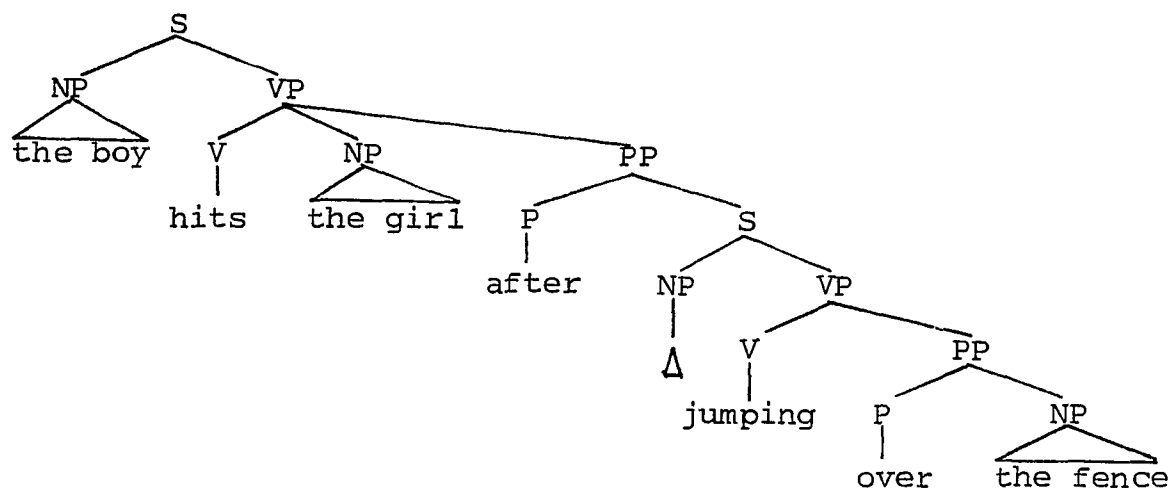
Section 2.2.1, this chapter, summarizes arguments suggesting that in adult grammar adverbial temporal complements are attached to the S as illustrated in (126).

(126)



Object control of structures such as (126) violates the c-command constraint due to the fact that the NP, the girl, is immediately dominated by the branching node, VP, which does not dominate the missing NP position (i.e. it does not c-command the missing complement subject). Based on the assumption that the c-command constraint is inviolable, Goodluck proposes that young children optionally attach adverbial temporal complements to the VP node as illustrated in (127).

(127)

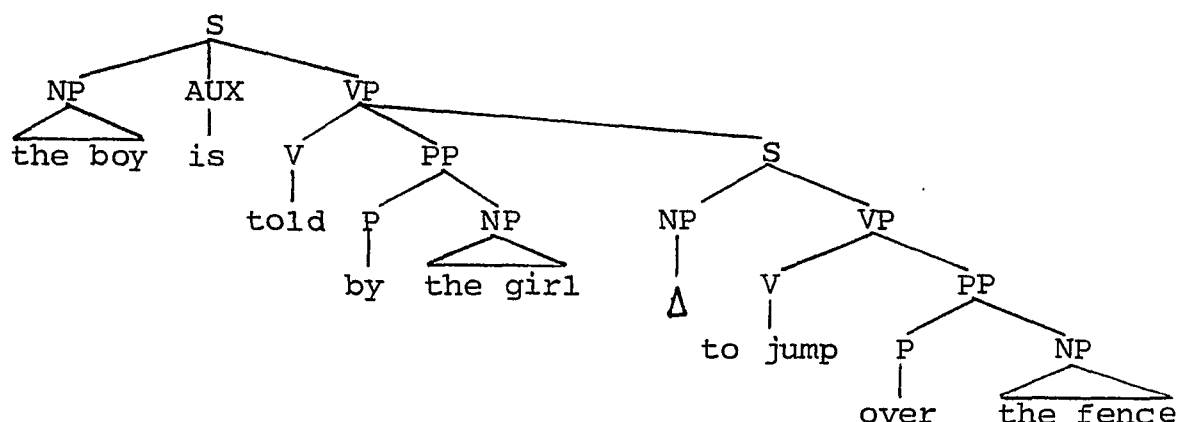


Assuming that the structure in (127) characterizes children's grammar, object control is now consistent with the c-command constraint. Thus, the hypothesis of optional VP attachment of complements is a crucial component of Goodluck's theory. The structure illustrated in (127) is similar to active tell sentences in that the subject NP, the boy, is also a possible controller due to the fact it, too, c-commands the missing NP. Goodluck (1978) proposes that children's grammars have a general rule which specifies that a matrix direct object controls complements attached to the VP (p. 37). This rule applies to infinitival complements following verbs such as promise, tell and ask, as well as adverbial temporal complements following verbs such as hit. Patterns of object control on these sentences (see Table 6, Chomsky, 1969; Maratsos, 1974; and Goodluck, 1978) are explained by postulating (1) the operation of the c-command constraint, (2) optional attachment of the complement to the VP, and (3) an additional rule specifying object control.

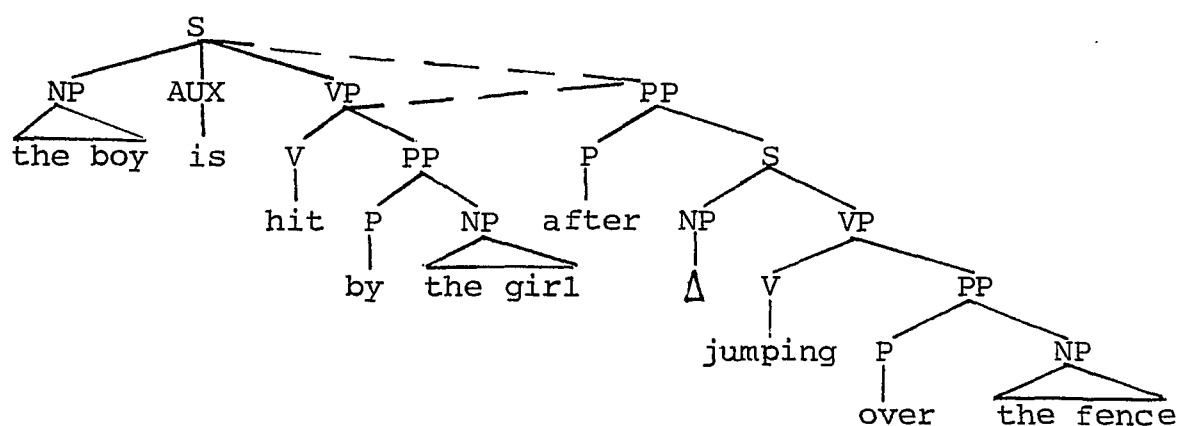
At the same time that children manifest patterns of object control on sentences such as (127) or active tell sentences, they manifest patterns of subject control on complements following passive sentences (see Table 6, Maratsos, 1974 and Goodluck, 1978) and complements following locative prepositional phrases (see Table 6, Goodluck, 1978). As pointed out in section 1.3.2, this chapter, these patterns conflict with Maratsos' semantic rule as well as the surface

and deep structure MDP. However, the patterns are consistent with the c-command constraint. The structure of the passive sentences tested by Goodluck are illustrated in (128) and (129).²³

(128)



(129)

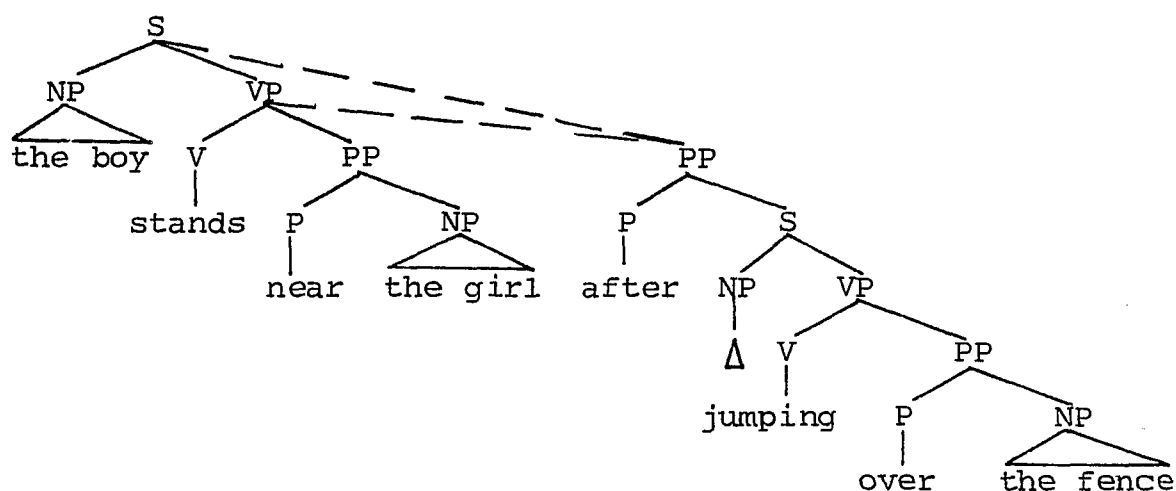


The solid line in (128) indicates that the infinitival complement is obligatorily attached to the VP, and the dotted line in (129) indicates that the adverbial temporal complement is optionally attached to the VP. Regardless of the level of attachment, the presence of the by phrase blocks control by the object NP, the girl. On the other hand, the

subject NP in both sentences c-commands the missing complement subject.

Sentences containing adverbial temporal complements following a locative prepositional phrase are similar to the passive constructions in that the VP contains a prepositional phrase. According to Goodluck's theory, children analyze the locative constructions as illustrated in (130).

(130)



Subject control of these constructions follows from the fact that the subject NP c-commands the missing complement subject while the object NP is blocked as a controller by the locative prepositional phrase (i.e. it is dominated by a branching node, PP, which does not dominate the missing NP position). Therefore, if it is assumed that children optionally attach adverbial temporal complements to the VP, then the c-command constraint on control is consistent with the fact that young children manifest subject control of complements following a passive by phrase and a locative prepositional phrase while

they manifest object control of complements following direct objects.

In a second experiment, Goodluck (1978) investigated children's interpretation of reduced in order to complements following (1) matrix direct objects and (2) locative prepositional phrases. Using an acting out task, she presented four and five year old with the following constructions:

Active matrix sentence with a direct object NP and an adverbial temporal complement

(131) Daisy hits Pluto after putting on the watch

Active matrix sentence with a direct object NP and a reduced 'in order to' complement

(132) Daisy hits Pluto to put on the watch

Active matrix sentence with a locative PP in the VP and a reduced 'in order to' complement

(133) Daisy stands near Pluto to do a somersault

It should be pointed out that sentences (132) and (133) are not acceptable to some speakers. Furthermore, (132) seems to be biased toward object control. However, it is important to note that ninety percent of the responses on (133) were subject controlled. The results of Goodluck's experiment are summarized in Table 7.

Table 7

Percentage of Subject Control Responses on Complements
Following a Direct Object or a Locative
Prepositional Phrase

Age	Construction Type		
	Direct Object + Adverbial Temporal Complement	Direct Object + <u>in order to</u> Complement	Loc. PP + <u>in order to</u> Complement
4	66.70	56.70	90.10
5	63.40	63.40	90.10
Overall	65.05	60.05	90.10

The percentage of subject control responses was significantly higher on in order to complements following a prepositional phrase than on either in order to or temporal complements following a direct object ($p = .001$). Results from the second experiment show that the contrasting pattern of subject control of complements following prepositional phrases and object control of complements following direct objects generalizes to in order to complements. These data constitute strong support for the theory that c-command constraint operates in children's grammars. The second experiment also forces a reinterpretation of some of Tavakolian's (1977) data. Tavakolian's study included a reduced in order to complement such as (58) (repeated here as (134)).

(134) The lion jumped over the pig to stand on
the horse

Tavakolian reported that young children manifested subject control of sentences such as (134) (see Table 6, Tavakolian, 1977). She attributed this response pattern to operation of the conjoined clause analysis. However, as Goodluck notes, the response pattern is also consistent with the c-command constraint. Sentence (134) is similar to (130) in that the verb phrase contains a locative prepositional phrase. Thus, the c-command constraint will block control by the object of the preposition. As a result, the subject NP, which c-commands the missing NP position, is selected as the controller.

Goodluck (1978) also investigated children's interpretation of preposed adverbial temporal complements such as (66) (repeated below as (135)).

(135) After jumping over the fence the boy hits
the girl

As indicated in Table 6, Goodluck found that young children manifest the same pattern of control on preposed complements as they do on non-preposed complements. She argues that these results support her hypothesis that both children and adults interpret missing complement subjects prior to preposing. This hypothesis is examined in greater detail in section 3, chapter III.

In summary, Goodluck proposes that the c-command constraint on control operates in children's grammars just as it does in adult grammar. According to the c-command control principle outlined in (123), noun phrases which c-command the missing NP position are possible controllers

of missing complement subjects. Noun phrases which do not c-command the missing NP position are blocked as possible controllers by the c-command restriction on control (see (124)). In order to account for children's tendency to manifest object control on in order to and adverbial temporal complements following matrix direct objects, Goodluck postulates that the complements are optionally attached to the VP. As a result both matrix NP's c-command the missing NP position. In view of this, it is necessary to postulate an additional rule which specifies that direct object NP's control complements attached to the VP. This rule also accounts for the pattern of object control observed on infinitival complements following the matrix verbs ask, tell, and promise. In sentences in which the complement follows a passive matrix clause or a locative prepositional phrase, the object of the preposition is blocked as a controller since it does not c-command the missing NP position. Thus, children manifest subject control of complements following prepositional phrases while they manifest object control of complements following direct objects.

4. The Development of Recursion in Children's

Grammars: The Five Grammar Types

Goodluck's (1978) proposal, that the c-command constraint on control governs children's interpretation of missing complement subjects, accounts for aspects of

Goodluck's data as well as response patterns reported by Tavakolian (1977), Maratsos (1974) and Chomsky (1969). (See Table 6 for a summary of the data.) In particular, Goodluck's proposal accounts for the fact that children manifest subject control on complements following prepositional phrases and object control of complements following a direct object.

Several response patterns reported by Goodluck represent selection of a particular controller in only fifty to sixty percent of the responses. (See Table 6.) Goodluck reports significant differences between responses to particular construction types which are consistent with her theory. However, the theory does not explain the fact that the responses on individual construction types are mixed. Thus, the c-command constraint seems to provide only a partial explanation of the facts. Furthermore, the theories proposed by Tavakolian (1977) and Chomsky (1969) are consistent with some aspects of the data.²⁴ For example, Tavakolian's theory is consistent with the fact that young children manifest subject control of complements following both promise and tell, whereas Chomsky's theory is consistent with children's tendency to manifest object control in cases where either type of control is permitted by the c-command constraint.

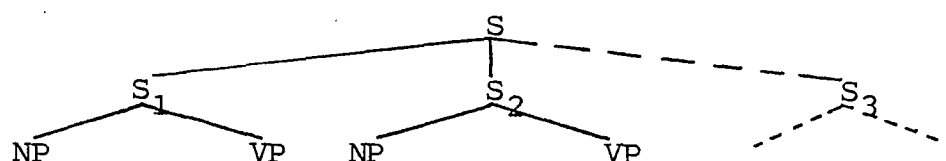
The purpose of this section is to propose a theory which will provide a unified account of young children's

interpretation of missing complement subjects. The major theories (Chomsky, 1969; Tavakolian, 1977; and Goodluck, 1978) which attempt to account for this aspect of children's language differ in terms of hypotheses concerning (1) the nature of the rules which determine the controllers of missing complement subjects, and (2) the structural analyses assigned multiple clause sentences.²⁵ A unified account of the data requires a theory which characterizes children's knowledge in terms of both (1) and (2). In this section it is postulated that children's structural analyses of multiple clause sentences develops in a series of stages which can be characterized in terms of five grammar types. These grammar types are termed: (1) subject oriented, (2) object oriented, (3) mixed subject-object, (4) approaching adult and (5) adult.²⁶ The grammar types are predicted to develop in the following order: 1, 2, 3, 4 and 5. Thus, subject oriented grammars represent the first stage of development and adult grammars represent the last stage. The theories proposed by Goodluck (1978) and Tavakolian (1977) are reconciled by the developmental hypothesis of grammar types. In particular, the two competing views are reconciled by the proposal that subject oriented grammars represent the initial stage in development and that object oriented grammars represent the next stage in development. The remaining three grammar types describe subsequent changes which occur as children develop an adult analysis of complement structures.

The theory proposed in this section also postulates that the c-command constraint on control and the minimal distance principle govern children's interpretation of missing complement subjects. This proposal reconciles the theories proposed by Goodluck (1978) and Chomsky (1969). Section 3, chapter I, outlines two hypotheses concerning the manner in which universals may operate in children's grammars: the delayed operation hypothesis and the immediate operation hypothesis. In view of the two hypotheses, the present research investigates the possibility that the c-command constraint may not be immediately operational in children's grammars. (See section 2, chapter III, for a discussion of the methods used to investigate the delayed operation hypothesis as it relates to the c-command constraint.)

4.1 Subject Oriented Grammars. Tavakolian's (1977) conjoined clause analysis postulates that children analyze multiple clause sentences as conjoined simplex sentences. According to this theory, children assign the following phrase structure to multiple clause sentences:²⁷

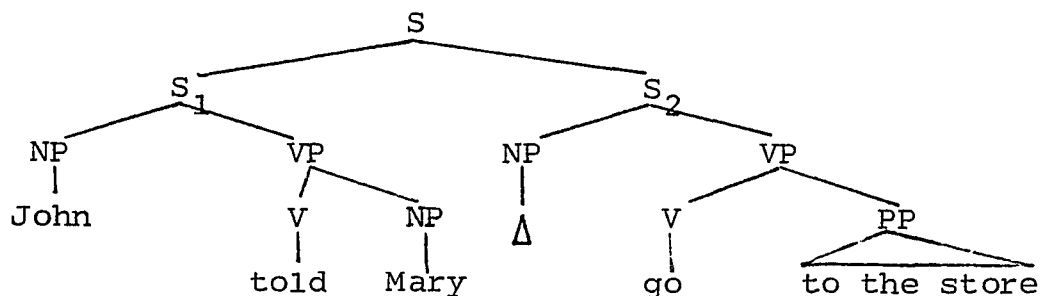
(136)



(Tavakolian, 1977 p. 30)

Tavakolian's theory predicts that infinitival complement sentences are analyzed as illustrated in (137).

(137)



The conjoined clause analysis specifies that the missing NP in S_2 is assumed to be coreferential with the subject of the first clause.²⁸ Thus, the theory predicts that children will manifest subject control of sentences such as (137).

In contrast, Goodluck's theory claims that S_2 is attached to the VP of S_1 . In structures such as this the c-command constraint specifies that either the subject or the object NP are possible controllers. Goodluck postulates that in these ambiguous cases there is a rule which selects the object of the matrix clause as the controller of the missing NP. As a result, her theory predicts object control of sentences such as (137).

Tell sentences such as (137) were tested by both Tavakolian and Goodluck. Data from the two studies is summarized in Table 6. For convenience, the percentage of subject and object controlled responses on the tell sentences is summarized in Table 8. In some cases, the children manifested 'other' responses. As a result the reported

percentages may not add up to 100 percent. In all cases, however, the percentage of 'other' responses was negligible.

Table 8

Percentage of Subject and Object Control on Infinitival
Complements Preceded by Active Sentences
with the Verb 'Tell'

Studies	AGES			
	3	4	5	6
	Control o s	Control o s	Control o s	Control o s
Tavakolian (1977)	46 46	58 38	71 29	n.t. n.t.
Goodluck (1978)	n.t. n.t.	95 5	98 2	83 17

Note. o = object control; s = subject control; n.t. = not tested

As indicated in Table 8, Tavakolian reports a higher percentage of subject controlled responses than Goodluck. Thus, children in Tavakolian's study manifested responses consistent with the conjoined clause analysis. The drop in subject control reported by Tavakolian reflects a corresponding rise in object control. This suggests that children abandon the conjoined clause analysis in favor of one that results in object control of tell sentences. Goodluck's and Tavakolian's theories can be reconciled in various ways. For example, the conjoined clause analysis may be developmentally prior

to attachment of the complement to the VP. This reconciles differences in the data, in that Tavakolian tested three, four and five year olds, whereas Goodluck tested four, five and six year olds. Lack of evidence of subject control in Goodluck's study is then attributed to the fact that her study did not include younger children. There is, however, a difference in the responses of four and five year olds as reported by Goodluck and Tavakolian (see Table 8). The percentage of object control reported by Tavakolian is much lower than that reported by Goodluck. The lower percentages reported by Tavakolian may be attributed to the greater difficulty of her test sentences as compared to those used by Goodluck. Constructions (138) and (139) are examples of the experimental sentences used by each investigator.

Tavakolian's experimental sentences

- (138) The lion tells the pig to stand on the
horse

Goodluck's experimental sentences

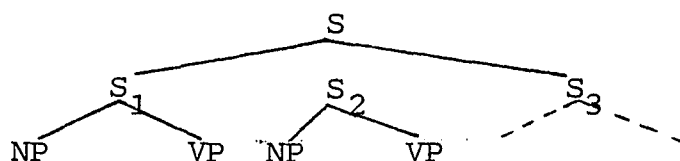
- (139) The boy tells the girl to jump over the
fence

Tavakolian's constructions involved three animate NP's whereas Goodluck's constructions involved only two. Section 1.1.2, this chapter, reports findings (Goodluck and Tavakolian, 1979) indicating that increasing the number of animate NP's in a sentence results in a significant increase in errors. The slightly lower percentage of object controlled responses manifested by Tavakolian's four and five

year olds as compared to Goodluck's subjects may therefore reflect the greater difficulty of Tavakolian's sentences.

In summary, the present research proposes that the conjoined clause analysis represents the initial stage in children's interpretation of multiple clause sentences. Grammars of this type are termed subject oriented grammars. It follows from Tavakolian's descriptions of the conjoined clause analysis that children with subject oriented grammars analyze multiple clause sentences as conjoined independent clauses. Thus, the sentences are assigned the phrase structure illustrated in (136), which is repeated here as (140).²⁹

(140)



As noted by Tavakolian (1977), this analysis entails that the child's grammar contains the phrase structure rule indicated in (141).

(141) $S \rightarrow S^*$

Therefore, this rule is also assumed to exist in subject oriented grammars. The conjoined clause analysis specifies that missing NP positions, relative pronouns, and subject pronouns of any embedded or conjoined clause are assumed to be coreferential with the first NP of the sentence (Tavakolian, 1977).³⁰ This rule, which is assumed to exist in subject oriented grammars, predicts: (1) subject control

of missing complement subject, and (2) selection of the matrix subject NP as a relativized NP or antecedent of a subject pronoun of an embedded or conjoined clause. The data on children's interpretation of adverbial clauses suggests that the order-of-mention strategy operates in children's grammars at the same time as the conjoined clause analysis. Thus, this strategy is also expected to operate in subject oriented grammars.

4.2 Object Oriented Grammars. As noted in the previous section, data summarized in Table 8 suggests that the conjoined clause analysis is abandoned at around age four. Table 8 indicates that there is a decline in subject control and a corresponding increase in object control of infinitival complements following active tell sentences. Object control of missing complement subjects seems to be a generalized pattern which occurs in response to (1) infinitival complements following a variety of speaking verbs (Chomsky, 1969; Maratsos, 1974; and Goodluck, 1978), (2) in order to and adverbial temporal complements following direct objects (Goodluck, 1978) and (3) participial phrases following perception and non perception verbs (Goodluck and Roeper, 1978).³¹ This pattern of object control is associated with the next stage in development which is termed object oriented grammars. It is postulated that this grammar type is characterized by attachment of complements to the verb phrase and attachment of relative clauses to the object NP.

In other words, object oriented grammars are characterized by the development of recursion in the VP and object NP. Evidence for this claim is derived from research on children's interpretation of adverbial clauses (section 1.2, this chapter), relative clauses (section 1.1.2, this chapter), and missing complement subjects (section 1.3, this chapter). Specific results which support the proposed characterization of object oriented grammars are summarized below.

The research on children's interpretation of adverbial clauses reveals that use of the order-of-mention strategy is followed by use of the main-clause-first strategy. As pointed out in section 1.2, the latter strategy indicates that children can distinguish between main and subordinate clauses. Thus, the appearance of the main-clause-first strategy is evidence that the stage following subject-oriented grammars (viz., object oriented grammars) is characterized by the development of embedded structures. As a result, object oriented grammars are predicted to be associated with use of the main-clause-first strategy, whereas subject oriented grammars are predicted to be associated with the order-of-mention strategy.

Research on relative clauses suggests that object oriented grammars can be characterized as having a VP node. That is, the grammars have a node in which the V is sister-adjoined with either a PP or object NP. Solan and Roeper (1978) investigated children's interpretation of OS and OO

relative clauses following the verbs push and put. Children ranging from four to six years of age were asked to act out the following sentences:

'Put' sentences

(142) The boy put the dog that kicked the horse in the barn (OS)

(143) The boy put the dog that the horse kicked in the barn (OO)

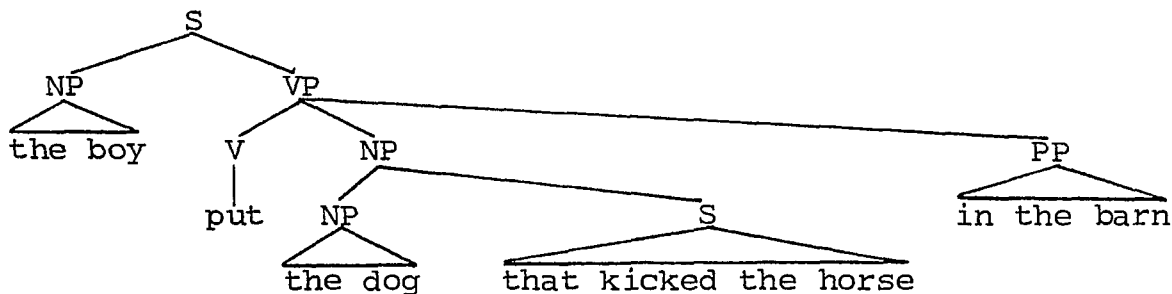
'Push' sentences

(144) The boy pushed the dog that kicked the horse (OS)

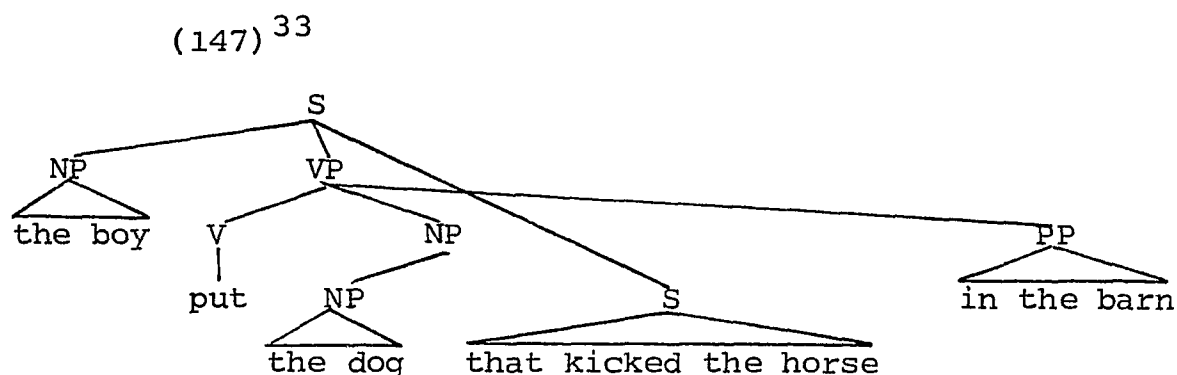
(145) The boy pushed the dog that the horse kicked (OO)

The verb put is subcategorized for a prepositional phrase. Thus, sentences such as (142) and (143) have the structure illustrated in (146).

(146)



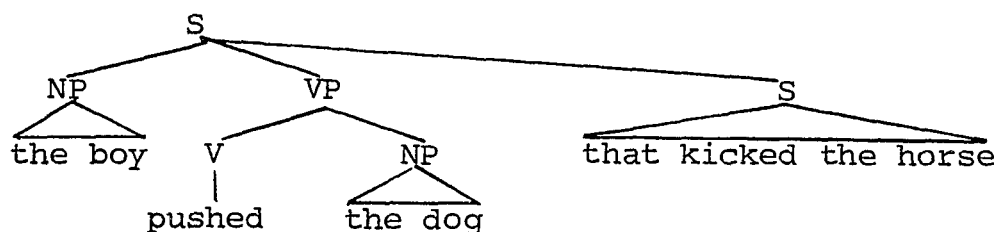
Solan and Roeper (1978) note that if children analyze the put sentences in a manner similar to the conjoined clause analysis, (i.e. the boy kicks the horse) the lines on the phrase marker will cross as illustrated in (147).³²



However, lines are prohibited from crossing by a structural constraint termed the "no tangle constraint" (Solan and Roeper, 1978).

In Solan and Roeper's study, thirty children were presented with five tokens of sentence type (142 - 145). As a result, there were a total of 600 responses which were divided equally among the four sentence types. Eighty percent of the responses were correct. Thus, the children manifested essentially correct understanding of the two types of relative clauses. The number of errors that occurred were not significantly related to either type of relative clause (OO vs OS) nor to type of main verb (put vs push). That is, there were an equal number of errors on each type of relative clause and on each type of verb. There was, however, a significant difference in the type of errors that were manifested in response to the put and push sentences. Some of the errors on the push sentences involved selection of the matrix subject as agent of the verb in the relative clause. This response, termed a structural error, was assumed to represent attachment of the relative clause to the S node as illustrated below.³⁴

(148)



None of the errors on the put sentences involved this type of response. In contrast, a common type of error was either failure to act out the relative clause or questioning of the agent of the relative clause. These errors, which were termed 'failure to attach', occurred more frequently on the put sentences than on the push sentences. Solan and Roeper's findings suggest that at four years of age children have a VP node in their grammar.³⁵ Thus, the NP-V-NP-PP sequence in the put sentences is analyzed as [_SNP+[_{VP}V+NP+PP]]. The absence of structural errors (S-attachment) and a relatively high proportion of failures to attach on the put sentences indicates knowledge that the prepositional phrase is attached to the VP (i.e. daughter adjoined). The error patterns reflect the operation of the "no tangle constraint" which blocks S-attachment in structures where it would result in lines crossing on a tree. S-attachment is not blocked in the push sentences since there is no prepositional phrase. This evidence which suggests that children have a VP, is important for the proposal that four year olds develop recursion in the VP and the object NP.

The results of Solan and Roeper's study can also be

interpreted as supporting the hypothesis that the object NP is a recursive node for four year old children. In particular, the high percentage of correct responses and the selective pattern of errors (which indicate a sensitivity to possible levels of attachment) suggest that the type of relative clauses tested by Solan and Roeper are attached to the object NP. Results reported by Goodluck and Tavakolian (1979) provide further support for this claim. In their study, four and five year olds correctly interpreted OS relatives following active and passive main clauses while they manifested object control of adverbial temporal complements following an active matrix clause and subject control of an adverbial temporal complement following a passive matrix clause.³⁶ Considering only the passive sentences, the contrast between responses to the relative clause and the adverbial temporal complement is evidence that the relative clause is correctly attached to the object NP. On the other hand, the pattern of subject control on the adverbial temporal complement following the passive matrix clause suggests that the complement is attached to a node other than the object NP.

The hypothesis that complements are attached to the VP is primarily motivated by the contrast in control patterns on complements following a matrix direct object as compared to complements following a prepositional phrase. The following section briefly reviews the arguments which were discussed in detail in section 3, this chapter.

Goodluck (1978) conducted three separate experiments investigating children's interpretation of missing complement subjects. The experiments tested children's comprehension of infinitival, adverbial temporal, and in order to complements following a variety of construction types. Table 6, summarizes the results of Goodluck's first experiment and Table 7, summarizes the results of her second experiment. For convenience, Table 9 summarizes aspects of all three of Goodluck's experiments as well as Tavakolian's results on children's interpretation of an in order to complement following a prepositional phrase.³⁷ In general, four and five year olds manifest significantly more object control responses on infinitival, in order to and adverbial temporal complements preceded by a matrix direct object than on the same complement types preceded by either a passive by phrase or a locative prepositional phrase. Thus, for children who manifest general patterns of object control, a prepositional phrase prior to the complement seems to result in a shift to subject control. This contrasting pattern of control is observed in sentences with a variety of matrix verbs which include speaking verbs such as tell, transitive action verbs such as hit, and intransitive action verbs such as stand and jump. As stated in section 1.3.2, these facts argue against semantic explanations such as the theory proposed by Maratsos (1974). The contrasting pattern of control is consistent with Goodluck's theory. Subject control of

Table 9

Percentage of Subject Control on Three Complement Types Following
Either Direct Objects or Prepositional Phrases

Direct Object Constructions				Prepositional Phrase Constructions			
				Passives		Locatives	
Ages	Adv. Temp. Complement			In Order To Complement	Infinitival Complement	Adv. Temp. Complement	In Order To Complement ^a
3	n.t.	n.t.	n.t.	n.t.	n.t.	n.t.	n.t. 79
4	45.00	66.70	45.00	56.70	86.70	86.70 80.00	67.50 90.10 92
5	60.80	63.40	59.20	63.40	91.70	83.30 61.70	80.80 90.10 96
6	67.50	n.t.	n.t.	n.t.	90.00	91.70 n.t.	85.00 n.t. n.t.
Av.	57.77	65.05	52.10	60.05	89.47	87.23 70.85	77.77 90.10 89

Source. Goodluck (1978) and Tavakolian (1977)

Note. n.t. = not tested; adv. temp. = adverbial temporal

^aData on the right-hand side of this column were reported by Tavakolian (1977).

complements following a prepositional phrase can be explained by postulating that children obey the c-command constraint. In these sentences, the constraint blocks control by the object NP regardless of whether the complement is attached to the VP or the S. (See section 3, this chapter, for a more detailed explanation.) If the constraint is assumed to be inviolable, then object control of complements following a matrix direct object implies that the complements are attached to the VP. (See section 3, this chapter.) Thus, the alternation between subject and object control of in order to, adverbial temporal, and infinitival complements provides indirect evidence of VP attachment.

In summary, subject oriented grammars constitute the initial stage in children's analysis of multiple clause sentences. This stage is followed by the development of object oriented grammars which are characterized by (1) a fully expanded VP node and (2) recursion in the VP and in the object NP. As a result, the phrase structure rules (149) and (150) are predicted to characterize object oriented grammars.

(149) VP $\longrightarrow$ V + (NP) + (PP) + (S)

(150) NP $\longrightarrow$ (DET) + N + (S)
(object)

In light of these developments, children are expected to manifest the main-clause-first strategy rather than the order-of-mention strategy in interpreting adverbial clauses.

In view of the fact that the hypothesis of VP attach-

ment is based, in part, on the assumptions of the inviolability and early operation of the c-command constraint, section 2 of chapter III outlines proposals for investigating both of these assumptions. It is important to point out that although the c-command constraint is expected to operate at the same time that children manifest object oriented grammars, it is not part of the definition of this grammar type. Object oriented grammars are defined primarily on the basis of the structural analysis which children assign to multiple clause sentences.

There are two additional issues related to characterizing object oriented grammars. One issue involves the tendency of children to select objects as controllers in cases where there is no prepositional phrase preceding the complement. As discussed in section 2.2.2 of this chapter, VP attachment means that both the subject and direct object NP are possible controllers (i.e. both NP's c-command the missing NP position). Thus, an additional rule is needed to account for the tendency to select the object (see section 2.2.2 for a discussion of this requirement). The pattern of object control is consistent with Chomsky's minimal distance principle. Thus, Chomsky's and Goodluck's theories can be reconciled by postulating that the minimal distance principle in conjunction with the c-command constraint guide children's interpretation of missing complement subjects. This hypothesis is stated as follows:

- (151) The closest c-commanding NP controls the missing NP of a complement clause

The principle proposed in (151) is consistent with both the pattern of subject control of complements preceded by prepositional phrases and with the pattern of object control of complements preceded by direct objects of active matrix clauses.

The final issue in characterizing object oriented grammars involves the question of the level of interpretation of complement subjects. Goodluck (1978) argues that missing complement subjects are interpreted prior to preposing. (See sections 2.2.4 and 3 of this chapter for a more detailed explanation.) According to this hypothesis, the same response patterns are predicted for preposed and non-preposed sentences. Goodluck's hypothesis as well as an alternative hypothesis are described in section 2.2.4 of this chapter. Section 3 of chapter III discusses a method for evaluating the two competing hypothesis.

4.3 Mixed Subject-Object Grammars. Careful inspection of Table 9 reveals that responses of younger children to adverbial temporal complements following direct objects are not uniformly object controlled. The percentages suggest mixed responses in which children are exhibiting either subject or object control. The mixed responses could be due to either (1) different response patterns exhibited by individual children or (2) a particular child exhibiting either

subject or object control on a particular construction type. In the former case, the differences in response patterns would be due to the fact that the children are at different stages in grammatical development. In the latter case, the child would be manifesting a mixed rule system. Summary data such as the percentages reported in Table 9 are not sufficient to choose between the alternative explanations.

A variety of studies have reported evidence suggesting that children develop mixed rule systems. For example, Cromer (1970) identified children manifesting a mixed rule system. These children, who Cromer classified as 'inter-mediates', manifested both subject and other responses to eager to please, easy to please, and nice to bite constructions.³⁸ Intermediate's who were presented with several sentences such as (152) would answer the question "who does the biting?" by selecting the duck on some occasions and an animal not mentioned in the sentence on other occasions.

(152) The duck is fun to bite

The important aspect of Cromer's finding is that the mixed responses developed after the primitive rule stage when the children selected only the duck. Thus, the period of mixed responses followed a stage when children manifested consistent response patterns which were incorrect in terms of adult grammar. In view of the fact that the mixed responses were followed by adult patterns, the mixed period was interpreted as reflecting alternation between a primitive rule

system and an adult rule system. Cambon and Sinclair (1974) report a similar pattern of results in that mixed responses to easy to see constructions preceded establishment of an adult pattern of responses. Chomsky (1969) reports a pattern of mixed subject and object control of infinitival complements following the matrix verbs promise and tell. Chomsky speculates that the mixed pattern of responses follows a consistent pattern of object control on both constructions and precedes establishment of an adult system in which object control is manifested on the tell sentences and subject control is manifested on the promise sentences. This finding suggests that the period of object control predicted in the present study will be followed by a period of mixed subject-object control of complement structures. This stage of development is termed mixed subject-object grammars. It is postulated that children will begin to develop correct attachment of complement structures to S nodes during this period. However, the possibility of either S or VP attachment is predicted to produce ambiguity. In other words, the child will be uncertain as to the correct level of attachment for particular complement types. This ambiguity is predicted to result in varying attachment for all complement types which in turn will produce mixed patterns of control. That is, children with mixed subject-object grammars will alternate between subject and object control on individual complement types. Results reported by Goodluck and Roeper (1978) support

the identification of a mixed subject-object stage. In their investigation of participial complements following perception and non-perception verbs, Goodluck and Roeper identified children manifesting either subject-oriented, object oriented, mixed or adult grammars. Their results suggest that individual children do manifest mixed patterns on individual construction types. Goodluck (1978) reports results which provide additional support for a stage of mixed subject-object grammars. Table 8 indicates that four and five year olds manifest consistent patterns of object control on infinitival complements following the matrix verb tell. However, six year old children manifest a sharp increase in subject control responses. This result replicates Chomsky's finding of mixed subject and object control on this construction type. Furthermore, it supports the claim that the mixed pattern of control follows a period when children manifest object control.

In summary, the present research postulates that the stage of object oriented grammars is followed by the development of mixed subject-object grammars. The latter grammar type represents a transition between (1) a primitive rule system in which recursion is limited to the VP and the object NP (viz., object oriented grammars) and (2) an adult rule system in which S, VP and both subject and object NP's are all recursive nodes. During the stage of mixed subject-object grammars, individual complements are optionally

attached to the S or the VP. Thus, children are predicted to manifest mixed patterns of subject or object control on individual construction types. It should be emphasized that the mixed patterns of control are predicted to result from variable attachment of the complement. The c-command constraint is expected to operate during this stage of development as it has in previous stages. As noted in the preceding section, a method for investigating the operation of the c-command constraint is outlined in section 2 of chapter III.

4.4 Approaching Adult and Adult Grammars. The studies which identify a mixed rule stage of development (Chomsky, 1969; Cromer, 1970; Cambon and Sinclair, 1974; and Goodluck and Roeper, 1978) report results suggesting that this stage is followed by development of an adult rule system. Chomsky (1969) identifies transitional stages for several construction types which were investigated in her study. She argues that the ages in which transitional systems appear and the length of the transitional periods vary from one construction to another. Eventually the transitional rule systems are replaced by an adult rule system. Cromer (1970) reports that the children in his study who exhibited an adult rule system (viz. the Passers) tended to be the oldest children. Although some of the older children were classified as Primitive Rule Users and Intermediates, none of the younger children manifested the adult rule system. Using the Peabody Picture Vocabulary test, Cromer (1970) found a

highly significant relation ($p < .001$) between mental age and response patterns. Children with the highest mental age manifested an adult system whereas children with the lowest mental age were the Primitive Rule Users. As mentioned in section 4.3 of this chapter, Goodluck and Roeper (1978) identified four stages in the development of the ability to interpret participial phrases following perception and non-perception verbs. The stages were termed subject oriented, object oriented, mixed and adult grammars. Goodluck and Roeper (1978) report that adult patterns of control were manifested only by the oldest children. The results are similar to Cromer's in that some of the older children manifested the more primitive grammars but none of the younger children manifested an adult system. The younger children in this case ranged in age from 3.4 to 5.3 years of age. Although a longitudinal study would provide the strongest evidence for a hypothesis concerning a particular developmental sequence, the cross-sectional studies of Chomsky (1966), Cromer (1970), and Goodluck and Roeper (1978) support the hypothesis proposed in the present research. Initially, children are expected to manifest a primitive rule system which is then replaced by a mixed rule system. This mixed rule system, which is termed mixed subject-object grammars, is predicted to be followed by development of an adult rule system.

Inspection of Tables 6 and 9 reveal a steady increase in subject control of preposed and non-preposed in

order to and adverbial temporal complements following either direct objects or prepositional phrases. These trends are postulated to represent an emerging adult rule system in which the variable attachment of individual complements (viz., mixed subject-object grammars) is replaced by correct attachment of complements and relative clauses to an S, VP or NP as required in adult grammar. Furthermore, attachment is consistent. Thus, children are predicted to have developed an adult grammar with respect to the level of attachment of complement structures and relative clauses. The c-command constraint is also expected to operate as in previous stages.

However, an additional stage, which is termed approaching adult grammars, is predicted to intervene before complete development of an adult grammar. Approaching adult grammars are distinguished from adult grammars on the basis of response patterns to sentential subject sentences.³⁹ As described in section 1.3.2 of this chapter, Tavakolian (1977) investigated young children's interpretation of sentential subject sentences such as (60) which is repeated below as (153).

(153) To kiss the lion would make the duck happy
Tavakolian (1977) reported that in sentences such as (153) children tended to pick an animal not mentioned in the sentence (an outside NP) as the controller of the missing complement subject. Tavakolian tested children ranging from 3.0 to 5.6 years of age. The children's responses were

classified as manifesting one of four possible patterns of control. Tavakolian (1977) identified the control patterns by a numbering system which reflected the NP's selected by the child to carry out the action in each clause. In sentence (153) the lion is 1; the duck, 2; and an outside NP, 3. A pattern of 21 indicates that in acting out the sentence the child made the duck kiss the lion. Therefore, the duck is the controller. A pattern of 31 means that an outside NP kisses the lion whereas a pattern of 12 means that the lion kisses the duck. The 12 pattern represents a reversal of the actors in the sentence. A fourth category was termed 'other'. An extremely small percentage of responses which could not be classified in terms of the three patterns described above, were listed in this fourth category. All adults agree that the 21 response pattern is correct. Some adults also allow the outside NP interpretation (i.e. 31 response pattern). However, the 31 response pattern is not the preferred interpretation.⁴⁰

Table 10 indicates the percentage of responses reported by Tavakolian (1977) in which children manifested one of the four possible patterns of control.

Table 10

Percentage of Types of Control Patterns Manifested
on Sentential Subject Sentences with
Missing Complement Subjects

Age	Control Patterns			
	21 Correct	31 Outside NP	12 Reversal	Other
3.0 - 3.6	29.17	50.00	16.67	4.17
4.0 - 4.6	33.33	54.17	8.33	4.17
5.0 - 5.6	12.50	79.17	4.17	4.17
Average	25.00	61.11	9.72	4.17

The developmental trend in the control patterns manifested in response to the sentential subject sentences differs from developmental trends observed on other complement types. As indicated in Table 10, there is a steady decline in the number of correct responses (21 responses) across age groups and a corresponding increase in the number of outside NP responses (31 response patterns). This developmental trend suggests that an adult analysis of sentential subject sentences may not develop at the same time as the adult analysis of other complement structures. Therefore, the stage of approaching adult grammar is predicted to intervene between the stages of mixed subject-object grammars and adult grammars. During this stage, children are predicted to manifest a consistent pattern of outside NP responses on sentential subject

sentences. In view of the fact that these sentences constitute exceptions to the c-command constraint, the pattern of outside NP responses may result from overgeneralization of the rule. Section 2.2, chapter II, outlines a method used in the present study to test the overgeneralization hypothesis.

Following the stage of approaching adult grammars children are expected to develop adult grammars. This grammar type is characterized by correct and consistent attachment of all complements and relative clauses. It is also characterized by development of knowledge of the domain of application of the c-command constraint. Therefore, children manifesting adult grammars have developed knowledge of the exceptions to the rule.

In conclusion, the research on adverbial clauses, relative clauses and missing complement subjects suggests that children go through five developmental stages in their analysis of multiple clause sentences. Initially, children analyze multiple clause sentences as conjoined independent clauses. This grammar type which is termed a subject oriented grammar is followed by development of an object oriented grammar. During this latter stage, complements are attached to the VP, while OS and OO relatives are correctly attached to the object NP. The conjoined clause analysis may be used to interpret sentences such as SS and SO relatives which are not yet analyzed by the child's grammar. The c-command constraint operates during the object oriented stage. However,

the constraint may be overgeneralized to constructions which constitute exceptions. During the next stage of development, the S node becomes a possible level of attachment for complement structures. This development is associated with ambiguity as to the proper level of attachment of individual complement types. As a result, a stage of variable and inconsistent attachment of individual complement structures develops. This third grammar type, termed mixed subject-object grammars, results in a mixture of subject and object control which is often incorrect in terms of adult grammar. The c-command constraint continues to operate as it did in previous stages. Children with mixed subject-object grammars may also overgeneralize the rule to exceptional cases. Subsequent development involves establishing the correct level of attachment of complements and all relative clauses. Infinitival complements are attached to the VP, in order to and adverbial temporal complements are attached to the S, and relative clauses are attached to both subject and object NP's. Initially, the adult rule system is not completely extended to sentential subject sentences. Thus, a stage termed approaching adult grammars intervenes between mixed subject-object and adult grammars. This intervening stage is characterized by consistent overgeneralization of the c-command constraint to sentential subject sentences. Development of knowledge of the exceptions to the c-command constraint results in the final stage termed adult grammars.

The following chapter outlines a method for testing this theory of development. In particular, it outlines a method for classifying children according to grammar type and it states specific predictions which enable evaluation of the hypothesis concerning the sequence in the development of the grammar types. In addition, the chapter outlines a method for assessing the operation of the c-command constraint in individual children.

FOOTNOTES

¹Extraposition moves embedded sentences to the end of the main clause as illustrated in (i) and (ii).

- (i) The fact that he was rude did not escape the committee.
- (ii) The fact did not escape the committee that he was rude.

Children who follow this rule assume that a sentence final relative clause modifies the subject of the main clause.

²This is based on Tavakolian's (1977) argument that while OS relatives are superficially similar to conjoined sentences, SO relatives are not. As a result, Tavakolian postulates that, with respect to SO relatives, children abandon the conjoined clause analysis and adopt an adult interpretation long before they do so with OS relatives. It should be noted, however, that Tavakolian's data did not support this claim (see Table 2).

³These results were replicated in a recent study by Hamburger and Crain (to appear).

⁴Recently, Hamburger and Crain (to appear) investigated children's interpretation of OS relatives. They report that 69 percent of the responses of three year olds were correct as compared to 19 percent reported in Tavakolian's study. In addition, the four and five year olds in Hamburger and Crain's study manifested improvement with 74 and 95 percent correct responses, respectively.

⁵This conclusion is supported by Hamburger and Crain's (to appear) results.

⁶As noted in the Introduction (see section 2, chapter I), the terms 'rule' and 'strategy' are not clearly distinguished in language acquisition research. In some cases, both terms have been used to refer to the same behavior. For example, the conjoined clause analysis is defined by Tavakolian (1977) as "a set of rules for assigning structure to a string and for interpreting missing noun phrases in the string (p. 37)". However, in a later paper, Goodluck and Tavakolian (1979) refer to the analysis as a "special parsing strategy".

Research (Fodor, Bever, and Garrett, 1974) on adult

comprehension strategies distinguishes between processing heuristics and structural aspects of the grammar. Fodor et al. (1974) suggest that strategies used in comprehension differ in form from rules used to describe knowledge of the grammar (*viz.* the set of internal representations of sentences that speakers encode and hearers recover in linguistic exchanges). There seems to be a fundamental difference between strategies used by adults and those used by children. Adults are able to recognize when a strategy results in an incorrect analysis of a sentence. In such cases an adult will re-process the sentence. Young children, on the other hand, are not able to recognize errors. Frequently, the so-called strategies seem to represent the only structural analysis that is available to the child. In view of this, it may be better to adopt a uniform terminology, such as 'interpretive rule' when referring to the manner in which children understand sentences.

However, in order to avoid confusion in reviewing previous research, the term 'strategy' will be retained in cases where it has been used in the past.

⁷See footnote 6.

⁸Recently the missing NP in sentences of this type has been represented by PRO (Chomsky and Lasnik, 1977; Chomsky, 1980a). Subject control refers to sentences in which the matrix subject NP is coreferential with PRO and object control refers to sentences in which the matrix object NP is coreferential with PRO. Chomsky (1980a) uses the term complement control instead of object control. Complement control refers to control by objects of prepositions as well as direct objects.

⁹This was originally formalized by Rosenbaum (1965) as an erasure principle governing deletion of the complement subject in the surface structure. The principle, termed the minimal distance principle (MDP), was adopted by Chomsky (1969) for describing the process of determining the controller of missing complement subjects during sentence comprehension. As described by Chomsky (1969), MDP is stated as follows: "the implicit subject of the complement verb is the NP most closely preceding it (p. 10)".

¹⁰In addition Tavakolian investigated children's interpretation of pronominal subjects in (1) parallel constructions, (2) sentential subject sentences with a 'that' complementizer, and (3) verbal complements with a 'that' complementizer. This enabled a comparison of the interpretation of missing complement subjects and pronominal coreference in children's grammar.

¹¹Tavakolian reports that children manifest similar patterns in their interpretation of missing complement subjects and pronominal subjects. Thus, she argues that children are using the same rule, the conjoined clause analysis, to determine the referent of missing complement subjects and pronominal subjects when they occur in structurally identical sentences. For example, consider the following sentences:

- (i) The sheep tells the duck to jump over the horse
- (ii) The sheep tells the duck for him to jump over the horse
- (iii) The sheep tells the duck that he should jump over the horse

Children, who use the conjoined clause analysis, analyze all three sentences as if they contained two independent conjoined clauses. The conjoined clause analysis specifies that a missing complement subject (sentence i) or a pronominal subject (sentences ii and iii) in a second clause are coreferential with the matrix subject. Thus, the conjoined clause analysis specifies that in all three sentences the subject NP, the sheep, will carry out the action indicated in the second clause.

¹²This is true for four year olds. Although five and six year olds manifest an increasing number of subject responses on (62) and (66), they continue to manifest a greater number of subject responses on (63), (64) and (65). Goodluck's theory attempts to explain the difference in the pattern of responses.

¹³Only command relations are defined in (67). This differs from Reinhart (1976) who includes both precede and command in defining the syntactic domain of a node.

¹⁴Chomsky and Lasnik (1977) expand COMP as illustrated in (i).

- (i) a. COMP $\rightarrow$ $\left\{ \begin{array}{l} + \text{ WH} \\ \text{for} \\ \emptyset \end{array} \right\}$

b. -WH is realized as that

¹⁵See footnote 14, this chapter.

¹⁶Phinney (1981) summarizes several recent theories

concerning the structure of infinitival complements.

¹⁷Following Goodluck (1978), the delta will be used to represent the missing complement subject. However, as pointed in the discussion of the syntactic structure of infinitival complements, Chomsky and Lasnik (1977) and Chomsky (1980a) represent the missing complement subject of control verbs with PRO.

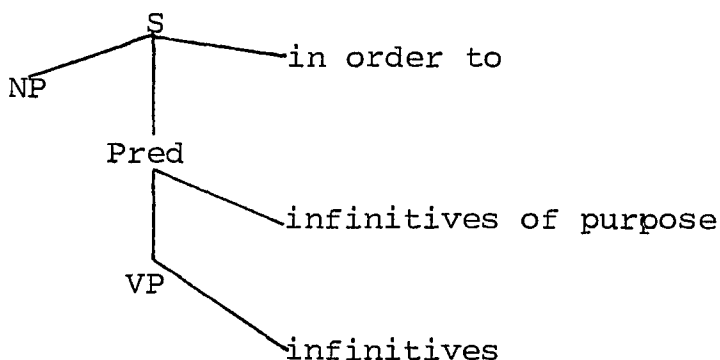
¹⁸Williams (1977) notes that purpose infinitives such as (i) may undergo preposing as illustrated in (ii).

(i) John picked Mary to get the keys

(ii) To get the keys, John picked Mary

Williams (1977) argues that purpose infinitives attach to Pred, a node which is located between the S and the VP as illustrated below.

(iii)



Goodluck (1978) correctly notes that this analysis will not allow object control if the c-command constraint is assumed to govern control. Alternatively, she argues that preposed S constituents are attached to S, whereas preposed VP constituents move into COMP. (See section 2.2.4, this chapter for further explanation of Goodluck's proposal.)

¹⁹Roeper (personal communication) points out that the c-command constraint is not sufficient to explain the differences in control in sentence(i) as compared to (ii).

(i) John was elected to bring money

(ii) The buildings were burned to collect insurance

These examples, in addition to control phenomena related to verbs such as promise suggest that lexical factors also affect control.

²⁰The passive by phrase is assumed to be generated directly in the base.

²¹Roeper (personal communication) has suggested the possibility that there may be no COMP at this stage in which case S attachment would be allowed.

²²For most speakers sentence (i) is acceptable.

(i) Who did Bill rely on to grab the keys?

In this case, the preposition on would be a constituent of the verb, and object control would not violate the c-command constraint. Fiengo (personal communication) suggests that if incorporation of the preposition into the verb were optional then the facts related to (119) and (i) as well as control phenomena would follow.

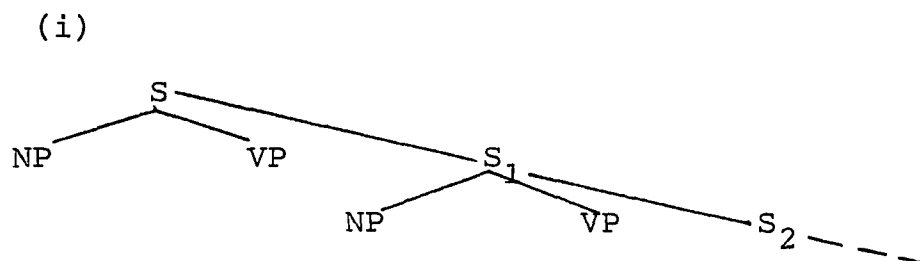
²³Goodluck (1978) compared children's interpretation of (1) adverbial temporal complements following active and passive matrix clauses and (2) OS relative clauses following active and passive matrix clauses. The children manifested a greater percentage of subject responses on temporal complements following a passive matrix clause than on temporal complements following an active matrix clause. There was no difference in the responses to the relative clause sentences. However, there was a significant difference in the percentage of subject responses on relative clauses and temporal complements following a passive matrix clause. Goodluck interpreted this contrast as evidence that, in the grammars of young children, temporal complements are not attached to the object NP, as are relative clauses, but to either the S or the VP.

²⁴As pointed out in section 1.3.2 of this chapter, Goodluck's data provides persuasive evidence against Maratsos' proposal. Thus, the theories proposed by Chomsky (1969), Tavakolian (1977), and Goodluck (1978) are considered the major competing theories.

²⁵See footnote 24 of this chapter.

²⁶The terms "subject oriented" and "object oriented" were originally introduced by Goodluck and Roeper (1978).

²⁷Solan and Roeper (1978) propose an alternative analysis in which they argue that young children assign the structure to multiple clause sentences illustrated in (i).



They term their analysis the topmost S analysis. In addition, Solan and Roeper propose that children have the phrase structure rules (ii) and (iii).

(ii) $S \rightarrow NP + VP + (S)$

(iii) $VP \rightarrow V + (NP) + (PP)$

In contrast, Tavakolian's theory implies that young children have the following phrase structure rule (iv).

(iv) $S \rightarrow S^*$

It is important to note that subject control of sentences analyzed according to the conjoined clause analysis violate the c-command constraint, whereas subject control of structures analyzed according to the topmost S analysis do not. If c-command is assumed to operate from the beginning stages of language acquisition, then the topmost S analysis would be the preferred analysis.

²⁸See footnote 27, this chapter.

²⁹The topmost S analysis (see footnote 27, this chapter) may characterize subject oriented grammars rather than the phrase structure illustrated in (140).

³⁰See footnote 10, this chapter.

³¹Using an acting-out task, Goodluck and Roeper (1978) investigated children's comprehension of participial phrases following nonperception verbs such as (i) and perception verbs such as (ii).

(i) Bozo kissed her wearing the watch

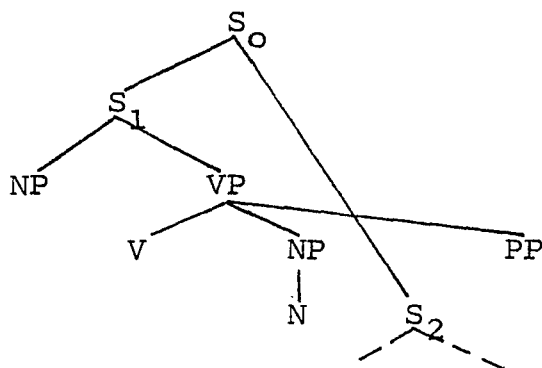
(ii) Bozo saw her carrying the basket

³²Solan and Roeper (1978) gave the children a preliminary vocabulary test to determine if they knew that put was subcategorized to take a prepositional phrase. Only those children who passed the test participated in the study.

³³The phrase marker illustrated in (147) follows from Solan and Roeper's (1978) hypothesis concerning young children's

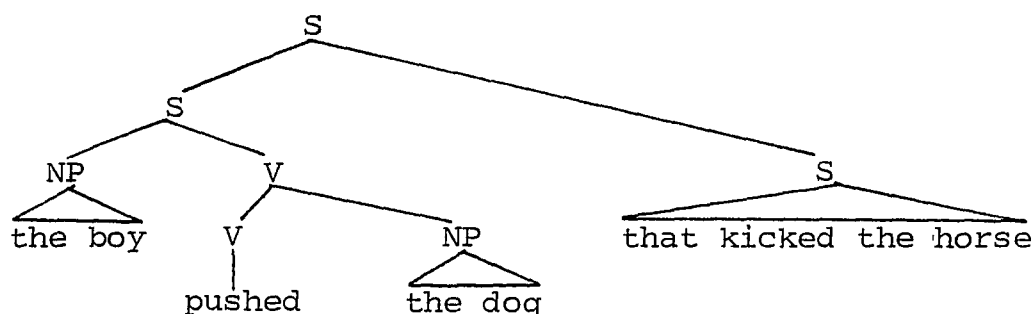
analysis of multiple clause sentences. The hypothesis, which is termed the topmost S analysis, is explained in footnote 27 of this chapter (see above). According to the conjoined clause analysis, subject responses on sentences (142) and (143) would imply the analysis illustrated in (i).

(i)



³⁴The structure illustrated in (148) follows from the topmost S analysis proposed by Solan and Roeper. (See footnote 27, above.) If the conjoined clause analysis is assumed, then subject responses on sentences (144) and (145) would imply the structural analysis illustrated in (i).

(i)



³⁵Goodluck (1978) originally made this point in her dissertation.

³⁶The relative clause research reported by Goodluck and Tavakolian (1979) was originally reported in Goodluck (1978). See also footnote 24, this chapter.

³⁷Experiment III reports the research comparing performance on complements and relative clauses which is also reported in Goodluck and Tavakolian (1979).

³⁸The term, 'other responses', refers to selection of an animal not mentioned in the sentence as the agent of the verb. In sentence (i), for example, an NP not mentioned in the sentence is doing the "seeing".

(i) The doll is easy to see

³⁹A pilot study revealed that there seemed to be a group of children who interpreted all complement structures correctly but manifested a uniform pattern of selecting an outside NP on the sentential subject sentences.

⁴⁰In a pilot study of eleven college students there was only one outside NP response out of a total of 66 responses.

CHAPTER III

THE PRESENT EXPERIMENT

The present experiment was designed to investigate (1) the rules that children use to identify the controller of missing complement subjects and (2) the structural analysis that children assign to multiple clause sentences. As outlined in the conclusion of chapter II, children were expected to manifest five developmental stages in their analyses of multiple clause sentences. These stages were described in terms of five grammar types (1) subject oriented, (2) object oriented, (3) mixed subject-object grammars, (4) approaching adult, and (5) adult grammars. The five grammar types were predicted to develop in the following order: (1), (2), (3), (4), and (5). It was further postulated that children obey the c-command constraint in determining the controllers of missing complement subjects. (See sections 2 and 3 of chapter II for an explanation of this principle.) The principle was predicted to begin to operate during the period when children manifest either object-oriented or mixed subject-object grammars. (See section 4 of chapter II.)

The purpose of this chapter is to describe the experimental design used to investigate the hypotheses outlined in the preceding paragraph. The chapter describes a method for classifying children according to grammar type which

uses response patterns manifested on a variety of construction types. Section 1 of this chapter lists the construction types that were used for classification and the response patterns which were expected to be associated with each grammar type.

The present experiment also investigated several issues concerning the manner in which the c-command constraint operates in children's grammars. In particular, the study evaluated hypotheses concerning (1) immediate versus delayed operation, (2) overgeneralization, and (3) inviolability of the constraint. Section 2 of this chapter outlines the methods used to investigate these issues. It also describes a system for assessing the degree of operation of the c-command constraint in children's grammar.

Section 3 outlines (1) two alternative hypotheses concerning the level of interpretation of missing complement subjects and (2) a method for choosing between the competing theories. Section 4 describes a method used to assess the reliability of children's response patterns. In addition, this section evaluates whether the reliability of children's response patterns is related to grammar type.

Chapter IV provides a detailed explanation of the materials and procedures used in the present experiment. However, in order to describe the design of the present experiment, it is necessary to summarize these procedures. The study involved four separate interviews. Thus, each child

participating in the study was seen individually on four separate occasions. The first interview was devoted to collection of a spontaneous language sample, which was later transcribed and analyzed using the Developmental Sentence Scoring (DSS) procedure developed by Laura Lee (1974). The DSS scores were considered to be measures of the child's general level of language development. The second and third interviews involved presentation of a comprehension task. The sentences presented during these two interviews constituted the main part of the study. Thus, the second and third interviews are referred to as the main comprehension task. During this part of the experiment, each child was presented with a set of small animals and asked to act out a total of forty-five sentences. Twenty-two sentences were presented in the second interview and the remaining twenty-three sentences were presented in the third interview. The construction types included in the main comprehension task (the second and third interviews) were used to (1) classify children according to grammar type and (2) identify children who obey the c-command constraint. The fourth interview of the experiment involved a comprehension task and a judgment task. This second comprehension task also required each child to act out sentences by manipulating small animals. The judgment task required each child to identify semantically deviant sentences. The judgments were indicated as follows: (1) unacceptable sentences were identified as "silly", and

(2) acceptable sentences were identified as "good" and/or acted out by the child.

1. The Five Grammar Types

1.1 The Constructions Tested: The Main Comprehension Task.

The construction types that were used in the main comprehension task (the second and third interviews) are listed in (1). There were a total of fifteen construction types. (See Appendices A and B for a list of the experimental sentences, and Appendix F for a list of the vocabulary used in constructing the experimental sentences.)

(1)

- I. Infinitival Complements following matrix verbs such as
 - A. Tell + Direct Object
 1. The lion tells the bear to climb up the ladder
 - B. Promise + Direct Object
 1. The lion promises the bear to climb up the ladder
- II. Non Preposed Adverbial Temporal Complements preceded by
 - A. Direct Object
 1. The lion hits the bear after climbing up the ladder
 - B. Locative Prepositional Phrases involving near, around, and over
 1. The lion stands near the bear after climbing up the ladder
 - C. Directional Prepositional Phrases involving on and at
 1. The lion hits at the bear after climbing up the ladder

- D. Passive by phrase
 - 1. The lion is hit by the bear after climbing up the ladder
- III. Non Preposed in order to complement preceded by
 - A. Direct Object
 - 1. The lion hits the bear in order to climb up the ladder
 - B. Locative Prepositional Phrases involving near, around, and over
 - 1. The lion stands near the bear in order to climb up the ladder
 - C. Directional Prepositional Phrases involving on and at
 - 1. The lion hits at the bear in order to climb up the ladder
- IV. Preposed Complements preceding a matrix clause containing a direct object
 - A. Preposed Temporal Complement
 - 1. After climbing up the ladder the lion hits the bear
 - B. Preposed in order to complement
 - 1. In order to climb up the ladder the lion hits the bear
- V. Sentential Subject Sentences
 - A. Infinitival
 - 1. To have to hit the lion scares the bear
 - B. Participial
 - 1. Hitting the lion scares the bear
- VI. Relative Clauses
 - A. Object-Subject
 - 1. The lion hits the bear that is climbing up the ladder
- VII. Dative PP Sentences
 - 1. The lion yells at the bear to climb up the ladder

1.2 Response Patterns Associated with the Five Grammar Types.

The principle purpose of the main comprehension task was to classify children according to (1) grammar type and (2) the

extent of operation of the c-command constraint. Previous research and theoretical considerations guided selection of the construction types used in the main comprehension task. Figure 1 summarizes the response patterns that were predicted to be associated with each grammar type. The predicted response patterns follow from the characterization of each grammar type as described in section 4 of chapter II. In order to clarify the following discussion of the response patterns, the characteristics of each grammar type will be briefly reviewed.

Subject oriented grammars are characterized by use of the conjoined clause analysis. Thus, complements and relative clauses are attached to the topmost S. In addition, a rule specifies that the first NP is (1) the controller of missing complement subjects or (2) the antecedent of relative pronouns. Object oriented grammars are characterized by attachment of complements to the VP and attachment of sentence final relative clauses to the object NP. The c-command constraint may begin to operate during this period. An additional rule such as the minimal distance principle specifies object control of complements in which either the subject or object NP c-commands the missing subject position. Mixed subject-object grammars are characterized by variable attachment of individual complements and relative clauses to either the S, VP or object NP. These attachments are often incorrect in terms of adult grammar. The c-command

Figure 1. Summary of Predicted Response Patterns for the Main Comprehension Task

Construction Types	Predictions				
	Grammar Type				Adult
	Subject Oriented	Object Oriented ^a	Mixed S-O ^a	Approach. Adult	
I. Infinitival Complements					
A. <u>Tell</u> + Direct Object					
1. The lion tells the bear to climb up the ladder	S	O	M	O	O
B. <u>Promise</u> + Direct Object					
2. The lion promises the bear to climb up the ladder	S	O	M	M	S
II. Non-Preposed Adverbial Temporal Complements preceded by:					
A. Direct Object*					
3. The lion hits the bear after climbing up the ladder	S	O	M	S	S
B. Locative Prepositional Phrase					
4. The lion stands near the bear after climbing up the ladder	S	O/S	M/S	S	S
C. Directional Prepositional Phrase*					
5. The lion hits at the bear after climbing up the ladder	S	O/S	M/S	S	S
D. Passive <u>by</u> Phrase					
6. The lion is hit by the bear after climbing up the ladder	S	O/S	M/S	S	S

Figure 1. Continued

Construction Types		Predictions				
		Grammar Type				Adult
		Subject Oriented	Object Oriented	Mixed S-O	Approach. Adult	
III.	Non-Preposed <u>in order to</u> Complements preceded by:					
	A. Direct Object*					
	7. The lion hits the bear in order to climb up the ladder	S	O	M	S	S
	B. Locative Prepositional Phrase					
	8. The lion stands near the bear in order to climb up the ladder	S	O/S	M/S	S	S
	C. Directional Prepositional Phrase*					
	9. The lion hits at the bear in order to climb up the ladder	S	O/S	M/S	S	S
IV.	Preposed Complements					
	A. Preposed Temporal Complement*					
	10. After climbing up the ladder the lion hits the bear	S	O	M	S	S
	B. Preposed <u>in order to</u> Complement*					
	11. In order to climb up the ladder the lion hits the bear	S	O	M	S	S

Figure 1. Continued

Construction Types	Predictions				
	Grammar Types				
	Subject Oriented	Object Oriented	Mixed S-O	Approach. Adult	Adult
V. Sentential Subject Sentences					
A. Infinitival*					
12. To have to hit the lion scares the bear	M ^C	NP ₂ /ONP	NP ₂ /ONP	ONP	NP ₂
B. Participial*					
13. Hitting the lion scares the bear	M ^C	NP ₂ /ONP	NP ₂ /ONP	ONP	NP ₂
VI. Object-Subject Relative Clauses*					
14. The lion hits the bear that is climbing up the ladder	S	O	M	O	O
VII. Dative PP Sentences*					
15. The lion yells at the bear to climb up the ladder	S	O ^b	M/S	O ^b	O

Note. S = subject control; O = object control; M = mixed subject and object control; ONP = control by a noun not mentioned in the sentence; NP₂ = second noun in the sentence; * = constructions used to classify children according to grammar type

^aThe development of the c-command constraint may occur in children manifesting these grammar types. Slash marks indicate two alternative patterns. Responses indicated on the left of the slash marks are for children who have not developed the constraint. Responses indicated on the right of the slash marks are for children who have developed the constraint.

^bThese response patterns may be associated with a small percentage of subject responses due to overgeneralization of the c-command constraint.

^cMixed control may include ONP responses.

constraint either begins to operate or continues to operate as it did in object oriented grammars. Approaching adult or adult grammars are characterized by correct attachment of complements and relative clauses to either the S, VP or subject and object NP's. However, approaching adult grammars differ from adult grammars in that the c-command constraint may be consistently overgeneralized to sentential subject sentences. Adult grammars, on the other hand, are characterized by knowledge of the exceptions to the c-command constraint.

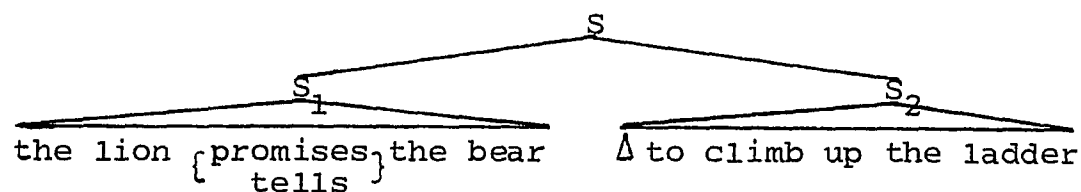
1.2.1 Infinitival Complements Following the Matrix Verbs 'tell' and 'promise'. Previous research (Chomsky, 1969; Maratsos, 1974; Tavakolian, 1977; and Goodluck, 1978) suggested that the tell (I-A) and promise sentences (I-B) would yield response patterns which differentiate between four of the five grammar types. It follows from the characteristics of the conjoined clause analysis, that subject oriented grammars should be associated with patterns of subject control on both of these construction types. Object oriented grammars, on the other hand, should be associated with patterns of object control. This follows from attachment of the complement to the VP, and operation of the minimal distance principle either alone or in conjunction with the c-command constraint. Mixed subject-object grammars are expected to be associated with mixed patterns of control due to variable attachment of the complement structures.

Chomsky (1969) reports that children manifest contrasting patterns of object control on tell sentences and mixed control on promise sentences. She speculates that this pattern follows a period when children manifest mixed control on both construction types. In view of Chomsky's findings, the pattern of object control of tell sentences and mixed control of promise sentences is expected to be associated with approaching adult grammars. Object control of the tell sentences is consistent with the fact that this grammar type is characterized by correct attachment of infinitival complements and operation of the c-command constraint in conjunction with the minimal distance principle. Mixed control on the promise sentences reflects beginning development of knowledge that promise is an exception to the class of speaking verbs. Knowledge of the exceptional status of promise is expected to be fully developed in adult grammars. Thus, adult grammars are expected to be associated with object control of tell sentences and subject control of promise sentences. Figure 2 illustrates the structural analyses of constructions I-A and I-B for the five grammar types.

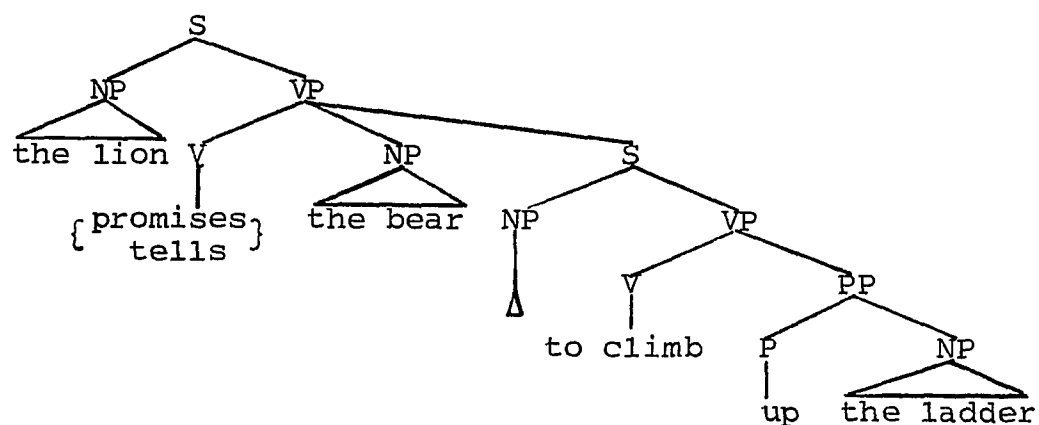
1.2.2 Adverbial Temporal Complements and 'In Order To' Complements. Evidence reported by Maratsos (1974), Goodluck (1978), and Tavakolian (1977) suggests that adverbial temporal complements such as II-A, II-B, II-D, and IV-A, and in order to complements such as III-A, III-B, and IV-B would yield response patterns enabling classification of children

Figure 2. Structural Analyses of the Promise and Tell Constructions for the Five Grammar Types

Subject Oriented Grammars



Object Oriented Grammars



Mixed Subject-Object Grammars

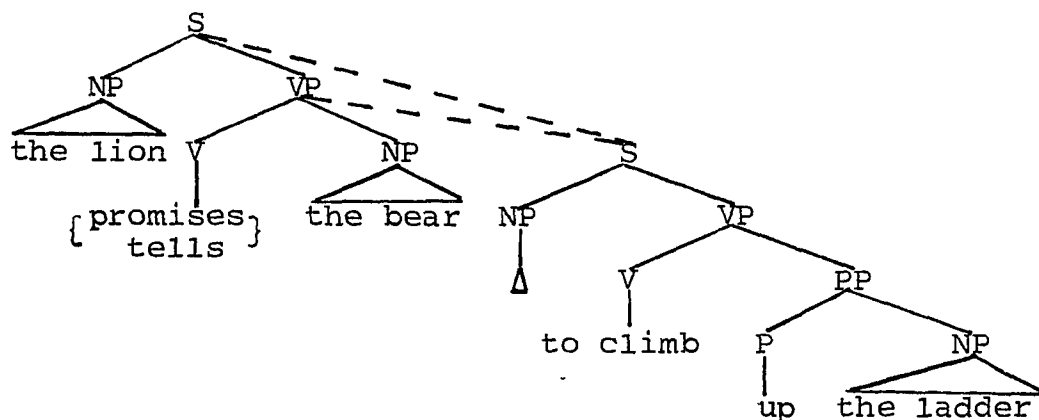
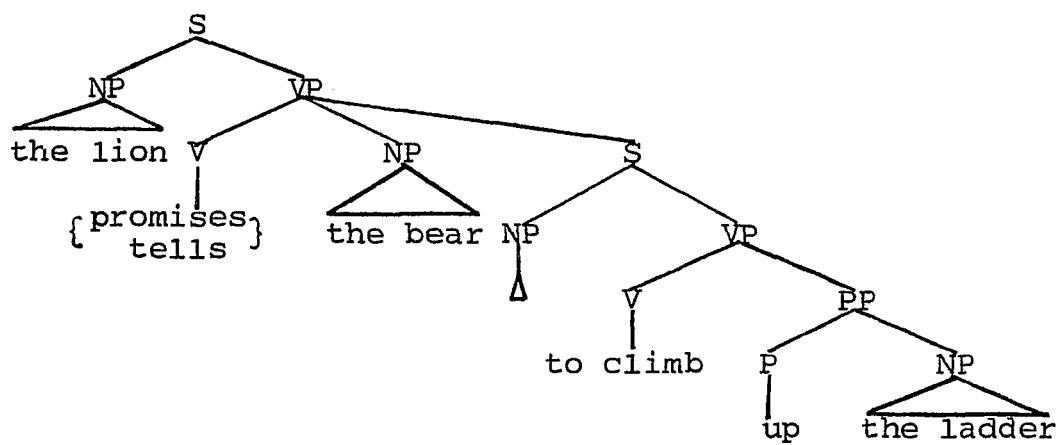


Figure 2. Continued

Approaching Adult and Adult Grammars

according to (1) grammar type, and (2) extent of operation of the c-command constraint. Both adverbial temporal complements and in order to complements were included in the main comprehension task in order to test the generality of children's response patterns. This contrasts with Goodluck's (1978) research in which the two types of complements were tested on separate populations. It also contrasts with Tavakolian's work which included only one type of in order to complement.

In the present experiment, both adverbial temporal and in order to complements occur in four construction patterns: (1) a non-preposed complement preceded by a direct object (II-A and III-A); (2) a non-preposed complement preceded by a locative prepositional phrase (II-B and III-B); (3) a non-preposed complement preceded by a directional prepositional phrase involving on or at (II-C and III-C); and (4) a preposed complement (IV-A and IV-B). In addition, the main comprehension task included a non-preposed adverbial temporal complement following a passive matrix clause (II-D).

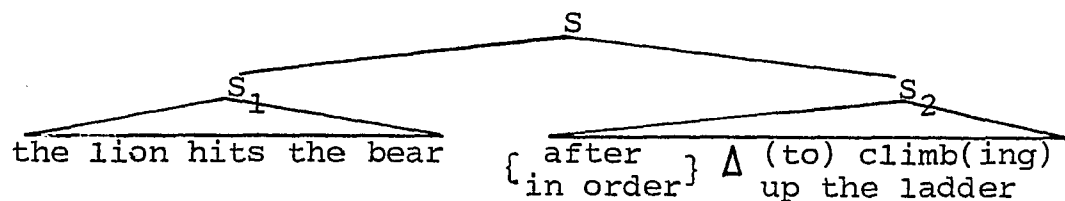
The non-preposed complement constructions II-A and III-A are expected to be associated with distinctive response patterns for object oriented and mixed subject object grammars as compared to subject oriented, approaching adult, and adult grammars. The latter three grammar types are associated with subject control. With respect to subject oriented grammars, the pattern results from operation

of the conjoined clause analysis. On the other hand, approaching adult and adult grammars are associated with subject control due to attachment of the complement to the S and operation of the c-command constraint. In contrast, object oriented grammars are expected to be associated with object control due to attachment of the complement to the VP and the minimal distance principle. This pattern is expected regardless of whether the c-command constraint has become operational. Mixed patterns of control are expected to be associated with mixed subject-object grammars due to variable attachment of the complement in conjunction with the c-command constraint and/or the minimal distance principle. Figure 3 summarizes the structural analyses of constructions II-A and III-A for the five grammar types.

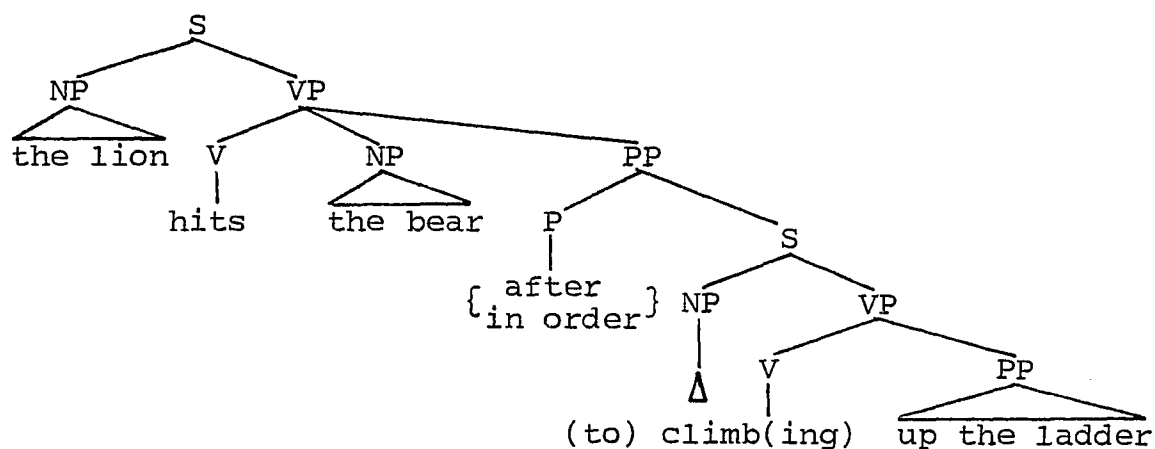
The response patterns for the preposed complements (IV-A and IV-B) are expected to be the same as those for the non-preposed complements following matrix direct objects (II-A and III-A). This hypothesis is based on Goodluck's theory that the interpretation of missing complement subjects occurs prior to preposing. (See sections 2.2.4 and 3, chapter II for a discussion.) If interpretation is assumed to occur prior to preposing, then it must occur at levels similar to the non-preposed structures illustrated in Figure 3. This is supported by Goodluck's finding that four, five, and six year old children seem to manifest similar patterns of control on both preposed and non-preposed

Figure 3. Structural Analyses of the Non-Preposed Complements II-A and III-A for the Five Grammar Types

Subject Oriented Grammars



Object Oriented Grammars



Mixed Subject-Object Grammars

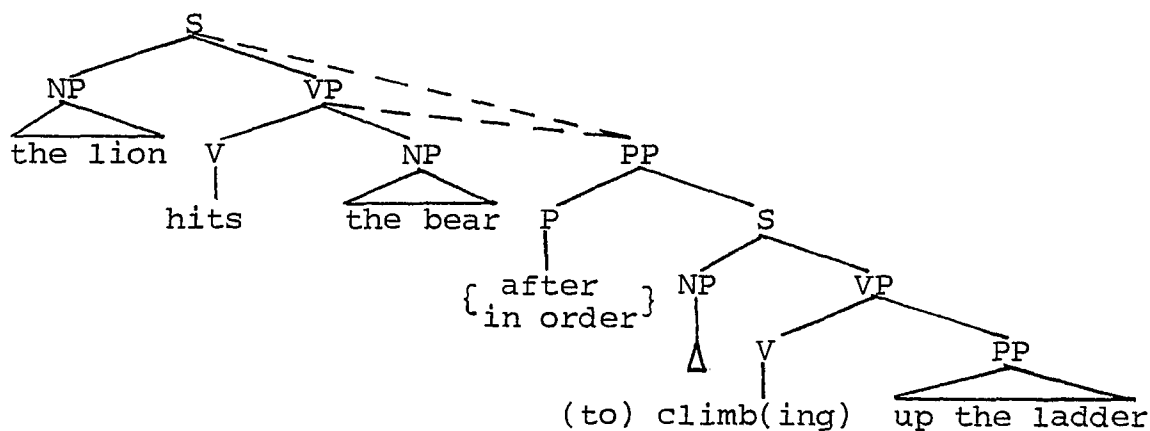
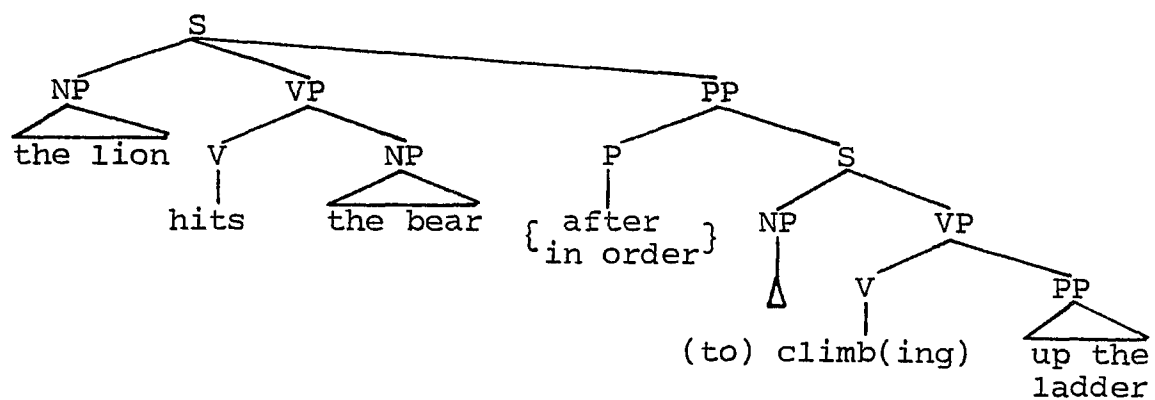


Figure 3. Continued

Approaching Adult and Adult Grammars

adverbial temporal complements following matrix clause direct objects (see Table 6, page 80). In addition, response patterns to both construction types differed significantly from response patterns to non-preposed complements following prepositional phrases. Thus, with respect to all five grammar types, the response patterns expected for the non-preposed constructions II-A and III-A are also expected for the preposed constructions IV-A and IV-B. (See section 3, of this chapter, for a description of the method for evaluating Goodluck's theory that interpretation of missing complement subjects occurs prior to preposing.)

Non-preposed complements following prepositional phrases (II-B, II-C, II-D, III-B, and III-C) were included in the main comprehension task to evaluate hypotheses concerning the operation of the c-command constraint. Constructions II-B and III-B contain prepositional phrases involving the locative words near, over, and around. As outlined in section 2.1.1 of this chapter, these constructions were used in the present experiment to assess the initial operation of the c-command constraint. Constructions II-C and III-C contain prepositional phrases involving the words on and at. These constructions were used to assess the generality of the c-command constraint (see section 2.1.3 of this chapter). In addition, constructions II-C and III-C provide an important control for semantic differences related to transitive and intransitive verbs. This is due to the fact that II-C and

III-C (sentence 2) contain the same transitive verbs as II-A and III-A (sentence 3).

Adverbial temporal and 'in order to' complements preceded by a prepositional phrase (II-C and III-C)

- (2) The lion hits at the bear { ^{after}
(ing) up the ladder _{in order} } (to) climb

Adverbial temporal and 'in order to' complements preceded by a direct object (II-A and III-A)

- (3) The lion hits the bear { ^{after}
up the ladder _{in order} } (to) climb(ing)

Thus, constructions II-C and III-C differ from II-A and III-A only with respect to inclusion of the prepositions on and at. The hypothesis that children obey c-command predicts that response patterns will differ despite similarities in the matrix verbs. Construction II-D involves a passive by phrase which provides a further test of the generality of the c-command constraint.

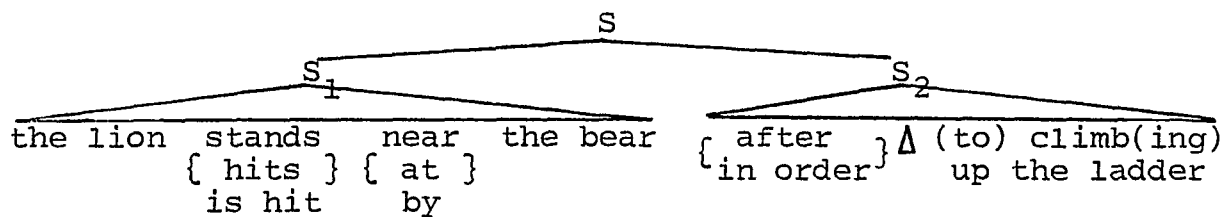
The c-command constraint is expected to become operational during the periods when children manifest object oriented and mixed subject-object grammars. The delayed operation hypothesis (i.e. the hypothesis that the constraint may not apply uniformly across all constructions from the beginning) results in two possible response patterns for each of these grammar types. (See section 2.1, this chapter for a discussion of the delayed operation hypothesis.) Object oriented grammars in which the c-command constraint is not operational are expected to be associated with object control responses on II-B, II-C, II-D, III-B, and III-C, due to

attachment of the complement to the VP and operation of the minimal distance principle. However, if the c-command constraint becomes operational, then the response patterns are expected to shift to subject control. Sections 2.2.3, 3, and 4 of chapter II argue that the c-command constraint results in subject control of complements following prepositional phrases regardless of the level of attachment of the complement. The two patterns expected for mixed subject-object grammars are (1) mixed control (if the c-command constraint is not operational), or (2) subject control (if the constraint is operational). The pattern of mixed control results from operation of the minimal distance principle and variable attachment of the complement to the S or VP.

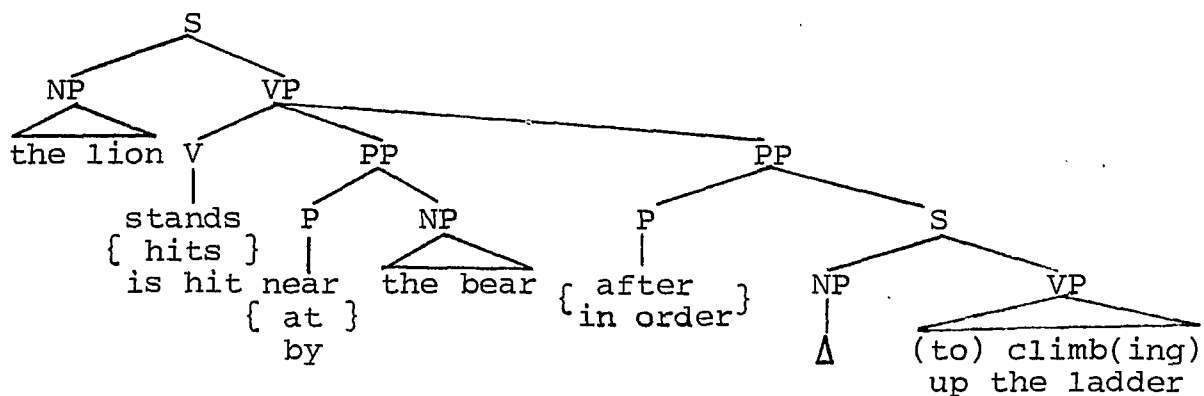
Subject oriented, approaching adult and adult grammars are expected to be associated with subject control on II-B, II-C, II-D, III-B, and III-C. In the case of subject oriented grammars, the response pattern reflects operation of the conjoined clause analysis; whereas, in the case of approaching adult and adult grammars, the response pattern reflects correct attachment of the complements to the S and operation of the c-command constraint. Figure 4 summarizes the structural analyses of Constructions II-B, II-C, II-D, III-B, and III-C, for the five grammar types.

Figure 4. Structural Analyses of Non-Preposed Complements
II-B, II-C, II-D, III-B, and III-C for the Five
Grammar Types

Subject Oriented Grammars



Object Oriented Grammars



Mixed Subject-Object Grammars

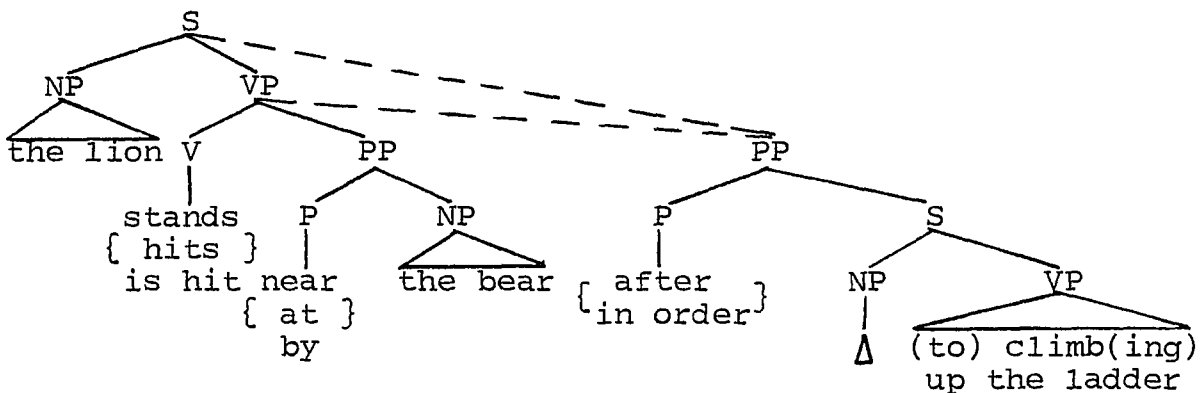
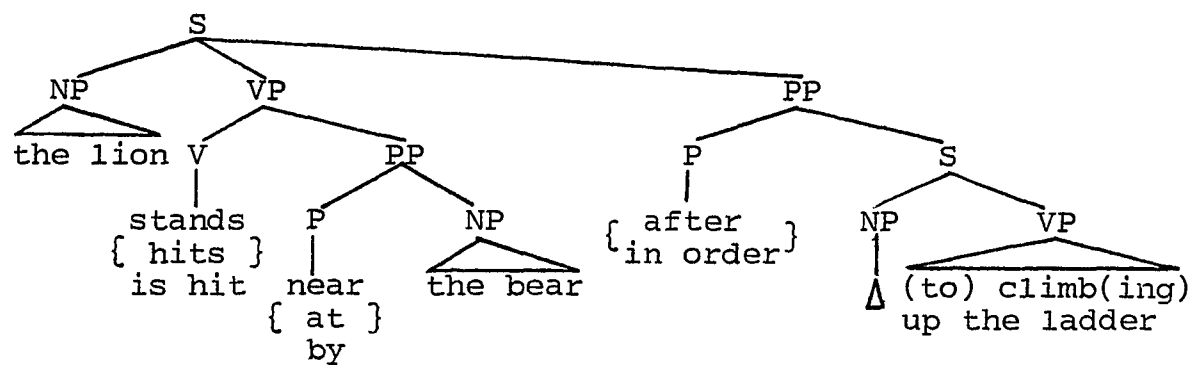


Figure 4. Continued

Approaching Adult and Adult Grammars

1.2.3 Sentential Subject Sentences. Sentential subject sentences such as (4) and (5) were also included in the main comprehension task.

(4) To have to hit the lion scares the bear

(5) Hitting the lion scares the bear

These sentences were used to evaluate the hypothesis that the c-command constraint is overgeneralized to exceptional cases. (See section 2.2, this chapter for a discussion of this hypothesis and the methods of evaluation.)

Tavakolian (1977) investigated children's interpretation of sentential subject sentences such as (6). (See also section 4.4, chapter II.)

(6) To kiss the lion would make the duck happy

Tavakolian reports that children selected an animal not mentioned in the sentence as the controller of the complement clause. These responses will be termed outside NP responses (ONP). Overall, sixty-one percent of the responses involved selection of an outside NP. With respect to individual age groups, three, four, and five year old children manifested 50, 54, and 79 percent ONP responses, respectively. (See also Table 10.)

Based on Tavakolian's results, subject oriented children are expected to manifest mixed responses which include selection of an outside NP. These children are expected to be the youngest age group in the present study. Therefore, they should be similar to the youngest children

tested by Tavakolian. The increase in ONP responses across age groups, which was observed by Tavakolian, is also expected in the present study. However, ONP responses in older children are postulated to result from overgeneralization of the c-command constraint (see section 2.2, this chapter for a discussion). The hypothesis of overgeneralization in conjunction with the delayed operation hypothesis results in two alternative response patterns for children with object oriented and mixed subject-object grammars. Overgeneralization predicts ONP responses in cases where the c-command constraint is operational. However, the delayed operation hypothesis predicts that for some of the object oriented and mixed subject-object children the c-command constraint may not be operational (see section 2.1, this chapter). These children are expected to manifest control by the second noun in the sentence. For example, in (7) these children should select the bear as the subject of the complement.

	NP ₁		NP ₂
(7)	{To have to hit Hitting	}	the lion scares the bear

This latter prediction follows from Tavakolian's finding that children are able to identify the first NP in sentence (6) as the object of the embedded verb. In view of this finding, it seems unlikely that children would select NP₁ as the controller of the complement in (7).

Pilot work revealed that approaching adult grammars are distinguished from adult grammars primarily in terms of the response patterns to sentential subject sentences. This is consistent with the trend of increasing ONP responses among older children which is suggested by Tavakolian's data. Thus, ONP response are expected to be associated with approaching adult grammars whereas selection of NP₂ is expected to be characteristic of adult grammars.

1.2.4 OS Relative Clauses. The main comprehension task also included object-subject relative clauses. Previous research (Tavakolian, 1977; Goodluck, 1978; Tavakolian and Goodluck, 1979; and Solan and Roeper, 1978) suggests that these sentence types would differentiate between the five grammar types. Subject oriented grammars are expected to be associated with selection of the subject noun as the relativized NP due to the conjoined clause analysis. (See section 1.1.2, and 4.1 of chapter II, for a summary of the data which support this hypothesis). In contrast, object oriented grammars are expected to be associated with selection of the object noun phrase as the relativized NP. This response pattern is due to attachment of the relative clause to the object NP. (See section 4.2, chapter II for a discussion of the data supporting this claim.) Mixed subject-object grammars are expected to be associated with selection of either the subject or object noun phrase as the relativized noun. This prediction is supported by Tavakolian and Goodluck's

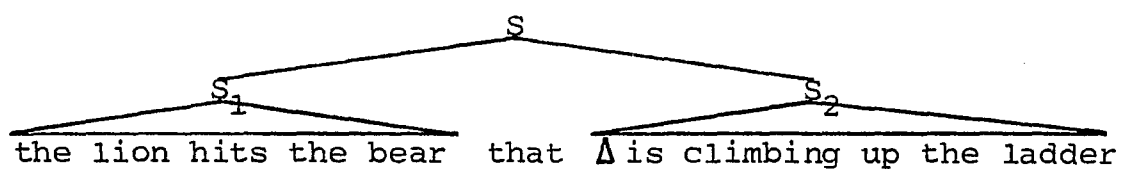
(1979) results in which five year olds manifested mixed patterns of subject and object responses on sentences of this type. These results suggest that mixed subject-object grammars may be characterized by variable attachment of both complement and relative clause structures.

Section 1.1.2, chapter II, reports data which shows that OS relatives are among the first relative clause structures to be interpreted correctly (see Table 2). In particular, de Villiers et al. (1979) report that among older children, 75 percent of the responses to OS relatives are correct. Based on these findings, approaching adult and adult grammars are expected to be associated with correct selection of the direct object in the main clause as the relativized NP. Figure 5 summarizes the structural analysis of OS relatives which are expected for each grammar type.

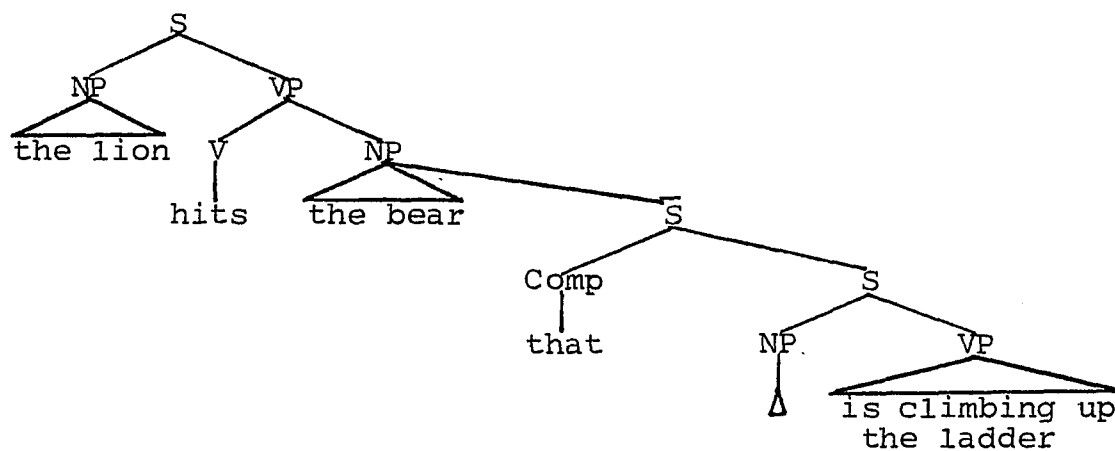
1.2.5 Dative PP Sentences. The final construction type included in the main comprehension task is dative PP sentences. Subject oriented grammars are expected to be associated with subject control due to the conjoined clause analysis. This hypothesis is supported by data reported by Tavakolian (1977) in which three year old children manifested 46 percent subject responses on constructions of this type. Tavakolian termed these constructions verbal complements and considered them to be tokens of tell sentences. Since she did not report separate data for the two sentence types, the results for the tell sentences are assumed to reflect response

Figure 5. Structural Analyses of OS Relative Clause Constructions for the Five Grammar Types

Subject Oriented Grammars



Object Oriented Grammars



Mixed Subject-Object Grammars

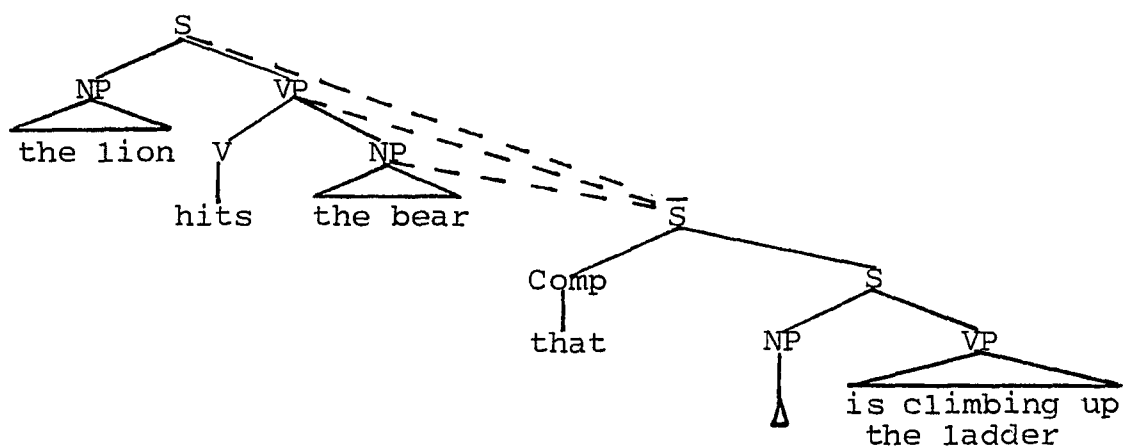
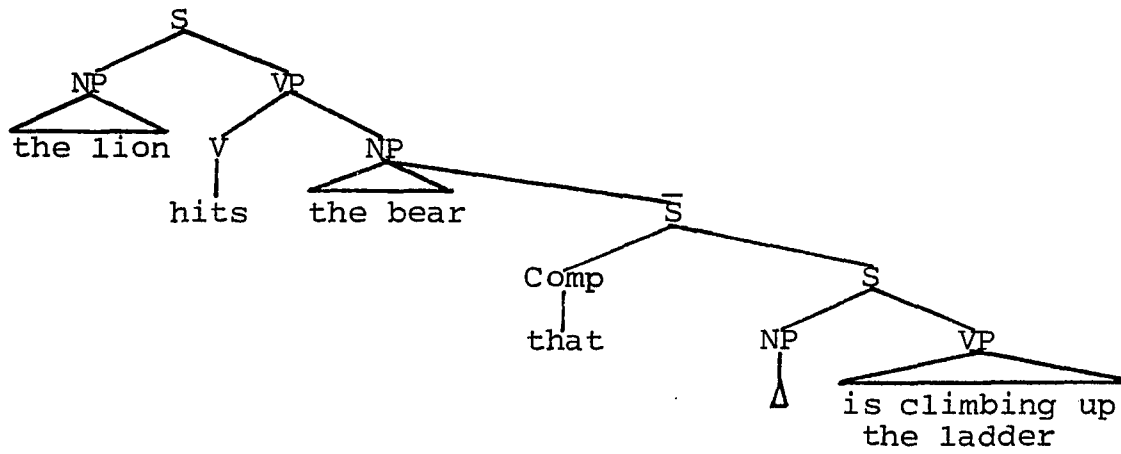


Figure 5. Continued

Approaching Adult and Adult Grammars

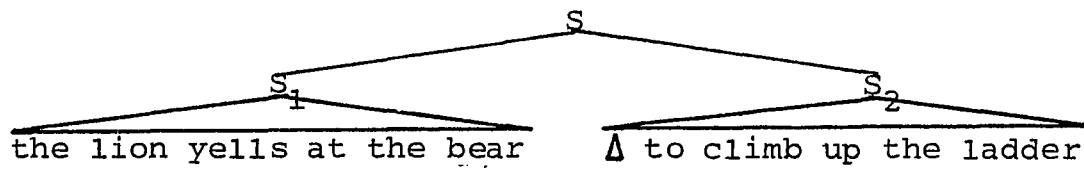
patterns to the dative PP constructions.

The response patterns expected for subject oriented grammar differ from those expected for the remaining four grammar types. Mixed control is expected for mixed subject-object grammars, due to variable attachment of the complement. In contrast, object control is expected to be the predominate response patterns associated with object oriented, approaching adult, and adult grammars. As illustrated in Figure 6, all three grammar types attach the complement to the VP. Object oriented grammars in which the c-command constraint is not yet operational are associated with object control due to the minimal distance principle. Once the c-command constraint becomes operational, children may manifest errors due to the fact that dative sentences constitute exceptions to the rule. Thus, object oriented and approaching adult grammars may be associated with occasional errors in which the subject is selected as the controller. This prediction results from the overgeneralization hypothesis which is explained in detail in section 2.2 of this chapter. In general, Tavakolian's data suggest that these errors constitute a small percentage of the responses of older children. Thus, object control is expected to be the predominate pattern for both approaching adult and adult grammars.

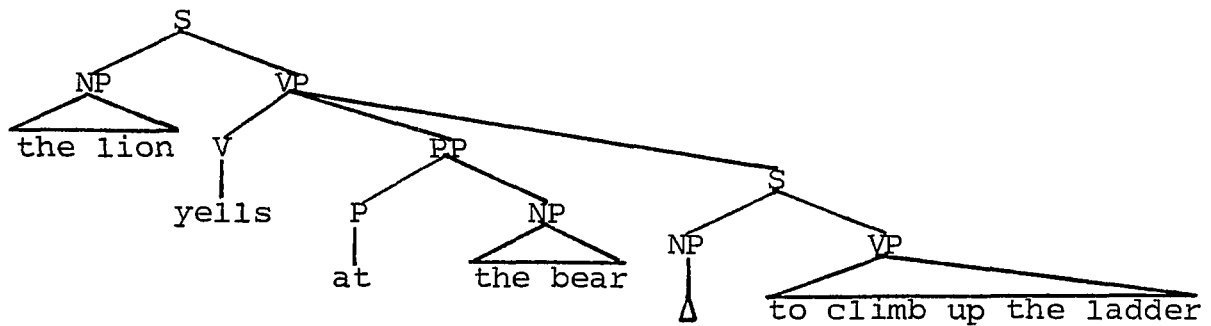
1.3 Classifying Children According to Grammar Type. As illustrated in Figure 1, each grammar type is associated with

Figure 6. Structural Analyses of Dative PP Constructions for the Five Grammar Types

Subject Oriented Grammars



Object Oriented Grammars



Mixed Subject-Object Grammars

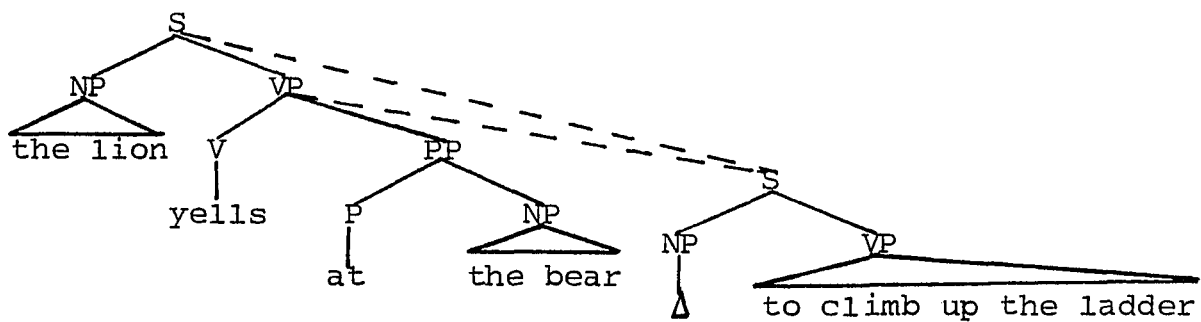
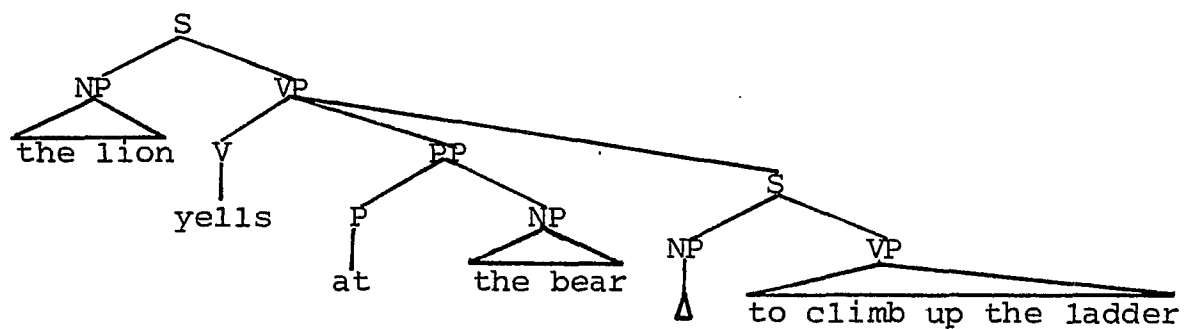


Figure 6. Continued

Approaching Adult and Adult Grammars

a distinct pattern of responses on the fifteen construction types. For example, subject oriented grammars are associated with a pattern of subject responses on all fifteen construction types, whereas object oriented grammars are associated with a pattern of object responses. These response patterns were used to classify each child according to grammar type.

The following sections outline the criteria for classification of subjects according to grammar type. The criteria were defined in terms of the percentage of either subject, object, or outside NP responses. The classification system was intended to identify children who manifested consistent response patterns. In most cases, consistency was operationally defined as at least 75 percent of the responses being of the same type. However, in the case of adult grammars, a criterion score of 80 percent was imposed. This was based on the assumption that highly consistent response patterns characterize adult grammar.

1.3.1 Subject Oriented Grammars. As indicated in Figure 1, subject oriented grammars are associated with a pattern of subject control on the following construction types:

(8)

<u>Construction Type</u>	<u>Example</u>
II-A	The lion hits the bear after crawling under the table
II-C	The lion hits at the bear after crawling under the table

<u>Construction Type</u>	<u>Example</u>
III-A	The lion hits the bear in order to crawl under the table
III-C	The lion hits at the bear in order to crawl under the table
IV-A	After crawling under the table the lion hits the bear
IV-B	In order to crawl under the table the lion hits the bear

This set of constructions was used to classify children as manifesting subject oriented grammars. The percentage of subject responses on these constructions, which was computed for each child in the study, was termed the critical subject control score. As stated in section 1.2 of this chapter, subject control is predicted to result from operation of the conjoined clause analysis. Consistent use of this analysis was operationally defined as a critical subject control score of at least 75%. There were three tokens of each of the eight construction types listed in (8). Thus, there were a total of 18 possible subject responses. A child who obtained a critical subject control score of 75% or greater exhibited at least 13 subject responses. This response pattern constituted the first criterion for classification of a child as manifesting a subject oriented grammar.

Children with approaching adult and adult grammars, were predicted to manifest the same response patterns on the constructions listed in (8). Thus, a second criterion

was used to identify children with subject oriented grammars. The second criterion involved the percentage of subject responses on constructions VI and VII. These constructions are repeated in (9) for convenience.

(9)

<u>Construction Type</u>	<u>Example</u>
VI	The lion hits the bear that is crawling under the table
VII	The lion yells at the bear to crawl under the table

The constructions in (9) differentiate between children with subject oriented grammars and those with either approaching adult or adult grammars due to the fact that the former grammar type is associated with subject control whereas the latter grammar types are associated with object control.

There were 3 tokens of each construction in (9) which yielded a total of 6 possible subject responses. Due to the small number of sentences, a consistent response pattern was operationally defined as at least 50 percent subject responses. This translated into 3 or more subject responses on the two constructions. In summary, children who were classified as manifesting subject oriented grammars had a critical subject control score of at least 75%, and a minimum of 50% subject responses on constructions VI and VII. (See Appendix G for a summary of the criteria for classifying children as having subject oriented grammars.)

1.3.2 Object Oriented Grammars. As summarized in Figure 1, object oriented grammars were expected to be associated with patterns of object control on almost all of the construction types. These patterns result from (1) attachment of embedded structures to either the VP or object NP and (2) operation of the minimal distance principle.

Three criteria were used for the classification of children manifesting object oriented grammars. Two of the criteria involved the constructions listed in (10) and (11).

(10)

<u>Construction Type</u>	<u>Example</u>
II-A	The lion hits the bear after crawling under the table
III-A	The lion hits the bear in order to crawl under the table
II-C	The lion hits at the bear after crawling under the table
III-C	The lion hits at the bear in order to crawl under the table

(11)

<u>Construction Type</u>	<u>Example</u>
VI	The lion hits the bear that is crawling under the table
VII	The lion yells at the bear to crawl under the table
IV-A	After crawling under the table the lion hits the bear
IV-B	In order to crawl under the table the lion hits the bear

Figure 1 indicates that object oriented grammars were expected to be associated with object control of the constructions listed in both (10) and (11). In view of this, the first criterion for classification was the percentage of object responses on the constructions listed in (10). This percentage was termed the critical object control score. A consistent pattern of object control was operationally defined as a critical object control score of at least 75%. There were 3 tokens of each construction type listed in (10), which yielded a total of 12 possible object responses. Therefore, a child who obtained a critical object control score of 75% or greater exhibited at least 9 object responses on these constructions.

The second criterion for classification was the percentage of object responses on the constructions listed in (11). Each of these constructions also had 3 tokens, which yielded a total of 12 possible object responses. A consistent response pattern was operationally defined as at least 75% object responses, which translated into 9 or more object responses.

The third criterion for classification was a critical subject control score of less than 45% (or a maximum of 44.9%). (See section 1.3.1, this chapter, for a definition of the critical subject control score.) This criterion, which translated into a maximum of 7 subject control responses, was necessary to insure a consistent pattern of object responses.

In particular, it excluded children who manifested mixed patterns of responses. In summary, children who were classified as manifesting object oriented grammars had a minimum critical object control score of 75%, a minimum of 75% object responses on the constructions listed in (11), and a subject control score of less than 45%. (See Appendix G for a summary of the criteria for classifying subjects as having an object oriented grammar.)

It should be noted that three criteria were used to classify object oriented children while only two criteria were used to classify subject oriented children. This difference results from the fact that the subject control score is based on six construction types whereas the object control score is based on only four construction types. The two constructions which are excluded from the object control score are included in the set listed under (11).

It is postulated (section 4.2, chapter II and section 1.2.2, this chapter) that the c-command constraint becomes operational during the stage when children exhibit object oriented grammars. Thus, children who exhibit object control on constructions II-A and III-A may exhibit subject control on constructions II-B and III-B. As a result, II-B and III-B could not be used to classify children with object oriented grammars. A method of indicating the degree that children obey the c-command constraint while manifesting patterns of object control on other constructions is

described in section 2.1.1 of this chapter.

1.3.3 Mixed Subject-Object Grammars. Mixed subject-object grammars represent a transitional stage between object oriented grammars and adult grammars. At this stage children manifest variable attachment of embedded structures to either an NP, VP, or S, which is often incorrect in terms of adult grammar. As summarized in Figure 1, this grammar type is associated with mixed responses to almost all the construction types.

Three criteria were used to classify children manifesting mixed subject-object grammars. Two criteria involved the critical subject and object control scores. A mixed response pattern was operationally defined as a critical subject control score ranging between 45 and 75%, and a critical object control score of less than 75%. Thus, classification of a child as manifesting this grammar type required (1) between 8 and 12 subject responses on the six construction types used to compute the critical subject score and (2) less than 9 object responses on the construction types used to compute the critical object control score. The third criterion involved the remaining responses on the six construction types used to compute the subject control score. At least 75% of these remaining responses must be object responses.

During this transitional stage in which children are shifting from object oriented grammars to adult grammars,

the c-command principle may continue to become operational. The degree to which the mixed subject-object children obey the constraint was measured by the assessment procedure described in section 2.1.1 of this chapter.

1.3.4 Approaching Adult Grammars. Approaching adult grammars represent a second transitional stage between object oriented grammars and adult grammars. This stage follows mixed subject-object grammars and is characterized by attachment of embedded structures to the VP, S or object NP as required in adult grammar. In addition, the c-command constraint is fully specified and completely operational. However, the principle may be overgeneralized to constructions which constitute exceptions. Overgeneralization is expected to result in ONP responses (i.e. selection of an animal not mentioned in the sentence) on sentential subject sentences (Constructions V-A and V-B). Overgeneralization is also expected to result in a small percentage of errors on the dative PP sentences (Construction VII).

Three criteria were used to identify children with approaching adult grammars. The first criterion was the critical subject control score defined in section 1.3.1, this chapter. Consistent attachment of complements to the S was operationally defined as a critical subject control score of 75%. This means that, on the constructions listed in (8), a minimum of 13 subject responses were required for classification as an approaching adult grammar.

The second criterion was 66% object responses on constructions VI and VII. This percentage, which is lower than the requirements for adult grammar, translated into a minimum of 4 object responses on the two construction types. The lower criterion was necessary in order to permit the small percentage of errors (on VII) which were expected to result from overgeneralization of the c-command constraint (see section 2.2, this chapter). This second criterion was important for distinguishing between children manifesting subject oriented grammars and those manifesting approaching adult grammars. (See section 1.3.1, this chapter.) The former group of children was expected to manifest subject responses, whereas the latter group was expected to manifest primarily object responses.

The third criterion for classification was also based on the overgeneralization hypothesis. This criterion required 50% ONP responses on the constructions listed in (12). (See section 4.4., chapter II and sections 1.2.3, and 2.2 this chapter, for a detailed discussion of the motivation for this criterion.)

(12)

Construction Type

Example

V-A

To have to hit the lion scares the bear

V-B

Hitting the lion scares the bear

Scores on these constructions were termed critical ONP scores. Since there were three tokens of each construction type, a

minimum of 3 ONP responses was required for classification as an approaching adult grammar. In summary, children classified as having this grammar type, exhibited (1) a minimum critical subject control score of 75%, (2) a minimum of 66% object responses on constructions VI and VII, and (3) a minimum critical ONP score of 50%.

1.3.5 Adult Grammars. Adult grammars are also characterized by correct attachment of the complement to the VP, S, or NP. The grammar type is distinguished from approaching adult grammars in (1) the consistency of the attachment, and (2) knowledge of the exceptions to the c-command constraint. Based on these considerations, three criteria were used to classify subjects as having adult grammars. The first criterion involved the critical subject control score described in section 1.3.1 of this chapter. A highly consistent attachment of complements to the S for the constructions listed in (8) was operationally defined as at least 80% subject responses. This percentage translated into 15 subject responses. The second and third criteria involved the percentage of object response on the constructions listed in (13).

(13)

<u>Construction Type</u>	<u>Example</u>
Group I	
VI	The lion hits the bear that is crawling under the table
VII	The lion yells at the bear to crawl under the table

Construction TypeExample

Group II

V-A

To have to hit the lion scares the bear

V-B

Hitting the lion scares the bear

Knowledge of the exceptions to the c-command constraint was expected to result in a reduction of errors on construction VII and frequent selection of the second NP as the controller in constructions V-A and V-B. Therefore, knowledge of the exceptions to c-command was operationally defined as 80% object responses on Group I and 80% second NP responses on Group II. There were three tokens of each construction which yielded a total of 6 possible responses. Thus, at least 5 object responses in Group I and at least 5 second NP responses in Group II were required for an adult grammar. In summary, children who were classified as manifesting adult grammars had a minimum critical subject control score of 80%, a minimum of 80% object responses on the constructions in Group I, and a minimum of 80% second NP responses on the constructions in Group II. (See Appendix G for a summary of the criteria for classifying subjects as having adult grammars.)

In conclusion, several criteria were used to classify children as belonging to one of five grammar types. The criteria, which were based on response patterns characterizing each grammar type, specified a minimum percentage of responses considered to represent a consistent pattern of

behavior. In order to be classified as manifesting a particular grammar type, a child was required to manifest a consistent response pattern which matched one of the patterns associated with a particular grammar type.

1.4 Predictions Concerning the Development of the Five Grammar Types.

1.4.1 Relationship of Grammar Type to Age. Section 4, of chapter II, argued that the five grammar types constitute stages in the development of embedded structures. In particular, it was proposed that the five grammar types develop in the following order:

(14)

First:	Subject Oriented Grammar
Second:	Object Oriented Grammar
Third:	Mixed Subject-Object Grammar
Fourth:	Approaching Adult Grammar
Fifth:	Adult Grammar

This sequence of development was based, in part, on evidence that the grammar types were related to age. The conjoined clause analysis, a principal aspect of subject oriented grammars, was reported to be characteristic of three year olds (Tavakolian, 1977). Optional VP attachment, characteristic of object oriented grammars, was reported to appear at around four years of age (Goodluck, 1978; and Goodluck and Tavakolian, 1979). In addition, mixed response patterns, characteristic of mixed subject-object grammars, were reported for older children (Chomsky, 1969; and Goodluck, 1978). As a result of these findings, the prediction

concerning the sequence in development of the five grammar types was stated as the following general hypothesis:

(15)

- (A) Children exhibiting subject oriented grammars would be the youngest group
- (B) Children exhibiting object oriented grammars would be older than the children in (A)
- (C) Children exhibiting mixed subject-object grammars would be older than the children in (B)
- (D) Children exhibiting approaching-adult grammars would be older than the children in (C)
- (E) Children exhibiting adult grammars would be older than the children in (D)

Based on this hypothesis, the order of means of the ages of children belonging to the five grammar types was predicted to be as follows: (s = subject oriented, o = object oriented, s-o = mixed subject-object, A-A = approaching adult, A = adult).

$$(16) \quad u_s < u_o < u_{s-o} < u_{A-A} < u_A$$

1.4.2 Relationship of Grammar Type to DSS Scores.

The present study investigated the relationship between performance on the main comprehension task and performance on a production task. The purpose of obtaining the latter performance measure was to provide a further test of the proposed developmental sequence of grammar types.

Recently, several methods of assessing productive language have been developed (e.g. Lee, 1974, Tyack and Gottsleben, 1977; and Bloom and Lahey, 1978). The general

assumption underlying these procedures is that an assessment of productive language provides a measure of a child's level of language development. Lee (1974) reports that scores obtained using her procedure correlate with age. In addition, normative data on her system is currently used by clinicians to identify children with language delays. Thus, Lee's procedure can be used to classify children according to level of language development. The present study used Lee's Developmental Sentence Scoring Analysis to analyze productive language samples collected from each child. The analysis procedure yields an overall score termed a DSS score. These scores were obtained for each child participating in the study.

The Developmental Sentence Scoring Analysis contains eight grammatical categories: noun modifiers, pronouns, main verbs, secondary verbs, negatives, conjunctions, interrogative reversals, and wh-questions. In addition, there are eight levels. Structures related to each grammatical category are listed within each level. (See Appendix I for the Developmental Sentence Scoring Analysis form.) The resulting sequence represents the development of each grammatical category. In general, the sequences proposed by Lee (1974) have been supported in subsequent research (Hsu, 1977).

According to Lee's system, language samples taken from children are analyzed sentence by sentence. Words or constructions within a sentence are matched to structures

listed under each grammatical category. The words or constructions are then assigned a point value depending on the level in which they are listed. The individual points are added to obtain a total for the sentence. Next, the sentence totals are added to obtain an overall sum which is then divided by the number of sentences used in the analysis. The resulting average is the DSS score. Children who use late developing structures will receive high DSS scores due to the fact that these structures are assigned the highest point values.

Four of the grammatical categories included in the assessment procedure evaluate use of embedded structures. In particular, the secondary verbs category includes a variety of infinitival constructions; the conjunction category includes adverbial clauses; and the pronoun category includes relative clauses and infinitive constructions following wh words. These constructions are listed as late developing constructions and are generally assigned point values ranging from 4 to 8. The adverbial clauses are all assigned the highest point value which is 8. Two other structures which are assigned a point value of 8 involve combinations of auxiliary elements. These structures seem to occur less frequently in children's speech than adverbial clauses.¹ As a result, high DSS scores generally reflect the use of embedded structures which were similar to the one's used in the main comprehension task of the present

study (i.e. infinitival complements, adverbial clauses, and relative clauses). It must be pointed out, however, that frequent use of structures assigned lower point values may also increase a child's DSS score. Since DSS scores reflect, at least in part, use of the same structures that are assessed in the main comprehension task, it was predicted that DSS scores would be related to grammar type.

A variety of studies (Lovell and Dixon, 1967; Shipley, Smith, and Gleitman, 1969; Nurss and Day, 1971; Fraser, Bellugi, and Brown, 1973; Baldie, 1976) have reported results indicating that comprehension of a particular syntactic structure precedes production of that structure. It follows from this view that a child who produces a particular structure may be assumed to comprehend that structure. It must be pointed out that results reported by de Villiers and de Villiers (1973) and Chapman and Miller (1975) suggest that the relationship between comprehension and production may not be as clear as once thought. However, de Villiers and de Villiers' (1973) data suggest that mean length of utterance (MLU) (a productive task) rather than age is a better predictor of children's ability to use word order in the comprehension of reversible active sentences. These data are consistent with the view that children who are producing a particular structure in a generalized manner (viz., using the structure in a variety of

contexts and with a variety of vocabulary items) also comprehend the structure.

In the preceding discussion of the DSS scoring system, it was suggested that low DSS scores tend to reflect infrequent use of embedded structures whereas high DSS scores tend to reflect increased use of these structures. In view of the proposed relationship between comprehension and production (viz. production of a structure in a generalized manner implies comprehension of the structure), it was predicted that relatively low DSS scores would be associated with the early developing grammar types in which children manifest primitive analyses of multiple clause sentences; whereas relatively high DSS scores would be associated with later developing grammar types. (See (14), this chapter, for the proposed developmental sequence of grammar types.) This relationship was stated in terms of the following general hypothesis:

(17)

- (A) Children exhibiting subject oriented grammars would obtain the lowest DSS scores in this study
- (B) Children exhibiting object oriented grammars would obtain higher DSS scores than the children in (A)
- (C) Children exhibiting mixed subject-object grammars would obtain higher DSS scores than the children in (B)

- (D) Children exhibiting approaching-adult grammars would obtain higher DSS scores than the children in (C)
- (E) Children exhibiting adult grammars would obtain higher DSS scores than the children in (D)

Based on this hypothesis, the order of means of DSS scores of children belonging to the five grammar types was predicted to be as follows: (s = subject oriented, o = object oriented, s-o = mixed subject-object, A-A = approaching adult, and A = adult).

$$(18) \quad u_s < u_o < u_{s-o} < u_{A-A} < u_A$$

2. Issues in the Development of the C-Command Constraint

There are several issues concerning the operation of the c-command constraint in children's grammars. The issues involve (1) the delayed versus immediate operation of the constraint, (2) overgeneralization of the constraint, and (3) violation of the constraint. The following sections discuss each of these issues.

2.1 The Operation of the C-Command Constraint in Children's Grammars: Delayed versus Immediate.

Section 3 of chapter I proposes that the operation of universals in children's grammar may differ from their operation in adult grammar in two ways. One, children's structural analysis of various

constructions may differ from adults such that the universal principle does not apply. In other words, structures within the domain of the principle are misanalyzed, and as a result, the range of application of the principle is limited. Secondly, the child's grammar may initially contain a sub-adult form of the principle. This could occur in languages in which a universal is characterized by marked parametric settings. Assuming that, initially, children's grammars are characterized by the unmarked parametric settings, then there will be a difference between children and adults until the marked settings are fixed by experience. Section 3, chapter I argues that the two factors affecting operation of a universal constitute binary conditions. In view of this, four logical possibilities were identified which describe the operation of universals in children's grammars. (See (1), chapter I.) These possibilities are repeated in (19) for convenience.

(19)

- (A) A sub-adult rule + incorrect structural analyses
- (B) A sub-adult rule + correct structural analyses
- (C) An adult rule + incorrect structural analyses
- (D) An adult rule + correct structural analyses

As stated in section 3, chapter I, the alternatives A, B, and C predict that differences will exist in the operation of a universal principle in children's grammars as compared to adult grammars. These alternatives (A, B, and C) were termed the delayed operation hypothesis. Alternative D, which was termed the immediate operation hypothesis, predicts that a universal will operate in the same manner in both children's and adult grammars. That is, the form of the rule and the analysis of structures within the domain of the rule are the same for both children and adults. It seems unlikely that alternative D could be true for children at the single- and two-word stage of language acquisition due to the fact that they have not developed an adult analysis of all the structures in the language. However, once children begin using complete sentences in their productive language, then alternative D, the immediate operation hypothesis, may describe the operation of a particular universal in the child's grammar. That is, the child's grammar includes (1) tacit knowledge of the adult form of the rule, and (2) correct analyses of all structures within the domain of the rule.

C-command and the c-command constraint are postulated to be universals which operate in the grammars of young children as well as adults (Goodluck, 1978). (See section 3, chapter II for a discussion of Goodluck's proposal.) In view of the alternatives concerning the operation of

universals in children's grammars (see (19), above), the present research evaluated whether the delayed operation hypothesis (alternatives A, B, and C) or the immediate operation hypothesis (alternative D) characterizes the operation of the c-command constraint in children's grammars. Although the parameters of the c-command constraint have not been identified, it seems plausible that there will be both marked and unmarked settings. As discussed in section 3, chapter I, the presence of marked parameters would result in the possibility of a sub-adult version of the rule. Alternatively, structures within the domain of the c-command constraint may be incorrectly analyzed by children. This latter possibility is illustrated below. Recall that the c-command constraint blocks control of missing complement structures by noun phrases which do not c-command the missing NP position. Thus, objects of prepositions cannot control missing NP's in complements which attach to either the VP or S of the main clause. However, if a child's analysis of a sentence fails to recognize the prepositional phrase, then control may be allowed due to the misanalysis of the NP as a direct object. Conceivably, this could occur in constructions where the preposition is likely to be viewed as part of the verb. In this case, the operation of the c-command constraint would appear to change as children learn to correctly identify prepositions and prepositional phrases. The constraint could be fully

specified in this example but it would not operate as it does in adult grammar due to the misanalysis of prepositional phrases.

The present study conducted several tests designed to evaluate whether the delayed operation hypothesis or the immediate operation hypothesis describe the operation of the c-command constraint in the grammars of children who are using complete sentences in their productive language.² Tests evaluating the delayed operation hypothesis are outlined in sections 2.1.1, 2.1.2, and 2.1.3 of this chapter. The study did not attempt to formally evaluate each of the three alternatives (A, B, and C) which are collectively referred to as the delayed operation hypothesis (see (19), this chapter). Choosing between these three alternatives would require a separate test which indicates whether or not each child has correctly analyzed all types of prepositional phrases. Although this was not done, it certainly seems feasible. Section 2.1.4 of this chapter outlines a test which evaluates the immediate operation hypothesis. This hypothesis, which is alternative D (see (19), this chapter), claims that children will manifest adult patterns of control on complements preceded by a prepositional phrase.

2.1.1 Assessing the Operation of the C-Command Constraint: C-Command Scores. In order to test the delayed operation hypothesis, a scoring system was designed to assess the extent that children obey the c-command constraint.

Responses to constructions II-B and III-B were used to compute these scores. The constructions are repeated in (20) for convenience.

(20)

<u>Construction Type</u>	<u>Example</u>
II-B	The lion stands near the bear after crawling under the table
III-B	The lion stands near the bear in order to crawl under the table

Assuming that the prepositional phrases are correctly analyzed, the c-command constraint blocks object control of the complements in these constructions. Thus, the constraint results in subject responses. (See section 3, chapter II and section 1.2.2, this chapter for a detailed discussion of the expected response patterns.) It is important to note that the conjoined clause analysis which is characteristic of subject oriented grammars is also expected to result in subject responses. Thus, the scoring was not used with children classified as manifesting subject oriented grammars.

The scoring system counts the number of subject responses on the constructions listed in (20). Since there were three tokens of each construction, the scores ranged from zero to six. Excluding children with subject oriented grammars, each child in the study was assigned a score indicating the total number of subject responses on the constructions. This score was termed the c-command score.

2.1.2 Relationship of C-Command Scores to Age and DSS Scores. The hypothesis that the operation of the c-command constraint is delayed suggests that the c-command scores would be related to age. (See section 2.1, this chapter for a discussion of the delayed operation hypothesis.) Thus, younger children were predicted to have low c-command scores, whereas older children were predicted to have high scores. Based on this hypothesis the following specific prediction was tested:

- (21) C-command scores would be positively related to age (for all subjects)

In view of the fact that the c-command constraint was predicted to begin to operate during the period when children manifest object oriented grammars or mixed subject-object grammars (see sections 4.2 and 4.3, chapter II), the hypothesis concerning the relationship between age and c-command scores was also evaluated with respect to these two groups of children. Thus, two additional predictions were tested:

- (22) Among object oriented children, c-command scores would be positively related to age
- (23) Among mixed subject-object children, c-command scores would be positively related to age

Section 1.4.2, this chapter, proposes that the development of grammar types is related to stages in language development as reflected in DSS scores. It seems reasonable to expect that structural principles such as c-command would

also be related to general stages in language development. To explore this relationship, the following specific predictions were tested:

- (24) C-command scores would be positively related to DSS scores (for all subjects)
- (25) Among object oriented children, c-command scores would be positively related to DSS scores
- (26) Among mixed subject-object children, c-command scores would be positively related to DSS scores

2.1.3 Operation of the C-Command Constraint as a Function of Complement Type and/or Prepositional Phrase.

The delayed operation hypothesis suggests that the c-command constraint may not apply to all complements during the initial stages of language acquisition. The view is supported by some of the data reported in Goodluck's (1978) study. In particular, Goodluck found that four year olds manifested 67.5 and 86.7 percent subject responses on sentences (27) and (28), respectively. This difference approached significance ($p \leq .079$).

Locative PP + temporal complement

- (27) The boy stands near the girl after jumping over the fence

Passive by phrase + temporal complement³

- (28) The boy is hit by the girl after jumping over the fence

In a separate study, Goodluck reported that four year old children manifested 90.1 percent subject controlled responses

on sentences such as (29).

Locative PP + reduced *in order to* complement

(29) Daisy stands near Pluto to do a somersault

By five years of age, children generally exhibited subject control on all three construction types, although the percentage obtained on sentences such as (27) was still below the percentage obtained on sentences such as (28) and (29) (Goodluck, 1978).

Differences in response patterns of four year olds to sentences (27) and (29) suggest that operation of the c-command constraint may vary as a function of complement type. That is, the c-command constraint seems to be operative in sentences containing reduced *in order to* complements prior to sentences containing temporal participial complements. This is supported by Tavakolian's finding that three year olds manifested subject control in 79 percent of the responses to sentences similar to (29).

Differences in response patterns to sentences (27) and (28) suggest that the type of prepositional phrase may also be a variable affecting the application of the c-command constraint in the grammars of young children. In particular, the constraint seems to block object control in sentences containing a passive *by* phrase prior to blocking object control in sentences containing a locative preposition. This finding is consistent with the proposal that operation of the constraint is affected by changes in the structural

analyses of constructions. In view of these results, one possible type of structural change may be an expanded category of words classified as prepositions and a corresponding increase in the identification of prepositional phrases across sentences.

Based on Goodluck's findings, the present study investigated whether there were differences in the operation of the c-command constraint as a function of either complement type or type of prepositional phrase. In particular, the study tested the hypothesis that the c-command constraint applies to constructions in the order outlined below:

(30)

<u>Order of Appearance</u>		<u>Construction Type</u>
First	III-B	<u>In order to</u> complement preceded by a locative prepositional phrase: e.g. The lion stands near the bear in order to climb up the ladder
Second	II-D	Adverbial temporal complement preceded by a passive <u>by</u> phrase: e.g. The lion is hit by the bear after climbing up the ladder
Third	II-B	Adverbial temporal complement preceded by a locative prepositional phrase: e.g. The lion stands near the bear after climbing up the ladder

The prediction concerning the order of application was restricted to construction types for which data from previous

research was available. Thus, the prediction involved only three construction types.

For each subject, scores were obtained indicating the number of subject responses on the individual construction types. There were three tokens of each construction which yielded a maximum score of three. Thus, each child was assigned three scores ranging from 0 to 3 for each of the constructions listed in (30). The delayed operation hypothesis in conjunction with the hypothesis that the c-command constraint begins to operate during the period of object oriented or mixed subject-object grammars suggested the following general predictions:

- (31) Children with object oriented or mixed subject-object grammars who achieve different scores on the 3 sentence types should obtain scores that are ordered as follows:

$$\text{III-B} > \text{II-D} > \text{II-B}$$

Based on this general prediction, two specific predictions were tested:

- (32) Children with object oriented or mixed subject-object grammars who achieve different scores on the constructions III-B, II-D, and II-B are more likely to exhibit the pattern in which $\text{III-B} > \text{II-D} > \text{II-B}$ than any other pattern
- (33) Children with object oriented or mixed subject-object grammars are more likely to achieve different scores on the 3 sentence types than children with subject oriented, approaching adult or adult grammars

2.1.4 The Immediate Operation Hypothesis: The C-Command Constraint and Response Patterns to Individual Construction Types. As described in section 2.1, this chapter, an alternative to the delayed operation hypothesis is the immediate operation hypothesis which claims that the c-command constraint operates in children's grammars in the same way that it does in adult grammars. According to the immediate operation hypothesis, children have tacit knowledge of (1) the adult form of the c-command constraint, and (2) the correct analyses of prepositional phrases which are structures that fall within the domain of the rule (see alternative D in (19) of this chapter).

In order to test the immediate operation hypothesis, the study evaluated response patterns to five constructions (II-B, II-C, II-D, III-B, and III-C) which were included in the main comprehension task. The constructions, which are repeated in (34) for convenience, involved adverbial temporal and in order to complements. In addition, they involved three types of prepositional phrases: (1) locative phrases following intransitive verbs, (2) directional phrases following transitive verbs, and (3) a passive by-phrase.

(34)

Locative prepositional phrase preceding an

A. adverbial temporal complement (II-B)

The lion stands near the bear after climbing
up the ladder

B. 'in order to' complement (III-B)

The lion stands near the bear in order to
climb up the ladder

Directional prepositional phrases with 'on' and 'at'
preceding an

A. adverbial temporal complement (II-C)

The lion hits at the bear after climbing up
the ladder

B. 'in order to' complement (III-C)

The lion hits at the bear in order to climb
up the ladder

Passive 'by' phrase preceding an adverbial temporal
complement (II-D)

The lion is hit by the bear after climbing up
the ladder

The c-command constraint specifies that the constructions listed in (34) are subject controlled. Therefore, the immediate operation hypothesis predicts that children will manifest subject responses on these constructions. That is, the c-command constraint is expected to apply regardless of the type of prepositional phrase. In addition, the constraint is expected to be operational in all grammar types.

The predicted response patterns for subject oriented children are ambiguous with respect to operation of the c-command constraint. These children are expected to manifest subject responses on the constructions listed in (34) as well as almost all the constructions included in the main comprehension task (see Figure 1). It was pointed out in chapter II that subject responses from subject oriented

children violate the c-command constraint, if the children analyze multiple clause sentences according to the conjoined clause analysis (see footnote 27, chapter II). If the constraint is assumed to be inviolable, then subject responses can be explained by postulating that either (1) the constraint is not operational at this stage or (2) subject oriented grammars are characterized by the topmost S analysis proposed by Solan and Roeper (1978). (See footnote 27, chapter II). The latter analysis, which is compatible with operation of the constraint, is consistent with the immediate operation hypothesis as well as the inviolability hypothesis. It must be pointed out that even if the topmost S analysis is assumed, subject responses would not necessarily imply that the constraint is operational during this stage of development. Previous research has not provided data which choose between the conjoined clause analysis and the topmost S analysis. However, data from several aspects of the present research may clarify the interpretation of the pattern of subject control which is expected for subject oriented children. (See section 2, chapter VI.)

Operation of the c-command constraint can be detected in the responses of object oriented and mixed subject-object children. This is due to the fact that operation of the constraint is expected to result in a differential pattern of control. Object oriented children are expected to manifest object responses on constructions II-A and III-A due to

attachment of the complement to the VP and operation of the minimal distance principle. (See section 1.2.2, this chapter, for a discussion of the response pattern.) (Constructions II-A and III-A are repeated in (35) for convenience.)

(35)

Main clause direct object preceding an

A. adverbial temporal complement (II-A)

The lion hits the bear after climbing up
the ladder

B. 'in order to' complement (III-A)

The lion hits the bear in order to climb up
the ladder

Assuming that the c-command constraint is immediately operational, then all object oriented children should manifest subject control of the constructions listed in (34) and object control of the constructions listed in (35). A contrasting pattern is also predicted for children with mixed subject-object grammars. With respect to this grammar type, variable attachment of the complement is expected to result in mixed responses on the constructions listed in (35) while the c-command constraint is expected to result in subject responses on the constructions listed in (34). In view of these general considerations, the prediction stated in (36) was tested for object oriented and mixed subject-object children.

- (36) Among the following construction pairs, children should exhibit a greater number of subject responses on the first construction type as compared to the second construction type

<u>I</u>	<u>vs.</u>	<u>2</u>
II-B	vs.	II-A
II-C	vs.	II-A
II-D	vs.	II-A
III-B	vs.	III-A
III-C	vs.	III-A

A differential pattern is not expected for children with approaching adult or adult grammars. Correct attachment of the complements and operation of the c-command constraint are expected to result in subject responses on the constructions in (34) as well as those in (35). Thus, three grammar types (subject oriented, approaching adult, and adult) are expected to manifest subject responses on the constructions in both (34) and (35). This means that the differential response patterns for the object oriented and mixed subject-object children should result in an overall difference (for the five combined groups) in the number of subject responses on the constructions in (34) as compared to those in (35). In view of this, the prediction stated in (36) was also tested for the entire group of children participating in the study.

2.2 Overgeneralization of the C-Command Constraint.

Tavakolian (1977) reports that children three, four, and five years of age manifest an increasing percentage of outside NP responses (ONP) on sentential subject sentences such as (37).

(See section 4.4, chapter II, and section 1.2.3, this chapter.)

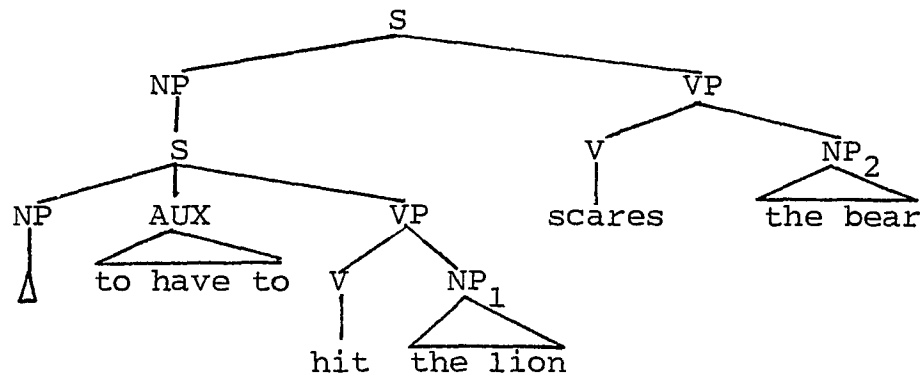
(37) To kiss the lion would make the duck happy

Sentential subject sentences seem, at least on the surface, to constitute an exception to the c-command constraint. Thus, the increasing number of ONP responses may reflect overgeneralization of the constraint.

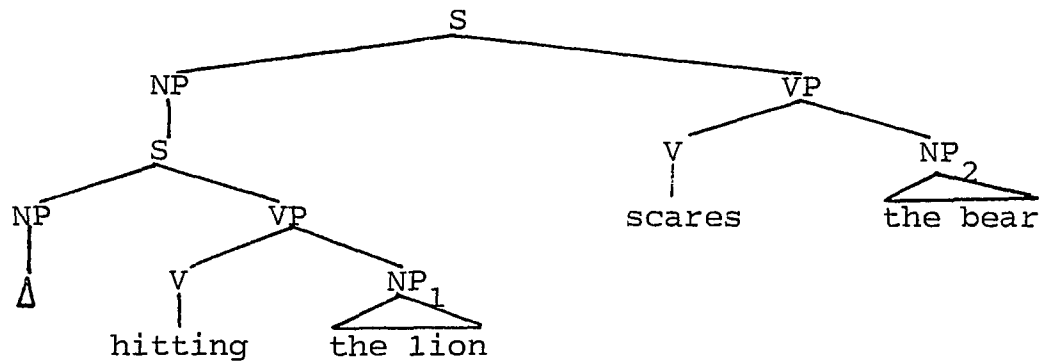
Overgeneralization of rules seems to be a common phenomenon in children's grammars. Brown (1973) reports overgeneralization of morphological rules. In addition, Chomsky (1969) reports examples of overgeneralization of a structural principle. In particular, Chomsky reports that overgeneralization of the minimal distance principle resulted in object control of infinitival complements following the main verbs promise and ask (e.g. ask X what to do). Both of these constructions are exceptions to MDP in that they require subject control of the complement. In view of Chomsky's findings, it was postulated that the c-command constraint would be overgeneralized to sentences which constitute exceptions.

In order to test the overgeneralization hypothesis, the main comprehension task included two types of sentential subject sentences (constructions V-A and V-B) which are illustrated in (38) and (39).

(38)



(39)



In sentences (38) and (39), the controller of the complement, the bear, is dominated by the branching node VP which does not dominate the missing complement subject. Thus, the bear does not c-command the missing NP position. Since sentences of this type are generated directly in the base, they appear to be exceptions to the c-command constraint.

Goodluck (personal communication) argues that sentences such as (38) and (39) are not exceptions to the c-command constraint due to the fact that they are free control complements. According to Goodluck (1978) the c-command constraint applies to only obligatory control complements. See also section 2.2.5, chapter II.) Free control complements

are defined as complements which are controlled by either a matrix NP or an outside NP (Goodluck, 1978). Sentence (37), which is repeated below as (40), is an example of a free control complement.

(40) To kiss the lion would make the duck happy

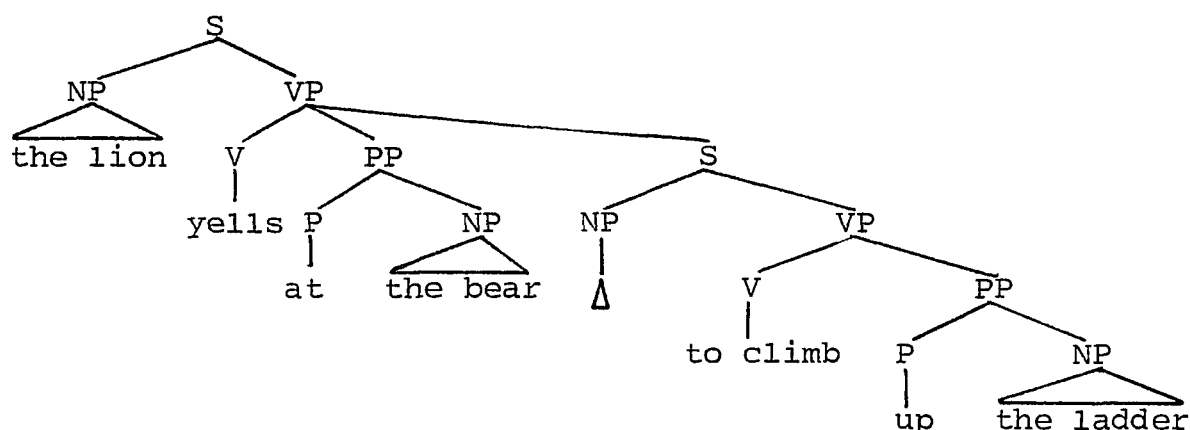
Obligatory control complements are those in which control by a matrix NP is obligatory. Goodluck (personal communication) proposes that semantic principles rather than structural principles bias sentences (38) and (39) toward control by NP₂. Thus, she claims that they are free control complements despite the fact that the complement must be controlled by the second NP.

Children may not initially distinguish between free and obligatory control complements. If their grammars do not make this distinction, then they may incorrectly apply the c-command constraint to sentential subject sentences. The constraint would block control by either NP in the sentence. As a result, children would select an outside NP as the controller of the complement clause.

In view of the two possible interpretations of ONP responses, dative PP sentences were also included in the main comprehension task. These sentences also seem to be exceptions to the c-command constraint. Furthermore, they are obligatory control complements for most speakers. (See section 1.2.5, this chapter and section 1.2.5, chapter II for a discussion.) Sentence (41) illustrates the structure

of the dative PP's included in the main comprehension task.

(41)



The complement is controlled by the noun phrase, the bear, which does not c-command the missing NP position. That is, the bear is dominated by a branching node, PP, which does not dominate the missing NP position. Thus, if dative PP's are obligatory control complements, then they appear to violate the c-command constraint.⁴ The overgeneralization hypothesis predicts that children will select either the subject or an outside NP as controller of dative PP sentences. In view of Tavakolian's (1977) data, overgeneralization is expected to result in a small percentage of errors on construction VII.⁵ (See also section 1.2.5, this chapter.)

Overgeneralization of morphological rules seems to occur across a wide range of exceptions. Furthermore, inspection of Chomsky's (1969) data reveals that all children who overgeneralized MDP to promise sentences also overgeneralized it to ask sentences (e.g. Ask X what to do?).

Thus, structural principles also seem to be overgeneralized to a variety of construction types. In view of this finding, the present study postulates that the c-command constraint will be overgeneralized to both sentential subject sentences (constructions V-A and V-B) and dative PP sentences (construction VII) at approximately the same point in the language acquisition process. Therefore, ONP responses on constructions V-A and V-B are expected to occur at the same time as an increase in errors on construction VII.

Inspection of Brown's (1973) data suggests that overgeneralization appears during the period when a rule is newly established. Thus, the response patterns associated with overgeneralization of the c-command constraint may also be expected to occur during the stages when the rule first appears or is newly established. The fact that the constraint is predicted to begin to operate during the stages of object oriented or mixed subject-object grammars leads to the following general prediction:

- (42) Children with object oriented or mixed subject-object grammars, who have developed the c-command constraint, should select an outside NP as the controller of sentential subject sentences and should manifest errors on dative PP sentences.

C-command scores (see section 2.1, this chapter) were used to identify those children who had developed the c-command constraint. Operation of the constraint in a child's grammar was operationally defined as a c-command score of 4 or more. Children obtaining such a score were

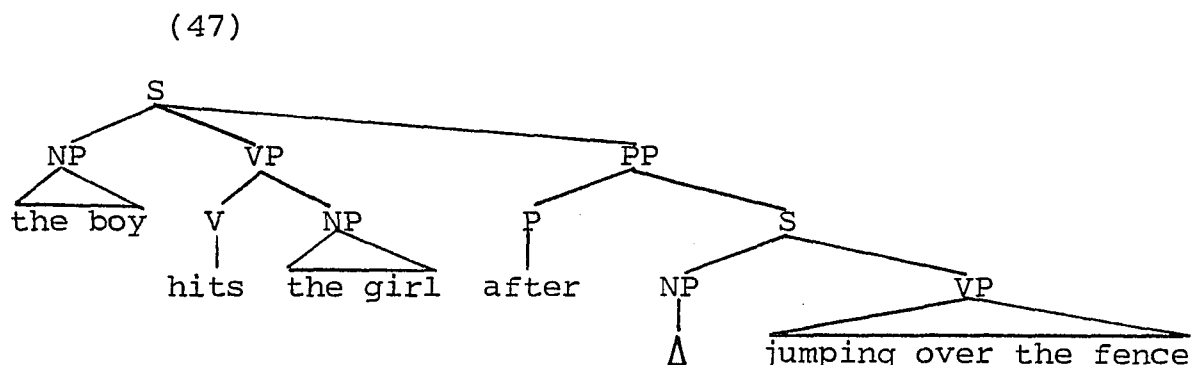
considered to have high c-command scores whereas children obtaining a score of 3 or less were considered to have low c-command scores. Based on the general hypothesis stated in (42) the following predictions were tested:

- (43) Given sentential subject sentences (constructions V-A and V-B), children with object oriented grammars and high c-command scores or children with mixed subject-object grammars and high c-command scores should pick an outside NP as the controller more often than children with either subject oriented grammars, or object oriented grammars and low c-command scores.
- (44) Given dative PP sentences (construction VII), children with object oriented grammars and high c-command scores should make more errors than children with object oriented grammars and low c-command scores.

Two additional predictions were formulated to test the overgeneralization hypothesis. The predictions were based on several considerations. First, children with object oriented grammars and approaching adult grammars are expected to correctly interpret object-subject relative clauses. Secondly, the c-command constraint is newly established for children with (1) approaching adult grammars or (2) object oriented grammars and high c-command scores. Thirdly, overgeneralization of the constraint is expected to result in errors on dative PP sentences.⁶ In view of these considerations, the predictions stated in (45) and (46) were tested:

- (45) Children with approaching adult grammars should make more errors on dative PP sentences (construction VII) than children with object oriented grammars and low c-command scores.
- (46) Children with object oriented grammars and high c-command scores, and children with approaching grammars should make more errors on dative PP sentences (construction VII) than on object-subject relative clauses (construction VI)

2.3 Violation of the C-Command Constraint. Putative universals which are believed to operate in children's grammars have been assumed to be inviolable. For example, Solan and Roeper (1978) claim that children will not violate the "no tangle constraint" and Goodluck (1978) claims that children will not violate the c-command constraint. As noted in chapter I, section 3, the assumption of inviolability is used to motivate hypotheses concerning children's knowledge of other aspects of grammar. In particular, the inviolability hypothesis is central to Goodluck's claim that children optionally attach complements to the VP. Her arguments, which are explained in section 3 of chapter II, are summarized here. In adult grammar, adverbial temporal complements are attached to the topmost S as indicated in (47).



The node which dominates the object NP does not dominate the missing NP position. Therefore, the c-command constraint blocks control by the object NP. Since young children manifest object control (see table 6, Goodluck, 1978), their response pattern violates the c-command constraint, if the children are assumed to assign the structure illustrated in (47). Goodluck argues, however, that children obey the c-command constraint and that object control results from attachment of the complement to the VP. Thus, the hypothesis of optional VP attachment is based on the assumption that the c-command constraint is inviolable.

It is argued in section 2.1 (this chapter) that, in children's grammars, the operation of principles such as c-command and the c-command constraint may be delayed. It is further postulated that the delay may result from either a sub-adult form of the rule or misanalysis of structures which fall within the domain of the rule. In either case, children may manifest behaviors which suggest a grammar that violates universals as they are specified in adult grammar. As a result, the assumption of inviolability should be

investigated.

The present study tested the hypothesis that children would resist violating the c-command constraint. Sentences were presented to children in order to identify those children who attach complements to the topmost S. Once these children were identified, they were presented with semantically deviant sentences to determine if they could be induced to violate the c-command constraint.

Adverbs have been classified as to whether they are dominated by an S or a VP. Classification is based on the positions which the adverb may occupy in a sentence. According to Jackendoff (1972), adverbs dominated by an S are expected to occur (1) initially, (2) before the auxiliary, and (3) finally; whereas adverbs dominated by a VP should occur (1) before the verb, (2) finally, and (3) at various places in between. Using this criterion, all of a sudden can be classified as an adverb dominated by an S. It follows, that if all of a sudden is inserted between a matrix sentence and a complement, it would force S attachment of the complement in adult grammar.

Children were given the following construction types in order to determine if all of a sudden forces S attachment of the complement.

Adverbial temporal complement preceded by a direct object

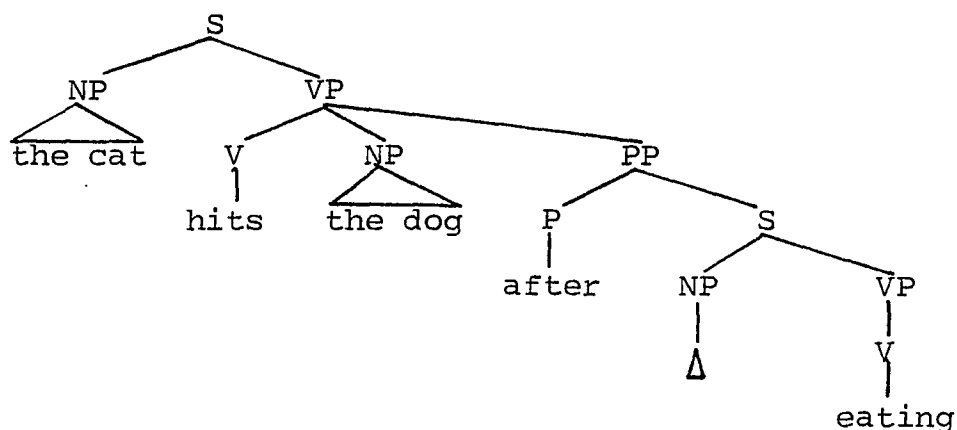
(48) The cat hits the dog after eating

Adverbial temporal complement preceded by 'all of a sudden'

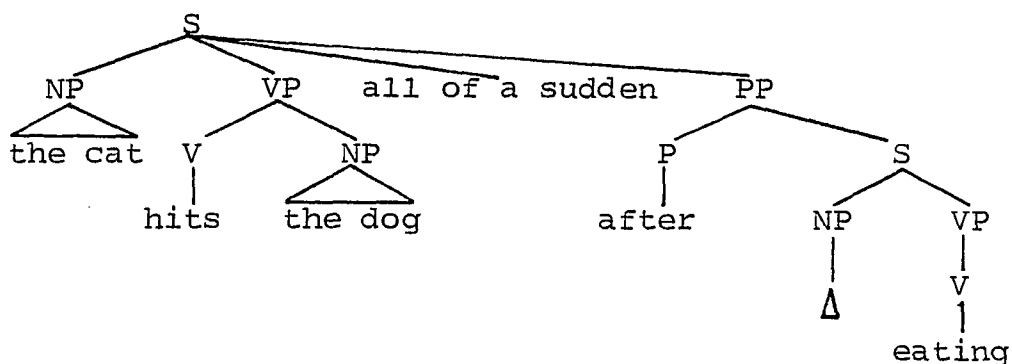
- (49) The cat hits the dog all of a sudden after eating

The children of interest were those who exhibited object control on sentences such as (48) and subject control on sentences such as (49). The shift in control was assumed to indicate a shift in the level of attachment of the complement. This change in attachment is illustrated in (50) and (51).

(50)



(51)



The shift in control presumably results from knowledge that all of a sudden attaches to the S. It is conceivable that some children have not acquired this knowledge and therefore will not manifest a shift in control. Both children who manifested a shift and those who did not were presented with semantically deviant sentences such as (52).

Semantically deviant adverbial temporal complement
preceded by 'all of a sudden'

- (52) The cat shoves the dog all of a sudden after
barking

The inviolability hypothesis predicts that children who shift from object control on sentences such as (50) to subject control on sentences such as (51) would exhibit subject control on sentences such as (52) and would note that the sentence is deviant. In contrast, children who exhibit object control on both sentences (50) and (51) would be expected to manifest object control on sentences such as (52) and would also be expected to fail to notice that the sentence is deviant.

Figure (7) summarizes the constructions used to evaluate the inviolability hypothesis. The constructions were presented in the fourth interview. (see chapter IV for a detailed discussion of the procedures and the experimental sentences.) The interview consisted of two parts. The first part included constructions I and II and two sets of filler sentences. Children were asked to act out the sentences using small animals. The second part included construction V

Figure 7. Summary of Predicted Response Patterns for the Fourth Interview

Construction Types	Predictions				
	Grammar Type				App. Adult Adult
	Subject Oriented	Object Oriented Low C-C	High C-C	Mixed S-O	
I. Adverbial Temporal Complement Preceded by a Direct Object 1. The owl hits the dog after eating	S	O	O	M	S
II. Adverbial Temporal Complement Preceded by <u>all of a sudden</u> 2. The owl hits the dog all of a sudden after eating	S	O or S	O or S	M	S
V. Semantically Deviant Sentence 3. The owl hits the dog all of a sudden after barking	S	O	O	S ^a	M ^b S ^a

Note. S = subject control; O = object control; M = mixed subject and object control

^aThese children will also note that the sentence is deviant

^bThese children may occasionally note that the sentence is deviant

(the semantically deviant sentence) and two additional sets of filler sentences. In the second part, children were asked to identify sentences that were "silly" and to either act out or note sentences that were "good".

Children with subject oriented grammars were predicted to manifest subject control on all three construction types (i.e., I, II, and V) due to operation of the conjoined clause analysis (see Figure 7). Children with approaching adult grammars and adult grammars were also predicted to manifest subject control. However, subject control for these children was predicted to result from attachment of the complement to S and operation of the c-command constraint. The insertion of all of a sudden was not predicted to change the response pattern of these children since they were already attaching the complement to the S. The hypothesis that the c-command constraint is inviolable predicts that children who manifest subject control should detect the semantic deviancy of construction V. Therefore, approaching adult and adult children were expected to label the construction as "silly".

Mixed subject-object grammars are characterized by variable attachment of the complement to either the S or the VP. As a result, children with this grammar type were predicted to manifest mixed control on the constructions in the fourth interview (see Figure 7). Some of these children, were expected to know that all of a sudden forces S attachment.

Thus, this sub-group of mixed subject-object children was predicted to note that construction V was deviant. However, the fact that all mixed subject-object children were predicted to manifest mixed patterns of control on construction II, meant that it would be impossible to identify the sub-group in advance.

The children of interest were those with object oriented grammars. This grammar type is characterized by attachment of the complement to the VP. The possibility that the c-command constraint is not immediately operational leads to the prediction that there are two groups of object oriented children: one group with grammars in which the c-command constraint is operational, and a second group in which the constraint is not operational. The children in the first group were identified by high c-command scores, whereas the children in the second group were identified by low c-command scores. The insertion of all of a sudden may result in S attachment of the complement for some of the object oriented children with low c-command scores. However, since these children have not yet developed the c-command constraint, the semantic bias of the deviant sentence may induce object control. Thus, object oriented children with low c-command scores were predicted to manifest object control on construction V.

The identification of object oriented children with high c-command scores enabled evaluation of the hypothesis

that the c-command constraint is inviolable at the earliest stages of grammatical development. The children with object oriented grammars were categorized into two groups on the basis of whether they shifted from object control of construction I (see Figure 7) to subject control of construction II (see Figure 7). Those that manifested a shift in control were termed "Shifters", whereas those that did not were termed "Non-shifters". The shift in control was interpreted as evidence that the complement was attached to the S in construction II. The semantically deviant sentence (construction V in Figure 7) was then presented to the children. Two categories of responses were expected (1) object control or (2) identification of the sentence as "silly". The hypothesis that children would not violate the c-command constraint led to the general predictions stated in (53) and (54).

(53) Given semantically deviant sentences (construction V), children with object oriented grammars and high c-command scores who shift from object control on construction I to subject control on construction II would manifest responses in category 2.

(54) Given semantically deviant sentences (construction V), children with object oriented grammars who do not shift from object control on construction I to subject control on construction II would manifest responses in category 1.

Based on these general predictions the following specific prediction was tested:

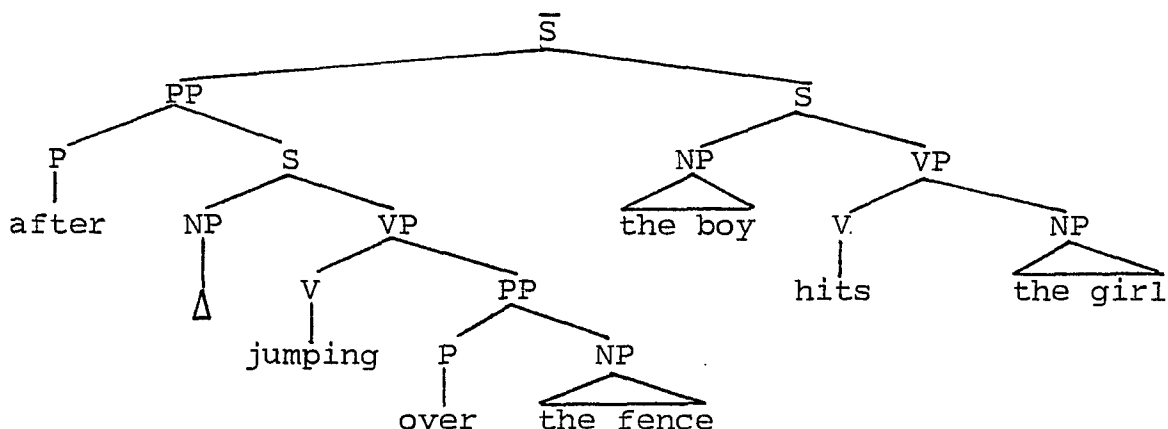
- (55) Given semantically deviant sentences, "Shifters" with high c-command scores would manifest more responses in category 2 than "Non-shifters" with low c-command scores.

3. The Level of Interpretation of Missing Missing Subjects

An important question concerning children's knowledge is whether they are sensitive to levels of structure other than surface structure. Preposed complements provide an opportunity to explore this aspect of children's knowledge. In particular, they provide an opportunity to investigate the level of interpretation of missing complement subjects.

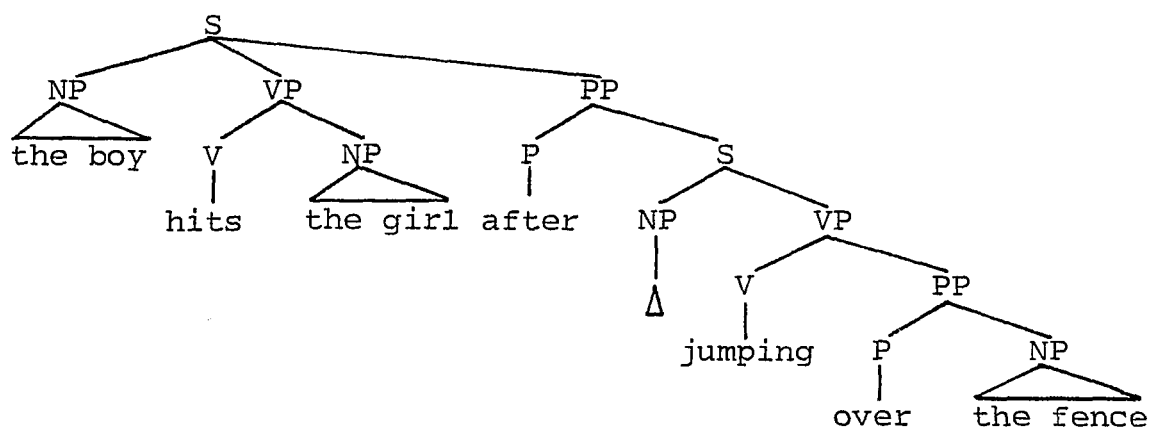
Goodluck (1978) originally proposed that both adults and children interpret missing complement subjects at a level other than surface structure. Her arguments, which are explained in section 2.2.4, chapter II, are summarized here. Goodluck claims that preposed complements attach to $\bar{S}$ as illustrated in (56).

(56)



Both the subject NP and the object NP are blocked as possible controllers by the c-command constraint. This is due to the fact that they are dominated by a branching node which does not dominate the missing NP position. As a result, either subject or object control would violate the c-command constraint, if control is determined at the level of surface structure. In order to explain the fact that preposed complements are subject controlled in adult grammar, Goodluck proposes that missing complement subjects are interpreted prior to preposing. This hypothesis is based on the assumption that the c-command constraint is inviolable. According to Goodluck's proposal, the controller in sentence (56) is determined at a level represented by non-preposed structures such as (57).

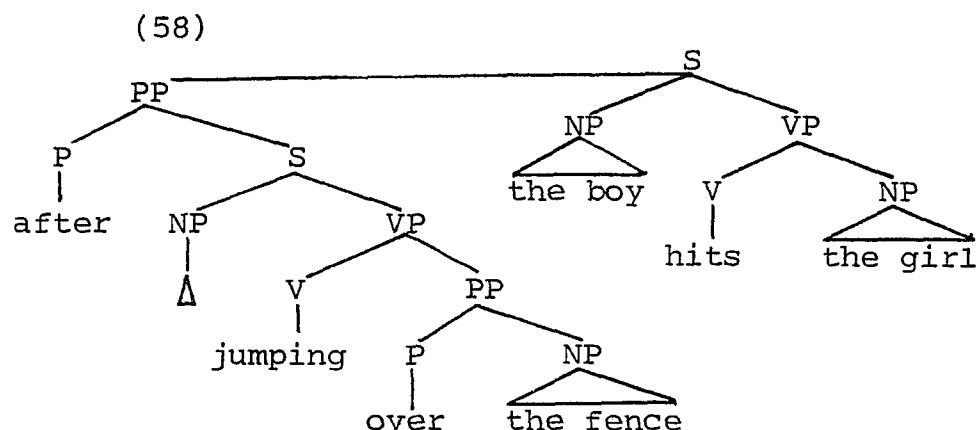
(57)



Subject control is now consistent with the c-command constraint. (See section 2.2.2, chapter II for an explanation.)

Section 2.2.4, chapter II, argues that there is an alternative analysis of preposed complements. In this

second analysis, preposed complements are attached to the matrix S as illustrated in (58) rather than $\bar{S}$.



Subject control of these structures does not violate the c-command constraint due to the fact that the subject NP is dominated by the branching node, S, which also dominates the missing NP position. If this alternative analysis is assumed to characterize adult grammar, then subject control of preposed complements does not entail that missing complement subjects be interpreted prior to preposing.

Children's response patterns bear on the issue of the level of interpretation of missing complement subjects. In particular, children who manifest object control on non-preposed structures provide crucial evidence due to the fact that object control of preposed structures is blocked by the c-command constraint in both (56) and (58). Thus, for this group of children, a pattern of object control on preposed complements would indicate that control is determined prior to preposing. Any other pattern of control for this group would indicate that control is determined at the level of

surface structure. Selection of an outside NP would indicate that the preposed complement is attached to $\bar{S}$, whereas subject control would indicate that the complement is attached to the matrix S. These predictions are based on the assumption that the c-command constraint operates in the children's grammars.

Goodluck (1978) reports that children four, five, and six years of age manifested 52.5, 39.0, and 34.2 percent object responses, respectively, on preposed complements. Among four and five year olds, 8.3 and 8.5 percent of the responses involved selection of an NP not mentioned in the sentence. This response disappeared for 6 year olds. Thus, object control accounted for the largest percentage of errors on preposed complements such as (56). The pattern of object control on preposed sentences paralleled the pattern of responses on the non-preposed sentences (see Table 6). However, Goodluck did not test whether individual children who manifested object control on non-preposed complements also manifested object control on preposed complements.⁷ In addition, the percentages do not suggest a dominate pattern of object control for four year olds. Instead, the percentages seem to reflect a mixed pattern of control. In order to provide a stronger test of the hypothesis that missing complement subjects are interpreted prior to preposing, it was predicted that children who exhibit object control on non-preposed constructions would exhibit object control of

preposed constructions; and children who exhibit subject control of non-preposed constructions would exhibit subject control of preposed constructions. The constructions used to evaluate this prediction are listed in (59).

(59)

Non-Preposed Constructions

Adverbial temporal complements following a matrix direct object (construction II-A; see section 1.1, this chapter)

The lion hits the bear after climbing up the ladder

'In order to' complements following a matrix direct object (construction III-A; see section 1.1, this chapter)

The lion hits the bear in order to climb up the ladder

Preposed Constructions

Preposed adverbial temporal complements (construction IV-A; see section 1.1, this chapter)

After climbing up the ladder the lion hits the bear

Preposed 'in order to' complements (construction IV-B; see section 1.1, this chapter)

In order to climb up the ladder the lion hits the bear

There were three tokens of each construction type. The type of control manifested by a child on each construction was determined on the basis of a criterion of two or more responses of the same type. That is, children were classified as manifesting object control on a construction if they exhibited at least two object responses, whereas they were

classified as manifesting subject control if they exhibited at least two subject responses. Once the type of control on each construction was identified, the following specific predictions were tested:

- (60) Children who exhibit object control on II-A would exhibit object control on IV-A more often than children who exhibit subject control on II-A; and children who exhibit subject control on II-A would exhibit subject control on IV-A more often than children who exhibit object control on II-A
- (61) Children who exhibit object control on III-A would exhibit object control on IV-B more often than children who exhibit subject control on III-A; and children who exhibit subject control on III-A would exhibit subject control on IV-B more often than children who exhibit object control on III-A

The predictions listed in (60) and (61) are based on the assumptions that the c-command constraint operates in children's grammars and that it is inviolable. However, the delayed operation hypothesis of universals suggests that these assumptions are not necessarily valid. Therefore, one further test of the level of interpretation hypothesis was conducted. The test attempted to insure that the c-command constraint was operative by selecting only those children with high c-command scores (viz. a score of 4 or more). As argued in the preceding paragraphs, those children who manifest object control on non-preposed structures provide the crucial data for the level of interpretation hypothesis. Thus, the test only involved these children. The type of control on each construction was determined in the manner

described in the preceding paragraph. Based on the hypothesis that control is determined prior to preposing, the predictions stated in (62) and (63) were tested:

- (62) Children with high c-command scores, who manifest object control on construction II-A would exhibit object control on construction IV-A more often than they exhibit subject control or any other response pattern
- (63) Children with high c-command scores, who manifest object control on construction III-A would exhibit object control on construction IV-B more often than they exhibit subject control or any other response pattern

4. Reliability of Children's Response Patterns

It has generally been assumed in language acquisition research that children would manifest consistent performance from one day to the next. However, in a study on children's interpretation of easy to see constructions, Cromer (1970) reported that children manifested inconsistent response patterns in a retest situation. The possibility that children's response patterns may be unreliable raises serious problems for drawing conclusions concerning the child's knowledge of the grammar. In view of this, the present study investigated the reliability of children's interpretation of missing complement subjects.

Cromer (1970) reported a relationship between the type of rule system characterizing a child's grammar and the reliability of the child's response patterns. Based on

performance in an initial comprehension task, children were classified as either primitive-rule users, intermediates, or passers. The primitive-rule users manifested a response pattern suggesting that they use a simple strategy which equated the surface structure subject with the deep structure subject. The passers were considered to have adult grammars in that they could recover the deep structure correctly. The intermediates were described as children with developing rule systems. Although they manifested knowledge that the surface structure subject was not always equivalent to the deep structure subject, they remained confused as to when the primitive rule should be abandoned. As a result, the intermediates manifested mixed responses which seemed to reflect alternate use of a primitive rule system and an adult system. Performance in a retest situation revealed that the children with either primitive rule systems or adult rule systems exhibited consistent response patterns, whereas the children with developing rule systems exhibited variable response patterns.

The five grammar types identified in the present study can be classified as belonging to one of Cromer's three types of rule systems. The proposed classification is based on the predicted sequence of development (see (14), this chapter) and the definition of the grammar types (see section 4, chapter II, for a detailed description of each grammar type). Cromer's use of the term "primitive rule"

suggests that it can be defined as a rule which (1) appears early in children's grammars and (2) differs from adult systems. Based on this definition, subject oriented and object oriented grammars may be considered to represent primitive rule systems. Both grammar types are predicted to appear early in the developmental sequence (see (14), this chapter). In addition, they represent analyses of multiple clause sentences which differ from analyses characterizing adult grammar. Subject oriented grammars attach all complement structures to the S node (see section 4.1, chapter II) and object oriented grammars attach all complements to the VP node (see section 4.2, chapter II).

Attachment of all complements to only one level differs sharply from adult grammars in which either the S, VP, or subject and object NP's are recursive nodes. In view of the fact that the c-command constraint may begin to operate during the stage of object oriented grammars (see section 2.1, this chapter), children with this grammar type and high c-command scores may be considered to have a developing rule system. Mixed subject-object grammars which are characterized by variable attachment of the complement to either the S, VP, or object NP may also be considered to be a developing rule system. This grammar type is postulated to represent a transitional stage between object oriented grammars and adult grammars. At this stage, children are abandoning the primitive rule of VP attachment in favor of

varying levels of attachment which characterize adult grammars (see section 4.3, chapter II). However, uncertainty as to the correct level of attachment for particular complements leads to mixed patterns of control on individual sentence types. Therefore, mixed subject-object grammars represent a developing rule system in which the S is becoming a recursive node and the child is learning the correct level of attachment for various complement types. Approaching adult and adult grammars represent adult rule systems in that both grammar types are characterized by correct attachment of complements to either the S, VP, or subject and object NP's (see section 4.4, chapter II).

In view of Cromer's findings concerning the relationship between the three types of rule systems (i.e. primitive, developing, and adult) and the reliability of children's response patterns, the following general relationship was predicted to exist between grammar type and reliability:

- (64) Children with either subject oriented grammars, or object oriented grammars and low c-command scores as well as those with approaching adult and adult grammars would manifest consistent response patterns in a test-retest situation; whereas children with either mixed subject-object grammars or object oriented grammars and high c-command scores would manifest variable response patterns in a test-retest situation

In order to test this hypothesis, responses on construction I of the fourth interview were compared to responses on construction II-A of the main comprehension

task. The constructions are listed in (65) (see also sections 1.1, and 2.3, this chapter).

(65) Construction II-A - The Main Comprehension Task

The lion hits the bear after climbing up the ladder

Construction I - Fourth Interview

The pig pushes the cow after waking up

Both constructions contain a missing complement subject and an adverbial temporal complement preceded by a direct object. Differences in vocabulary and inclusion of only an intransitive verb in the complement of construction I control for possible carry-over effects. As a result, the test-retest situation involved alternate forms. Differences in the number of subject responses on the two construction types were determined for each child who participated in both the main comprehension task and the fourth interview. Based on the general hypothesis stated in (64), the following specific predictions were tested.

- (66) Children with object oriented grammars and high c-command scores should exhibit more differences in their responses to construction I (fourth interview) as compared to construction II-A (main comprehension task) than children with subject oriented grammars, approaching adult grammars, adult grammars, and object oriented grammars and low c-command scores
- (67) Children with mixed subject-object grammars should exhibit more differences in their response to construction I (fourth interview) as compared to construction II-A (main comprehension task) than children with subject oriented grammars, approaching adult grammars,

adult grammars, and object oriented grammars and low c-command scores

5. Summary of Predictions

In summary, the present study investigated the validity of the hypothesis that five grammar types describe stages in the development of children's structural analyses of multiple clause sentences. In addition, the study investigated the following hypotheses concerning the operation of the c-command constraint in children's grammars: the delayed operation hypothesis, the immediate operation hypothesis, the overgeneralization hypothesis, and the inviolability hypothesis. Finally, the study investigated the issue of the level of interpretation of complement structures and the reliability of children's response patterns. The specific predictions that were tested are summarized below:

I. The Five Grammar Types

- A. The Relationship of Grammar Type to Age (see section 1.4.1)

$$u_s < u_o < u_{s-o} < u_{A-A} < u_A \text{ (see (17))}$$

- B. The Relationship of Grammar Type to DSS Score (see section 1.4.2)

$$u_s < u_o < u_{s-o} < u_{A-A} < u_A \text{ (see (18))}$$

II. Issues in the Operation of the C-Command Constraint

- A. The Delayed Operation Hypothesis

1. Relationship of C-Command Scores to Age and DSS Scores (see section 2.1.2)

C-command scores would be positively related to age (see (21))

Among object oriented children, c-command scores would be positively related to age (see (22))

Among mixed subject-object children, c-command scores would be positively related to age (see (23))

C-command scores would be positively related to DSS scores (see (24))

Among object oriented children, c-command scores would be positively related to DSS scores (see (25))

Among mixed subject-object children, c-command scores would be positively related to DSS scores (see (26))

2. The Operation of C-Command as a Function of Complement Type and/or Prepositional Phrase (see section 2.1.3)

Children with object oriented or mixed subject-object grammars who achieve different scores on constructions III-B, II-D, and II-B are more likely to exhibit the pattern in which $III-B > II-D > II-B$ than any other pattern (see (32))

Children with object oriented or mixed subject-object grammars are more likely to achieve different scores on the 3 sentence types than children with subject oriented, approaching adult or adult grammars (see (33))

B. The Immediate Operation Hypothesis (see section 2.1.4)

Among the following construction pairs, children should exhibit a greater number of subject responses on the first construction type as compared to the second construction type (see (36))

<u>1</u>	<u>vs.</u>	<u>2</u>
II-B	vs.	II-A
II-C	vs.	II-A
II-D	vs.	II-A
III-B	vs.	III-A
III-C	vs.	III-A

C. The Overgeneralization Hypothesis (see section 2.2)

Given sentential subject sentences (construction V), children with object oriented grammars and high c-command scores or children with mixed subject-object grammars and high c-command scores should pick an outside NP as the controller more often than children with either subject oriented grammars, or object oriented grammars and low c-command scores (see (43))

Given dative PP sentences (construction VII), children with object oriented grammars and high c-command scores should make more errors than children with object oriented grammars and low c-command scores (see (44))

Children with approaching adult grammars should make more errors on dative PP sentences (construction VII) than children with object oriented grammars and low c-command scores (see (45))

Children with object oriented grammars and high c-command scores and children with approaching adult grammars should make more errors on dative PP sentences (construction VII) than on object-subject relative clauses (construction VI) (see (46))

D. The Inviolability Hypothesis (see section 2.3)

Given semantically deviant sentences, "Shifters" with high c-command scores would manifest more responses in category 2 (subject control or response refusal) than "Non-shifters" with low c-command scores (see (55))

III. The Level of Interpretation of Missing Complement Subjects (see section 3)

Children who exhibit object control on II-A would exhibit object control on IV-A more often than children who exhibit subject control on II-A; and children who exhibit subject control on II-A would exhibit subject control on IV-A more often than children who exhibit object control on II-A (see (60))

Children who exhibit object control on III-A would exhibit object control on IV-B more often than children who exhibit subject control on III-A; and children who exhibit subject control on III-A would exhibit subject

control on IV-B more often than children who exhibit object control on III-A (see (61))

Children with high c-command scores, who manifest object control on construction II-A would exhibit object control on construction IV-A more often than they exhibit subject control or any other response pattern (see (62))

Children with high c-command scores, who manifest object control on construction III-A would exhibit object control on construction IV-B more often than they exhibit subject control or any other response pattern (see (63))

IV. The Reliability of Children's Responses (see section 4)

Children with object oriented grammars and high c-command scores should exhibit more differences in their responses to construction I (fourth interview) as compared to construction II-A (main comprehension task) than children with subject oriented grammars, adult grammars, and object oriented grammars and low c-command scores (see (66))

Children with mixed subject-object grammars should exhibit more differences in their responses to construction I (fourth interview) as compared to construction II-A (main comprehension task) than children with subject oriented grammars, approaching adult grammars, adult grammars, and object oriented grammars and low c-command scores (see (67))

FOOTNOTES

¹In the sixty-four language samples collected in the present study, embedded and conjoined structures occurred more frequently than combinations of auxiliary elements.

²The productive language samples collected from each child participating in the study indicated that all the children were using complete sentences. (See section 2, chapter V, for a description of the productive language of the children participating in the study.)

³As indicated in section 1.1, this chapter, passive constructions (construction II-D) are included in the present research. Section 2.2.3, chapter II discusses the adult analysis of these constructions as well as operation of the c-command constraint. Sections 3, chapter II, and 1.2.2, this chapter, discuss children's analysis of this construction and operation of the c-command constraint. As noted in these sections, if the prepositional phrase is correctly analyzed and the constraint is operational, then children should manifest subject control.

⁴If the preposition is assumed to be part of the verb, then the sentences would not violate the c-command constraint. (See also footnote 22, chapter II.)

⁵Due to the fact that overgeneralization is predicted to result in either subject responses or ONP responses on dative sentences, the term 'error' is used as a general label to refer to both types of responses

⁶See footnote 5, this chapter.

⁷Goodluck generously provided this information. However, a statistical test was still needed in order to determine whether similar patterns were manifested on preposed and non-preposed complements by individual children.

CHAPTER IV

METHOD AND MATERIALS

1. Description of Subjects

Previous research (Tavakolian, 1977; Goodluck and Roeper, 1978; and Goodluck, 1978) indicates that (1) subject oriented grammars may appear only in very young children, (2) the c-command constraint may be operative in children as young as 3 years of age, and (3) correct interpretation of missing complement subjects may not be completely developed by 6 years of age. In order to investigate all stages in the development of childrens interpretation of missing complement subjects, the present study tested children whose age ranged from 3 years 2 months to 8 years 4 months. A total of 72 children were interviewed in the study. Of those children who participated, 64 completed the first three interviews of the study.¹ Among the 64 children there were 40 females and 24 males. The number of males and females completing the first three interviews within various age groups is summarized in Table 11.

Table 11

The Number of Subjects Completing the First Three Interviews According to Age and Sex

	Age Groups			Sex		Total
	Yrs.-Mos.	to	Yrs.-Mos.	Females	Males	
1.	3-2	to	4-0	5	2	7
2.	4-1	to	4-6	5	2	7
3.	4-7	to	5-0	5	2	7
4.	5-1	to	5-6	6	2	8
5.	5-7	to	6-0	3	4	7
6.	6-1	to	6-6	4	3	7
7.	6-7	to	7-0	6	3	9
8.	7-1	to	7-6	2	4	6
9.	7-7	to	8-3	4	2	6
Total				40	24	64

Of the 64 children who completed the second and third interview, 50 children were asked to participate in a fourth interview. All children in the original group who were at least 5 years 3 months of age were asked to return. In addition, selected younger children were asked to return. The younger children were selected on the basis of their willingness to (1) participate and (2) follow the procedures. It is important to note that at the end of the third interview some of the younger children exhibited disinterest in the task and an unwillingness to follow instructions. It was

felt that these children would not successfully complete the fourth interview. The number of males and females participating in the fourth interview within various age groups is summarized in Table 12.

Table 12

The Number of Subjects Participating in the Fourth Interview According to Age and Sex

	Age Groups			Sex		Total
	Yrs.-Mos.	to	Yrs.-Mos.	Females	Males	
1.	3-2	to	4-0	1	0	1
2.	4-1	to	4-6	4	1	5
3.	4-7	to	5-0	3	1	4
4.	5-1	to	5-6	4	2	6
5.	5-7	to	6-0	3	4	7
6.	6-1	to	6-6	3	3	6
7.	6-7	to	7-0	6	3	9
8.	7-1	to	7-6	2	4	6
9.	7-7	to	8-3	4	2	6
Total				30	20	50

The subjects participating in the study attended three private schools. Thirty five children attended a preschool located in Flushing, New York (School 1); 20 attended a denominational school with a preschool, kindergarten, and 1st grade which was located in Teaneck, New Jersey

(School 2); and 17 attended the elementary program of a denominational school located in Dumont, New Jersey (School 3). The children included in the study were monolingual and had no known physical, intellectual or emotional impairments. School records, teacher judgments, and information provided by parents were used to establish these criteria for each subject.

2. Procedure

Each child was seen three times during a two week period. In addition, selected children were seen for a fourth time, which generally followed the third interview by 1 or 2 days. During the first interview an elicited language sample was collected, whereas during the three subsequent interviews comprehension tasks were presented. The comprehension tasks involved acting-out a set of experimental sentences in a manner described by Chomsky (1969).

2.1 First Interview. An elicited language sample was collected during a period of active play involving both the child and the experimenter. A variety of materials were used in this interview in order to interest children from all age groups. Depending on the child's age, materials from the following list were selected and placed on a rug. (An asterisk indicates those materials that were available to all children.)

1. hermit crabs or caterpillars*
2. a doll house
3. assorted doll furniture*
4. small movable and non-movable dolls*
5. a variety of match box cars with movable parts
6. a dump truck with movable parts
7. colored clay
8. wood boards
9. a variety of plastic flowers, trees, and benches
10. pipe cleaners
11. assorted plastic foods and a mechanical blender
12. assorted plastic medical items
13. assorted plastic dishes and silverware

The children were interviewed individually. Each child was asked if he or she wanted to see the experimenter's pets. When the child arrived, he or she was shown the pets and the toys. Each child was then told that he or she could play with the toys or the pets. The experimenter and the child sat on the rug and the child proceeded to pursue an activity of his or her choosing. During the play period, the experimenter engaged the child in conversation. General questions were asked such as "What should we do next?" to encourage the child to talk. Generally, the children needed very little encouragement. Most of the children directed activities, constructed imaginary situations or talked about themselves and their experiences in a manner which provided ample spontaneous conversation.

A tape recorder and microphone were located on the rug directly in front of the child. Most children inquired as to what it was and why it was there. The experimenter identified the tape recorder and explained that she wanted to remember everything the child said. Children who wanted

to talk into the tape recorder and to hear their voices were allowed to do so.

Each child was interviewed for 25 to 30 minutes. With two exceptions, a minimum of 50 utterances were collected for each subject. For one subject, 48 utterances were collected, and for another subject, who was extremely shy, only 5 utterances were collected.² Following the interview each child was told that he or she could come again. Each child was then asked if he or she would like to return.

The utterances collected during this interview were transcribed and analyzed according to the procedures outlined by Lee (1974). The procedure for Developmental Sentence Scoring (Lee, 1974) was used to analyze and score each language sample, and a DSS score was obtained for each child.

2.2 Second and Third Interviews. During the second and third interviews the main comprehension task was presented to the child. The experimenter read each sentence and the child was asked to act it out using a set of animals. Appendices A and B list the sentences used in the second and third interviews. Sixty four copies of the appendices were prepared, which allowed the experimenter to use them as (1) a guide to the stimulus sentences and (2) a sheet for recording each of the child's responses. Twenty two sentences were presented during the second interview and the remaining twenty three sentences were presented during the third inter-

view. The sentences were read to the child in random order. A computer was used to generate sixty-four randomized sequences for the numbers 1 through 45. These individual randomized sequences were then used as a guide for the presentation of the sentences to each child. (Note that the sentences are numbered 1 through 45 on appendices A and B.) The experimenter read the sentences listed on the Appendices according to the order of the numbers listed on the randomized sequence. Check marks were entered on the randomized number sequence as each sentence was read.

The comprehension task was presented to each child individually. The child and the experimenter sat on the floor on opposite sides of a table. (See the section 3.1 for a description of the table.) At the beginning of the second interview each child was given a test to assess his or her comprehension of the vocabulary in the experimental sentences. Excluding performance on the word promise, further participation in the study was contingent on demonstration of 100 percent comprehension of the vocabulary items listed on the test.³ The vocabulary test was constructed in such a way as to provide training in the procedures that the child was expected to follow during the second, third, and fourth interviews.

In the second interview, half of the children received 22 of the experimental sentences listed in Appendix A and half of the children received 22 of the sentences listed

in Appendix B. The vocabulary test differed depending on the experimental sentences that were to be used. Thus, two vocabulary tests, Forms H and I were developed. Form H was used in conjunction with Appendix A, and Form I with Appendix B. In the third interview, the remaining 23 sentences were read from the appendix not used in the second interview. For example, if Appendix A was used in the second interview with a particular child, then Appendix B was used with that child when he or she returned for the third interview. This means that each child encountered a different set of animals in the second and third interviews. As a result, a short vocabulary test was required for the third interview. As in the second interview, 100 percent comprehension of the vocabulary items was required for presentation of the experimental sentences. The vocabulary tests, training procedures, and instructions for the second and third interviews for each child are outlined in Forms H and I. (See Appendix D for these forms.)

2.3 Fourth Interview. The fourth interview was designed to test whether children would violate the c-command constraint. In addition, it provided data on the reliability of children's response patterns. As in the second and third interviews, the children were asked to act out a set of sentences using animals. In addition, they were asked to judge whether some of the sentences presented to them were semantically anomalous.

As in the second and third interviews, the child and the experimenter sat on the floor on opposite sides of the same table used in the previous interviews. Some new animals, vocabulary, and procedures were used in this interview, which required a new set of instructions and a short vocabulary test. One hundred percent comprehension of the vocabulary items was required for presentation of the experimental sentences. As in the previous interviews, the instructions and vocabulary test were combined. (See Appendix C for the experimental sentences and Appendix E for the vocabulary test and instructions.)

The fourth interview was divided into two parts. Separate instructions preceded each part. The experimental sentences presented during the first part were all semantically appropriate and the child acted out each sentence using procedures similar to those used in the second and third interviews. One deviation from the previous interviews was that all the animals remained on the table instead of being placed back in their boxes after each sentence. Once the sentences in Part I were completed, additional instructions were given as to the procedures to be used in the Part II. (See Appendix E for the specific instructions.) In Part II the experimental sentences were semantically anomalous. Therefore, each child was required to judge whether the stimulus sentences were acceptable or unacceptable. The children were instructed to (1) use the animals to act out

those sentences which were good, and (2) identify sentences that were not good (semantically deviant) as "silly". The experimental sentences in Part II were then presented.

Appendix C lists the experimental sentences used in the fourth interview. Twelve sentences were presented in Part I and 9 sentences were presented in Part II. Fifty copies of Appendix C were prepared and used as (1) a reference for the stimulus sentences and (2) a record sheet for each child's responses. The sentences in Part I and II were read in random order. A computer was used to generate 50 random sequences for the numbers 1 through 12 and 1 through 9. These randomized sequences were then used as a guide for the presentation of the sentences in each part. The experimental sentences are divided into Parts I and II on Appendix C and are numbered 1-12 and 1-9, respectively. The experimenter read the sentences listed in each part according to the order of the numbers listed on the randomized sequence. Check marks were entered on the randomized number sequence as each sentence was read. This procedure was modified slightly in Part II. In order to provide the child with additional examples of acceptable and unacceptable sentences, the experimenter began Part II by reading sentence #4, a semantically deviant sentence, followed by sentence #7, an acceptable sentence. The randomized sequence was then followed in the manner described above.

3. Materials

3.1 Table and Seating Arrangement. As described in Sections 2.2 and 2.3, the experimenter and child sat on opposite sides of a table which was located on the floor. The seating arrangement and the table are illustrated in Figure 8.

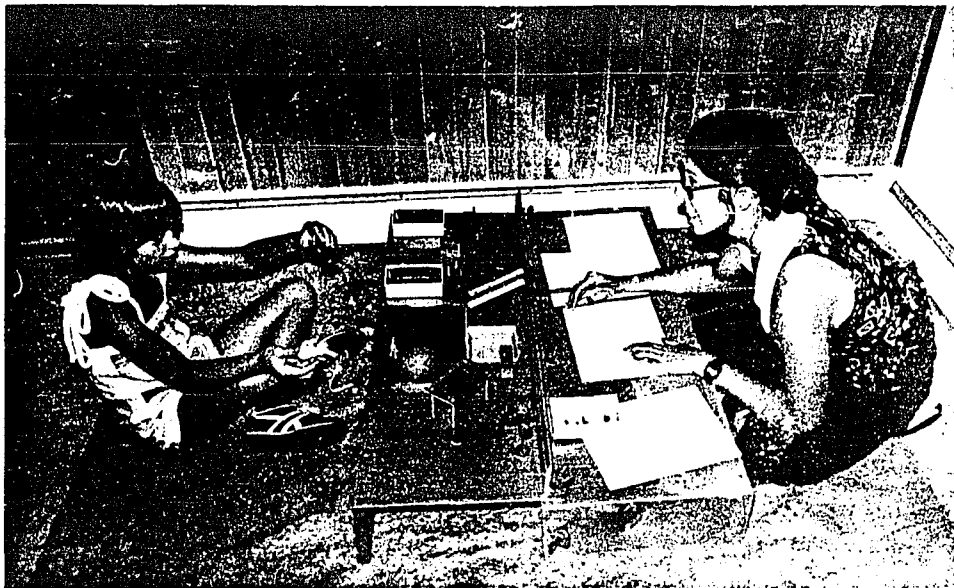


Figure 8. The table used during the second, third, and fourth interviews, and the seating arrangement of experimenter and child.

The table was constructed out of pine boards and paneling, and folded up into a suitcase to facilitate transportation. The table and ladder mentioned in the experimental sentences were constructed out of dowls and paneling and were permanently attached to the table top.⁴ A small square plastic container was filled with water for each interview and

recessed as shown in the photograph. A small square piece of green felt was glued to the table top. As shown in the photograph, a small chair was also attached to the table top, and small plastic branches mounted on circular bases were used as decoration. Due to the fact that an assistant helped in the collection of the data, two identical tables were constructed.

3.2 Animals. Small plastic animals ranging in height from 2 to 7 centimeters were purchased from local hobby stores. The animals were made in England and had realistic markings and coloring. With the exception of an owl which had wire feet, none of the animals had movable parts. All of the animals could be easily placed in an upright position.⁵

For the second and third interviews, the animals were placed in plastic containers which were lined with brightly colored felt. Three animals were grouped together in the containers. Two of the three animals matched the animal pairs that were mentioned in the experimental sentences listed in Appendices A and B. A third animal, which was not mentioned in the sentences, was also included in each box. The animals were grouped in boxes as follows:

Appendix A

Box 1: (blue felt lining) - lion, bear, elephant
Box 2: (red felt lining) - cow, horse, goat
Box 3: (yellow felt lining)-duck, rabbit, dog

Appendix B

Box 1: (blue felt lining) - tiger, gorilla, camel
 Box 2: (red felt lining) - pig, sheep, donkey
 Box 3: (yellow felt lining) - dog, cat, rabbit

The animals were grouped in terms of three general categories: zoo animals, farm animals, and common pets. In addition, the three animals within each group were matched in terms of (1) ferocity of the live animals represented and (2) actual size of the plastic reproductions. As described in Section 2.2, this chapter, the experimental sentences from only one appendix were used in each interview. Thus, 9 animals and 3 containers were used in the second and the third interviews.

Six animals were used during the fourth interview. The animals included a/an: owl, dog, cow, pig, duck, and cat. The owl was the only new animal introduced in the fourth interview. Prior to the interview, all the animals were placed in a plastic box. During the vocabulary test, the child located each animal in the box and placed it on the green felt. The animals then remained on the table for the duration of the interview. A duplicate set of animals was purchased and identical boxes were prepared for use by the assistant.

4. Sentences

4.1 Second and Third Interviews. Seven major construction types were presented during the second and third interviews. The construction types included several subclassifications

which yielded a total of 15 construction types. Each construction type was represented by three sentences. Thus, there was a total of 45 experimental sentences. The 45 sentences were constructed using the vocabulary listed in Appendix F. Two sets of 45 sentences were constructed which differed only with respect to animal pairs. The sets of sentences are listed in Appendices A and B, and the animal pairs used in the Appendices are as follows:

Appendix H

lion - bear
duck - rabbit
cow - horse

Appendix I

tiger - gorilla
pig - sheep
dog - cat

Balancing was used to control for possible effects of the order of presentation of animals. Thus, within each appendices two forms, Forms A and B, were developed in which the ordering of the animals was reversed. Half of the children who received Appendix A in the second interview received Form A, and the remaining half received Form B. The same procedure was followed with respect to Appendix B. In the third interview, the same forms were used with each child even though the alternate Appendix provided the experimental sentences. For example, a child who received experimental sentences from Appendix A-Form A in the second interview received experimental sentences from Appendix B-Form A in the third interview.

Balancing was also used to control for possible effects of types of animal pairs. Thus, the animal pairs occurred with equal frequency with respect to each of the following: (See Appendix F for specific vocabulary items.)

- a. construction type
- b. matrix verbs and associated prepositional phrases
- c. complement verbs and associated prepositional phrases

4.2 Fourth Interview. Four construction types were presented during Part I of the fourth interview and three construction types were presented during Part II. Each construction type is represented by 3 sentences which gives a total of 12 sentences in Part I and 9 sentences in Part II. The following animal pairs were used in constructing the sentences:

owl - dog
cow - pig
duck - cat

Appendix F lists the vocabulary items used to construct the sentences for the fourth interview, and Appendix C lists the actual sentences.

The constructions in Part I contained two sets of experimental sentences (Constructions I and II) and two sets of filler sentences. The experimental sentences are listed as Constructions I and II in Figure 7. The filler sentences included a simple declarative sentence with conjoined subject NP's (Construction III), and a complex sentence with conjoined

direct object NP's followed by an infinitival complement (Construction IV). (See Appendix C for Constructions I, II, III, and IV.)

The constructions in Part II contained two sets of filler sentences (Constructions VI and VII) and one set of experimental sentences (Construction V). (See Appendix C for Constructions V, VI, and VII and also Figure 7 for Construction V.) The filler sentences in Construction VII were acceptable conjoined sentences involving a transitive verb which specified the interaction of two animals, and an intransitive verb which specified a sound made by one of the animals. The filler sentences in Construction VI were semantically deviant conjoined sentences involving the same verb types as Construction VII. The deviancy derived from the inappropriate juxtaposition of animal and noise.

Balancing was used to control for the possible effects of the order of presentation of animals. Thus, two forms were developed for Appendix C, Forms A and B, in which the ordering of the animals was reversed. Half of the children received sentences from Form A and the remaining half received sentences from Form B.

Balancing was also used to control for possible effects of types of animal pairs. Thus, the animal pairs occurred with equal frequency with respect to each of the following: (See Appendix F for specific vocabulary items.)

- a. construction type
- b. matrix verbs
- c. complement verbs
- d. matrix and complement verbs with associated prepositional phrases

5. Scoring of Responses

The child's responses to the experimental sentences were recorded directly on the sentence lists. The experimenter circled the animal which the child used to carry out the action specified in the complement. If both animals carried out the action then both were circled. Furthermore, if a child selected an animal not mentioned in the sentence or if the child performed the action, then ONP (meaning outside NP) was recorded next to the sentence. A check mark was placed on the clause which was acted out first, an F was placed on any clause which the child failed to act out, and an R was placed on any main clause in which the order of agent and object was reversed. In the fourth interview, notes were entered next to sentences judged by the child to be semantically deviant.

The responses were later summarized on individual response sheets. Those animals which had been circled were recorded as either subject, object, first NP, second NP, or outside NP responses. Subject or object referred to the grammatical function of the animal in the main clause.

Outside NP referred to agents carrying out the complement action which were not mentioned in the main clause. First and second NP were used only with constructions V-A and V-B (main comprehension task) (see Figure 1). They were used to identify sentence internal nouns which were selected as controllers. For those sentences in which the order of agent and object in the main clause was reversed (excluding passives), the grammatical function of the animal carrying out the action of the complement was based on the reversed form of the sentence. In sentences in which the main clause was passive, the controller of the complement clause was determined from the sentence as it was read, irrespective of whether reversals occurred in the main clause. In sentences involving in order to, simultaneous use of both animals was scored as subject control, provided the action was carried out in the manner described in the sentence.

6. Experimenters

An assistant was hired to help in conducting the experiment. The assistant was a graduate fellow in the clinical psychology program at Fairleigh Dickinson University. The principal investigator trained the assistant in the procedures used to take language samples and to conduct the second, third, and fourth interviews. The assistant received approximately 15 hours of training which included both observation of the methods and supervised practicum.

During this period both experimenters simultaneously scored responses of the children. The experimenters continued simultaneous scoring until they achieved 100 percent agreement in their interpretation of the responses. Sixty four copies of each of the instructions and vocabulary tests (Appendices D and E) were prepared so that the experimenters would have a systematic outline of the procedures for each child.

In general most of the children participating in the study were randomly assigned to experimenters. However, initially those children who were judged to be the most cooperative were assigned to the assistant. Table 13 summarizes the ages and sex of the children interviewed by each experimenter.

Table 13

Age and Sex of the Children Interviewed by Each Experimenter

Age Groups				Principal Investigator			Assistant		
Yrs.-Mos. to Yrs.-Mos.				F	M	Total	F	M	Total
1.	3-2	to	4-0	3	2	5	2	0	2
2.	4-1	to	4-6	4	1	5	2	0	2
3.	4-7	to	5-0	2	2	4	3	0	3
4.	5-1	to	5-6	5	1	6	1	1	2
5.	5-7	to	6-0	3	2	5	0	2	2
6.	6-1	to	6-6	3	2	5	1	1	2
7.	6-7	to	7-0	4	1	5	2	2	4
8.	7-1	to	7-6	2	1	3	0	3	3
9.	7-7	to	8-3	3	1	4	1	1	2
Total				29	13	42	11	11	22

Note. F = Females; M = Males

Table 14 summarizes the percentage of subjects interviewed by each experimenter.

Table 14
Percentage of Subjects Interviewed
by Each Experimenter

Females		Males		Total	
P.I.	A	P.I.	A	P.I.	A
72.5	27.5	54.2	45.8	65.6	34.4

Note. P.I. = Principal Investigator; A = Assistant

Footnotes

¹Three children were unable to pass the vocabulary test (see Section 2.2 of this chapter). The remaining 5 children either refused to come back for the remaining interviews or were absent from school.

²Since a DSS Score could not be computed on 5 utterances, the second child was not requested to participate in subsequent interviews.

³Results reported by Chomsky (1969) suggested that young children could not be expected to understand the meaning of promise.

⁴Pilot interviews revealed that objects should be firmly attached to the table top. Movable objects proved to be very distracting for the children and often interfered with the conduct of an interview.

⁵Pilot interviews revealed that animals which fell over easily were distracting to the children and would delay the interview.

CHAPTER V

RESULTS

The results chapter is divided into nine sections. The first section describes the results of tests evaluating the effect of four nuisance variables on grammar type and DSS scores. This is followed by a brief description of the language samples which were collected and the range of DSS scores obtained in the study. The third section describes the classification of subjects according to grammar type and analyzes the response patterns of those subjects who were unclassifiable. The fourth section presents a summary, according to grammar type, of the response patterns on the fifteen constructions used in the main comprehension task. The fifth section describes results related to the development of grammar types. In particular, this section presents the results of tests evaluating the relationship of grammar type to age and DSS scores. The sixth section summarizes the results of tests related to issues in the operation of the c-command constraint. This section includes results of tests evaluating the relationship of c-command scores to age and DSS scores, and also results of tests evaluating the operation of the c-command constraint across several construction types. In addition, the sixth section describes test results related to the overgeneralization hypothesis and the inviolability hypothesis. Results of tests evaluating hypo-

theses concerning the level of interpretation of missing complement subjects and reliability of children's response patterns are described in sections seven and eight, respectively. Section nine summarizes the results of tests evaluating children's interpretation of the order of events in multiple clause sentences.

1. Determination of the Effect of Nuisance Variables

Experimenters, schools, sex, and race of the children, constituted nuisance variables in the study. Analyses were performed to determine the possible effects of these variables on grammar type and DSS scores.

1.1 Experimenter Effects.

1.1.1 DSS Scores. Pooled variance t-tests were performed within schools and sex to determine the experimenter effects on DSS scores. None of the tests were significant at $p \leq .20$ (two-tailed tests).

Combined tests (Rosenthal, 1978) of experimenter effects were also performed. The purposes of these tests were two-fold: (1) to increase the power of the tests of individual experimenter effects, discussed above, and (2) to detect possible interaction of experimenter effects with schools and/or sex. P-levels for seven combined tests ranged from .38 to .49.

1.1.2 Grammar Types. A chi-square test of independence was performed to determine the possibility of a relation of experimenters to grammar types. The test was not significant ($p > 0.41$).

1.2 School Effects on DSS Scores. Two analyses of covariance within sex and race were performed to determine if differences in DSS scores were attributable to differences in schools. Age was the covariate in both analyses. Due to the small number of blacks participating in the study (see section 1.4, this chapter) these analyses were carried out on the data of caucasian children only. Both the analysis of covariance within females and the analysis of covariance within males were not significant. The F ratio in each case was less than 1.

1.3 Sex Effects.

1.3.1 DSS Scores. Three analyses of covariance were performed within schools and within race to determine if sex influenced DSS scores. Age in all three analyses was the covariate. Again, due to the small number of blacks, race was limited to caucasian children. All three analyses were not significant, yielding F ratios of less than 1.

1.3.2 Grammar Type. An analysis of covariance (with two covariates) was performed to determine if there was a relation of sex to grammar type. Age and race were covariates. The test was not significant ($p = .214$). Three

tests of proportions were also performed to determine if there were significant differences in the proportion of males and females belonging to specific pairs of grammar types. None of these tests were significant at the .05 level.

1.4 Race Effects. Among those children who completed the first three interviews, 54 were caucasian and 10 were black. Eight of the black children attended School 2 (see chapter III, section 1), whereas only 1 attended each of the remaining two schools. Of the 8 children attending school 2, 3 were males and 5 were females.

1.4.1 DSS Scores. Two analyses of covariance were performed within schools and within sex to determine if race influenced DSS scores. Age was a covariate in both analyses. Analyses of covariance (as opposed to analyses of variance) were considered to be desirable since the black children tended to be older. Due to the limited number of black children tested at Schools 1 and 3, the analyses included only those children attending School 2. Neither test was significant (F ratios were less than 1 in both cases).

1.4.2 Grammar Type. An analysis of covariance was performed to determine if there was a relation of race to grammar type. Sex and age were covariates. The test was not significant ($F < 1$).

In conclusion, none of the statistical tests of effects of nuisance variables (experimenter, school, sex

and race) yielded significant results.

2. Language Samples and DSS Scores

DSS scores were computed for each subject participating in the study. The scores ranged from 5.41 to 18.12. The youngest child in the study obtained a DSS score of 7.72 and the oldest child obtained a DSS score of 11.66.

It is important to recall that the Developmental Scoring (DSS) procedure is used to evaluate a child's syntactic development after he or she is speaking in complete sentences 50 percent of the time (Lee, 1974). All of the children in the study satisfied this criterion. In addition, the DSS procedure is used to analyze only the complete sentences which are obtained in a sample. Lee (1974) recommends that a minimum of fifty utterances should be selected for analysis. One child in the study manifested only 48 analyzable sentences. However, the remaining sixty-three children manifested well over fifty analyzable utterances. Therefore, with the exception of one sample, 50 utterances were used to determine the DSS score of each child. Forty-eight utterances were used in the exceptional case. In general, the children used very few sentence fragments. Thus, all the children in the study can be described as communicating with predominantly complete sentences which had, at most, some minor grammatical errors.

3. Classification of Subjects According to Grammar Type

Of the sixty four children who completed the first three interviews, fifty five exhibited response patterns which were classifiable in terms of one of the five grammar types. (See section 1.3, chapter III, for a description of the criteria for classification.) Table 15 lists the number of children classified in each grammar type.

Table 15¹

Number of Children Classified in Each Grammar Type

Grammar Type	Number of Children
Subject Oriented	2
Object Oriented	29
Mixed Subject-Object	9
Approaching Adult	12
Adult	3
Total	55

There were nine children who were unclassifiable. Two of the children satisfied the first criterion for an object oriented grammar, but failed to satisfy the second criterion. This suggests a lack of consistency in attachment of the complement to either the VP or object NP. Of

the seven remaining unclassifiable children, five seemed to represent transitional stages between object oriented grammars and mixed subject-object grammars. The critical subject and object control scores for these children were 22 & 67; 39 & 58; 33 & 58; 28 & 67; and 39 & 58, respectively. Among these children, the subject and object control scores failed to meet the criteria for either an object oriented grammar or a mixed subject-object grammar. The object control scores indicated a decline in attachment of the complement to the VP, whereas the subject control scores indicated that attachment of the complement to the S was increasing. All of these children exhibited at least 83% object responses on constructions VI and VII which ruled out subject-oriented grammars. In addition, they exhibited c-command scores ranging from 3 to 6 indicating that the c-command constraint was either beginning to operate or fully established. These facts support the claim that the grammars of the five children represented a developmental stage beyond that characterized by an object oriented grammar. Of the two remaining unclassifiable children, one satisfied the first criterion and half of the second criterion for an adult grammar. However, the child exhibited only four object responses on constructions VI and VII which was below the 80% required for adult grammars. Thus, this child seemed to represent a transitional stage between approaching adult and adult grammars. Both subject responses occurred on

construction VII suggesting that the child had not yet completely learned the exceptions to the c-command constraint. The remaining unclassifiable subject failed to exhibit any response patterns which would suggest a transitional stage in grammar development. The child's critical subject and object control scores were 17.0 and 67 percent, respectively. This subject, who was 5 years and 4 months of age, at the time of testing obtained a DSS score of 6.18. Using the normative data provided by Laura Lee (1974) this DSS score falls below the 10th percentile for DSS scores obtained by children of the same age. This suggests a possible language delay which has resulted in failure to develop rule systems that are characteristic of normal language development. This child's DSS score contrasts with the DSS scores of the other eight unclassifiable children whose response patterns are described above. Seven of these children fall within ages for which normative DSS data is provided. The DSS scores for six of these children fall on or above the 50th percentile for their particular age group. The DSS score of the remaining child falls slightly below the 25th percentile. In summary, there were nine children whose response patterns were unclassifiable according to the five grammar types outlined in the study. Six of these children exhibited response patterns which seemed to represent further transitional stages in grammatical development. Of the remaining unclassifiable children, two exhibited response patterns which

were characteristic of object oriented grammars except for a lack of consistency on two construction types. Finally, one child exhibited responses that were unsystematic and suggestive of an abnormal pattern in language development.

4. Response Patterns According to Grammar Type

Chapter III (section 1.2, Figure 1) described the response patterns on fifteen construction types which were expected to be associated with each grammar type. Some of the constructions listed in Figure 1 were used to classify children according to grammar type (see section 1.3, and Appendix G for a description of the constructions used for classification). Several constructions were not used for classificatory purposes (viz., constructions I-A, I-B, and II-D). Two constructions were used as classificatory sentences with respect to only two grammar types (viz., V-A and V-B were used only for approaching adult and adult grammars).

Table 16 summarizes, according to grammar type, the mean number of correct responses on each construction in the main comprehension task. Table 17 summarizes the mean number of incorrect responses on those construction types in which more than one type of error occurred. For example, on constructions V-A and V-B incorrect responses involved either selection of an outside NP or selection of the 1st NP as the controller of the complement. For the remaining constructions in the main comprehension task, errors involved either

Table 16

Mean Number of Correct Responses on Constructions in the Main Comprehension Task
(2nd and 3rd Interviews) According to Grammar Type

Grammar Type	Constructions												2nd NP		
	Subject Controlled										Object Controlled				
	IB ^a	IIA	IIB	IIC	IID ^a	IIIA	IIIB	IIIC	IVA	IVB	IA ^a	VI	VII	VA	VB
Subject Oriented	0.50	3.00	3.00	2.50	2.00	3.00	2.50	3.00	2.00	2.00	3.00	1.00	2.00	0.50	1.50
Object Oriented	0.57	0.32	1.18	0.54	2.07	0.25	1.14	0.18	0.46	0.18	2.93	2.79	2.75	1.32	1.60
Mixed Subj.-Obj.	1.80	1.70	2.70	2.10	2.20	1.70	2.50	1.30	1.60	1.30	2.90	2.20	2.20	0.60	0.80
Approaching Adult	2.25	2.58	2.92	2.92	1.83	2.67	2.92	2.75	2.17	2.58	3.00	2.83	2.58	0.17	0.08
Adult	1.33	3.00	2.67	3.00	2.33	2.67	3.00	2.67	2.00	2.67	3.00	3.00	3.00	3.00	2.33
Overall	1.09	1.31	1.95	1.53	2.05	1.22	1.84	1.14	1.25	1.13	2.95	2.68	2.58	1.05	1.17

Note. Maximum possible score is a mean of three.

^aConstructions not used for classificatory purposes.

Table 17

Mean Number of Incorrect Responses on the Preposed Complement Constructions (IV-A & IV-B) and Sentential Subject Constructions (V-A & V-B) According to Grammar Type

Grammar Type	Type of Control Errors							
	Object Control		1st NP		Outside NP			
	IV-A	IV-B	V-A	V-B	IV-A	IV-B	V-A	V-B
Subject Oriented	0.50	1.00	0.00	0.50	0.00	0.00	1.50	1.00
Object Oriented	2.36	2.79	0.89	0.53	0.00	0.00	0.57	0.71
Mixed Subject-Object	0.90	1.50	0.90	0.60	0.40	0.10	1.50	1.60
Approaching Adult	0.75	0.42	0.17	0.00	0.00	0.00	2.67	2.92
Adult	1.00	0.33	0.00	0.00	0.00	0.00	0.00	0.33
Overall	1.67	1.87	0.59	0.41	0.08	0.00	1.23	1.38

Note. Maximum possible score is a mean of three.

selection of an object when subject control was correct, or selection of the subject when object control was correct. The percentage of failures to act out an entire sentence was negligible. A total of 2,872 sentences were presented during the interviews which constituted the main comprehension task. Overall, only two responses occurred in which a child failed to act out an entire sentence. There were, however, 3.1 percent failures to act out the main clause of a sentence, and .8 percent failures to act out the complement clause (see Appendix H, Tables C and D). In addition, children reversed the agents and objects of the main clause in 3.7 percent of the responses (see Appendix H, Table B).

The tell sentences (I-A) were interpreted correctly by all the children in the study. There were a total of 192 responses of which 189 were correct and 3 were errors. Each error was manifested by a different child. The quality of the responses differed in that older children made up dialogues for the animals whereas younger children did not. A silent action showing two animals coming together was accepted as enactment of the action specified in the main clause (viz., telling) even though the child did not verbalize a dialogue. In 5 percent of the responses, children did not act out the main clause of the tell sentences. However, all the children acted out the directed action (i.e. the action in the complement clause).

The experimenters observed that the quality of responses for older and younger children also tended to differ for the promise sentences (I-B), the in order to sentences (III-A, III-B, III-C), and the OS Relatives. With respect to the promise sentences only the older children tended to verbalize dialogues between the two animals. The same scoring procedure was applied to the promise sentences as to the tell sentences. That is, a silent action showing two animals coming together was accepted as demonstration of the action specified in the main clause (viz., promising). In 12 percent of the responses, children failed to act out the main clause. However, in all responses, the action in the complement clause was demonstrated, although the controller was frequently incorrect (see Table 16). With respect to the in order to sentences, interpretation of the meaning of in order to was apparent in the responses of older children. For example, in a sentence such as the lion hits the bear in order to climb up the ladder, the older children would place the bear in front of the ladder so that it prevented the lion from climbing. The child would then make the lion hit the bear out of the way. Although younger children acted out the clauses correctly, they often failed to demonstrate the meaning of in order to in the same way as the older children. A similar difference was observed in the quality of the responses on OS relatives. In a sentence such as the lion hits the bear that is climbing up the ladder, older children

carefully placed the bear on the ladder prior to the action of hitting. Younger children, on the other hand, acted out the hitting action prior to the climbing action. As indicated in Table 16, the matrix direct object was generally selected to carry out the action specified in the relative clause.² Although the response was correct, the demonstration did not always capture the complete meaning of the sentence.

A final comment should be made on the quality of the demonstrations of constructions II-C and III-C which contained hits at, pulls at, and pushes on, as compared to constructions II-A and III-A which contained only hits, pulls, and pushes. (See section 1.1, chapter III, and Appendices A and B for examples.) Considering the meaning of the words, it seems that demonstrations of push as compared to push on would be indistinguishable. However, demonstrations of sentences involving hits at and pulls at should be distinguishable from demonstrations of sentences involving only hits and pulls. For example, consider the following sentences:

- (1) The lion hits the bear after climbing up the ladder
- (2) The lion hits at the bear after climbing up the ladder

In sentence (1) the lion should come in contact with the bear, whereas in sentence (2), the lion should not. With respect to sentences involving pull, there should be actual movement of the direct object. In contrast, only a pulling motion on

the part of the subject without corresponding movement on the part of the object are required for sentences involving pulls at. The experimenters did not observe any differences in the quality of the demonstrations of constructions II-C and III-C as compared to II-A and III-A. The children tended to demonstrate hits at, pulls at and pushes on in the same way that they demonstrated hits, pulls and pushes.

5. Sequence in the Development of Grammar Types

5.1 Relationship of Grammar Type to Age. The sixty four children participating in the study ranged in age from 3 years 2 months to 8 years 3 months. Table 18 summarizes the means and standard deviations of the ages of the children belonging to each grammar type.

Table 18

Means and Standard Deviations of Ages of Children
Belonging to Each Grammar Type

Grammar Type	Mean		Standard Deviation	Sample Size
	Days	Years		
1-Subject Oriented	1481.75	4.06	237.94	2
2-Object Oriented	1903.27	5.21	399.55	29
3-Mixed subject-object	2081.75	5.70	375.14	9
4-Approaching Adult	2640.75	7.23	299.23	12
5-Adult	2817.77	7.72	104.04	3
6-Unclassifiable Subjects	2019.11	5.53	369.88	9

One analysis of variance and one analysis of covariance were performed to determine if children belonging to different grammar types differ significantly in age. For the analysis of covariance, the covariates were sex and race. Results of the analyses are summarized in Table 19. Both F ratios were significant ($p < .0000001$) and the means were in the predicted direction. Calculation of ω^2 indicated that an estimated forty-two percent of age variance was attributable to grammar type. Table 20 indicates results of planned pairwise multiple comparisons of treatment means. Seven out of the ten comparisons were significant at the .05 level or better.

Table 19

Analysis of Variance and Covariance: D. V. - Age; I. V. Grammar Type;
Covariates: Race & Sex

ANOVA

Source of Variation	SS	df	MS	F	P <
Treatments	6947736.6	5	1389547.3	10.42	.0000004
Error	7734524.5	58	133353.87		
Total	14682261.1	63			

ANOCOV

Source of Variation	SS	df	MS	F	P <
Treatments	.72921X10 ⁷	5	.14584X10 ⁷	11.524	.0000001
Error	.70872X10 ⁷	56	.12656X10 ⁶		
Total	.14379X10 ⁷	61			

Note. D. V. = dependent variable; I. V. = independent variable

$$\omega_{age}^2 = .42$$

Table 20

Relationship Between Age and Grammar Type: Results of
Planned Multiple Comparisons of Treatment Means

Comparisons			p Value for Contrasts of Adjusted Means (Analysis of Covariance)	p Value for Contrasts of Unadjusted Means (Analysis of Variance)
Group		Group		
1	vs.	2	.073	.063
1	vs.	3	.02 *	.031 *
1	vs.	4	.0001 ***	.001 ***
1	vs.	5	.00007***	.015 *
2	vs.	3	.062	.09
2	vs.	4	.00001***	.0000005***
2	vs.	5	.00003***	.0001 ***
3	vs.	4	.001 ***	.001 ***
3	vs.	5	.002 **	.005 **
4	vs.	5	.137	.234

Note. 1 = subject oriented grammar; 2 = object oriented grammar; 3 = mixed subject-object grammar; 4 = approaching adult grammar; and 5 = adult grammar.

*p < .05

**p < .01

***p < .001

5.2 Relationship of Grammar Type to DSS Scores. DSS scores were obtained on all the children participating in the study. Table 21 summarizes the means and standard deviations of the DSS scores for children belonging to each grammar type.

Table 21

Means and Standard Deviations of DSS Scores
for Children Belonging to Each Grammar Type

Grammar Type	Mean	Standard Deviation	Sample Size
1-Subject Oriented	8.74	3.73	2
2-Object Oriented	9.99	2.59	29
3-Mixed Subject-Object	11.46	2.35	9
4-Approaching Adult	12.57	2.12	12
5-Adult	13.57	4.33	3
6-Unclassifiable Subjects	9.84	2.40	9
All Subjects	10.78	2.78	64

An analysis of variance and one analysis of covariance were performed to determine if children belonging to the different grammar types differed significantly with respect to their DSS scores. In the analysis of covariance, the covariates were sex, and race. The results of the two analyses are summarized in Table 22. The analysis of variance was significant at the .016 level, and the analysis

Table 22

Analysis of Variance and Covariance: D. V. - DSS Score; I. V. - Grammar Type;
Covariates: Race and Sex

ANOVA					
Source of Variation	SS	df	MS	F	p <
Treatments	100.03	5	20.02	3.07	.016
Error	378.41	58	6.52		
Total		63			
ANOCOV: COV: Race & Sex					
Source of Variation	SS	df	MS	F	p <
Treatments	111.76	5	22.353	3.5402	.008
Error	353.59	56	6.3141		
Total	465.35	61			

Note. D. V. = dependent variable; I. V. = independent variable.

$$\omega_{DSS}^2 = .14$$

of covariance was significant at the .008 level. In addition, the means were in the predicted direction. Calculation of ω^2 indicated that an estimated fourteen percent of DSS variance was attributable to grammar type. Table 23 indicates results of planned multiple pairwise comparisons of treatment means. Five out of the ten pairwise comparisons of the adjusted means were significant at the .05 level or better.

6. Issues in the Operation of the C-Command Constraint

This section summarizes results of tests evaluating the following four hypotheses concerning the operation of the c-command constraint: (1) the delayed operation hypothesis, (2) the immediate operation hypothesis, (3) the overgeneralization hypothesis, and (4) the inviolability hypothesis.

6.1 The Delayed Operation Hypothesis

6.1.1 The Relationship of C-Command Scores to Age and DSS Scores. C-command scores were obtained for sixty two of the children participating in the study. The scores, which ranged from zero to six, reflected the total number of subject responses on constructions II-B and III-B (adverbial temporal and in order to complements following locative prepositional phrases). (See section 1.1, chapter III, for

Table 23

Relationship Between DSS Scores and Grammar Type: Results of
Planned Multiple Comparisons of Treatment Means

Comparisons		p Value for Constrasts of Adjusted Means (2nd Analysis of Covariance)	p Value for Contrasts of Unadjusted Means (Analysis of Variance)
Group	Group		
1	vs. 2	.35	.253
1	vs. 3	.11	.086
1	vs. 4	.05 *	.027 *
1	vs. 5	.024*	.022 *
2	vs. 3	.035*	.062
2	vs. 4	.003**	.002 **
2	vs. 5	.007**	.0123 *
3	vs. 4	.24	.156
3	vs. 5	.09	.1064
4	vs. 5	.19	.272

Note. 1 = subject oriented grammar; 2 = object oriented grammar; 3 = mixed subject-object grammar; 4 = approaching adult grammar, and 5 = adult grammar.

*p < .05

**p < .01

illustrations.) A score of zero was assumed to represent lack of the c-command constraint, whereas a score of six was assumed to represent operation of the constraint. Subject oriented children were excluded due to the fact that their response patterns would be ambiguous with respect to operation of the c-command constraint (see sections 2.1.1, and 2.1.4, chapter III, for a discussion). Table 24 summarizes the number of children obtaining each c-command score, and the mean ages and DSS scores for each group.

Table 24
Mean Ages and DSS Scores Associated With
Each C-Command Score

C-Command Scores	N	Means	
		DSS	Ages ^a
0	2	8.44	6.01
1	9	9.59	5.05
2	10	8.91	4.67
3	8	10.25	5.21
4	4	10.98	5.95
5	11	12.09	6.20
6	18	12.41	6.94

Note. N = number

^aAges are in years.

Pearson correlation coefficients were obtained to determine

if the c-command scores were positively related to age and DSS scores (see section 2.1.1, predictions (21) and (24)). Each coefficient was tested for significance by means of a t-test, and the p-level associated with each t was determined. The c-command scores were significantly related to both age ($p = .000006$) and DSS scores ($p = .00008$). It is important to point out that c-command scores reflect the number of correct responses on the two construction types. Thus, it is not surprising that the number of correct responses increases with age and level of grammatical development. However, this is not the trend that is predicted by the immediate operation hypothesis. Thus, the results do not support the claim that the c-command constraint is both fully specified and fully operational from the beginning stages of language acquisition. Instead, the results support the delayed operation hypothesis.

Table 25 reports the mean ages, DSS scores, and c-command scores for four grammar types (see introductory paragraph, this section, for an explanation of the exclusion of subject oriented grammars).

Table 25
Mean Ages, DSS Scores and C-Command Scores
for Four Grammar Types

Grammar Type	N	Means		
		Age ^a	DSS	C-Command
Object Oriented	29	5.21	9.99	2.44
Mixed Subject-Object	9	5.70	11.46	5.10
Approaching Adult	12	7.23	12.57	5.80
Adult	3	7.72	13.57	5.70
Unclassifiable	9	5.53	9.84	3.10

Note. N = number

^aAge is in years.

Pearson correlation coefficients were obtained to determine if c-command scores were positively related to age and DSS scores for children with either object oriented or mixed subject object grammars (see section 2.1.1, predictions (22), (23), (25), and (26)). Each coefficient was tested for significance by means of a t-test, and the p-level associated with each t was determined. Among object oriented children, c-command scores were significantly related to both age ($p = .04$) and DSS scores ($p = .05$). In contrast, c-command scores were not significantly related to either age or DSS scores for children with mixed subject-object grammars. These results suggest that the c-command constraint begins to operate during the period when children manifest object

oriented grammars and that it is established by the time that children manifest mixed subject-object grammars. This is supported by inspection of the data reported in Table 25. There is a large difference in the mean c-command scores of object oriented children as compared to the means for the remaining three grammar types. On the other hand, the mean c-command score for the mixed subject-object children is similar to the mean scores of approaching adult and adult children.

Results reported in Table 26 provide further evidence concerning the proposed relationship between the operation of the c-command constraint and grammar type.

Table 26

Percentage of Children Obtaining Each C-Command Score According to Grammar Type

Grammar Types	N	C-Command Scores						
		0	1	2	3	4	5	6
Object Oriented	29	3	31	28	14	7	14	3
Mixed Subj.-Obj.	9	0	0	0	0	22	44	33
Approaching Adult	12	0	0	0	0	0	17	83
Adult	3	0	0	0	0	0	33	67
Unclassifiable	9	11	0	22	44	0	0	22

Note. N = number

Table 26 indicates that children with mixed subject-object grammars manifested c-command scores ranging from four to six and children with approaching adult and adult grammars manifested just the highest scores of five and six. In contrast, children with object oriented grammars manifested the entire range of c-command scores. It is important to recall, that c-command scores ranging from zero to three (termed low c-command scores) were considered to represent lack of operation of the constraint; whereas scores ranging from four to six (termed high c-command scores) were considered to represent operation of the constraint (see section 2.2, chapter III). As indicated in Table 26, children with mixed subject-object, approaching adult, and adult grammars manifested only high c-command scores. In contrast, the object oriented children can be divided into two groups: one group with low c-command scores, and a second group with high c-command scores. Seventy-six percent of the object oriented children manifested low c-command scores. Furthermore, this group of object oriented children had a mean age of 4.95 years and a mean DSS score of 9.43; while the group with high c-command scores had a mean age of 6.06 years and a mean DSS score of 10.93. Thus, the object oriented children with low c-command scores tended to be younger than those with high c-command scores. These data suggest that the c-command constraint is not immediately operational in the grammars of object oriented children. Operation seems

to begin toward the latter part of the object oriented stage, and is established, at least with respect to locative prepositional phrases, by the time the child manifests a mixed subject-object grammar.

6.1.2 Operation of the C-Command Constraint as a Function of Complement Type and/or Prepositional Phrase. An additional test of the delayed operation hypothesis was the prediction that children would manifest a specific sequence in the acquisition of subject control on three construction types: (1) construction III-B (in order to complement followed by a locative prepositional phrase); (2) construction II-D (adverbial temporal complement following a passive by phrase); and (3) construction II-B (adverbial temporal complement following a locative prepositional phrase) (see sections 1.1, and 2.1.3, chapter II for examples). The three construction types differ with respect to complement type (III-B vs. II-B) and type of prepositional phrase (II-B vs. II-D). The operation of the c-command constraint is expected to result in subject control, regardless of the level of attachment of the complement (see section 2.1.3 for a discussion).

The prediction of a developmental order was limited to the three constructions (III-B, II-D, and II-B), due to the fact that these were the only constructions for which previous results suggested a possible sequence in the operation of the constraint. (See section 2.1.3, chapter III, for

a discussion of the data.) Previous research (Goodluck, 1978 and Tavakolian, 1977) suggested that the order of acquisition would be as follows: first, III-B; second, II-D; and third, II-B. (See also section 2.1.3, chapter III.) Since the c-command constraint was predicted to appear either during the period of object oriented grammars or mixed subject-object grammars, children with these grammar types were expected to manifest differences in the number of subject responses such that $III-B > II-D > II-B$. In order to test this hypothesis, it was predicted that object oriented and mixed subject-object children who achieve different scores on the three constructions would be more likely to exhibit the pattern $III-B > II-D > II-B$ than any other pattern (see prediction (32), chapter III). It was also predicted that children with object oriented or mixed subject-object grammars would be more likely to achieve different scores on the constructions (III-B, II-D, and II-B) than children with subject oriented, approaching adult or adult grammars (see prediction (33), chapter III). Table 27 summarizes the number of children obtaining the same or different scores on the three construction types.

Table 27

The Number of Same or Different Scores on Constructions
III-B, II-D, and II-B According to Grammar Type

Response Patterns	Grammar Type				Total	Percent
	s	o	s-o	A _A A ^a		
1. Different Scores on all 3	0	10	1	1	12	21.8
2. Different Scores on at least 2	2	17	6	9	34	61.8
3. Same Scores on all 3	0	2	2	5	9	16.4
Total	2	29	9	15	55	100.0

Note.

^aResponses were combined for children exhibiting approaching adult and adult grammars.

A Fisher Exact Test was performed to determine if children with object oriented or mixed subject-object grammars were more likely to achieve different scores on the three construction types than children with subject oriented, approaching adult, or adult grammars (prediction (33), chapter III). Patterns in which the number of subject responses differed for at least two of the constructions were exhibited by 92 percent of the children with object or mixed subject-object grammars and by 71 percent of the children with subject, approaching adult, and adult grammars. The difference between these proportions was significant at $p = .05$, one-tailed test.

Due to the small number of children exhibiting different responses on all three constructions it was impossible to test prediction (32) as originally stated. However, it was possible to evaluate the developmental sequence by comparing the relative frequency of subject responses for individual pairs of construction types. Thus, for children with object oriented or mixed subject-object grammars the number of subject responses to the following construction pairs was evaluated:

(3) III-B vs. II-D

(4) II-D vs. II-B

(5) III-B vs. II-B

Given the binary nature of the dependent variable, a sign test was used to determine if there was evidence of the sequential development of the c-command constraint with respect to construction types. Table 28 summarizes the number of children obtaining different frequencies of subject responses on the construction pairs and the direction of those differences with respect to the original prediction concerning the relative number of subject responses on the three construction types. A plus indicates differences in the predicted direction, whereas a minus indicates differences in the opposite direction.

Table 28

Percentages and Direction of the Relative Number of
Subject Responses to Three Construction Pairs
for Children with Object Oriented or Mixed
Subject-Object Grammars

Direction of Differences	Construction Pairs					
	III-B > o	II-D s-o	II-D > o	II-B s-o	III-B > o	II-B s-o
Predicted +	20(4)	50(2)	86(18)	40(2)	52(12)	50(3)
Opposite -	80(16)	50(2)	14(3)	60(3)	48(11)	50(3)
Total	100(20)	100(4)	100(21)	100(5)	100(23)	100(6)

Note. Numbers in parentheses indicate frequencies; o = object oriented grammar; s-o = mixed subject object grammar.

Of those children with object oriented grammars who exhibited differences in the number of subject responses to III-B and II-D, a significantly larger number of children (viz., 16 vs. 4) showed more subject responses to II-D than to III-B ($p < .012$, two-tailed test). It should be noted that the pattern of subject responses was in the opposite direction from the predicted pattern. Among those children with object oriented grammars who exhibited differences in the number of subject responses to II-D and II-B, a significantly larger number of children (viz., 18 vs. 3) showed more subject responses to II-D than to II-B ($p < .002$, two-tailed test). This response pattern corresponds to the predicted pattern.

The number of children exhibiting a greater number of subject responses to III-B than II-B did not differ significantly, from those exhibiting the reverse pattern. This was true for children with both object oriented and mixed subject-object grammars. Furthermore, there were no significant differences in the patterns of responses to III-B vs. II-D and II-D vs. II-B for children with mixed subject-object grammars.

The results suggest that children do not manifest a developmental sequence in the acquisition of subject responses to constructions II-B and III-B. This is confirmed by the similarity in the mean number of subject responses across all grammar types which is reported in Table 16. Thus, with respect to locative constructions, the c-command constraint applies uniformly to both adverbial temporal and in order to complements. However, there is a difference in the number of subject responses on II-D as compared to both II-B and III-B. In both cases, the passive by phrase (II-D) is associated with a greater number of subject responses than the locative prepositional phrases (II-B and III-B).

It was originally predicted that the c-command constraint would be established by the time children manifested approaching adult and adult grammars. Thus, it was expected that for these grammar types there would be no difference in the number of subject responses on the constructions III-B, II-D, and II-B. However, inspection of the data suggested

that this was not the case. A post hoc analysis was performed which compared the response patterns of children with approaching adult or adult grammars to those of children with object oriented grammars. Focusing only on children who exhibited differences in the number of subject responses to III-B, II-D, and II-B, Table 29 summarizes the proportion of children with object oriented or approaching adult and adult grammars exhibiting each of four possible response patterns. (The response patterns refer to the relative number of subject responses on the construction pairs.)

Table 29

The Proportion of Children with Object Oriented and Combined Approaching Adult and Adult Grammars Exhibiting Possible Response Patterns to 4 Construction Pairs

Response Patterns	Grammar Types	
	Object Oriented	Approaching Adult Adult
1. II-D > III-B	80	0
2. III-B > II-D	20	100
3. II-D > II-B	86	11
4. II-B > II-D	14	89

Note. Proportions are stated in percent.

A Fisher Exact Test revealed that among those children who exhibited differences in the number of subject responses

on at least two of the construction types, a significantly larger number of children with adult and approaching adult grammars than children with object oriented grammars exhibited the response pattern in which the number of subject responses on III-B was greater than the number on II-D ($p < .0005$, two-tailed test). In addition, a significantly larger number of children with adult and approaching adult grammars than children with object oriented grammars exhibited the response pattern in which the number of subject responses on II-B was greater than the number on II-D ($p < .0004$, two-tailed test). Thus, among those children exhibiting differences in the number of subject responses to constructions III-B, II-D, and II-B, the patterns exhibited by children with adult or approaching adult grammars were the reverse of patterns exhibited by children with object oriented grammars. That is, children with approaching adult and adult grammars interpreted constructions II-B and III-B correctly, while they made errors (viz., object responses) on the passive construction II-D. In contrast, children with object oriented grammars interpreted the passive (II-D) correctly more often than either construction II-B or III-B. Inspection of Table 16 also shows that during the period of approaching adult and adult grammars the mean number of subject responses on II-D decreases to a level below that of II-B and III-B. This decline in the number of subject responses during the period when the c-command constraint seems

to be firmly established is surprising in view of the early pattern of correct responses. A post hoc analysis was performed to determine whether, among object oriented children, the number of subject responses on the passive construction was related to c-command scores. Table 30 summarizes the mean number of subject responses manifested by object oriented children with either high or low c-command scores.

Table 30

Mean Number of Subject Responses on II-D
Manifested by Object Oriented Children

Grammar Type	Mean Subject Responses
1. Object Oriented + Low C-Command Scores	1.90
2. Object Oriented + High C-Command Scores	2.67

Note. Low c-command scores = scores ranging from zero to three; high c-command scores = scores ranging from four to six. Maximum possible score = a mean of 3.

If these early subject responses result from operation of the c-command constraint then children with object oriented grammars and high c-command scores would be predicted to manifest a greater number of subject responses on II-D, than children with object oriented grammars and low c-command scores. A pooled variance t-test revealed that there was a significant difference ($p = .04$, one tailed test) in the number of

subject responses manifested by the two groups.

6.2 The Immediate Operation Hypothesis: The C-Command Constraint and Response Patterns to Individual Construction Types. The immediate operation hypothesis claims that the c-command constraint operates in children's grammars in the same way that it does in adult grammar. Thus, the constraint should apply regardless of the type of complement or the type of prepositional phrase. As a result, object oriented, mixed subject-object, approaching adult, and adult children were predicted to manifest subject control on five constructions in which the type of complement and prepositional phrase were varied. (See section 2.1.4, chapter III, for examples of the constructions and a discussion of the exclusion of subject oriented children.) The operation of the c-command constraint was expected to be detectable in the grammars of object oriented and mixed subject-object children. This was due to the fact that the constraint was predicted to result in differential control patterns on complements following prepositional phrases as compared to complements following direct objects. It was postulated that object oriented children would manifest subject control of complements following a prepositional phrase and object control of complements following direct objects (see section 2.1.4, chapter III, for a discussion of the response pattern). Mixed subject-object children were expected to manifest subject control of complements following preposi-

tional phrases while they manifest object control of complements following direct objects (see section 2.1.4, chapter III). In contrast, children with approaching adult and adult grammars were predicted to manifest subject control on complements following direct objects as well as those following prepositional phrases (see section 2.1.4, chapter III).

In order to test the immediate operation hypothesis, correlated t-tests were performed to determine if object oriented and mixed subject-object children exhibited a greater number of subject responses on complements following prepositional phrases (constructions listed under A, Figure 9) as compared to complements following direct objects (constructions listed under B, Figure 9). (See also prediction (36), chapter III.)

A		B
II-B	vs.	II-A
II-C	vs.	II-A
II-D	vs.	II-A
III-B	vs.	III-A
III-C	vs.	III-A

Figure 9. Listing of planned comparisons among seven construction types

The constructions listed under A involved adverbial temporal complements following (1) locative prepositional phrases (II-B), (2) directional prepositional phrases (II-C), and (3) a passive by phrase (II-D). The constructions also

included in order to complements following locative prepositional phrases (III-B), and directional prepositional phrases (III-C). The constructions listed under B involved adverbial temporal complements and in order to complements following direct objects (II-A and III-A, respectively). (See sections 1.1 and 2.1.4, chapter III, as well as Appendices A and B for examples of the constructions listed in A and B.)

Table 31 indicates the mean number of subject responses on the seven constructions listed in Figure 9 for each grammar type, and Table 32 summarizes the p-levels for the planned comparisons within grammar type. Among the object oriented children, only three of the five comparisons were significant and among the mixed subject-object children only two of the five comparisons were significant. For both grammar types, the comparisons of II-C vs. II-A and III-C vs. III-A were not significant. Surprisingly, approaching adult children manifested significant differences on two comparisons. The difference for the comparison, II-D vs. II-A, was opposite from the predicted direction ($p = .02$, two-tailed test).

The differences in the number of subject responses on the seven constructions listed in Figure 9 were predicted only for object oriented and mixed subject-object children. However, it was expected that the differences would be evident when all five groups were combined (see section 2.1.4,

Table 31

Mean Number of Subject Responses on Seven Constructions Within Grammar Type

Grammar Type	Constructions						
	II-A	II-B	II-C	II-D	III-A	III-B	III-C
Subject Oriented	3.000	3.000	2.500	2.000	3.000	2.500	3.000
Object Oriented	0.321	1.179	0.536	2.071	0.250	1.143	0.179
Mixed Subj.-Obj.	1.700	2.700	2.100	2.200	1.700	2.500	1.300
Approaching Adult	2.583	2.917	2.917	1.833	2.667	2.917	2.750
Adult	3.000	2.667	3.000	2.333	2.667	3.000	2.667
Overall	1.312	1.953	1.531	2.047	1.219	1.844	1.141

Note. Maximum possible score equals a mean of three.

Table 32

P-Levels for Planned Comparisons of the Number of Subject Responses
on Seven Constructions Within Grammar Type

Grammar Type	Planned Comparisons Between Constructions				
	II-B vs.II-A	II-C vs.II-A	II-D vs.II-A	III-B vs.III-A	III-C vs.III-A
Subject Oriented	n.s.	n.s.	n.s.	n.s.	n.s.
Object Oriented	p=.00001***	p=.104	p<.00000***	p=.0006***	n.s. ^a
Mixed Subj.-Obj.	p=.0115 *	p=.11	p=.05 *	p=.084	n.s. ^a
Approaching Adult	p=.083	p=.033	p=.02 ^{a,b*}	p=.041 *	n.s.
Adult	n.s.	n.s.	n.s.	n.s.	n.s.

Note. P-levels are not reported if they are greater than .11.

^aDifferences are opposite from the predicted direction.

^bTwo tailed test.

*p < .05

**p < .01

***p < .001

chapter III for a discussion). Thus, correlated t-tests were performed to determine if, for the combined groups, there was a greater number of subject responses on the constructions listed under A in Figure 9, as compared to the constructions listed under B in Figure 9. (See also prediction (36), chapter III.) Table 33 indicates, for the combined groups, the mean number of subject responses and differences between the means for the seven construction types listed in Figure 9. Differences for the planned comparisons are indicated in parentheses and significance levels for one-tailed tests are indicated below the parentheses. Four of the five comparisons were significant and the differences were in the predicted direction. However, the comparison between III-C and III-A was not significant and the difference was in the opposite direction from the prediction.

The immediate operation hypothesis predicts that the number of subject responses on constructions II-B as compared to II-C and III-B as compared to III-C should be the same since all four constructions involve complements which follow prepositional phrases. However, inspection of the data suggests that this was not the case. A post hoc analysis was done to determine if there was a significant difference in the number of subject responses on the construction pairs. Correlated t-tests revealed that, for the combined groups, the number of subject responses on II-B was significantly greater

Table 33

Mean Number of Subject Responses and Differences Between Means for Seven Construction Types

		Construction Types						
Construction Types		II-A	II-B	II-C	II-D	III-A	III-B	III-C
Means/Means		1.312	1.953	1.531	2.047	1.219	1.844	1.141
II-A	1.312	0	(.641) p<.0000***	(.219) p=.025*	(.735) p=.0001	-.093	.532	-.171
II-B	1.953		0	-.422	.094	-.734	-.109	-.812
II-C	1.531			0	.516	-.312	.313	-.390
II-D	2.047				0	-.828	-.203	-.906
III-A	1.219					0	(.625) p<.0000***	(-.078) ^a n.s.
III-B	1.844						0	-.702
III-C	1.141							0

Note. n.s. means not significant. Values for means could range from zero to three.

^aDifference is opposite from the predicted direction.

*p < .05
 **p < .01
 ***p < .001

than II-C ($p = .00002$, two-tailed test) and the number of subject responses on III-B was significantly greater than III-C ($p = .000002$, two-tailed test). A post hoc comparison was also performed within each grammar type. Table 34 indicates the p-levels for the post hoc comparisons.

Table 34

Post Hoc Comparisons of the Number of Subject Responses on Four Construction Types

Grammar Type	Construction Types	
	II-B vs. II-C	III-B vs. III-C
Subject Oriented	n.s.	n.s.
Object Oriented	$p = .00002^{***}$	$p = .00008^{***}$
Mixed Subject-Object	$p = .024^*$	$p = .006^{**}$
Approaching Adult	n.s.	$p = .16$
Adult	n.s.	n.s.

Note. P-levels above .16 are not reported.

* $p < .05$
 ** $p < .01$
 *** $p < .001$

Table 34 indicates that children with object oriented and mixed subject-object grammars manifested a significantly greater number of subject responses on constructions II-B as compared to II-C and III-B as compared to III-C.

These results in conjunction with the data reported in Tables 31, 32, and 33 do not support the hypothesis that

the c-command constraint applies uniformly across all construction types. The significant difference in the number of subject responses on constructions II-B as compared to II-A and III-B as compared to III-A indicate that the c-command constraint applies to locative prepositional phrases during the period when children manifest object oriented and mixed subject-object grammars. Operation of the constraint continues through the periods when children manifest approaching adult and adult grammars. The failure to obtain significant differences in the number of subject responses on the directional prepositional phrase constructions, II-C and III-C, as compared to the direct object constructions, II-A and III-A, indicates that the constraint does not apply to the directional prepositional phrases at the same time as it does to the locative prepositional phrases. This is confirmed by the fact that object oriented children and mixed subject-object children manifest a significantly greater number of subject responses on the locative prepositional phrase constructions, II-B and III-B, than on the directional prepositional phrase constructions, II-C and III-C, respectively (see Table 34). These differences tend to disappear by the time children are manifesting approaching adult and adult grammars (see Tables 31, 32, and 34). Thus, the constraint seems to apply uniformly to locative and directional prepositional phrases when children are manifesting the more advanced grammar types.

The comparison of the passive construction, II-D, and the direct object construction, II-A, yielded results which parallel the pattern of development noted in section 6.1.2 of this chapter. The prediction that children would manifest more subject responses on II-D than II-A was confirmed. However, inspection of Tables 31 and 32 reveals that the predicted difference occurs only among object oriented and mixed subject-object children. Approaching adult and adult children manifest a difference that is opposite from the predicted direction. These results reflect the fact that the number of subject responses on the passive construction (which are initially high) tend to decline while the number of subject responses on other constructions tend to increase. The results on the passive suggest additional support of the view that the operation of the c-command constraint is influenced by the type of prepositional phrase in the main clause.

In summary, the results reported in sections 6.1 and 6.2 of this chapter are consistent with the delayed operation hypothesis while they fail to support the immediate operation hypothesis. The significant relation of c-command scores to age and the fact that a large percentage of object oriented children manifested low c-command scores suggests that the c-command constraint is not immediately operational in the grammars of young children. Furthermore, once the constraint becomes operational, it does not apply uniformly to construc-

tions which fall within the domain of the rule. In particular, the constraint applies to locative prepositional phrases before it applies to directional prepositional phrases. The issue of whether the difference in operation is attributable to a sub-adult form of the rule or structural misanalysis of prepositional phrases will be discussed in section 2 of chapter VI.

6.3 The Overgeneralization Hypothesis.

6.3.1 Sentential Subject Sentences. Children are expected to overgeneralize the c-command constraint to constructions which constitute exceptions in adult grammar. Thus, children who have developed the c-command principle were expected to select outside NP's as the controllers of sentential subject sentences (constructions V-A and V-B). Pooled variance t-tests were performed to determine if children with object oriented grammars and high c-command scores, or children with mixed subject-object grammars selected outside NP's (ONP's) as the controllers of constructions V-A and V-B more often than children with either subject oriented grammars or object oriented grammars and low c-command scores (see prediction (43), chapter III). Table 35 summarizes the mean number of outside NP responses on constructions V-A and V-B for each grammar type.

Table 35

Mean Number of ONP Responses on Constructions V-A and
V-B According to Grammar Type

Group	Grammar Type	Mean ONP Responses
1.	Subject Oriented	2.50
	<u>Low C-Command Scores</u>	
2.	Object Oriented	1.36
	<u>High C-Command Scores</u>	
3.	Object Oriented	1.71
4.	Mixed Subject Object	3.40
5.	Approaching Adult	5.58
6.	Adult	0.33

Note. Maximum possible score was a mean of three. Low c-command scores are scores ranging from zero to three. High c-command scores are scores ranging from four to six.

Children with object oriented grammars and high c-command scores (Group 3) manifested a greater number of ONP responses than children with object oriented grammars and low c-command scores (Group 2). However, the difference was not significant ($p = .40$). Group 3 also did not manifest significantly more ONP responses than Groups 1 and 2, combined ($p = .38$). However, children with mixed subject-object grammars (Group 4) manifested significantly more ONP responses than Group 2 ($p = .028$), and Groups 1 and 2, combined ($p = .035$). The results for the mixed subject-object children are consistent

with the hypothesis that the c-command constraint is over-generalized.

ONP responses on constructions V-A and V-B constituted one of the classificatory criteria for approaching adult grammars (see section 1.3.4, chapter III). Thus, the mean for the group reflects the classification system.³ However, it is important to point out that these children manifested an extremely consistent pattern of responses. Table 36 summarizes the percentage of children manifesting each possible number of ONP responses on the sentential subject sentences. Only one approaching adult child manifested a score of less than five ONP responses (viz., 3 ONP responses). The remaining children (92 percent) manifested scores of either 5 or 6. The trend of an increasing number of ONP responses as a function of age, which was observed in Tavakolian's data, is replicated in the present research. Older age groups, which are included in the present study, reveal that the trend culminates with a highly consistent pattern of ONP responses.

6.3.2 Dative PP Sentences. Dative PP sentences (construction VII) constitute a second exception to the c-command constraint in English. Thus, overgeneralization of the constraint was expected to result in an increased number of errors on construction VII. Overall, the 64 children participating in the study manifested very few errors on this construction. There were a total of 192 responses on

Table 36

Percentage of Children Manifesting Each Possible Number of ONP Responses
on Constructions V-A and V-B According to Grammar Type

Grammar Type	N	ONP Responses						
		0	1	2	3	4	5	6
Subj. Or.	2	50(1)	0	0	0	0	0	50(1)
Obj. Or. Low C-C ^a	22	55(12)	18(4)	4.5(1)	4.5(1)	4.5(1)	4.5(1)	9(2)
High C-C ^a	7	57(4)	0	0	29 (2)	0	0	14(1)
Mixed S-O	9	33(3)	0	0	0	22 (2)	11 (1)	33(3)
Ap. Adult ^b	12	0	0	0	8 (1)	0	17 (2)	75(9)
Adult ^c	3	67(2)	33(1)	0	0	0	0	0

Note. N refers to number of children. Numbers in parentheses indicate frequencies.

^aC-C means c-command score.

^bThe classificatory criteria for this grammar type included the number of ONP responses on constructions V-A and V-B. (See section 1.3.4, chapter III.)

^cThe classificatory criteria for this grammar type included the number of 2nd NP responses on constructions V-A and V-B. (See section 1.3.5, chapter III.)

construction VII. One hundred and sixty-five of the responses were correct and twenty-seven were incorrect. The errors involved twenty-six subject responses and one ONP response. Pooled variance t-tests were performed to determine if children with object oriented grammars and high c-command scores made significantly more errors on construction VII than children with object oriented grammars and low c-command scores (see prediction (44), chapter III). Table 37 summarizes the mean number of errors on construction VII within grammar type.

Table 37
Mean Number of Errors on Construction VII
Within Grammar Type

Group	Grammar Type	Mean Errors
	<u>Low C-Command Scores</u>	
1.	Object Oriented	0.220
	<u>High C-Command Scores</u>	
2.	Object Oriented	0.286
3.	Mixed Subject-Object	0.888
4.	Approaching Adult	0.416
5.	Adult	0.000

Note. Maximum possible score was a mean of three. Low c-command scores are scores ranging from zero to three. High c-command scores are scores ranging from four to six.

Children with object oriented grammars and high c-command scores did not make significantly more errors on construction VII than children with object oriented grammars and low c-command scores ($p = .33$). It should be noted that children with mixed subject-object grammars manifested a higher mean number of errors on construction VII than children with other grammar types.

Another prediction related to the overgeneralization hypothesis stated that children with approaching adult grammars would also manifest errors on construction VII. A pooled variance t-test was performed to determine if children with approaching adult grammars exhibited a greater number of errors on construction VII than children with object oriented grammars and low c-command scores (see prediction (45), chapter III). Table 37 shows that children with approaching adult grammars exhibited more errors on construction VII than children with object oriented grammars and low c-command scores. Although the difference was in the predicted direction, it was not significant ($p = .19$).

A final test of the overgeneralization hypothesis involved a comparison of responses on object-subject relative clauses (construction VI) and dative PP sentences (construction VII). Children with object oriented and approaching adult grammars were expected to interpret object-subject relatives correctly (see section 1.2.4, chapter III). In view of this, both groups were predicted to make more errors

on construction VII (due to overgeneralization of the c-command constraint), than on construction VI (see prediction (46), chapter III). With the exception of subject oriented children, most of the children in the study manifested correct responses on construction VI. The fact that subject responses on this construction was a classifactory criterion for subject oriented grammars (see section 1.3.1, chapter III) resulted in a high mean number of errors for this group (see Table 16). Overall, there were a total of 192 responses. One hundred and sixty-nine of the responses were correct and twenty-three were incorrect. The errors involved one failure to act out the sentence, one ONP response, and twenty-one subject responses. Four of the subject responses were manifested by the children with subject oriented grammars. The remaining seventeen errors were manifested by object oriented, mixed subject-object, approaching adult, and unclassifiable children. Eight of these errors were manifested by mixed subject-object children. (See also Table 16). Table 38 indicates the differences between the mean number of errors on construction VII as compared to construction VI within grammar type.

Table 38

Differences Between Mean Number of Errors on Construction
VII as Compared to Construction VI
Within Grammar Type

Group	Grammar Type	Mean Differences	Direction of Differences
<u>Low-C-Command Scores</u>			
1.	Object Oriented	0.05	VII > VI
<u>High C-Command Scores</u>			
2.	Object Oriented	0.00	VII = VI
3.	Mixed Subject-Object	0.00	VII = VI
4.	Approaching Adult	0.25	VII > VI
5.	Adult	0.00	VII = VI

Note. Low c-command scores are scores ranging from zero to three and high c-command scores are scores ranging from four to six.

Children with object oriented grammars and high c-command scores did not manifest a difference in the mean number of errors on construction VII as compared to construction VI. Children with approaching adult grammars manifested the largest mean difference in errors on the two construction types. Although the difference was in the predicted direction (i.e., VII > VI), a correlated t-test revealed that it was not significant ($p = .14$).

In summary, four sets of predictions were used to evaluate the overgeneralization hypothesis. One set of

predictions involved sentential subject sentences and three sets of predictions involved dative PP sentences. With regards to the sentential subject sentences, mixed subject-object children manifested significantly more ONP responses than object oriented children with low c-command scores. In addition, approaching adult children manifested a highly consistent pattern of ONP responses. Both of these results are consistent with the overgeneralization hypothesis. In contrast, none of the predictions concerning the dative PP sentences were confirmed. However, mixed subject-object children and approaching adult children manifested the highest mean number of errors on dative PP sentences. In addition, children with approaching adult grammars manifested the largest mean difference in errors on construction VII as compared to construction VI. It is interesting to note that the children who seem to have just established the c-command constraint (i.e., mixed subject-object and approaching adult children) also manifest ONP responses and errors on the dative PP sentences. However, the pattern of responses is only suggestive in view of the fact that only one prediction was confirmed.

6.4 The Inviolability Hypothesis. A fourth interview was conducted to evaluate the inviolability hypothesis and the reliability of children's response patterns (see section 2.3, chapter IV for a description of the interview). The

present section discusses the results that are related to the inviolability hypothesis, whereas section 8, this chapter, discusses the results related to reliability. Table 39 indicates, according to grammar type, the number of children who participated in the fourth interview.

Table 39

Number of Children Participating in the Fourth Interview According to Grammar Type

Grammar Type	Number of Children
1. Subject oriented	2
2. Object oriented	20
3. Mixed subject-object	8
4. Approaching adult	11
5. Adult	3
6. Unclassifiabiles	6
Total	50

Some of the younger children who participated in the second and third interviews (the main comprehension task) were not asked to participate in the fourth interview. As discussed in section 1 of chapter IV, this was due to the fact that these children manifested disinterest in the task.

The fourth interview included three experimental constructions and four filler constructions (see section 4.2, chapter IV). The experimental constructions are listed below

in (6) (see also section 2.3, chapter II; Figure 7; and Appendix C for examples).

(6)⁴

Adverbial temporal complement preceded by a direct object (construction I, fourth interview)

The owl hits the dog after eating

Adverbial temporal complement preceded by a direct object and 'all of a sudden' (construction II, fourth interview)

The owl hits the dog all of a sudden after eating

Semantically deviant sentence with complement preceded by a direct object and 'all of a sudden' (construction V, fourth interview)

The owl hits the dog all of a sudden after barking

The inviolability hypothesis claims that young children will not violate the c-command constraint. In order to test this hypothesis, the interview included construction II, which was intended to provide evidence that children attach the complement to the S node, and construction V, which provided evidence as to whether a semantic bias toward object control would induce children to violate the constraint.⁵

The insertion of all of a sudden was predicted to result in a shift from object control on construction I to subject control on construction II for at least some children with object oriented grammars (see section 2.3, chapter III). Table 40 summarizes, according to grammar type, the

Table 40

The Number and Magnitude of Shifts in Subject Responses on
 Constructions I and II (Fourth Interview)
 According to Grammar Type

Grammar Type	Magnitude of Shifts					Total
	Oposite Direction	0	+1	+2	+3	
1. Subject oriented	0	1	1	0	0	2
2. Object oriented	0	15	5	0	0	20
3. Mixed subject-object	2	5	1	0	0	8
4. Approaching adult	0	10	1	0	0	11
5. Adult	0	3	0	0	0	3
6. Unclassifiable	2	4	0	0	0	6
Total	4	38	8	0	0	50

number and magnitude of the shifts. Table 41 summarizes the mean number of subject responses within grammar type on constructions I, II, and V of the fourth interview.⁶

Table 41

Mean Number of Subject Responses Within Grammar Type
on Constructions I, II, and V of the Fourth
Interview

Grammar Type	Constructions		
	I	II	V
1. Subject oriented	2.00	2.50	1.00
2. Object oriented	0.35	0.60	0.44
3. Mixed subject-object	1.71	1.57	1.86
4. Approaching adult	2.46	2.55	2.64
5. Adult	3.00	3.00	2.67

Correlated t-tests were performed to determine if insertion of all of a sudden resulted in the predicted increase in the number of subject responses on construction II as compared to construction I. Children with subject oriented grammars were excluded from the analysis due to the small sample size (viz., two). Among the children with object oriented grammars, there was a significant increase in the number of subject responses on construction II as compared to construction I ($p < .025$, one-tailed test). There were no significant differences in the number of subject responses on the

two constructions for children with the remaining grammar types.

The hypothesis that the c-command constraint is inviolable predicts that children with high c-command scores who manifested a shift would be more likely to exhibit subject control on construction V than children with low c-command scores who did not shift (see prediction (55), chapter III). As indicated in Table 40, the magnitude of the largest shift resulting from the insertion of all of a sudden was an increase of one subject response. Among the twenty children with object oriented grammars who participated in the fourth interview, five children had developed the c-command constraint as indicated by high c-command scores. One child in this group did not produce valid responses to the semantically deviant sentences.⁷ Thus, data from only four subjects were available to evaluate the prediction that "shifters" with high c-command scores would exhibit more subject responses on construction V than "non-shifters" with low c-command scores. In addition, only two of the four subjects were "shifters". Table 42 summarizes the mean number of subject responses on construction V for "shifters" and "non-shifters".

Table 42

Mean Number of Subject Responses on Construction V
(4th Interview) for "Shifters" as compared to
"Non Shifters"

Group	Number of Children	Mean Number of Subject Responses
<u>Shifters</u>		
1. High C-Command Scores	2	0.50
2. Low C-Command Scores	2	0.50
<u>Non Shifters</u>		
3. High C-Command Scores	2	1.50
4. Low C-Command Scores	12	0.25

Note. Low c-command scores are scores ranging from zero to three. High c-command scores are scores ranging from four to six.

In view of the small number of children in Group 1, a complete randomization test was used to evaluate whether this group manifested a greater number of subject responses than group 4. Although the difference between the two groups was in the predicted direction, it was not significant. In general, object oriented children with high c-command scores manifested a higher mean number of subject responses on construction V than those with low c-command scores. However, the difference primarily reflected the responses of one subject who manifested subject responses on constructions I and II, as well as V.

In order to further evaluate whether the semantic bias induced children to violate the c-command constraint, a post hoc analysis was done to determine if construction V resulted in a shift from subject control to object control. The tests compared the number of subject responses on constructions V and II.⁸ As indicated in Table 41, the semantic bias did result in a decrease in the number of subject responses on V as compared to II, for children with (1) subject oriented grammars, (2) object oriented grammars, and (3) adult grammars. Correlated t-tests revealed that for children with object oriented grammars the difference was not significant. Due to the sample size of children with subject oriented grammars (viz., two) and adult grammars (viz., three) it was impossible to test for the significance of the difference. With respect to the children with adult grammars, the decline in the number of subject responses on construction V resulted from a decrease of only one subject response. Children with mixed subject-object and approaching adult grammars exhibited an increase in the number of subject responses. The differences were not significant. The percent agreement of responses on construction V as compared to II was also determined. Table 43 summarizes the percent agreement for the various grammar types.

Table 43

Percentage of Children Manifesting Agreement
of Responses on Constructions II and V
(Fourth Interview)

Grammar Type	Response Patterns	
	Same	Same or Differ by 1
1. Subject oriented	0	50
2. Object oriented		
Low C-Command Score	67	92
High C-Command Score	50	100
3. Mixed subject-object	71	100
4. Approaching adult	73	100
5. Adult	67	100

Several additional post hoc analyses were performed to investigate the relationship between responses on construction V and grammar type. It was predicted that children with approaching adult and adult grammars would exhibit significantly more subject responses on construction V than children with either object oriented or mixed subject-object grammars. Pooled variance t-tests were used to assess this prediction. Children with approaching adult and adult grammars did not differ significantly. Thus, the two groups were combined for further analyses. Table 44 summarizes the p-levels of the obtained t's for the various comparisons.

Table 44

Comparisons Between Grammar Types of the Number of
Subject Responses on Construction V

Comparison	p-level	
1. AA & A vs. s	p=.008**	two-tailed test
2. AA & A vs. o	p<.000***	one-tailed test
3. AA & A vs. s-o	p=.03 *	one-tailed test
4. s-o vs. o	p=.004**	two-tailed test

Note. One-tailed tests were used in which direction could be predicted. A-A = approaching adult; A = adult; s-o = mixed subject object; o = object oriented; and s = subject oriented.

*p<.05

**p<.01

***p<.001

In conclusion, the prediction concerning "shifters" vs. "non-shifters", which was designed to test the hypothesis of inviolability, was not confirmed. However, the sample sizes were extremely small. In view of this, the results of the test should be considered inconclusive. Post hoc analyses suggest indirect support for the inviolability hypothesis. A comparison of the number of subject responses on construction II and V revealed that with the exception of subject oriented children, the remaining groups resisted the effect of a semantic bias toward object control. With respect to subject oriented children, differences in means on the two constructions (see Table 41) and a low percentage

in agreement of responses by individual subjects (see Table 43) indicates that this group was susceptible to the semantic bias. However, children who had developed the c-command constraint (viz., mixed subject-object, approaching adult and adult children) were not induced by the semantic bias in construction V to violate the constraint. With the exception of the subject oriented children, the pattern of interpretation on construction V seemed to be determined by the child's grammar type. That is, object oriented children manifested object responses, mixed subject-object children manifested mixed responses, and approaching adult and adult children manifested subject responses. This claim is supported by the means reported in Table 40 and the significant differences in those means reported in Table 44. The response patterns of the mixed subject-object, approaching adult and adult groups suggest that structural principles exist in the more advanced grammar types which can override a strong semantic bias. In contrast, primitive grammar types such as subject oriented grammars, seem to be susceptible to these semantic biases.

A final comment should be made on children's ability to identify semantically anomalous sentences. A comparison was made of the children's relative performance on the correct and semantically deviant filler sentences in the fourth interview. The 50 children participating in the fourth interview ranged in age from 3 years 7 months to

8 years 3 months. Four children could not consistently distinguish between the grammatically correct and semantically anomalous filler sentences (see constructions VI and VII, Appendix C). Table 45 summarizes the age, sex, DSS scores, and grammar type of the children who were unable to detect the semantically anomalous filler sentences.

Table 45

Age, Sex, DSS Scores, and Grammar Types of the Children
Unable to Make Deviancy Judgements

Subjects	Yrs.-Mos.-Days	Sex	DSS Scores	Grammar Type
1.	4-4-11	M	5.41	object oriented
2.	4-7-22	F	10.42	mixed subject-object
3.	5-0-12	F	8.80	object oriented
4.	5-10-1	F	7.82	object oriented

Table 46 summarizes the responses of these children on construction V.

Table 46

Responses on Construction V of the Five Children
Unable to Make Deviancy Judgements on the
Filler Sentences

Subjects ^a	Responses
1.	All object responses
2.	Identified all three tokens as deviant
3.	All object responses
4.	Noted the deviancy of two sentences and failed to act out one sentence

Note.

^aSee Table 45 for the characteristics of each subject.

In view of the performance of these five children on the filler sentences, their responses on construction V were not considered valid. Thus, they were not included in any of the analyses involving construction V. Ninety-two percent of the children participating in the fourth interview could consistently distinguish between the correct and semantically deviant filler sentences. Furthermore, their responses on construction V were consistent with their responses on constructions I and II. These results suggest that children as young as four years of age can detect semantic anomalies.⁹

7. The Level of Interpretation of Missing

Complement Subjects

Based on control phenomena related to preposed complements, it has been proposed that missing complement subjects are interpreted at a level other than surface structure (see sections 2.2.4 and 3, chapter II, and section 3, chapter III for a discussion). In order to evaluate this hypothesis it was predicted that the type of control manifested on constructions II-A and III-A of the main comprehension task would also be manifested on IV-A and IV-B, respectively, of the main comprehension task (see section 3, chapter III for a discussion). The Fisher Exact Probability Test was used to evaluate the following specific predictions:

- (7) Children who exhibit object control on construction II-A would exhibit object control on construction IV-A significantly more often than children who exhibit subject control on II-A (see prediction (60), chapter III)
- (8) Children who exhibit subject control on construction II-A will exhibit subject control on construction IV-A significantly more often than children who exhibit object control on II-A (see prediction (60), chapter III)
- (9) Children who exhibit object control on construction III-A will exhibit object control on construction IV-B significantly more often than children who exhibit subject control on III-A (see prediction (61), chapter III)
- (10) Children who exhibit subject control on construction III-A will exhibit subject control on construction IV-B significantly more often than children who exhibit object control on III-A (see prediction (61), chapter III)

The method described in Section 3, chapter III, was used to determine the type of control manifested by each child on constructions II-A, III-A, IV-A, and IV-B. There were four possible control patterns on the construction pairs II-A as compared to IV-A and III-A as compared to IV-B: object control on both; object control on the first and subject control on the second; subject control on the first and object control on the second; or subject control on both. A child's response pattern on the two sets of construction pairs was determined on the basis of the type of control manifested to each construction type. Table 47 summarizes the number of children exhibiting each type of response pattern. All the predictions were confirmed ((7) and (8), $p < .0004$; (9) and (10), $p < .000$).

One further test was performed to evaluate the hypothesis that interpretation of missing complement subjects occurs prior to preposing. The test involved children with high c-command scores, who manifested object control on constructions II-A and III-A. The c-command constraint is assumed to operate in the grammars of this group of children. Thus, regardless of whether the preposed complement is attached to S or $\bar{S}$, object control of constructions IV-A and IV-B would only be possible if interpretation occurs prior to preposing.¹⁰ (See section 3, chapter III for a discussion of this hypothesis.) A binomial test of an hypothesis about a proportion was used to evaluate the

Table 47

Number of Children Exhibiting Each Type of Response Pattern
on the Construction Pairs: II-A and IV-A;
and III-A and IV-B

Constructions	Response Patterns					Total
	O-O	O-S	S-O	S-S	Unc.	
1. II-A and IV-A	25	7	5	14	4	55
2. III-A and IV-B	28	2	6	17	2	55

Note. O-O = object control on both; O-S = object control on the 1st and subject control on the 2nd; S-O = subject control on the 1st and object control on the 2nd; S-S = subject control on both.

following predictions:

- (11) Children with high c-command scores who manifest object control on II-A, would exhibit object control on IV-A more often than any other response pattern (see prediction (62), chapter III)
- (12) Children with high c-command scores who manifest object control on III-A would exhibit object control on IV-B more often than any other response pattern (see prediction (63), chapter III)

Prediction (11) was not confirmed, whereas prediction (12) was confirmed ($p=.033$).

The results reported in this section are generally consistent with the proposal that interpretation of missing complement subjects occurs prior to preposing. Confirmation of predictions (7) and (9) is particularly important since object control of the preposed constructions would be blocked after preposing regardless of whether the preposed complement is attached to the S or $\bar{S}$. However, a crucial assumption is that the children manifesting object control obey the c-command constraint. Predictions (11) and (12) were intended to test the hypothesis concerning the level of interpretation using children who could be assumed to obey the c-command constraint. The results of these tests only provided partial confirmation of the hypothesis. A confounding variable was the fact that some of the children were classified as having mixed subject-object grammars. Thus, variability in attachment of the complement may explain failure to obtain evidence confirming prediction (11).

8. Reliability of Children's Responses

The relationship of reliability of children's response patterns to grammar type was investigated in a test-retest situation which used alternate forms of adverbial temporal complements following a matrix direct object.

Section 4, chapter III, argued that mixed subject-object grammars and object oriented grammars with high c-command scores represent developing rule systems. The section also argued that subject oriented and object oriented grammars with low c-command scores represent primitive rule systems, whereas approaching adult and adult grammars represent established rule systems. In view of Cromer's (1970) findings, it was predicted that (1) children with either mixed subject-object grammars or object oriented grammars and high c-command scores would manifest variable response patterns in a test-retest situation and (2) children with either subject oriented grammars, object oriented grammars and low c-command scores, approaching adult grammars or adult grammars would manifest consistent response patterns in a test-retest situation. These predictions were tested by comparing responses on construction I of the fourth interview to responses on construction II-A of the main comprehension task.¹¹ (See section 4, chapter III, and Appendices A, B, and C for examples of these construction types.)

On the average, the fourth interview was conducted between one to two days following completion of the main comprehension task (i.e., the second and third interviews). The number of subject responses on both constructions I and II-A was determined for each child. Table 48 summarizes the mean number of subject responses on construction II-A of the main comprehension task and constructions I, II, and V of the fourth interview.

Table 48

Mean Number of Subject Responses on Construction II-A
(2nd and 3rd Interviews) and Constructions
I, II, and V (4th Interview)

Grammar Type	Interviews					
	2nd & 3rd		4th			
	N ^a	II-A	N ^a	I	II	V
Subject Oriented	2	3.000	2	2.000	2.500	1.000
Object Oriented	29	0.321	20	0.350	0.600	0.444
Mixed Subject-Object	9	1.700	8	1.714	1.571	1.857
Approaching Adult	12	2.583	11	2.455	2.545	2.636
Adult	3	3.000	3	3.000	3.000	2.667

Note.

^aN refers to the number of subjects in each category.

The difference between the number of subject responses on construction II-A as compared to I was determined for each subject. Table 49 summarizes, according to grammar

Table 49

The Number of Children Within Grammar Type Exhibiting Differences in Their Responses to Construction I of the Fourth Interview and II-A of the Second and Third Interviews

Group	Grammar Type	Differences				Total
		0	1	2	3	
<u>Developing Rule Systems</u>						
1.	Object Oriented - High C-Command Scores	3	1	0	1	5
2.	Mixed Subject-Object	1	3	4	0	8
<u>Primitive Rule Systems</u>						
3.	Subject Oriented	1	0	1	0	2
4.	Object Oriented - Low C-Command Scores	9	6	0	0	15
<u>Established Rule Systems</u>						
5.	Approaching Adult	7	1	2	1	11
6.	Adult	3	0	0	0	3
Total		24	11	7	2	44
7.	Groups 3 - 6 combined	20	7	3	1	31

type, the number of children exhibiting differences in their responses to the two construction types. The magnitude of the differences ranged from zero to three. The Fisher Exact Probability Test was performed to evaluate whether children with object oriented grammars and high c-command scores (Group 1) exhibited a greater number of different responses on construction I (4th Interview) as compared to construction II-A (main comprehension task), than children with subject oriented grammars, approaching adult grammars, adult grammars, and object oriented grammars and low c-command scores (Groups 3-6) (see prediction (66), chapter III). The number of differences manifested by Group 1 did not differ significantly from those manifested by Groups 3 - 6 ($p=.61$). The Fisher Exact Probability Test was also performed to determine whether children with mixed subject-object grammars (Group 2) exhibited a greater number of different responses on construction I as compared to construction II-A than children with subject oriented grammars, approaching adult grammars, adult grammars, and object oriented grammars and low c-command scores (Groups 3 - 6) (see prediction (67), chapter III). The number of differences manifested by Group 2 did differ significantly from those manifested by Groups 3 - 6 ($p=.012$). This result is consistent with the hypothesis that children with developing rule systems will manifest greater variability in a test-retest situation than children with either primitive

rule systems or established rule systems. In view of the fact that, during the stage of object oriented grammars, initial operation of the c-command constraint does not result in a variable response pattern, it appears that the variability manifested by mixed subject-object children must be due to mixed attachment of the complement to either the S or the VP. This is supported by the fact that children with mixed subject-object grammars seem to have established the c-command constraint (see section 6.1.1, this chapter). Failure to obtain significant results with object oriented children is also consistent with this claim, since object oriented grammars are characterized by a primitive rule system in which the complement is attached to the VP. Thus, the crucial factor affecting the reliability of children's interpretation of missing complement subjects appears to be the nature of the child's structural analysis of multiple clause sentences rather than operation of the c-command constraint.

Table 50 summarizes, according to grammar type, the percentage of children manifesting agreement of responses on construction I (fourth interview) as compared to construction II-A (main comprehension task).

Table 50

Percentage of Children Manifesting Agreement of Responses on Construction I (Fourth Interview) and Construction II-A (Main Comprehension Task)

Grammar Type	Response Patterns	
	Same	Same or Differ by 1
1. Subject Oriented	50	50
2. Object Oriented		
Low C-Command Scores	60	100
High C-Command Scores	60	80
3. Mixed Subject-Object	13	50
4. Approaching Adult	64	73
5. Adult	100	100

Note. Low c-command scores are scores ranging from zero to three. High c-command scores are scores ranging from four to six.

Inspection of Table 50 reveals that only 50 percent of the mixed subject-object children and the subject oriented children manifested response patterns on construction I of the fourth interview and construction II-A of the main comprehension task which were either the same or differed by one. In contrast, children with object oriented, approaching adult, and adult grammars manifested greater agreement in their responses on the two construction types. Thus, object oriented, approaching adult and adult children tend to exhibit consistent response patterns across separate

interviews whereas both subject oriented and mixed subject-object children manifest variable response patterns.

9. Interpretation of the Order of Events in Multiple Clause Sentences

The purpose of this section is to investigate the relationship between grammar types and strategies used by young children to interpret the order of events in multiple clause sentences. Section 1.2, chapter II, reports evidence that children manifest two strategies in interpreting order of events: the order-of-mention strategy and the main-clause-first strategy. Children using the order-of-mention strategy act out the clauses in the order in which they occur. Thus, these children do not seem to distinguish between main and subordinate clauses (see section 1.2, chapter II, for a discussion). Children using the second strategy act out the main clause first. The use of this strategy is evident when the subordinate clause is preposed to the front of a sentence. Children using the main-clause-first strategy are able to distinguish between main and subordinate clauses (see section 1.2, chapter II, for a discussion).

Four of the five grammar types identified in the present research assign different structural analyses to multiple clause sentences. The nature of these analyses suggests a relationship between grammar type and the two strategies used to interpret the order of events in multiple

clause sentences. As described in section 4.1, chapter II, subject oriented grammars are characterized by attachment of all complements to the topmost S and lack of recursion in the VP and NP nodes. As a result, children with this grammar type are predicted to be unable to distinguish between main and subordinate clauses. Object oriented grammars, which constitute the next stage in development, are characterized by attachment of complements to the VP and object NP (see section 4.2, chapter II). The development of recursion enables children with this grammar type and succeeding grammar types (viz., mixed subject-object, approaching adult, and adult) to distinguish between main and subordinate clauses. In view of this, children with object oriented grammars were predicted to manifest the main-clause-first strategy (see section 4.2, chapter II). On the other hand, children with subject oriented grammars were predicted to use the order-of-mention strategy (see section 4.1, chapter II).

Comparing performance on constructions II-A, II-B, II-C, II-D, III-A, III-B, and III-C with constructions IV-A and IV-B enabled determination of the strategy used by children participating in the study to interpret the order of events. All constructions were presented during the main comprehension task (see section 1.1, chapter III; and Appendices A and B). Constructions II-A, II-B, II-C, and II-D, which involve adverbial temporal complements introduced

by after, are organized as follows:

(13) Main clause + 'after' + subordinate clause

The lion hits the bear after climbing up
the ladder

Correctly interpreting the order of events in constructions II-A, II-B, II-C, and II-D requires acting out the subordinate clause first. This behavior indicates knowledge of the meaning of after. Constructions III-A, III-B, and III-C, which involve in order to complements, have the following organization:

(14) Main clause + 'in order to' + subordinate clause

The lion hits the bear in order to climb
up the ladder

Correctly interpreting these constructions requires acting out the main clause first followed by the subordinate clause. Construction IV-A contains a preposed adverbial temporal complement introduced by after and construction IV-B contains a a preposed in order to complement. The organization of each is illustrated below:

(15) 'After' + subordinate clause + main clause

After climbing up the ladder, the lion hits
the bear

'In order to' + subordinate clause + main clause

In order to climb up the ladder, the lion
hits the bear

Correctly interpreting the order of events requires acting out the subordinate clause first in construction IV-A, and the main clause first in IV-B.

Use of either the order-of-mention strategy or the main-clause-first strategy was determined by counting the number of times the main clause was acted out first for each construction type. There were three tokens of each constructions. Thus, there were twelve possible responses on the non-preposed adverbial temporal complements (II-A, II-B, II-C, and II-D); nine on the non-preposed in order to complements (III-A, III-B, and III-C); three on the preposed adverbial temporal complement (IV-B); and three on the preposed in order to complement (IV-B). Table 51 summarizes the number of main-clause-first responses which would correspond to each strategy.

Table 51

Number of Main-Clause-First Responses Corresponding
to Each Interpretation Strategy

Strategies	Constructions			
	II-A,B,C,D ^a	III-A,B,C ^b	IV-A	IV-B
Order-of-Mention	12	9	0	0
Main-Clause-First	12	9	3	3
Adult	0	9	0	3

Note. Adult refers to knowledge of the meaning of after and in order to.

^aII-A,B,C,D includes constructions II-A, II-B, II-C, and II-D

^bIII-A,B,C includes constructions III-A, III-B, and III-C

The number of main clause first responses on each construction was tabulated for all children participating in the main comprehension task. Table 52 summarizes criteria used to classify children according to whether they used the order-of-mention strategy, the main-clause-first strategy, or knowledge of the meaning of after and in order to (viz., adult strategy) to interpret the order of events in multiple clause sentences.

Table 52
Criteria Used to Determine a Child's
Interpretation Strategy

Strategy	Constructions			
	II-A,B,C,D ^a	III-A,B,C ^b	IV-A	IV-B
Order-of-Mention	Min. 10	Min. 7	Max. 1	Max. 1
Main-Clause-First	Min. 10	Min. 7	Min. 2	Min. 2
Adult	Max. 5	Min. 7	Max. 1	Max. 1

Note. Min = Minimum score; Max. = Maximum score; Adult refers to knowledge of the meaning of after and in order to.

^aII-A,B,C,D includes constructions II-A, II-B, II-C, and II-D

^bIII-A,B,C includes constructions III-A, III-B, and III-C

The minimum score indicates the minimum number of main-clause-first responses required to satisfy the criteria, and

the maximum score indicates the maximum number of main-clause-first responses which were allowed in order to satisfy the criteria. Table 53 summarizes, according to grammar type, the percentage of children who manifested each strategy.

Table 53

Percentage of Children Within Grammar Type
Manifesting Each Interpretive Strategy

Strategy	Grammar Type					Unc.	Total
	s	o	s-o	A-A	A		
Order of Mention	0	7	0	0	0	0	3
Main-Clause-First	50	41	22	8	0	11	27
Adult	50	38	78	92	100	55	59
Unclassifiable	0	14	0	0	0	33	11

Note. s = subject oriented; o = object oriented; s-o = mixed subject-object; A-A = approaching adult; A = adult; Unc. = unclassifiable; Adult strategy refers to knowledge of the meaning of after and in order to

The seven children who were unclassifiable according to strategy manifested mixed responses. Five of the children manifested an understanding of after and difficulty with in order to; whereas two of the children manifested mixed response patterns on both complement types.

An important finding is that the subject oriented children did not manifest the order-of-mention strategy. Surprisingly, one of the children manifested understanding

of both after and in order to. Only two children in the study manifested the order-of-mention strategy and both were object oriented children. Among the group of object oriented children, 41 percent manifested the main-clause-first strategy, 38 percent manifested knowledge of the meaning of after and in order to, and 14 percent manifested mixed responses which indicated developing knowledge of after. If it is assumed that understanding of the meaning of the subordinate conjunctions develops after the main-clause-first strategy, then ninety-three percent of the object oriented children demonstrated the ability to distinguish between main and subordinate clauses. These results provide independent support for the claim that object oriented grammars are characterized by recursion in the VP and object NP.

10. Summary of Results

A variety of tests were performed to evaluate hypotheses concerning (1) the five grammar types and their sequential development, (2) the operation of the c-command constraint, (3) the level of interpretation of missing complement subjects, and (4) the relationship of grammar type to the reliability of children's response patterns. In addition, the study reported results concerning the relationship of grammar type to children's use of strategies in interpreting the order of events in multiple clause sentences.

The predictions concerning the five grammar types and their sequential development were confirmed. Grammar type was significantly related to both age and DSS scores and the means were in the predicted direction (see section 5, this chapter).

With respect to the operation of the c-command constraint, the delayed operation hypothesis was supported whereas the immediate operation hypothesis was not. C-command scores were significantly related to both age and DSS scores. This was true for the combined groups as well as for object oriented children (see section 6.1.1, this chapter). These results in conjunction with the fact that a large percentage of object oriented children manifested low c-command scores suggest that the c-command constraint becomes operational (at least with respect to locative

prepositional phrases) sometime during the stage when children manifest object oriented grammars. Comparison of the mean number of subject responses on constructions differing only with respect to complement type revealed that the c-command constraint applies uniformly across complement type. (See sections 6.1.2 and 6.2., this chapter.) However, significant differences in the number of subject responses were obtained on complements preceded by locative prepositional phrases as compared to those preceded by directional prepositional phrases or a passive by phrase (see sections 6.1.2 and 6.2, this chapter). Thus, the type of prepositional phrase preceding the complement appears to influence operation of the constraint. This result, which is consistent with the delayed operation hypothesis, constitutes further evidence against the immediate operation hypothesis.

Two additional hypotheses concerning the operation of the c-command constraint were the overgeneralization hypothesis and the inviolability hypothesis. Most of the tests related to the overgeneralization hypothesis did not yield significant results (see section 6.3, this chapter). However, an important trend emerged in the data. There was an increasing number of outside NP (ONP) responses on sentential subject sentences across grammar types (see section 6.3.1). The trend culminated with an extremely consistent pattern of ONP response among the oldest children in the study.

This response pattern resulted in classification of the majority of the older children as manifesting approaching adult grammars and classification of a very small percentage of children in the study (viz., five percent) as manifesting adult grammars.

The inviolability hypothesis was indirectly supported by several post hoc analyses (see section 6.4, this chapter). In general, object oriented, mixed subject-object, approaching adult and adult children manifested response patterns on the semantically deviant construction V (fourth interview) which were consistent with the response patterns predicted to be associated with each grammar type (see section 6.4, this chapter). More importantly, the semantic bias toward object control on construction V (fourth interview) did not induce mixed subject-object, approaching adult, or adult children to violate the c-command constraint.

The results reported in the present research also supported the hypothesis that children interpret missing complement subjects at a level other than surface structure (see section 7, this chapter). In addition, grammar type was found to be related to the reliability of children's response patterns (see section 8, this chapter) and to the strategies children use to interpret the order of events in multiple clause sentences (see section 9, this chapter).

FOOTNOTES

¹Elimination of two constructions from an original classification system resulted in changes of the classification of two subjects. These changes did not affect the results in that the mean ages and DSS scores of the children were close to the group means.

²It is interesting to compare these results with those of Hamburger and Crain (to appear). Both the present research and Hamburger and Crain's investigated children's comprehension of restrictive OS relative clauses. Although the constructions in the present research mentioned only two animals, three animals were made available to the children for acting out the sentences. Two of the toy animals corresponded to the animals mentioned in the sentences; whereas the third animal, which represented a different species, was not mentioned. Using Hamburger and Crain's terminology, felicity conditions were not met due to the fact that only one type of animal referred to by the head of the relative clause was made available to the child. Despite the fact that felicity conditions were unmet, over 88 percent of the sentences were interpreted correctly. Among children ranging from 3 years 2 months to 3 years 11 months, 71 percent of the sentences were interpreted correctly. Thus, although the present study did not meet the felicity conditions of the sentences, 3 year old children manifested a higher percentage of correct responses than those tested by Hamburger and Crain.

Hamburger and Crain (to appear) report that 55 percent of their five year olds failed to act out the relative clause portion of the sentences. In the present research, only one percent of the responses involved failure to act out the relative clause (see Appendix H, Table D). Furthermore, all of the older children in the present research acted out both clauses. Thus, it appears that if felicity conditions are unmet, children will compensate by acting out the relative clause as well as the matrix clause.

³Construction V-A and V-B were also part of the classificatory criteria for adult grammars. The low number of ONP response manifested by this group reflects the criteria for classification.

⁴It is important to note that constructions I, II, and V refer to constructions presented during the fourth interview. These constructions differ from I-A, I-B, II-A, II-B, II-C, II-D, V-A and V-B which were presented during

the second and third interviews (the main comprehension task). Section 1.1 of chapter III, Figure 1, Appendix A and Appendix B provide examples of constructions I-A, I-B, II-A, II-B, II-C, II-D, V-A, and V-B. Section 2.3 of chapter III, section 6.4 of chapter V, Figure 7, and Appendix C provide examples of constructions I, II, and V.

⁵See footnote 4, this chapter.

⁶The mean number of subject responses on construction V reflect only the responses of children who demonstrated the ability to make deviancy judgements. This was determined on the basis of the children's interpretation of filler sentences (construction VI and VII) which were included in Part II of the fourth interview (see Appendix C for examples). The method of identifying children who were unable to make deviancy judgements is discussed on page 337 of this chapter. A description of the children who were unable to make the judgements is included on pages 339 and 340 of this chapter. As pointed out on page 340, ninety-two percent of the children participating in the fourth interview were able to make deviancy judgements.

⁷See footnote 6, this chapter.

⁸See footnote 6, this chapter.

⁹One child was 3 years 6 months of age. Thus, children younger than four years of age may be able to detect semantically anomalous sentences.

¹⁰This argument assumes that the c-command constraint is operational in the child's grammar, and that it is inviolable.

¹¹See footnote 4, this chapter.

CHAPTER VI

DISCUSSION

The present research investigated children's ability to understand sentences containing missing complement subjects. More specifically, the study attempted to determine (1) the structural analyses which children assign multiple clause sentences, and (2) the rules that children use to identify the controller of missing complement subjects. These issues constitute the two major topics of the discussion section.

1. The Structural Analysis of Multiple
Clause Sentences

1.1 The Validity of the Hypothesis of the Five Grammar Types and Their Sequential Development. It was postulated that children's knowledge of the structure of multiple clause sentences could be described in terms of five grammar types: (1) subject oriented, (2) object oriented, (3) mixed subject-object, (4) approaching adult, and (5) adult. It was further postulated that the grammar types develop in the following sequence: (1), (2), (3), (4), and (5). In order to test this hypothesis, behaviors were identified which were considered to constitute evidence of the structural analysis characterizing each grammar type. These behaviors consisted of patterns of responses on sets of

construction types. As a result, each grammar type was associated with a specific pattern of responses on at least eight construction types. Children were then classified according to grammar type on the basis of their responses to the classificatory sentences.

Several aspects of the results support the claim that the grammar types represent a valid description of children's knowledge of the structure of multiple clause sentences. First, eighty-six percent of the children were classifiable according to grammar type. Thus, response patterns which were predicted to exist on the basis of the definition of each grammar type were actually observed in a large proportion of the children participating in the study. Secondly, there were significant differences in the mean ages of children manifesting each grammar type and the means were in the predicted direction (see Tables 18 and 19). Furthermore, seven out of ten comparisons of the adjusted mean ages of each grammar type were found to be statistically significant (see Table 20). Finally, there were significant differences in the mean DSS scores of the children manifesting each grammar type and the means were also in the predicted direction (see Tables 21 and 22). Five out of ten of the planned multiple comparisons of adjusted mean DSS scores were significant (see Table 23). Thus, a productive measure of general language development correlated with performance on a comprehension task.

The ordering of mean ages and DSS scores of each group of children and the significant differences in individual comparisons provide strong support for the proposed developmental sequence of grammar types.

The relationship between DSS scores and grammar type does not appear to be as strong as the relationship between age and grammar type. This is evident in the fact that (1) fewer of the planned multiple comparisons were significant for DSS scores than for age (see Tables 20 and 23), and (2) an estimated forty-two percent of age variance was attributable to grammar type, whereas only an estimated fourteen percent of DSS variance was attributable to grammar type (see Tables 19 and 22). The weaker relationship between DSS scores and grammar type may be due to the fact that DSS scores can increase as a result of either frequent use of early developing structures or the use of late developing structures. It is doubtful whether frequent use of early developing structures such as personal pronouns represents the same degree of language development as the use of complex structures such as relative or adverbial clauses.

In general, the hypothesis of the five grammar types and their sequential development is strongly supported by the relationship of grammar type to both age and DSS scores. However, it is conceivable that something other than the proposed structural analyses could account for the response

patterns manifested by each group of children. Thus, the following sections are concerned with determining whether the structural analyses characterizing each grammar type represent a correct description of children's knowledge. Each group of children are examined with respect to their interpretation of (1) the non-classificatory sentences, (2) alternate forms of the classificatory sentences in a test-retest situation, (3) the semantically deviant sentences, and (4) the order of events. In addition, the results of tests evaluating hypotheses concerning the operation of the c-command constraint are discussed as they relate to the issue of the descriptive adequacy of each grammar type.

1.1.1 Subject Oriented Grammars. Subject oriented grammars were postulated to represent the first stage in children's analysis of multiple clause sentences. It was predicted that children at this stage (1) analyze multiple clause sentences as conjoined simplex sentences, and (2) use an interpretive rule which specifies that missing complement subjects, relative pronouns and subject pronouns of an embedded clause are coreferential with the first NP of a sentence (see section 4.1, chapter II). Children classified as manifesting subject oriented grammars exhibited several response patterns which conflict with this definition. With respect to the non-classificatory constructions, the

children manifested object control of both the tell sentences (construction I-A, see Table 16) and the promise sentences (construction I-B, see Table 16). They also manifested object control on a classificatory construction in which infinitival complements followed verbs such as whisper to (dative PP's) (construction VII, see Table 16). In all three cases, subject control was predicted (see Figure 1). Secondly, the children failed to manifest the order-of-mention strategy in interpreting the order of events in multiple clause sentences. The proposal that subject oriented children analyze all multiple clause sentences as conjoined simplex sentences entails that the grammar lacks recursion in either the VP or NP nodes. In view of this, it was predicted that children with this grammar type would be unable to distinguish between main and subordinate clauses. It was further predicted that, as a result, they would use the order-of-mention strategy (see section 4.1, chapter II). One of the two children classified as manifesting subject oriented grammars exhibited the main-clause-first strategy and the other interpreted the order of action correctly. Based on the assumption that correct interpretation is more advanced than the main-clause-first strategy, it appears that both children demonstrated the ability to distinguish between main and subordinate clauses. A third example of response patterns which conflicted with the predicted behaviors involves performance on the test-retest

situation. Subject oriented children were expected to exhibit consistent response patterns in this situation due to the fact that the grammar type represents a primitive rule system. Although the sample size (viz., two) precluded any statistical analyses, inspection of the means in Table 48, the differences reported in Table 49, and the percent agreement reported in Table 50 suggest a variable response pattern across interviews.

The inconsistencies between obtained and predicted behaviors represent a serious problem for the proposed grammar type. A second problem is that only two children participating in the study were classified as manifesting the grammar type.¹ This represents an extremely small sample. Previous studies have also failed to obtain a significant sample of children manifesting subject oriented grammars. In a study of children's interpretation of perception and non-perception verbs, Goodluck and Roeper (1978) classified thirty-one children, ranging from 3.4 to 6.7 years of age, according to grammar type. Only five children (sixteen percent) were classified as manifesting subject oriented grammars. If Goodluck and Roeper's study is combined with the present research, then only seven children out of ninety-five (seven percent) manifested this grammar type. In contrast, over fifty percent of the children in Goodluck and Roeper's study and forty-five percent of the children in the present study manifested object oriented grammars.

There seems to be at least two possible explanations for the failure to obtain a larger sample of subject oriented children. One explanation may be that the grammar type is manifested by even younger children than three year olds. Goodluck and Roeper (1978) offer a similar explanation to account for the small percentage of subject oriented children identified in their own study. However, this would not explain why the response patterns of the two subject oriented children in the present research conflict with the predicted response patterns.

An alternative explanation is that subject oriented grammars as defined in the first paragraph (see also section 4.1, chapter II) do not represent the first stage in the development of children's analysis of multiple clause sentences. That is, children may not initially analyze multiple clause sentences as conjoined simplex sentences. Instead, object oriented grammars, which are characterized by attachment of complements to the VP, may represent the first stage. Prior to the development of object oriented grammars, children may not assign any structural analysis to embedded clauses. When confronted with constructions containing missing complement subjects, they may use the interpretive rule defined in the first paragraph to select a controller. This rule, which is neither a linear notion nor a structural notion, is used to interpret sentences in which the child's grammar fails to generate a structural

analysis.² It seems likely that at the single and two-word stages of language acquisition, children's grammars do not generate a structural analysis of embedded clauses. Somewhere between the ages of two to three and a half, this aspect of their grammar begins to develop. As sentences are assigned a structural analysis, the interpretive rule is abandoned. In the present research, the two subject oriented children appear to be at the stage where they are beginning to develop a structural analysis of multiple clause sentences. The data suggest that infinitival complements following verbs of speaking are the first type of embedded structures which are assigned a structural analysis. The patterns of object control on constructions I-A, I-B, and VII manifested by the subject oriented children are consistent with the claim that the infinitival complements are attached to the VP. Thus, the two children are beginning to develop object oriented grammars. Development of recursion in the VP may have enabled the children to distinguish between main and subordinate clauses. Furthermore, the fact that the attachment is just developing may explain the variability in the children's response patterns in a test-retest situation. (See section 4, chapter III for hypotheses concerning the effects of developing rule systems on reliability.) Attachment of complements to the VP have not yet generalized to either adverbial temporal or in order to complements. Thus, the children continued to rely on the

interpretive rule which resulted in subject control of these constructions as well as the OS relative clauses.

The motivation for rejecting an early stage in which complements are attached to the S is based on response patterns involving the semantically deviant sentences and considerations related to general patterns of language development. With respect to the deviant sentences (construction V, fourth interview), the subject oriented children were the only group who manifested susceptibility to the effects of a semantic bias. This fact suggests that structural principles were not guiding their interpretation of adverbial temporal complements, since children who have developed a structural analysis of multiple clause sentences are able to resist the effects of a semantic bias. (See section 6.4, chapter V for a discussion of the relationship between grammar type and the effects of a semantic bias.) In addition, assuming S attachment at this early stage would result in a pattern of development which is inconsistent with general patterns that have been observed in previous research. Changes in children's rule systems are typically characterized by transitional periods in which both the old rule and the developing rule are operative (Chomsky, 1969; Cromer, 1970; and Goodluck and Roeper, 1978). In the present research, S attachment did not remain an option for the next stage of development (viz., object oriented grammars) nor was there a period of mixed control

between subject and object oriented grammars as there was between object oriented and approaching adult grammars. Development of S attachment in approaching adult grammars was preceded by a transitional stage in which individual complements were variably attached to either the S or the VP (viz., mixed subject-object grammars). In contrast, the youngest children in this study either manifested a consistent pattern of subject control on adverbial temporal and in order to complements or a consistent pattern of object control. There was no evidence of variable attachment of individual complements.

In summary, it is argued that the first stage in children's analysis of multiple clause sentences is attachment of embedded structures to the VP (i.e., object oriented grammars) rather than attachment of embedded structures to $\bar{S}$ as defined in subject oriented grammars. It is further proposed that prior to the development of VP attachment children do not assign any structural analysis to multiple clause sentences. Instead, they use the interpretive rule specified as part of subject oriented grammars to determine (1) the controller of missing complement subjects, (2) the relativized NP of a sentence, or (3) the antecedent of a subject pronoun in an embedded clause. According to this revised theory, subject oriented grammars are redefined to include only the interpretive rule which specifies that the first NP of a sentence is coreferent with missing complement

subjects, relative pronouns, or subject pronouns of an embedded clause. The revised theory accounts for the behavior patterns that were observed in the two subject oriented children in the present research. In addition, the general pattern of development that emerges is consistent with previous descriptions of stages in language development.

1.1.2 Object Oriented Grammars. According to the revised theory, object oriented grammars represent the first stage in children's analysis of multiple clause sentences. As outlined in section 4.2, chapter II, children with this grammar type are assumed to attach complement structures to the VP and OS relative clauses to the object NP. With respect to control of missing complement subjects, they are assumed to use the minimal distance principle initially, and then the c-command constraint in conjunction with the MDP. Section 2 of this chapter discusses the development of the c-command constraint. Thus, the present discussion is limited to questions related to the level of attachment of complement structures.

Several aspects of the data support the hypothesis of VP attachment. First, a large proportion of children participating in the study (viz., forty-five percent) were classified as manifesting object oriented grammars. As pointed out in the previous section, this percentage replicated results obtained by Goodluck and Roeper (1978).

In addition, the ages of the two groups were similar. The age range of Goodluck and Roeper's group extended from 3.4 to 6.7 years, and that of the present study extended from 3.2 to 6.9 years (see Table A, Appendix H). Furthermore, using Goodluck and Roeper's age categories, the proportion of object oriented children falling into each of the three age groups was roughly the same for both studies. Thus, two independent research projects reported similar data concerning the existence of object oriented grammars in young children.

It may be useful to recall the original arguments which motivated the proposal that children attach complements to the VP. As outlined in section 1.2, chapter II, subject control of complements following a passive by phrase or a locative prepositional phrase could not be accounted for by either the MDP or Maratsos' semantic rule. The c-command constraint did offer an explanation. However, the fact that children manifested object control of adverbial temporal complements following a direct object constituted a problem for the c-command constraint if the complement was assumed to attach to the S as in adult grammar. (See section 3, chapter II for a discussion.) This problem was resolved by assuming that children attach the complement to the VP. Thus, the hypothesis of VP attachment was motivated by the claim that the c-command constraint operates in children's grammars. Results reported by Goodluck (1978) which support

this claim were replicated in the present research. That is, for the combined groups, there were significantly more subject responses on complements following a passive by phrase (construction II-D) and locative prepositional phrases (constructions II-B and III-B) than on complements following a direct object (constructions II-A and III-A) (see Table 33). Evidence which is even more compelling is that many children manifested consistent patterns of object control across a variety of constructions (viz., object oriented children) while they manifested subject responses on constructions II-D, II-B, and III-B (see Tables 16, 31, and 32). The contrast between subject control of complements following a prepositional phrase and object control of complements following direct objects provides strong evidence that the c-command constraint operates in the grammars of young children. However, the fact that seventy-six percent of the object oriented children manifested low c-command scores also suggests that the constraint may not be immediately operational. This issue is discussed in section 2 of this chapter. Parity of argument seems to dictate that the object oriented children with low c-command scores also have VP attachment.

A second crucial assumption motivating the hypothesis of VP attachment is that the c-command constraint is inviolable (see section 3, chapter II for a discussion). In order to evaluate the inviolability hypothesis, semantically

deviant sentences (construction V) were included in the fourth interview to determine whether children who had developed the c-command constraint could be induced to violate it. The results of statistical tests evaluating the performance of object oriented children, who had developed the constraint, were inconclusive due to the failure to obtain a significant number of "shifters" (see section 6.4, chapter V). However, indirect evidence supports the claim that these children will resist violating the constraint. The high c-command scores of children with mixed subject-object, approaching adult, and adult grammars indicates that the c-command constraint is operative in all three grammar types. In view of the fact that children with approaching adult and adult grammars were predicted to attach complements to the S, object control of the semantically deviant construction V (fourth interview) would represent violation of the constraint. In contrast, object control for children with mixed subject-object grammars would not necessarily mean that the constraint is violated due to the fact that the grammar type is characterized by variable attachment to either the S or VP. In cases of VP attachment, either the subject or object NP c-commands the missing NP position (see section 3, chapter III). The means reported in Table 41 reveal that children with all three grammar types manifested the same degree of subject control on the semantically deviant construction V (fourth

interview) as they did on constructions I and II.³ In fact, children with mixed subject-object and approaching adult grammars manifested a slight increase in the mean number of subject responses on the semantically deviant construction V as compared to constructions I and II (see Table 41). There was a decline in the number of subject responses for children with adult grammars. However, the decline resulted from a decrease in only one subject response. These results suggest that the patterns of subject control were unaffected by the semantic bias. More importantly, individual children in all three grammar types show a high percentage of agreement in their responses on the semantically deviant construction V as compared to construction II (see Table 43). This clearly shows that children who have developed the c-command constraint and who attach complements to the S resist violating the constraint despite a strong semantic bias to do so. The crucial aspect of the data is that the inviolability hypothesis is supported for both developing grammars as well as for adult grammars. In particular, the high percentage of agreement on constructions II and V (fourth interview) for mixed subject-object children indicate that variable attachment of the complement did not affect the children's resistance to violating the c-command constraint. In view of this finding, it seems reasonable to assume that the inviolability hypothesis also applies to object oriented children who have developed the

c-command constraint. As a result, the original motivating arguments for attachment of complements to the VP are supported with respect to object oriented children who have high c-command scores.

The entire group of object oriented children manifested a remarkable consistency in their response patterns. In addition to the eight classificatory constructions, the children manifested object control on the non-classificatory tell and promise sentences (see constructions I-A and I-B, respectively, Table 16), and on the three constructions (I, II, and V) presented during the fourth interview (see Table 48). Comparison of performance in the fourth interview to that of the main comprehension task revealed that individual children manifested reliable response patterns in a test-retest situation. A total of ninety-five percent of the object oriented children manifested response patterns which were either the same or differed by only one response on the two construction types (see Tables 49 and 50). Thus, object oriented children who have developed the c-command constraint (children with high c-command scores) and those who have possibly not yet developed the constraint (children with low c-command scores) manifest similar patterns of object control on complements preceded by a direct object and the patterns are reliable across interviews. These results suggest that the same grammatical processes(viz., VP attachment) operate in both object oriented children with

high c-command scores and those with low c-command scores.

Further evidence supporting this hypothesis of VP attachment derives from the reliability data. The prediction that object oriented children would manifest consistent response patterns across interviews was motivated by (1) arguments that the grammar type represents a primitive rule system, and (2) a theory (Cromer, 1970) of the relationship between reliability and types of rule systems (see section 4, chapter III). It is important to note that the theory was based on children's interpretation of different types of constructions than those used in the present research. Confirmation of the prediction suggests that the assumptions concerning the type of rule system existing in object oriented grammars were correct. However, describing object oriented grammars as a primitive rule system may be somewhat misleading. It appears that the grammar type contains some of the components of adult grammar but generally lacks the number of options which characterize an adult rule system. In this regard, it is important to consider Goodluck's (1978) proposal that attachment of embedded structures to the VP is optional in children's grammar. Presumably, Goodluck meant that some complements attach to the VP while others attach to the S. The consistency of the children's response patterns across such a wide range of construction types suggests that S attachment is not an option in object oriented grammars. In addition, evidence reported by

Goodluck and Tavakolian (1979) suggests that four and five year olds attach relative clauses to the object NP and complements to the VP.⁴ If complement structures cannot be attached to the S or NP, then attachment to the VP must be obligatory. Performance on construction II of the fourth interview provides evidence supporting this claim.⁵ The insertion of all of a sudden was predicted to force attachment of the complement to the S. Although object oriented children manifested a significant increase in the number of subject responses on construction II (fourth interview) as compared to I (fourth interview), only five children out of fifteen (thirty-three percent) manifested the shift in control (see Table 40). Furthermore, in all cases, the magnitude of the shift was an increase of only one subject response (see Table 40). As indicated by Table 41, the predominant response pattern on construction II was object control. In general, these results indicate a strong resistance to S attachment.⁶ It seems likely that if VP attachment were optional, there would be little or no resistance to S attachment of complements following adverbs such as all of a sudden. Hence, the tendency to resist S attachment can be interpreted as evidence that VP attachment is obligatory.

Interpretation of the order of events in multiple clause sentences also provides important evidence relating to the issue of attachment. The claim that object oriented

grammars are characterized by development of recursion in the VP and object NP nodes resulted in the prediction that these children would use the main-clause-first strategy to interpret the order of events. The prediction was based on the assumption that the development of recursion would enable the children to distinguish between main and subordinate clauses. As reported in Table 53, forty-one percent of the object oriented children manifested the main-clause-first strategy, thirty-eight percent interpreted the order of events correctly, and fourteen percent manifested knowledge of after and mixed responses on the in order to complements. Data reported in section 1.2, chapter II, indicate that the main-clause-first strategy develops prior to knowledge of the meaning of subordinating conjunctions. Thus, it appears that the children who interpreted the order of events correctly and those who manifested knowledge of the meaning of after represent a stage of development beyond that represented by children manifesting the main-clause-first strategy. Therefore, it can be concluded that all of these children distinguish between main and subordinate clauses. Combining the percentages of object oriented children manifesting either the main-clause-first strategy, correct interpretation, or knowledge of only after indicates that ninety-three percent were able to distinguish between main and subordinate clauses (see Table 53). These results are consistent with the proposal that object oriented

children have developed recursion. In summary, several lines of evidence provide independent motivation for the claim that the first stage in children's analysis of multiple clause sentences involves obligatory attachment of complements to the VP.

As stated in the introductory paragraph to this section, the definition of object oriented grammars specifies that (1) complements are attached to the VP and (2) OS relative clauses are attached to the object NP. (See also section 4.2, chapter II.) Object responses on the OS relative clause construction constituted part of the second classificatory criteria for object oriented grammars (see section 1.3.2, chapter III). It is apparent from the fact that a large percentage of children were classified as manifesting this grammar type, that a grammatical system exists which specifies both object control of complement structures and selection of an object NP as a relativized NP. With the exception of the subject oriented children and two mixed subject-object children, OS relative clauses were interpreted correctly by all the children in the study (see section 6.3.2, chapter V). This includes the responses of unclassifiable children. The correct interpretation of OS relative clauses by object oriented children is consistent with the claim that these children attach relative clauses to the object NP. Thus, the results support the proposal that object oriented grammars are characterized by recursion

in both the VP and object NP.⁷

1.1.3 Mixed Subject-Object Grammars. Following the stage of object oriented grammars, a transitional period was predicted in which children develop the option of S attachment. It was expected that this transitional period would be characterized by variable attachment of embedded structures to either the S, VP, or object NP. As a result, grammars of this type, which were termed mixed subject-object grammars, were expected to be associated with mixed patterns of subject and object control. Fourteen percent of the subjects participating in the study manifested this grammar type (see Table 15). Thus, a significant group of children exhibited mixed response patterns. The mean ages and DSS scores of the group supported the hypothesis that the grammar type represented a transitional stage between object oriented and adult grammars (see Tables 18 and 21). It is interesting to note that Goodluck and Roeper (1978) reported that sixteen percent of their subjects manifested mixed patterns of control. The results of both studies constitute strong evidence for the existence of the proposed grammar type.

There is an important contrast in the responses of the mixed subject-object children. As indicated by Tables 16, 26, 31, and 32, these children manifested relatively consistent patterns of subject control on complements following either a passive by phrase (construction II-D) or

locative prepositional phrases (constructions II-B and III-B), while they manifested mixed responses on complement structures following direct objects (constructions II-A and III-A, the main comprehension task; and constructions I and II, the fourth interview). The patterns of subject control constitute evidence that the c-command constraint operates during this stage of development. At the same time, the contrast between subject control and mixed control is consistent with the hypothesis of variable attachment of complement structures.

Conceivably, an alternative explanation could be proposed which attributes the mixed patterns of control to intermittent application of the c-command constraint rather than variable attachment of the complement. This alternative view would be supported by the fact that (1) the c-command constraint was expected to begin to operate during this period (see section 4.3, chapter II), and (2) developing rule systems were expected to be associated with inconsistent response patterns (see section 4, chapter III). The reliability data reported in the present study provides a basis for choosing between the two explanations. Results reported in section 8, chapter V, reveal that children with object oriented grammars and high c-command scores manifested stable response patterns across interviews whereas children with mixed subject-object grammars manifested variable response patterns (see Table 49). In view of the fact that

both groups had high c-command scores (see Table 26), the differences in reliability can only be attributed to differences in attachment of the complement. Thus, variable attachment rather than intermittent application of the c-command constraint seems to be responsible for the mixed responses.⁸

The definition of variable attachment has two interpretations: one, some complements are attached to the S while others are attached to the VP; or two, individual complements are alternately attached to either the S or the VP. Notice that mixed patterns of control were manifested on individual construction types. This was true for all the classificatory constructions (see Table 16), the non-classificatory promise sentences (construction I-B, see Table 16), and the three constructions (I, II, and V) in the fourth interview (see Table 48). These results indicate that the second interpretation applies to mixed subject-object grammars. That is, variable attachment means that individual complements are alternately attached to either the S or the VP. The reliability data also show this to be the case, in that the children exhibited variable response patterns on alternate forms of the same construction type.

Mixed subject-object children manifested a slight decline in object control on constructions VI (OS relative clauses) and VII (Dative PP's) as compared to children with object oriented, approaching adult, and adult grammars (see

Table 16). With respect to construction VII, the decline, which resulted from an increase in subject responses, could be attributable to either variable attachment of the complement or overgeneralization of the c-command constraint (see section 2.2, chapter III). The fact that the number of errors on VII did not differ significantly from those on VI (see Table 38) suggests that the pattern of responses on both constructions resulted from the same grammatical processes. In view of the fact that the overgeneralization hypothesis does not apply to relative clause constructions, it seems that variable attachment is occasionally extended to relative clause and dative PP constructions. It must be emphasized, however, that the overall pattern of control on both constructions suggests that variable attachment is relatively infrequent.

The tell sentences (construction I-A) seems to be the only complement construction to which variable attachment did not apply. With the exception of one subject response, mixed subject-object children interpreted the tell sentences correctly (see Table 16). This response pattern conflicts with the predicted pattern (see Figure 1), as well as findings reported in previous research (Chomsky, 1969; Tavakolian, 1977; and Goodluck, 1978). The present study differs from Chomsky's work in that the tell sentences were not consistently contrasted with verbs such as ask and promise (which constitute lexical exceptions to the minimal

distance principle). Although promise was included in the main comprehension task, it rarely occurred in series with the tell sentences due to the large number of constructions presented during the interview. This removed the possibility of children generalizing confusion related to verbs such as promise to the tell sentences. In addition, the tell sentences in the present research included only two animate NP's. Thus, the sentences contrasted with Tavakolian's in that the processing load was reduced. Furthermore, unlike both Tavakolian's and Goodluck's work, the data on the tell sentences did not include any other verb types. These factors may explain why previous studies reported mixed patterns; whereas the present study did not. However, the resistance of the tell sentences to variable attachment remains to be explained. Perhaps, it is related to the fact that initial hypotheses concerning attachment (viz., VP attachment associated with object oriented grammars) happens to be correct for this construction. As a result, later grammatical developments such as variable attachment are unlikely to change the pattern of responses unless the child is confronted with either (1) sentences that are difficult to process (e.g. Tavakolian's sentences) or (2) extremely confusing situations (e.g. a series of test sentences involving only promise and tell or ask and tell). The small percentage of errors manifested on constructions VI and VII is consistent with this view. Both constructions were

analyzed and interpreted correctly at an earlier stage of development. Thus, they, too, are resistant to variable attachment.

1.1.4 Approaching Adult and Adult Grammars. Section 4, chapter II, argues that the stage of variable attachment of complements is followed by correct attachment to either the S, VP, or subject and object NP's.⁹ This final stage in children's analysis of multiple clause sentences was assumed to characterize both approaching adult and adult grammars. In addition, the c-command constraint was predicted to operate as it does in adult grammar. However, approaching adult children were expected to lack knowledge of exceptions to the rule (see section 4.4, chapter II, and sections 1.3.4 and 1.3.5, chapter III).

Combining the number of children classified as manifesting approaching adult and adult grammars, a total of twenty-three percent of the children in the study exhibited patterns of control which were assumed to represent correct attachment of complement structures (see Table 15). The claim that these children have developed an adult rule system is supported by the fact that they represented the oldest group in the study (see Table 18), and they manifested the highest DSS scores (see Table 21). In addition, they exhibited correct responses on the majority of the constructions. This included all of the classificatory constructions as well as the non-classificatory tell sentences

(construction I-B, see Table 16), and the three constructions (I, II, and V) presented during the fourth interview (see Table 48). Furthermore, the response patterns of the individual children were reliable across interviews. Comparing construction I (the fourth interview) to construction II-A (the main comprehension task) revealed that both groups manifested a high percentage of agreement. The adult children exhibited uniformly correct response on both constructions, whereas seventy-three percent of the approaching adult children exhibited responses that were the same or differed by one (see Table 50). Combining the two grammar types, seventy-nine percent of the children manifested responses that were the same or differed by only one response. Based on Cromer's theory of the relationship between reliability and types of rule systems, the reliability of the children's response patterns in a test-retest situation constitutes evidence that they were using an adult rule system. Performance on the semantically deviant construction V (fourth interview) also provides evidence supporting this claim. Both groups of children were consistently able to detect the deviancy (see Tables 41 and 44). As described in section 1.1.2, this chapter, this ability implies that the complement is attached to the S, and that the child resists violating the c-command constraint.

According to the classificatory criteria, approaching adult and adult children differ in terms of the consistency

of their response patterns (see sections 1.3.4 and 1.3.5, chapter III). This difference is apparent in the means reported in Tables 16 and 48 as well as in the data on reliability (see Tables 49 and 50). However, the major distinction between the two grammar types involves the interpretation of sentential subject sentences (constructions V-A and V-B, the main comprehension task). According to the classificatory criteria outlined in sections 1.3.4 and 1.3.5, chapter III, children with approaching adult grammars select outside NP's (ONP) as the controllers of sentential subject sentences, whereas children with adult grammars select the second NP. (See Figure 1 for a summary of the response patterns associated with each grammar type.) Thus, it was predicted that an older group of children would manifest adult patterns of control on infinitival, adverbial, and in order to complements while they manifest ONP response on sentential subject sentences. This prediction was confirmed. Nineteen percent of the children participating in the study manifested approaching adult grammars. The mean ages and DSS scores indicate that this group represents a transitional stage between mixed subject-object and adult grammars.

Among the children ranging from 6.6 to 8.25 years of age (the oldest group), fifty-two percent were classified as approaching adult (see Table A, Appendix H). In contrast, only five percent of this age group manifested adult

grammars (see Table A, Appendix H). If the range is further limited to children between the ages of 7.6 and 8.25, then sixty-seven percent manifested approaching adult grammars and thirty-three percent manifested adult grammars. Thus, among older children, who correctly interpreted infinitival, adverbial, and in order to complements, the predominant pattern of control on sentential subject sentences was ONP responses. Furthermore, the fact that ninety-two percent of the approaching adult children manifested ONP scores of either five or six (six is the maximum possible score) indicates that the pattern was extremely consistent (see Table 36).

ONP responses were not confined to approaching adult grammars. With the exception of adult children, the responses were manifested by children with all grammar types (see Table 36). However, the responses did not appear until 4.3 years of age (see Table F, Appendix H). In general, there was a gradual increase in ONP responses across age groups and grammar type (see Table 36 and Table F, Appendix H).

It is important to note that the opportunity for an ONP response was present on all construction types. That is, a third animal which was not mentioned in the sentence was included in each animal group placed before the child (see section 3.2, chapter IV, and also Appendix D for a detailed description of the procedures). It is striking,

then, that ONP responses only occurred on the sentential subject sentences. (See Table 17.) The similarity in both the procedure and the vocabulary across all construction types rules out an explanation which appeals to either situational or semantic cues. Clearly, the responses indicate a sensitivity to sentence structure.

It was postulated that ONP responses result from overgeneralization of the c-command constraint (see section 4.4, chapter II, and sections 1.3.4 and 2.2, chapter III). The overgeneralization hypothesis was tested by several predictions which attempted to show that the development of the c-command constraint influences interpretation of sentences constituting exceptions to the rule. In particular, children who had recently established the constraint and who also manifested high c-command scores were expected to manifest ONP responses on sentential subject sentences (constructions V-A and V-B) and errors (viz., subject or ONP responses) on Dative PP sentences (construction VII). However, the results failed to show a consistent relationship between c-command scores and ONP responses. Furthermore, none of the predictions concerning construction VII were confirmed. There were some suggestive trends in that mixed subject-object children manifested the highest proportion of errors on construction VII (see Table 37), and also manifested a significantly greater number of ONP responses on constructions V-A and V-B than children with object

oriented grammars and low c-command scores (see Table 36). Approaching adult children also manifested errors on construction VII. However, for both mixed subject-object and approaching adult groups, the number of errors on VII did not differ significantly from those manifested on construction VI (see Table 38). Thus, it seems unlikely that the errors on VII resulted from overgeneralization of the c-command constraint.

The limited support for the overgeneralization hypothesis leaves the ONP responses on sentential subject sentences largely unexplained. Tavakolian (1977) proposed that ONP responses on sentential subject sentences result from a rule which marks proforms and possible antecedents as non-coreferential when the proform precedes the antecedent. The tendency of subject and object oriented children to select the second NP as the controller of the complement falsifies this theory at least with respect to younger children (see Tables 16 and 17). Solan's (1978) work on anaphora suggests that older children have abandoned directional rules such as the one proposed by Tavakolian. Furthermore, Tavakolian's rule fails to account for the patterns of subject and object control on the preposed constructions IV-A and IV-B (see Tables 16 and 17). Thus, it seems unlikely that the rule accounts for the ONP responses manifested by children with approaching adult grammars. The fact that ONP responses are limited to

sentential subject sentences is consistent with Goodluck's distinction between free and obligatory control complements (see section 2.2.5, chapter II). The possibility that children are sensitive to this distinction definitely warrants further investigation.

It would be premature to reject the overgeneralization hypothesis without further study. The predicted relationship between c-command scores and ONP responses was based on the assumption that the c-command constraint was not operating in the grammars of object oriented children with low c-command scores. This assumption may not be valid in view of the fact that this group of children manifested subject responses on the passive sentences (see Table 30 and section 2, this chapter, for a discussion). If the c-command constraint is operating at this early stage of object oriented grammars, then the ONP responses which were manifested by this group would not constitute disconfirmation of the overgeneralization hypothesis. Furthermore, the failure to confirm the hypothesis with respect to construction VII, could be attributed to lack of statistical power of the test. Namely, when small differences are expected (as was the case for construction VII; see section 2.2, chapter III) large sample sizes are needed for adequate statistical power (i.e., to obtain statistically significant results). The contrasted groups were small (see Table 26). Therefore, failure to find statistical significance could

have been due to the small sample sizes.

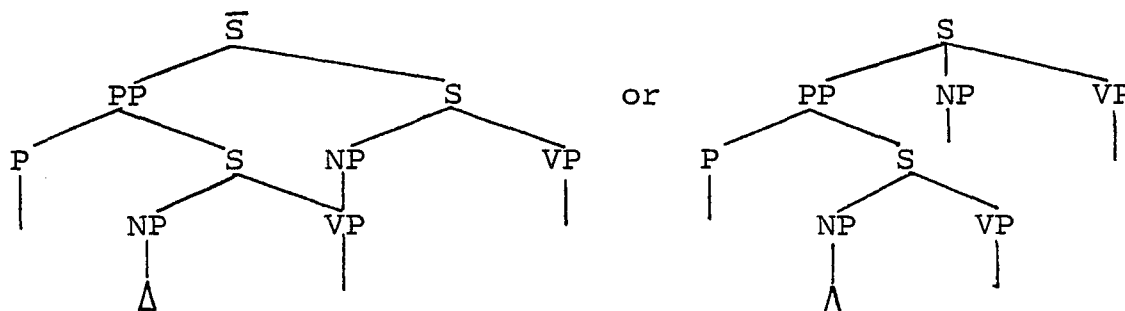
Before concluding this section of the discussion, it is important to note two apparent milestones in the development of children's analyses of the structure of multiple clause sentences. First, an adult analysis (viz., correct attachment of the embedded structure to either the S, VP, or subject and object NP's) does not appear to develop before five years of age. This is based on the fact that the youngest child manifesting either an approaching adult or adult grammar was 5.5 years of age. Secondly, development of an adult analysis seems to be completed for all children by eight years of age. Only approaching adult or adult grammars were manifested by children between the ages of 7.6 and 8.25 (see Table A, Appendix H). However, among this group, approaching adult rather than adult grammars was the predominant grammar type. Thus, many children beyond eight years of age are continuing to develop adult patterns of control on sentential subject sentences. In addition, older children continue to have difficulty correctly interpreting passive sentences (construction II-D, see approaching adult grammars, Table 16), and promise sentences (construction I-B, see adult grammars, Table 16). The passive construction is discussed in section 2 of this chapter. With respect to the promise sentences, the children classified as manifesting adult grammars exhibited mixed patterns of control. The finding replicated results reported by Chomsky (1969) in

which children who were approximately the same age also manifested mixed responses. Apparently, for many children, an adult analysis of the structure of multiple clause sentences develops prior to the knowledge of control patterns of such exceptional cases as promise and ask.

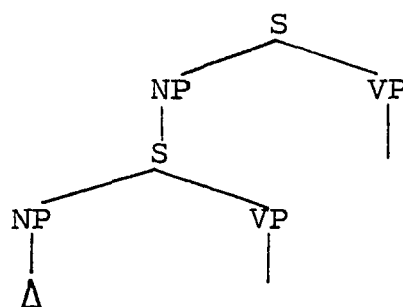
1.2 Conclusions. The theory of the five grammar types and their sequential development was confirmed through a variety of independent tests. According to the theory, children between the ages of three and four begin to develop structural principles which guide their interpretation of multiple clause sentences. Certainly, semantic and pragmatic strategies can and do influence children's linguistic behavior. This seems to be especially true when their grammars fail to generate an analysis of sentences which they are asked to interpret. However, in the absence of semantic and pragmatic clues young children demonstrate considerable knowledge of sentence structure. Surprisingly, this knowledge can override strong semantic biases.

Response patterns on the preposed complement structures (constructions IV-A and IV-B) provide further evidence of children's sensitivity to syntactic structure. For example, consider the surface structure of preposed complements as compared to that of sentential subject sentences.

- (1) Preposed Complements (see section 2.2.4, chapter II for a discussion of the alternative analyses)



- (2) Sentential Subject Sentences



With respect to surface structure, both constructions are similar in that the complement occurs in initial position. However, preposed complements are transformationally derived, whereas the sentential subject sentences are generated directly in the base. Despite the similarity in surface structure, children manifested strikingly different patterns of control on the two construction types. That is, the ONP responses which occurred on the sentential subject sentences were essentially absent on the preposed complement structures (six responses occurred in the entire study; see also Tables 16 and 17). This indicates a sensitivity to differences in underlying structure. Furthermore, it is consistent with the claim that children interpret missing complement subjects

in preposed constructions at a level other than surface structure.

This claim was tested by comparing response patterns on non-preposed constructions (II-A and III-A) to those on the preposed constructions (IV-A and IV-B) (see section 7, chapter V). The results demonstrated that children who manifested object control on non-preposed complements also manifested object control on preposed complements; whereas children who manifested subject control on non-preposed complements manifested subject control on preposed complements (see Table 47). These results supported the hypothesis that control is determined prior to preposing.

The interpretation of the preposed complements by children who manifested object control on the non-preposed constructions (II-A and III-A) was particularly important. As illustrated in (1), there are two alternative analyses of preposed constructions. In one analysis, the preposed complement attaches to $\bar{S}$, whereas in the second the preposed complement attaches to S . If the first analysis is assumed, either subject or object control would violate the c-command constraint at the level of surface structure. Thus, the fact that children manifest both types of control would constitute evidence that interpretation occurs at a level other than surface structure. However, if the second analysis is assumed, only object control would violate the constraint at the level of surface structure. In this case,

patterns of subject control would not rule out the possibility that interpretation occurs at the level of surface structure. Therefore, patterns of object control provide crucial evidence, since they violate the c-command constraint at the level of surface structure regardless of whether the preposed complement is attached to S or $\bar{S}$.

(See section 3, chapter III for a detailed discussion of these arguments.) It follows that finding individual children who manifested object control on both non-preposed and preposed constructions provides persuasive support for the hypothesis that missing complement subjects are interpreted at a level other than surface structure. However, this conclusion is based on two assumptions: one, the c-command constraint operates in children's grammars, and two, the constraint is inviolable. Evidence supporting both assumptions is discussed in section 1.1.2 of this chapter. In addition, two further predictions were tested which attempted to insure that the children who manifested object control on both preposed and non-preposed complements also obeyed the c-command constraint (see section 7, chapter V). Only one prediction was confirmed. As discussed in section 7, chapter V, failure to confirm the second prediction could be attributable to the fact that the test included children with mixed subject-object grammars as well as object oriented grammars. Variable attachment, which characterizes the former group, could account for subject responses on the preposed complements.

In general, the results support the hypothesis that children interpret missing complement subjects prior to preposing. This finding reinforces the claim that young children's interpretation of multiple clause sentences is guided by a knowledge of syntactic structure. It appears that these children are not only capable of assigning a structural analysis to complex sentences, but they are also sensitive to levels of underlying structure as well as surface structure.

2. Rules Used to Determine Controllers of Missing Complement Subjects: Operation of the C-Command Constraint in Children's Grammar

The investigation of children's structural analysis of multiple clause sentences was intimately tied to an investigation of the rules determining the controllers of missing complement subjects. Thus, the study focussed on the patterns of control manifested by individual children. It was postulated that the c-command constraint in conjunction with the minimal distance principle guides children's interpretation of missing complement subjects. The fact that children initially attach all complements to the VP provides an opportunity to test the theory that the c-command constraint in conjunction with the MDP operates in children's grammars. The theory predicts that children will manifest subject control of complements following a

prepositional phrase while they manifest object control of complements following a direct object (see sections 3 and 4, chapter II and section 2.1.4, chapter III). As stated in section 1.1.2, this chapter, the results of this study replicated findings reported by Goodluck (1978). For the combined groups, children manifested a significantly greater number of subject responses on complements following either a passive by phrase (construction II-D) or a locative prepositional phrase (constructions II-B and III-B) than on complements following a direct object (constructions II-A and III-A) (see Table 33). This difference also existed within grammar types (see Tables 31 and 32). These findings provide convincing support for the theory that the c-command constraint in conjunction with the MDP determine the controllers of missing complement subjects.

Although the c-command constraint does seem to guide children's interpretation of missing complement subjects, there are several issues concerning the manner in which it operates. Section 1 of this chapter discussed two issues: the inviolability hypothesis and the overgeneralization hypothesis. This section is concerned with evaluating whether the c-command constraint, a putative universal, operates in children's grammars in exactly the same manner as it does in adult grammar, or whether there are differences in operation due to either a sub-adult form of the rule or the misanalysis of constructions which fall within the domain

of the rule. Section 3, chapter I, proposed that there are four logical possibilities which describe the operation of universals in children's grammars (see (1), chapter I, and (19), chapter III). These possibilities are repeated here for convenience.

(3)

- (A) A sub-adult rule + incorrect structural analyses
- (B) A sub-adult rule + correct structural analyses
- (C) An adult rule + incorrect structural analyses
- (D) An adult rule + correct structural analyses

The first three possibilities (A, B, and C) constitute alternative versions of what was termed the delayed operation hypothesis, whereas the fourth possibility (D) refers to the immediate operation hypothesis (see section 3, chapter I and section 2.1, chapter III). According to the delayed operation hypothesis, operation of the c-command constraint in children's grammar should differ from its operation in adult grammar. The differences may be related to the type of complement, prepositional phrase, or some other aspect of structure. In addition, the hypothesis predicts that changes will occur across age and grammar type as a result of either changes in the form of the rule or changes in the analyses of structures falling within the domain of the rule. (See also section 2.1, chapter III.)

In contrast, the immediate operation hypothesis predicts that the c-command constraint will apply in children's grammar as it does in adult grammar regardless of the type of complement or type of prepositional phrase. The hypothesis also predicts that the constraint should operate in a similar manner in the grammars of all children participating in the study.

A system of assessing the operation of the c-command constraint was devised which counted the number of subject responses on complements following locative prepositional phrases (II-B and III-B). The resulting scores, which were termed c-command scores, ranged from zero to six. A c-command score of four or more was considered to reflect operation of the constraint. The c-command scores were positively related to both age and DSS scores. Since the scores reflect the number of correct responses on the two construction types, this relationship was not surprising. However, the trend did not support the immediate operation hypothesis. Instead the results suggest that the constraint is not immediately operational, at least with respect to complements preceded by locative prepositional phrases. The mean c-command scores for each grammar type suggest that with respect to the locative constructions, II-B and III-B, the constraint begins to apply sometime during the period when children manifest object oriented grammars (see Table 25). This was supported by the fact that the c-command

scores for this group were positively related to both age and DSS scores. These results confirmed predictions related to the delayed operation hypothesis.

Developmental processes related to constructions II-B and III-B seem to be completed by the time children manifest mixed subject-object grammars. The c-command scores for this group were not significantly related to either age or DSS scores. In addition, all the children manifested high c-command scores (viz., four to six) (see Table 26). Finally, the mean c-command score for the mixed subject-object group was similar to that of the approaching adult and adult groups (see Table 25).

Children's interpretation of complements following the directional prepositions on and at (constructions II-C and III-C) provided further disconfirmation of the immediate operation hypothesis. The hypothesis predicts that children will interpret these constructions in the same manner that they interpret constructions containing either locative prepositional phrases or a passive by phrase. This means that children should manifest a significantly greater number of subject responses on constructions II-C and III-C than on II-A and III-A (see section 2.1.4, chapter III). For the combined groups, the number of subject responses on construction II-C differed significantly from construction II-A (see Table 33). However, this pattern did not hold within grammar types (see Table 32). In addition, the pattern did

not hold for construction III-C as compared to III-A either for the combined groups (see Table 33) or within grammar type (see Table 32). In general, constructions II-C and III-C were interpreted in a manner similar to complements following direct objects (II-A and III-A) rather than complements following locative prepositional phrases (II-B and III-B). This is particularly evident in Table 34, which shows that the number of subject responses on II-C and III-C differ significantly from the number of subject responses on II-B and III-B for both object oriented and mixed subject-object children. Thus, the c-command constraint applies to constructions involving locative prepositional phrases prior to those involving directional prepositional phrases. It is apparent from an inspection of Tables 31 and 32, that the constraint begins to apply to the latter construction types during the period of mixed subject-object grammars and that it is established by the time children are manifesting approaching adult grammars. These results provide further support for the delayed operation hypothesis in contrast to the immediate operation hypothesis.

In view of the fact that the delayed operation hypothesis seems to describe the operation of the c-command constraint, it is necessary to consider which of the alternative versions of the hypothesis (viz., A, B, or C) characterize children's grammars (see (3), this chapter). This involves determining whether children's grammars include a

sub-adult form of the constraint, a structural misanalysis of prepositional phrases, or both. Once the c-command constraint begins to operate, it seems to apply uniformly across complement types. Inspection of Tables 31 and 33 reveal that the mean number of subject responses on constructions II-B and III-B are the same for the entire group of children as well as for individual grammar types. Complement type does seem to be a factor in children's interpretation of constructions II-C and III-C. This seems to be particularly true for object oriented and mixed subject-object children (see Table 31). However, the major factor contributing to the differences in the application of the constraint seems to be the type of prepositional phrase which precedes the complement. The results reported in section 6.1.2, chapter V, indicate that subject responses initially appear on complements following passive by phrases (II-D). This is confirmed by inspection of the means for object oriented children (see Table 16). Somewhat later subject responses appear on complements following locative prepositional phrases (II-B and III-B) and finally, during the stage of mixed subject-object grammars, they appear in response to complements following directional prepositional phrases (II-C and III-C). It is difficult to imagine the type of rule which would account for these facts. The initial restricted application would require reference to specific types of prepositional phrases. Development would

then involve increasing generality. This suggests that development proceeds from a marked rule to an unmarked rule. Not only does this proposal seem counter-intuitive, but there don't seem to be any other rules in children's grammar with a similar pattern of development. A much more plausible explanation is that children have misanalyzed constructions which fall within the domain of the rule. That is, they have misanalyzed prepositional phrases. The interaction of the type of prepositional phrase and application of the constraint could be explained by postulating that the prepositions are initially viewed as particles. As a result, the sentences would be misanalyzed as containing direct objects. Such an analysis means that for grammars in which the complement is attached to the VP, the object noun phrase c-commands the missing NP position. As a result the object NP is no longer blocked as a controller. This would explain patterns of object control on complements following prepositional phrases. According to this view, development involves learning to recognize prepositional phrases which has the effect of increasing the range of application of the c-command constraint.

With respect to constructions II-C and III-C, several facts support the structural misanalysis proposal. First, the words on and at function as both particles and prepositions in adult grammar. Secondly, they appear as particles in children's early utterances (Hsu, 1977). Finally, the

quality of the children's demonstrations in the present research suggest that the verbs in the two constructions were treated as transitive verbs (see section 4, chapter V).

Adopting the structural misanalysis theory would mean that the object oriented children with low c-command scores are also treating the locative prepositions in constructions II-B and III-B as particles. There is, however, no data in the present research which could be used to evaluate this proposal. Although the structural misanalysis hypothesis has a strong intuitive appeal, further research is clearly needed. One avenue of investigation would be to design a task which differentiates between children who are analyzing prepositional phrases correctly and those who are not. The structural misanalysis hypothesis could then be tested by determining whether the c-command constraint applies in only those cases in which the prepositional phrase is analyzed correctly.

A final comment should be made concerning the passive construction (II-D). Although the response patterns of object oriented children on this construction were consistent with the c-command constraint, the patterns of approaching adult children were not. With respect to the object oriented children, it is important to note that there were a greater number of subject responses on the passive than on either constructions II-B or III-B. This is evident from inspection of the means reported in Tables 16

and 31, and it is also evident from the fact that object oriented children manifested the patterns II-D>II-B and II-D>III-B significantly more often than the reverse patterns (see Table 28). Inspection of Table 30 reveals that object oriented children with low c-command scores manifested a mean of 1.9 subject responses on the passive construction. This indicates that many of these children manifested a consistent pattern of subject control on the passive while they manifested object control on complements following locative prepositional phrases (II-B and III-B). As stated in the preceding discussion, it appears that the c-command constraint applies initially to the passive. Furthermore, it seems to apply in a consistent manner from the beginning stages of object oriented grammar. This suggests that (1) the c-command constraint applies as soon as children have developed an analysis of multiple clause sentences, and (2) the passive by phrase is the first phrase to be analyzed as a prepositional phrase.

However, children with approaching adult grammars manifest a surprising decline in the number of subject responses on the passive construction (see Tables 16, 31, and 32). As a consequence of the decline, the number of subject responses on both II-B and III-B are greater than those on II-D (see Table 29). This pattern is also true for II-C and III-C as compared to II-D, as well as II-A and III-A versus II-D (see Tables 16 and 31). Hence, patterns

observed in object oriented children were reversed for approaching adult and adult children. The decline in subject responses is troubling because the c-command constraint was assumed to apply to this construction at the early stages of development. It could be argued that older children are violating the c-command constraint. This, of course, would have far-reaching consequences for the theories outlined in the present research. However, the explanation seems untenable in view of the fact that these children resisted violating the constraint on the semantically deviant sentences (see section 6.4, chapter V). Thus, older children's interpretation of the passive construction remains a puzzling finding among an array of results which provide a fairly consistent picture of the operation of the c-command constraint across grammar types.

In summary, the results of the present research suggest that the c-command constraint does not operate in children's grammars in the same manner that it does in adult grammar. In particular, it does not apply uniformly to all types of prepositional phrases. Instead, there is a developmental progression where it applies first to the passive by phrase, second to locative prepositional phrases, and third to directional prepositional phrases. The differences in application can be attributed to the gradual development of the ability to recognize an increasing range of prepositional phrases. This results from development

of the distinction between prepositions and particles. As a result, the constraint applies to an expanding range of sentence types. According to this view, the constraint is fully specified as it is in adult grammar. However, it is not fully operational due to the misanalysis of main clauses as containing direct objects rather than objects of a preposition. Thus, among the three alternative versions of the delayed operation hypothesis (see (3)), alternative C seems to describe the operation of the c-command constraint in the grammars of the children participating in the present research. That is, the children have tacit knowledge of the adult form of the constraint, but an incorrect analysis of prepositional phrases.

This conclusion has implications for subject oriented grammars. According to the original definition of the grammar type, children initially analyze multiple clause sentences as conjoined simplex sentences which are attached to $\bar{S}$ (see section 4.1, chapter II). However, subject control of structures analyzed in this way violate the c-command constraint (see footnote 27, chapter II and section 2.1.4, chapter III). The assumption that children's early grammars include an adult form of the constraint in conjunction with the assumption of inviolability requires a redefinition of subject oriented grammars. Two alternative proposals have been suggested: one, subject oriented grammars are characterized by the topmost S analysis as proposed by Solan and Roeper

(1978) (see footnote 27, chapter II); or two, subject oriented grammars do not include a structural analysis of sentences (see section 1.1.1, this chapter). In this latter proposal, the grammar includes only an interpretive rule. As argued in section 1.1.1, this chapter, data from the present study seems to support the second proposal.

3. Conclusions

The present study attempted to investigate children's knowledge of the structure of multiple clause sentences and the rules used to interpret missing complement subjects. The study was designed to control variables which could result in performance that either under- or over- estimated children's knowledge. The convergence of several independent lines of evidence suggests that the tasks did, in fact, tap structural knowledge rather than semantic or pragmatic strategies. It seems worthwhile to review some of the findings which indicate that the children's response patterns were guided by structural principles. One striking example was the fact that response patterns on semantically deviant sentences were related to grammar type. In this case, structural principles were able to override the effects of a semantic bias. Sensitivity to structure was also evident in the fact that young children manifested outside NP (ONP) responses on only one construction type (viz., sentential subject sentences) despite the fact that such a

response was possible on all sentences which were presented to the children. As argued in section 1.1.4, this chapter, the similarity in both procedure and vocabulary across all construction types rules out an explanation which appeals to either situational or semantic cues. Children's knowledge of structural principles appears to extend to underlying levels as well as surface structure. This was evident in the differences in response patterns on sentential subject sentences as compared to preposed complements. It was also evident in the fact that patterns of control on the preposed complements were related to patterns on non-preposed complements.

It appears that children's knowledge of structural principles develops somewhat independently of semantic and pragmatic aspects of the language. Children manifest consistent patterns of control long before they manifest knowledge of the meaning of subordinating conjunctions such as after or in order to. Even the interpretation of the order of events is guided by structural principles (viz., distinguishing between main and subordinate clauses) before it is guided by knowledge of the meaning of words such as after or before. In a similar manner, children use their knowledge of structure to interpret OS relative clauses before they develop an understanding of the restrictive meaning of the relative pronoun that.

The five grammar types attempt to specify the structural principles which guide children's interpretation of multiple clause sentences. However, further research is needed to determine whether they represent a descriptively adequate account of children's knowledge. In particular, the relationship between grammar type and children's interpretation of embedded structures other than those investigated in the present study needs to be evaluated. The theory of the five grammar types makes explicit predictions concerning children's interpretation of structures such as OO and SO relative clauses as well as many other construction types. Thus, the model leads to numerous verifiable predictions.

The general pattern of development which emerges from the theory of the five grammar types differs from the pattern of development suggested by the hypothesis testing model. From the beginning, children are developing structural principles which are correct when compared to adult grammars. The main difference between children's and adult systems seems to be in the number of options available to the child or in the degree of differentiation between structures. For example, in the early stages of the structural analysis of multiple clause sentences, children obligatorily attach complements to only one level. Development involves expansion of the options in level of attachment. In another example, the structural analysis theory suggests that objects of prepositions are erroneously

treated as direct objects. Development in this case involves correctly differentiating between the two structures. This process results in expanded application of the c-command constraint to an increasing range of construction types. In both of these cases, there is a gradual modification of aspects of the child's early grammatical system. Hence, development does not seem to involve a radical reorganization which is implied by the hypothesis testing model of language acquisition. Instead, fundamental principles which are present from the beginning are modified through processes of differentiation, expansion of options, or setting of specific parameters.

FOOTNOTES

¹It is important to point out that although DSS scores were obtained for each child, they were not used to select children. However, it was necessary for a child to give enough utterances to compute either a DST or a DSS score. As discussed in section 2.1, chapter IV, one child uttered only five sentences. This child was not asked to continue due to the fact that the language sample was not sufficient for any type of analysis and also due to the apparent discomfort the child in an experimental situation.

²Solan and Roeper's (1978) investigation of young children's interpretation of OS relative clauses involving the verbs push and put argues against a simple linear system. Their results suggest that children do attach relative clauses to the topmost S and that they are sensitive to the "no tangle constraint". However, the children in Solan and Roeper's study were older (viz., four to six years of age) and the sentences involved three animate NP's. In view of the age of the children and the possible contaminating effects of three animate NP's (see Goodluck and Tavakolian, 1979), it is not clear whether their results apply to subject oriented children.

³See footnote 4, chapter V.

⁴The results are also discussed in Goodluck (1978). See footnote 23, chapter II, for a summary of the arguments.

⁵See footnote 4, chapter V.

⁶It could be argued that the results indicate lack of knowledge that all of a sudden forces S attachment. However, among the object oriented children, all of the shifts were in the predicted direction. If the increases are assumed to represent knowledge that all of a sudden forces S attachment, then the fact that the magnitude was not greater than one in all cases indicates a resistance to S attachment.

⁷Although it is conceivable that correct responses could occur when relative clause are erroneously attached to the VP, the results of Goodluck (1978), Goodluck and Tavakolian (1979), and Solan and Roeper (1978) suggest that correct responses on the sentences result from attachment of the relative clause to the object NP. (See also footnote 23, chapter II; section 4.2, chapter II; and section 1.2.4, chapter III.)

⁸Another possible explanation of the mixed responses is that mixed subject-object children are abandoning the minimal distance principle. However, the patterns of correct interpretation of the tell sentences and the dative PP sentences (see Table 16 and section 6.3.2, chapter V) argue against this view.

⁹Subject NP's are assumed to be recursive nodes at this stage. This implies that they become recursive nodes during the stage when children manifest mixed subject-object grammars. However, further research is needed to determine whether these assumptions are correct.

APPENDIX A

Experimental Sentences - Second and Third Interviews Set A

- I. Infinitival Complements
 - A. Tell + Direct Object
 - 1. The lion tells the bear to crawl under the table
 - 2. The duck tells the rabbit to hop into the pool
 - 3. The cow tells the horse to climb up the ladder
 - B. Promise
 - 4. The duck promises the rabbit to crawl under the table
 - 5. The cow promises the horse to hop into the pool
 - 6. The lion promises the bear to climb up the ladder
- II. Non Preposed Adverbial Temporal Complements
 - A. Direct Object
 - 7. The lion hits the bear after crawling under the table
 - 8. The duck pushes the rabbit **after hopping** into the pool
 - 9. The cow pulls the horse after climbing up the ladder
 - B. Prepositional Phrases involving near, around & over
 - 10. The duck stands near the rabbit after climbing up the ladder
 - 11. The cow walks around the horse after crawling under the table
 - 12. The lion jumps over the bear after hopping into the pool
 - C. Prepositional Phrases involving at & on
 - 13. The duck hits at the rabbit after crawling under the table
 - 14. The cow pushes on the horse after hopping into the pool
 - 15. The lion pulls at the bear after climbing up the ladder

APPENDIX A - Set A

D. Passive by phrase

- 16. The duck is hit by the rabbit after climbing up the ladder
- 17. The cow is pushed by the horse after crawling under the table
- 18. The lion is pulled by the bear after hopping into the pool

III. Non Preposed in order to Complements

A. Direct Object

- 19. The cow hits the horse in order to hop into the pool
- 20. The lion pushes the bear in order to climb up the ladder
- 21. The duck pulls the rabbit in order to crawl under the table

B. Prepositional Phrases involving near, around & over

- 22. The lion stands near the bear in order to crawl under the table
- 23. The duck walks around the rabbit in order to hop into the pool
- 24. The cow jumps over the horse in order to climb up the ladder

C. Prepositional Phrases involving at & on

- 25. The lion hits at the bear in order to hop into the pool
- 26. The duck pushes on the rabbit in order to climb up the ladder
- 27. The cow pulls at the horse in order to crawl under the table

IV. Preposed Complements

A. Temporal Complements

- 28. After hopping into the pool the duck hits the rabbit
- 29. After climbing up the ladder the cow pushes the horse
- 30. After crawling under the table the lion pulls the bear

B. In order to Complements

- 31. In order to crawl under the table the cow hits the horse
- 32. In order to hop into the pool the lion pushes the bear
- 33. In order to climb up the ladder the duck pulls the rabbit

APPENDIX A - Set A

V. Sentential Subject Sentence

A. Infinitival

- 34. To have to hit the duck scares the rabbit
- 35. To have to push the cow scares the horse
- 36. To have to pull the lion scares the bear

B. Participial

- 37. Hitting the cow scares the horse
- 38. Pushing the lion scares the bear
- 39. Pulling the duck scares the rabbit

VI. Object-Subject Relative Clauses

- 40. The lion hits the bear that is climbing up the ladder
- 41. The duck pushes the rabbit that is crawling under the table
- 42. The cow pulls the horse that is hopping into the pool

VII. Dative PP Sentences

- 43. The lion yells at the bear to crawl under the table
- 44. The duck whispers to the rabbit to hop into the pool
- 45. The cow shouts at the horse to climb up the ladder

APPENDIX A

Experimental Sentences - Second and Third Interviews Set B

- I. Infinitival Complements
 - A. Tell + Direct Object
 - 1. The bear tells the lion to crawl under the table
 - 2. The rabbit tells the duck to hop into the pool
 - 3. The horse tells the cow to climb up the ladder
 - B. Promise
 - 4. The rabbit promises the duck to crawl under the table
 - 5. The horse promises the cow to hop into the pool
 - 6. The bear promises the lion to climb up the ladder
- II. Non Preposed Adverbial Temporal Complements
 - A. Direct Object
 - 7. The bear hits the lion after crawling under the table
 - 8. The rabbit pushes the duck after hopping into the pool
 - 9. The horse pulls the cow after climbing up the ladder
 - B. Prepositional Phrases involving near, around & over
 - 10. The rabbit stands near the duck after climbing up the ladder
 - 11. The horse walks around the cow after crawling under the table
 - 12. The bear jumps over the lion after hopping into the pool
 - C. Prepositional Phrases involving at & on
 - 13. The rabbit hits at the duck after crawling under the table
 - 14. The horse pushes on the cow after hopping into the pool
 - 15. The bear pulls at the lion after climbing up the ladder

APPENDIX A - Set B

D. Passive by phrase

- 16. The rabbit is hit by the duck after climbing up the ladder
- 17. The horse is pushed by the cow after crawling under the table
- 18. The bear is pulled by the lion after hopping into the pool

III. Non Preposed in order to Complements

A. Direct Object

- 19. The horse hits the cow in order to hop into the pool
- 20. The bear pushes the lion in order to climb up the ladder
- 21. The rabbit pulls the duck in order to crawl under the table

B. Prepositional Phrases involving near, around & over

- 22. The bear stands near the lion in order to crawl under the table
- 23. The rabbit walks around the duck in order to hop into the pool
- 24. The horse jumps over the cow in order to climb up the ladder

C. Prepositional Phrases involving at & on

- 25. The bear hits at the lion in order to hop into the pool
- 26. The rabbit pushes on the duck in order to climb up the ladder
- 27. The horse pulls at the cow in order to crawl under the table

IV. Preposed Complements

A. Temporal Complements

- 28. After hopping into the pool the rabbit hits the duck
- 29. After climbing up the ladder the horse pushes the cow
- 30. After crawling under the table the bear pulls the lion

B. In order to Complements

- 31. In order to crawl under the table the horse hits the cow
- 32. In order to hop into the pool the bear pushes the lion
- 33. In order to climb up the ladder the rabbit pulls the duck

APPENDIX A - Set B

V. Sentential Subject Sentences

A. Infinitival

- 34. To have to hit the rabbit scares the duck
- 35. To have to push the horse scares the cow
- 36. To have to pull the bear scares the lion

B. Participial

- 37. Hitting the horse scares the cow
- 38. Pushing the bear scares the lion
- 39. Pulling the rabbit scares the duck

VI. Object-Subject Relative Clauses

- 40. The bear hits the lion that is climbing up the ladder
- 41. The rabbit pushes the duck that is crawling under the table
- 42. The horse pulls the cow that is hopping into the pool

VII. Dative PP Sentences

- 43. The bear yells at the lion to crawl under the table
- 44. The rabbit whispers to the duck to hop into the pool
- 45. The horse shouts at the cow to climb up the ladder

APPENDIX B

Experimental Sentences - Second and Third Interviews Set A

- I. Infinitival Complements
 - A. Tell + Direct Object
 - 1. The tiger tells the gorilla to crawl under the table
 - 2. The dog tells the cat to hop into the pool
 - 3. The pig tells the sheep to climb up the ladder
 - B. Promise
 - 4. The dog promises the cat to crawl under the table
 - 5. The pig promises the sheep to hop into the pool
 - 6. The tiger promises the gorilla to climb up the ladder
- II. Non Preposed Adverbial Temporal Complements
 - A. Direct Object
 - 7. The tiger hits the gorilla after crawling under the table
 - 8. The dog pushes the cat after hopping into the pool
 - 9. The pig pulls the sheep after climbing up the ladder
 - B. Prepositional Phrases involving near, around & over
 - 10. The dog stands near the cat after climbing up the ladder
 - 11. The pig walks around the sheep after crawling under the table
 - 12. The tiger jumps over the gorilla after hopping into the pool
 - C. Prepositional Phrases involving at & on
 - 13. The dog hits at the cat after crawling under the table
 - 14. The pig pushes on the sheep after hopping into the pool
 - 15. The tiger pulls at the gorilla after climbing up the ladder

APPENDIX B - Set A

D. Passive by phrase

- 16. The dog is hit by the cat after climbing up the ladder
- 17. The pig is pushed by the sheep after crawling under the table
- 18. The tiger is pulled by the gorilla after hopping into the pool

III. Non Preposed in order to Complements

A. Direct Object

- 19. The pig hits the sheep in order to hop into the pool
- 20. The tiger pushes the gorilla in order to climb up the ladder
- 21. The dog pulls the cat in order to crawl under the table

B. Prepositional Phrases involving near, around, and over

- 22. The tiger stands near the gorilla in order to crawl under the table
- 23. The dog walks around the cat in order to hop into the pool
- 24. The pig jumps over the sheep in order to climb up the ladder

C. Prepositional Phrases involving at and on

- 25. The tiger hits at the gorilla in order to hop into the pool
- 26. The dog pushes on the cat in order to climb up the ladder
- 27. The pig pulls at the sheep in order to crawl under the table

IV. Preposed Complements

A. Temporal Complements

- 28. After hopping into the pool the dog hits the cat
- 29. After climbing up the ladder the pig pushes the sheep
- 30. After crawling under the table the tiger pulls the gorilla

B. In order to Complements

- 31. In order to crawl under the table the pig hits the sheep
- 32. In order to hop into the pool the tiger pushes the gorilla
- 33. In order to climb up the ladder the dog pulls the cat

APPENDIX B - Set A

V. Sentential Subject Sentences

A. Infinitival

- 34. To have to hit the dog scares the cat
- 35. To have to push the pig scares the sheep
- 36. To have to pull the tiger scares the gorilla

B. Participial

- 37. Hitting the pig scares the sheep
- 38. Pushing the tiger scares the gorilla
- 39. Pulling the dog scares the cat

VI. Object-Subject Relative Clauses

- 40. The tiger hits the gorilla that is climbing up the ladder
- 41. The dog pushes the cat that is crawling under the table
- 42. The pig pulls the sheep that is hopping into the pool

VII. Dative PP Sentences

- 43. The tiger yells at the gorilla to crawl under the table
- 44. The dog whispers to the cat to hop into the pool
- 45. The pig shouts at the sheep to climb up the ladder

APPENDIX B

Experimental Sentences - Second and Third Interviews : Set B

I. Infinitival Complements

A. Tell + Direct Object

1. The gorilla tells the tiger to crawl under the table
2. The cat tells the dog to hop into the pool
3. The sheep tells the pig to climb up the ladder

B. Promise

4. The cat promises the dog to crawl under the table
5. The sheep promises the pig to hop into the pool
6. The gorilla promises the tiger to climb up the ladder

II. Non Preposed Adverbial Temporal Complements

A. Direct Object

7. The gorilla hits the tiger after crawling under the table
8. The cat pushes the dog after hopping into the pool
9. The sheep pulls the pig after climbing up the ladder

B. Prepositional Phrases involving near, around & over

10. The cat stands near the dog after climbing up the ladder
11. The sheep walks around the pig after crawling under the table
12. The gorilla jumps over the tiger after hopping into the pool

C. Prepositional Phrases involving at & on

13. The cat hits at the dog after crawling under the table
14. The sheep pushes on the pig after hopping into the pool
15. The gorilla pulls at the tiger after climbing up the ladder

D. Passive by phrase

16. The cat is hit by the dog after climbing up the ladder
17. The sheep is pushed by the pig after crawling under the table
18. The gorilla is pulled by the tiger after hopping into the pool

APPENDIX B - Set B

III. Non Preposed in order to Complements

A. Direct Object

- 19. The sheep hits the pig in order to hop into the pool
- 20. The gorilla pushes the tiger in order to climb up the ladder
- 21. The cat pulls the dog in order to crawl under the table

B. Prepositional Phrases involving near, around and over

- 22. The gorilla stands near the tiger in order to crawl under the table
- 23. The cat walks around the dog in order to hop into the pool
- 24. The sheep jumps over the pig in order to climb up the ladder

C. Prepositional Phrases at and on

- 25. The gorilla hits at the tiger in order to hop into the pool
- 26. The cat pushes on the dog in order to climb up the ladder
- 27. The sheep pulls at the pig in order to crawl under the table

IV. Preposed Complements

A. Temporal Complements

- 28. After hopping into the pool the cat hits the dog
- 29. After climbing up the ladder the sheep pushes the pig
- 30. After crawling under the table the gorilla pulls the tiger

B. In order to Complements

- 31. In order to crawl under the table the sheep hits the pig
- 32. In order to hop into the pool the gorilla pushes the tiger
- 33. In order to climb up the ladder the cat pulls the dog

APPENDIX B - Set B

V. Sentential Subject Sentences

A. Infinitival

- 34. To have to hit the cat scares the dog
- 35. To have to push the sheep scares the pig
- 36. To have to pull the gorilla scares the tiger

B. Participial

- 37. Hitting the sheep scares the pig
- 38. Pushing the gorilla scares the tiger
- 39. Pulling the cat scares the dog

VI. Object-Subject Relative Clauses

- 40. The gorilla hits the tiger that is climbing up the ladder
- 41. The cat pushes the dog that is crawling under the table
- 42. The sheep pulls the pig that is hopping into the pool

VII. Dative PP Sentences

- 43. The gorilla yells at the tiger to crawl under the table.
- 44. The cat whispers to the dog to hop into the pool
- 45. The sheep shouts at the pig to climb up the ladder

APPENDIX C

Experimental Sentences - Fourth Interview Set A

Part I

- I. Adverbial Temporal Complement preceded by Direct Object
 1. The owl hits the dog after eating
 2. The cow pushes the pig after waking up
 3. The duck pulls the cat after drinking
- II. Adverbial Temporal Complement preceded by all of a sudden
 4. The duck hits the cat all of a sudden after waking up
 5. The owl pushes the dog all of a sudden after drinking
 6. The cow pulls the pig all of a sudden after eating
- III. Conjoined NP's & Simple Declarative Sentence
 7. The owl and the dog crawl under the table
 8. The cow and the pig hop into the pool
 9. The duck and the cat climb up the ladder
- IV. Conjoined NP's + Infinitival Complement
 10. The owl chooses the cow and the pig to crawl under the table
 11. The dog picks the duck and the cat to hop into the pond
 12. The cow helps the owl and the dog to climb up the ladder

APPENDIX C - Set A

Part II

V. Semantically Deviant Sentences

1. The cow hits the pig all of a sudden after oinking
2. The duck pushes the cat all of a sudden after meowing
3. The owl pulls the dog all of a sudden after barking

VI. Filler Sentences - Deviant

4. The owl barks and then hits the dog
5. The cow pushes the pig and the pig is mooing
6. The duck pulls the cat and the cat is quacking

VII. Filler Sentences - Non Deviant

7. The duck hits the cat and the cat is meowing
8. The owl hoots and then pushes the dog
9. The cow moos and then pulls the pig

APPENDIX C

Experimental Sentences - Fourth Interview Set B

Part I

- I. Adverbial Temporal Complement preceded by Direct Object
 1. The dog hits the owl after eating
 2. The pig pushes the cow after waking up
 3. The cat pulls the duck after drinking
- II. Adverbial Temporal Complement preceded by all of a sudden
 4. The cat hits the duck all of a sudden after waking up
 5. The dog pushes the owl all of a sudden after drinking
 6. The pig pulls the cow all of a sudden after eating
- III. Conjoined NP's & Simple Declarative Sentence
 7. The dog and the owl crawl under the table
 8. The pig and the cow hop into the pool
 9. The cat and the duck climb up the ladder
- IV. Conjoined NP's + Infinitival Complement
 10. The duck chooses the pig and the cow to crawl under the table
 11. The pig picks the cat and the duck to hop into the pool
 12. The cat helps the dog and the owl to climb up the ladder

APPENDIX C - Set B

Part II

- V. Semantically Deviant Sentences
 - 1. The pig hits the cow all of a sudden after mooing
 - 2. The cat pushes the duck all of a sudden after quacking
 - 3. The dog pulls the owl all of a sudden after hooting
- VI. Filler Sentences - Deviant
 - 4. The dog hoots and then hits the owl
 - 5. The pig pushes the cow and the cow is oinking
 - 6. The cat pulls the duck and the duck is meowing
- VII. Filler Sentences - Non Deviant
 - 7. The cat hits the duck and the duck is quacking
 - 8. The dog barks and then pushes the owl
 - 9. The pig oinks and then pulls the cow

APPENDIX D

Vocabulary Tests and Instructions for the
Second and Third Interviews

Form H

Form to be Used with Appendix A in the Second
Interview and Appendix B in the Third Interview

Second Interview

(Use with Appendix A)

(Enter check marks next to the items missed)

I. Animals

(Place each box of animals before the child and ask
the child) "Can you show me the _____?" (Name the
animals in each box before presenting the next box.)
(Name each animal according to the following list:)

lion	_____
bear	_____
elephant	_____
duck	_____
rabbit	_____
dog	_____
cow	_____
horse	_____
goat	_____

(Leave the boxes on the child's side of the table.)

II. Objects

(Ask the child) "Now, can you show me the _____?"
(Name each object in the list.)

ladder	_____
table	_____
pool	_____

APPENDIX D (continued)

III. Tell

(Take out the horse and the cow.)

Instructions: "Now we are going to say some things to the animals." (Say)

1. Will you tell the horse to "go away". tell _____
2. Now, will you tell the cow to "come here". tell _____

IV. Promise

Instructions: "Now I want you to promise something." (Read the following sentences and ask the accompanying questions.)

1. Promise the cow that you will get him some food. What will you say? promise _____
2. Now, promise the horse that you will let him play. What will you say? promise _____

V. Dative verbs

Instructions: "We are going to say some more things to the animals. I will show you what we are going to do. First, I will call to the horse to 'come here'." (Take the horse and demonstrate.) (Read the following sentences)

1. Now, can you shout at the horse to "come here". shout at _____
2. Now, whisper to the horse to "come here". whisper _____
3. Now, yell at the horse to "come here". yell at _____

Instructions: "Now the animals are finished. You can put them back in their box so they can rest."

Instructions: "Now, we are going to do something different with these toys. All of these animals like to play with each other. I will tell you some of the things that the animals like to do. You wait until I am finished, and then you make the animals do what I say on the grass---here. (Point to the green felt.)"

APPENDIX D (continued)

When the animals are finished you put them back in their box so they can rest.

Now these animals (point to the box containing the lion, bear, and the elephant) get to play. You can bring them out onto the grass. (Have the child put the animals on the green felt.)

VI. Transitive Verbs

(Read the following sentences and, if necessary, say "Show me that" at the end of each sentence:)

1. The lion hits the bear	hit	_____
2. Now, the lion pushes the bear	push	_____
3. Now, the lion pulls the bear	pull	_____

VII. Intransitive Verbs + Proposition
(Proceed as in VI.)

1. The bear stands near the lion	stands near	_____
2. The bear walks around the lion	walks around	_____
3. The bear jumps over the lion	jumps over	_____

Instructions: "Now the animals are finished. You can put them back in their box so they can rest."

Instructions: "Now these animals can come out and play. (Point to the box containing the duck, rabbit and dog.) You can put the animals on the grass. I will tell you what the animals like to do and you can show me. Remember to wait until I'm finished talking."

VIII. Intransitive Verbs + Preposition
(Proceed as in VI.)

1. The rabbit crawls under the table.	crawls under	_____
2. The rabbit hops into the pool.	hops into	_____
3. The rabbit climbs up the ladder.	climbs up	_____

APPENDIX D (continued)

IX. Scare & Acting-out Two Actions

(Read the following sentences and ask the accompanying questions)

1. Now, the duck scares the rabbit. Can you show me that? How do we know the rabbit is scared?

scare _____

2. Now, the duck scares the rabbit and the rabbit crawls under the table. Can you show me that? How do we know the rabbit is scared?

scare _____

Instructions: "It is important to show me everything that the animals do."

X. Outside NP & Acting-out Two actions

(This is intended to show the child that it is permissible to pick an animal not mentioned in the sentence.)

(Read the following sentence.)

1. It is pulling the rabbit so the rabbit climbs up the ladder.

Instructions: "Sometimes the other animal might do something. In a sentence like this, either the dog or the duck could pull the rabbit. You could have picked either one. Now, remember it is important to show me everything the animals do."

Instructions: "These animals are finished. You can put them back in the box so they can rest."

Instructions: "Now, the animals will do some more things. Are you ready to hear what they do? Good. I will tell you what they do. You wait until I'm finished, and then you make them do what I've said. Remember to show me everything that the animals do. Let's see which animals go first. (Refer to randomized sequence for the first number and then find the sentence in Appendix A with the corresponding number.) These animals go first. (Point to the box containing the animals which are mentioned in the sentence.) You can put the animals on the grass. (Have the child put the animals on the green felt.) (Read the sentence you have located.) Can you show me that? Good. (Continue using the same procedure until you have read 22 sentences.) The animals are finished playing for today. Would you like to come back?"

APPENDIX D (continued)

Third Interview

(Use with Appendix B)

Instructions: "We are going to play the same game that we played last time. Just like last time, I will tell you some of the things that the animals like to do. You wait until I'm finished, and then you make the animals do what I say--here on the grass. (Point to the green felt.) When the animals are finished you put them back in their box so they can rest."

Instructions: "We will use some new animals this time. Here are the animals."

I. Animals

(Place each box of animals before the child and ask the child) "Can you show me the _____?" (Name the animals in each box before presenting the next box.) (Name each animal according to the following list:)

tiger	_____
gorilla	_____
camel	_____
sheep	_____
pig	_____
donkey	_____
dog	_____
cat	_____
rabbit	_____

(Leave the boxes on the child's side of the table.)

II. Objects

(Ask the child) "Can you show me the _____?" (Name each object in the list.)

ladder	_____
pool	_____
table	_____

APPENDIX D (continued)

Instructions: "Now I will tell you what the animals like to do. You wait until I'm finished, and then you make them do what I've said. When they are finished you put them back in their box so they can rest. Remember to show me everything that the animals do. Are you ready? Good. Let's see which animals go first. (Refer to the randomized sequence used in the second interview and locate the 23rd number.) (This should be easy, since the first 22 numbers were presented in the second interview and have been checked-off.) (Find the sentence in Appendix B which corresponds to the number you have located.) These animals go first. (Point to the box containing the animals which are mentioned in the sentence.) You can put the animals on the grass. (Have the child put the animals on the green felt.) (Read the sentence you have located.) Can you show me that? Good. (Continue using the same procedure until all 23 sentences have been presented.) The animals are finished playing for today. Thank you for coming." (If the child will be returning for the fourth interview, ask, "Would you like to come back again?"

APPENDIX D (continued)

Vocabulary Tests and Instructions for the
Second and Third Interviews

Form I

Form to be Used with Appendix B in the Second
Interview and Appendix A in the Third Interview

Second Interview

(Use with Appendix B)

(Enter check-marks next to the items missed)

I. Animals

(Place each box of animals before the child and ask
the child) "Can you show me the _____?" (Name the
animals in each box before presenting the next box.)
(Name each animal according to the following list:)

tiger	_____
gorilla	_____
camel	_____
sheep	_____
pig	_____
donkey	_____
dog	_____
cat	_____
rabbit	_____

(Leave the boxes on the child's side of the table.)

II. Objects

(Ask the child, "Now, can you show me the _____?"
(Name each object in the list.)

ladder	_____
table	_____
pool	_____

APPENDIX D (continued)

III. Tell

(Take out the sheep and the pig)

Instructions: "Now we are going to say some things to the animals." (Say)

1. Will you tell the sheep to "go away" tell _____

2. Now, will you tell the sheep to "come here". tell _____

IV. Promise

Instructions: "Now I want you to promise something."

(Read the following sentences and ask the accompanying questions.)

1. Promise the pig that you will get him some food. What will you say? promise _____

2. Now, promise the pig that you will let him play. What will you say? promise _____

V. Dative verbs

Instructions: "We are going to say some more things to the animals. I will show you what we are going to do. First, I will call to the pig to 'come here'." (Take the pig and demonstrate.) (Read the following sentences.)

1. Now, can you shout at the pig to "come here". shout at _____

2. Now, can you whisper to the pig to "come here". whisper to _____

3. Now, yell at the pig to "come here". yell at _____

Instructions: "Now the animals are finished. You can put them back in their box so they can rest."

APPENDIX D (continued)

Instructions: "Now we are going to do something different with these toys. All of these animals like to play with each other. I will tell you some of the things that the animals like to do. You wait until I'm finished, and then you make the animals do what I say on the grass--here. (Point to the green felt.) When the animals are finished you put them back in their box so they can rest.

Now these animals (point to the box containing the tiger, gorilla and the camel) get to play. You can bring them out onto the grass. (Have the child put the animals on the green felt.)

VI. Transitive Verbs

(Read the following sentences and, if necessary, say, "Show me that" at the end of each sentence:)

1. The tiger hits the gorilla hit _____
2. Now, the tiger pushes the gorilla push _____
3. Now, the tiger pulls the gorilla pull _____

VII. Intransitive Verbs + Preposition
(Proceed as in VI.)

1. The gorilla stands near the tiger
 stands near _____
2. The gorilla walks around the tiger
 walks around _____
3. The gorilla jumps over the tiger
 jumps over _____

Instructions: "Now the animals are finished. You can put them back in their box so they can rest."

Instructions: "Now these animals can come out and play. (Point to the box containing the dog, cat and rabbit.) You can put the animals on the grass. I will tell you what the animals like to do and you can show me. Remember to wait until I'm finished talking."

APPENDIX D (continued)

VIII. Intransitive Verbs + Preposition
(Proceed as in VI.)

1. The dog crawls under the table

crawls under _____

2. The dog hops into the pool

hops into _____

3. The dog climbs up the ladder

climbs up _____

IX. Scare & Acting-out Two Actions
(Read the following sentences and ask the accompanying questions.)

1. Now, the cat scares the dog. Can you show me that? How do we know the dog is scared?

scare _____

2. Now, the cat scares the dog and the dog crawls under the table. Can you show me that? How do we know the dog is scared?

scare _____

Instructions: "It is important to show me everything that the animals do."

X. Outside NP & Acting-out Two Actions
(This is intended to show the child that it is permissible to pick an animal not mentioned in the sentence.)
(Read the following sentence.)

1. It is pulling the dog so the dog climbs up the ladder.

Instructions: "Sometimes the other animal might do something. In a sentence like this, either the cat or the rabbit could pull the dog. You could have picked either one. Now, remember it is important to show me everything the animals do."

Instructions: "These animals are finished. You can put them back in the box so they can rest."

APPENDIX D (continued)

Instructions: "Now the animals will do some more things. Are you ready to hear what they do? Good. I will tell you what they do. You wait until I'm finished and then you make them do what I've said. Remember to show me everything that the animals do. Let's see which animals go first. (Refer to randomized sequence for the first number and then find the sentence in Appendix B with the corresponding number.) These animals go first. (Point to the box containing the animals which are mentioned in the sentence.) You can put the animals on the grass. (Have the child put the animals on the green felt.) (Read the sentence) Can you show me that? Good. (Continue using the same procedure until you have read 22 sentences) The animals are finished playing for today. Would you like to come back?"

Third Interview

(Use with Appendix A)

Instructions: "We are going to play the same game that we played last time. Just like last time, I will tell you some of the things that the animals like to do. You wait until I'm finished and then you make the animals do what I say--here on the grass. (Point to the green felt) When the animals are finished you put them back in their box so they can rest."

Instructions: "We will use some new animals this time. Here are the animals."

I. Animals

(Place each box of animals before the child and ask the child) "Can you show me the _____?" (Name the animals in each box before presenting the next box. (Name each animal according to the following list:)

lion	_____
bear	_____
elephant	_____
duck	_____
rabbit	_____
dog	_____
cow	_____
horse	_____
goat	_____

APPENDIX D (continued)

(Leave the boxes on the child's side of the table.)

II. Objects

(Ask the child) "Can you show me the _____?"

(Name each object in the list.)

ladder	_____
pool	_____
table	_____

Instructions: "Now, I will tell you what the animals like to do. You wait until I'm finished, and then you make them do what I've said. When they are finished you put them back in their box so they can rest. Remember to show me everything that the animals do. Are you ready? Good. Let's see which animals go first. (Refer to the randomized sequence used in the second interview and locate the 23rd number.) (This should be easy, since the first 22 numbers were presented in the second interview and have been checked-off.) (Find the sentence in Appendix A which corresponds to the number you have located.) These animals go first. (Point to the box containing the animals which are mentioned in the sentence.) You can put the animals on the grass. (Have the child put the animals on the green felt.) (Read the sentence you have located.) Can you show me that? Good. (Continue using the same procedure until all 23 sentences have been presented.) The animals are finished playing for today. Thank you for coming." (If the child will be returning for the fourth interview ask, "Would you like to come back again?"

APPENDIX E

Vocabulary Test and Instructions for the
Fourth Interview

(Enter check marks next to the item missed.)

Part I

Instructions: "We are going to play with some old and some new animals today. Here are the animals that we will be using. (Place the animals before the child and leave them out after they have been identified.)"

I. Animals

(Ask the child) "Can you show me the _____?"
(Name each animal according to the following list:)

owl	_____
dog	_____
cow	_____
pig	_____
duck	_____
cat	_____

II. Objects

(Ask the child) "Now, can you show me the _____?"
(Name each object in the list:)

ladder	_____
table	_____
pool	_____

Instructions: "Now the animals will do some things. Just like we did before, I will tell you what the animals do. You wait until I'm finished, and then you can show me."

III. Intransitive Verbs

(Read the following sentences, and, if necessary, at the end of each sentence, ask the child)
"Can you show me that?" (or say,)"Show me that."

1. The owl is eating.	eating	_____
2. Now, the dog is waking up.	waking up	_____
3. And, now the cow is drinking	drinking	_____

IV. Intransitive Verbs and Identification of Sounds made by Different Animals

(Say) "Now, some animal is _____. " (Insert a verb from the list and then ask) "What animal does that? Can you show me _____?" (Insert verb)

		"What animal does that?"		"Can you show me (e.g. mooing)"
1. mooing	_____		cow	_____
2. meowing	_____	"	cat	_____
3. oinking	_____	"	pig	_____
4. barking	_____	"	dog	_____
5. quacking	_____	"	duck	_____
6. hooting	_____	"	owl	_____

V. Two Animals Together

Instructions: "Now, some of the animals will do some things together. I will tell you what they do and then you can show me." (Read each sentence and, if necessary, at the end of the sentence ask) "Can you show me that?" (or say) "Show me that."

1. The owl and the duck sit on the chair. _____
2. The pig pushes the dog and the cow. _____

VI. Transitive Verbs

(Read the following sentences, and, if necessary, at the end of each sentence ask) "Can you show me that?" (or say) "Show me that."

1. Now, the cat chooses the owl. chooses _____
2. Now, the cat picks the duck. picks _____
3. And, now the cat helps the dog up the ladder helps _____

VII. All of the sudden (Proceed as in VI)

1. Now the dog hits the cat all of the sudden (Say) "Yes the dog sneaks up and hits the cat all of the sudden." _____
2. The cow pushes the pig all of the sudden _____

Instructions: "Now, the animals will do some more things. Are you ready to hear what they do? Good. I will tell you what they do. You wait until I'm finished, and then you make them do what I've said. Remember to show me everything that the animals do. Let's see which animals go first. (Refer to randomized sequence for the first number and then find the sentence in Appendix C with the corresponding number.) These animals go first. (Place the animals on the green felt.) (Read the sentence you have located.) Can you show me that? Good. (Continue using the same procedure until you have read all the sentences in Part I.)

Part II

Instructions: "Now the animals may do some silly things. I'll tell you some of the silly things that they do."

1. (Say) "The cat is hooting." (Ask) "Is that right?"
(Say) "No, cats can't hoot. That's a silly sentence."
2. (Say) "Now, the dog is meowing." (Ask) "Is that right?"
(Say) "No, dogs can't meow, That's a silly sentence."

Instructions: "Now some of the sentences will be good. When they are good, you can show me what the animals are doing. But, some of the sentences will be silly. When they are silly, you tell me 'That's a silly sentence'." Are you ready? Good. Let's see which animals go first. (Start with sentence #4 followed by sentence #7.) (After sentence #7, follow a randomized sequence for the presentation of the remaining sentences.) (Proceed in the manner described in Part I.)

APPENDIX F

Vocabulary Used in the Construction of The
Experimental Sentences for the Second, Third,
and Fourth Interviews

2nd and 3rd Interviews:Animals

lion-bear
duck-rabbit
cow-horse

tiger-gorilla
pig-sheep
dog-cat

Matrix Verbs and Prepositions

Transitive Verbs

hits
pushes
pulls

Transitive Verb + Preposition

hits at
pushes on
pulls at

Speaking Verbs

tells
promises

Sentential Subject Sentences

scares

Dative PP's

yells at
whispers to
shouts at

Intransitive Verbs + Locative
Preposition

stands near
walks around
jumps over

Complement Structures

{ after }
{ in order }

(either infinitival form or
-ing inflection)

crawl under the table
hop into the pool
climb up the ladder

APPENDIX F (continued)

4th Interview:Animals

owl-dog
cow-pig
duck-cat

Complement Verbs

eating
waking up
drinking

Matrix Verbs

hits
chooses
picks
climbs

Matrix or Complement Verb

(either -s or -ing inflection)

hoot
moo
quack
bark
oink
meow

Matrix or Complement Verbs + Prepositional Phrases

(to) crawl under the table
hop into the pool
climb up the ladder

APPENDIX G

Criteria for Classification of Subjects
According to Grammar Type

Control Scores: Scores indicating the degree of attachment of the complement to the S (critical subject control scores) or to the VP (critical object control score)

Critical Subject Control Score

Definition: The percentage of subject responses on the following six construction types:

<u>Construction Type</u>	<u>Examples</u>
II-A	The lion hits the bear after crawling under the table
II-C	The lion hits at the bear after crawling under the table
III-A	The lion hits the bear in order to crawl under the table
III-C	The lion hits at the bear in order to crawl under the table
IV-A	After crawling under the table the lion hits the bear
IV-B	In order to crawl under the table the lion hits the bear

Total number of possible subject responses = 18

Critical Object Control Score

Definition: The percentage of object responses on the following four construction types:

<u>Construction Type</u>	<u>Examples</u>
II-A	The lion hits the bear after crawling under the table
II-C	The lion hits at the bear after crawling under the table
III-A	The lion hits the bear in order to crawl under the table
III-C	The lion hits at the bear in order to crawl under the table

Total number of possible object responses = 12

APPENDIX G (continued)

Subject Oriented Grammar

Definition: Attachment of embedded structures to the topmost S node in all sentences including those in which attachment to the VP or object NP is required in adult grammar. A rule specifies that missing NP positions, relative pronouns, and subject pronouns of any embedded or conjoined clause are coreferential with the first NP of the sentence.

Criteria for Classification:

1. Critical Subject Control Score of at least 75%.
(Minimum number of subject responses required = 13)
2. 50% subject responses on constructions VI and VII.
(Minimum number of subject responses required = 3)

Object Oriented Grammar

Definition: Attachment of embedded structures to the VP or object NP in all sentences including those in which attachment to S is required in adult grammar. The c-command constraint may become operational during this stage.

Criteria for Classification:

1. Critical Object Control Score of at least 75%.
(Minimum number of object responses required = 9)
2. Critical Subject Control Score of no more than 44.9%.
(Maximum number of subject responses permitted = 7)
3. 75% object responses on constructions VI, VII, IV-A, and IV-B. (Minimum number of object responses required = 9)

Mixed Subject-Object Grammar

Definition: Optional attachment of embedded structures to either the VP, S, or object NP. Attachment is variable and often incorrect when compared to adult grammar. The c-command constraint may become operational during this period.

APPENDIX G (continued)

Criteria for Classification:

1. Critical Subject Control Score falling between 45% and 75%. (Minimum number of subject responses required = 8; Maximum number of subject responses permitted = 12)
2. Object Control Score of no more than 74.9%. (Maximum number of object responses permitted = 8)
3. 75% of the remaining responses on the constructions used to calculate the Critical Subject Control Score must be object responses.

Approaching Adult Grammar

Definition: Embedded structures are attached to either the VP, S, or object and subject NP's as required in adult grammar. The c-command constraint is fully specified and operational. It may be overgeneralized to sentential subject sentences (constructions V-A and V-B) and Dative PP's (construction VII).

Criteria for Classification:

1. Critical Subject Control Score of at least 75%. (Minimum number of subject responses required = 13)
2. 66% object responses on constructions VI and VII. (Minimum number of object responses required = 4)
3. 50% ONP responses on constructions V-A and V-B. (Minimum number of ONP responses required = 3)

Adult Grammar

Definition: Embedded structures are correctly attached to either the VP, S, or subject and object NP's. The attachment must be highly consistent. Knowledge of the exceptions to the c-command constraint has developed.

Criteria for Classification:

1. Critical Subject Control Score of at least 80% (Minimum number of subject responses required = 15)

APPENDIX G (continued)

2. 80% object responses on constructions VI and VII.
(Minimum number of object responses required = 5)
3. 80% second NP responses on constructions V-A and
V-B.
(Minimum number of second NP responses required = 5)

APPENDIX H

Tables Summarizing Additional Results

- Table A Distribution of Children Exhibiting Each Grammar Type Across Age Groups
- Table B Percentage of Reversals of Main Clause Agents and Objects According to Grammar Type
- Table C Percentage of Failures to Act Out the Main Clause According to Grammar Type
- Table D Percentage of Failures to Act Out the Complement Clause According to Grammar Type
- Table E Mean Number of Correct Responses on Constructions in the Main Comprehension Task (2nd and 3rd Interviews) According to Age Groups
- Table F Mean Number of Incorrect Responses on the Preposed Complement Constructions (IV-A and IV-B) and Sentential Subject Constructions (V-A and V-B) According to Age Groups

Table A
Distribution of Children Exhibiting Each Grammar
Type Across Age Groups

Age Group ^a	Grammar Type						Total
	s	o	s-o	A-A	A	Unc.	
1. 3-2 to 4-0	1	5	0	0	0	1	7
2. 4-1 to 4-6	1	5	0	0	0	1	7
3. 4-7 to 5-0	0	3	3	0	0	1	7
4. 5-1 to 5-6	0	4	0	1	0	3	8
5. 5-7 to 6-0	0	4	2	0	0	1	7
6. 6-1 to 6-6	0	5	2	0	0	0	7
7. 6-7 to 7-0	0	3	1	4	0	1	9
8. 7-1 to 7-6	0	0	1	3	1	1	6
9. 7-7 to 8-3	0	0	0	4	2	0	6
Total	2	29	9	12	3	9	64

Note. s = subject oriented; o = object oriented; s-o = mixed subject-object; A-A = approaching adult; A = adult; Unc = unclassifiable.

^aAge groups are defined in terms of years and months.

Table B
Percentage of Reversals of Main Clause Agents and Objects
According to Grammar Type

Grammar Type	Construction Types														
	IA	IB	IIA	IIB	IIC	IID	IIIA	IIIB	IIIC	IVA	IVB	VA	VB	VI	VII
Subject Oriented	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0
Object Oriented	3	5	5	3	7	22	5	3	3	1	1	0	3	1	5
Mixed Subj.-Obj.	3	8	3	3	3	3	7	3	3	8	3	11	8	8	0
Approaching Adult	0	0	0	0	0	5	0	0	0	0	0	0	0	0	3
Adult	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0
Unclassifiable	0	0	7	3	11	8	8	3	8	11	11	0	0	8	3
Overall	2	3	4	3	5	14	4	3	3	3	3	2	3	3	3

Table C

Percentage of Failures to Act Out the Main Clause
According to Grammar Type

Grammar Type	Construction Types														
	IA	IB	IIA	IIB	IIC	IID	IIIA	IIIB	IIIC	IVA	IVB	VA	VB	VI	VII
Subject Oriented	16	16	0	0	0	0	0	0	0	0	0	33	50	0	0
Object Oriented	7	15	2	3	2	5	0	0	0	2	1	10	11	2	1
Mixed Subj.-Obj.	3	14	0	0	0	3	0	0	3	0	0	0	11	0	0
Approaching Adult	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Adult	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unclassifiable	8	11	3	0	3	3	0	0	3	0	0	14	11	0	3
Overall	5	12	2	2	2	4	0	0	1	1	1	8	10	1	1

Table D
Percentage of Failures to Act Out the Complement Clause
According to Grammar Type

Grammar Type	Construction Types														
	IA	IB	IIA	IIB	IIC	IID	IIIA	IIIB	IIIC	IVA	IVB	VA	VB	VI	VII
Subject Oriented	0	0	0	0	0	0	0	0	0	16	0	33	0	0	0
Object Oriented	0	0	1	1	0	1	1	0	0	2	0	7	4	1	0
Mixed Subj.-Obj.	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0
Approaching Adult	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adult	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unclassifiable	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Overall	0	0	1	1	1	1	1	0	0	2	1	4	2	1	0

Table E

Mean Number of Correct Responses on Constructions in the Main Comprehension Task
(2nd and 3rd Interviews) According to Age Groups

Age Groups ^a	Type of Control											Object Control			2nd NP	
	Subject Control															
	IB	IIA	IIB	IIC	IID	IIIA	IIIB	IIIC	IVA	IVA	IVA	IA	VI	VII	VA	VB
1. 3-2 to 4-0	0.57	0.71	1.29	1.00	1.57	0.71	1.14	0.71	1.14	1.14		2.86	2.14	2.43	1.71	2.43
2. 4-1 to 4-6	0.43	0.43	1.29	1.00	1.43	0.71	1.71	0.86	0.86	0.14		2.86	2.43	2.43	0.86	1.00
3. 4-7 to 5-0	0.86	1.14	1.57	1.43	2.29	1.14	1.57	0.57	0.43	1.00		3.00	2.43	2.29	0.71	1.00
4. 5-1 to 5-6	0.14	1.38	1.86	1.25	2.38	0.50	1.13	0.63	0.86	0.50		3.00	2.63	2.75	1.00	0.88
5. 5-7 to 6-0	0.86	0.71	1.86	1.00	1.86	1.00	1.43	0.43	0.86	0.71		3.00	2.71	2.86	1.57	1.71
6. 6-1 to 6-6	1.14	1.14	2.29	1.14	2.38	0.86	1.86	0.71	0.57	0.43		2.86	2.71	2.43	0.71	0.29
7. 6-7 to 7-0	1.56	1.44	2.00	1.56	2.11	1.44	2.11	1.44	1.56	1.44		3.00	2.78	3.00	0.67	0.67
8. 7-1 to 7-6	3.00	2.50	3.00	2.83	1.50	2.33	3.00	2.50	2.50	2.33		3.00	3.00	2.17	1.00	0.67
9. 7-7 to 8-3	1.67	2.67	2.67	3.00	2.50	2.67	3.00	2.83	2.17	2.67		3.00	3.00	2.67	1.33	1.17
Overall	1.09	1.31	1.95	1.53	2.05	1.22	1.84	1.14	1.25	1.13		2.95	2.68	2.58	1.05	1.17

Note. Maximum possible score is a mean of three.

^aAge groups are defined in terms of years and months.

Table F

Mean Number of Incorrect Responses on the Preposed Complement
Constructions (IV-A & IV-B) and Sentential Subject
Constructions (V-A & V-B) According to Age Groups

Age Groups ^a		Type of Control Errors							
		Object Control		1st NP		Outside NP			
		IV-A	IV-B	V-A	V-B	IV-A	IV-B	V-A	V-B
1.	3-2 to 4-0	1.86	1.86	1.00	0.57	0.00	0.00	0.00	0.00
2.	4-1 to 4-6	1.86	2.86	1.14	0.86	0.14	0.00	0.71	1.00
3.	4-7 to 5-0	2.43	1.86	1.14	0.71	0.00	0.14	0.57	0.86
4.	5-1 to 5-6	1.88	2.38	0.50	0.63	0.13	0.00	1.50	1.50
5.	5-7 to 6-0	1.86	2.29	0.71	0.43	0.00	0.00	0.71	0.86
6.	6-1 to 6-6	1.71	2.43	0.43	0.43	0.43	0.00	1.86	1.57
7.	6-7 to 7-0	1.22	1.56	0.11	0.00	0.00	0.00	2.22	2.33
8.	7-1 to 7-6	0.50	0.67	0.17	0.00	0.00	0.00	1.83	2.17
9.	7-7 to 8-3	0.83	0.33	0.17	0.00	0.00	0.00	1.50	1.83
Overall		1.67	1.87	0.59	0.41	0.08	0.00	1.23	1.38

Note. Maximum possible score is a mean of three.

^aAge groups are defined in terms of years and months.

APPENDIX I

The Developmental Sentence Scoring
Analysis Form

(From: Developmental Sentence Analysis, by L. Lee,
pp. 134 - 135. Copyright 1974 by Northwestern
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Chart 8. The Developmental Sentence Scoring (DSS) Reweighted Scores

	NOUN MODIFIERS	PRONOUNS	MAIN VERBS	SECONDARY VERBS	NEGATIVES	CONJUNCTIONS	INTERROGATIVE REVERSALS	WH-QUESTIONS
1	A. this, that	1st and 2nd person: I, me, my, mine, you, your(s)	A. Uninflected verb: I see you. B. copula, is or 's: It's red. C. is + verb + ing: He is coming.		is, this, that + copula or auxiliary is, 's, + not: It's not mine. This is not a dog. That is not moving.		Reversal of copula: Isn't it red? Were they there?	
2		3rd person: he, him, his, she, her, hers	A. -s and -ed: plays, played B. Irregular past: ate, saw C. Copula: am, are, was, were D. Auxiliary am, are, was, were	Five early-developing infinitives: I want to see (want to see) I'm gonna see (going to see) [to] see (to see) Let's [to] play (let us to play)				A. who, what, what + noun: Who am I? What is he eating? What book are you reading? B. where, how many, how much, what...do, what...for Where did it go? How much do you want? What is he doing? What is a hamster for?
3	A. no, some, more, all, lot(s), one(s), two (etc.), other(s), another B. something, somebody, someone	A. Plural: we, us, our(s), they, them, their B. these, those		Non-complementing infinitives: I stopped to play. I'm afraid to look. It's hard to do that.		and		
4	nothing, nobody, none, no one		A. can, will, may + verb: may go B. Obligatory do + verb: don't go C. Emphatic do + verb: I do see.	Participle, present or past: I see a boy running. I found the toy broken.	can't, don't		Reversal of auxiliary be: Is he coming? Isn't he coming? Was he going? Wasn't he going?	
5		Reflexives: myself, yourself, himself, herself, itself, themselves		A. Early infinitival complements with differing subjects in kernels: I want you to come. Let him [to] see. B. Later infinitival complements: I had to go. I told him to go. I tried to go. He ought to go. C. Obligatory deletions: Make it [to] go. I'd better [to] go. D. Infinitive with wh-word: I know what to get. I know how to do it.	isn't, won't	A. but B. so, and so, so that C. or, if		when, how, how + adjective When shall I come? How do you do it? How big is it?
6		A. Wh-pronouns: who, which, whose, whom, what, that, how many, how much I know who came. That's what I said. B. Wh-word + infinitive: I know what to do. I know who/whom to take	A. could, would, should, might + verb: might come, could be B. Obligatory does, did + verb C. Emphatic does, did + verb			because	A. Obligatory do, does, did: Do they run? Does it bite? Didn't it hurt? B. Reversal of modal: Can you play? Won't it hurt? Shall I sit down? C. Tag question: It's fun, isn't it? It isn't fun, is it?	
7	A. any, anything, anybody, anyone B. every, everything, everybody, everyone C. both, few, many, each, several, most, least, much, next, first, last, second (etc.)	(his) own, one, oneself, whichever, whoever, whatever Take whatever you like.	A. Passive with get, any tense Passive with be, any tense B. must, shall + verb: must come C. have + verb + en: I've eaten D. have got: I've got it.	Passive infinitival complement: With get: I have to get dressed. I don't want to get hurt. With be: I want to be pulled. It's going to be locked.	All other negatives: A. Uncontracted negatives: I can not go. He has not gone. B. Pronoun-auxiliary or pronoun-copula contraction: I'm not coming. He's not here. C. Auxiliary-negative or copula-negative contraction: He wasn't going. He hasn't been seen. It couldn't be mine. They aren't big.			why, what if, how come how about + gerund Why are you crying? What if I won't do it? How come he is crying? How about coming with me?
8			A. have been + verb + ing B. had been + verb + ing C. modal + have + verb + en: may have eaten D. Other auxiliary combinations: should have been sleeping	Gerund: Swimming is fun. I like fishing. He started laughing.		A. where, when, how, while, whether (or not), till, until, unless, since, before, after, for, as, as if, like, that, than I know where you are. Don't come till I call. B. Obligatory deletions: I run faster than you [run]. I'm as big as a man [is big]. It looks like a dog [looks]. C. Elliptical deletions (score 0). That's why [I took it]. I know how [I can do it]. D. Wh-words + infinitive: I know how to do it. I know where to go.	A. Reversal of auxiliary have: Has he seen you? B. Reversal with two or three auxiliaries: Has he been eating? Couldn't he have waited? Could he have been crying? Wouldn't he have been going?	whose, which, which + noun Whose car is that? Which book do you want?

APPENDIX J

Comments on the Classification System

The inclusion of constructions II-C and III-C in the criteria for classification according to grammar type may have introduced a confounding variable. This is due to the fact that subject responses on the constructions may reflect operation of the c-command constraint in conjunction with either VP attachment or S attachment. Hence, subject responses on these constructions are ambiguous with respect to level of attachment. In view of this, all the children who participated in the study were reclassified using only constructions II-A, III-A, IV-A and IV-B to compute the critical subject and object control scores. The reclassification system is summarized in Table A.

Table A
Revised Criteria for Classification
According to Grammar Type

Construction Types	Number of Tokens	Grammar Type				
		s	o	s-o	A-A	A
II-A, III-A, IV-A, & IV-B	12					
Critical Subject		Min 9	Max 3	4-8	Min 9	Min 10
Control Score						
Critical Object		Max 3	Min 9	75% ^a	Max 3	Max 2
Control Score						
VI & VII	6					
Subject Responses		Min 3	—	—	—	—
Object Responses		—	Min 4	—	Min 4	Min 5
V-A & V-B	6					
ONP Responses		—	—	—	Min 3	—
2nd NP Responses		—	—	—	—	Min 5

Note. s = subject oriented; o = object oriented; s-o = mixed subject object; A-A = approaching adult; A = adult; Min = minimum; and Max = maximum

^aSeventy-five percent of the remaining responses must be object responses (see also section 1.3.3, chapter III).

The revised criteria for classification resulted in the reclassification of eleven children. Table B summarizes, according to the revised system, the number of children manifesting each grammar type as well as the mean ages and DSS scores for each group.

Table B

Number of Children According to the Revised Classification System Manifesting Each Grammar Type and the Mean Ages and DSS Scores for Each Group

Grammar Type	Number	Means	
		Ages ^a	DSS Scores
Subject Oriented	1	3.58	6.11
Object Oriented	30	5.15	9.87
Mixed Subject-Object	19	5.77	11.01
Approaching Adult	10	7.23	12.82
Adult	2	7.72	13.81
Unclassifiable	2	7.59	12.31

Note.

^aAges are in years

The revised classification system resulted in fewer unclassifiable children than the previous system. Analyses of variance were performed to determine if children belonging to different grammar types differed significantly with respect to age and DSS scores. Both F ratios were significant (Age: $F=11.62$, $p<.000001$; DSS: $F=3.55$, $p=.012$). All the means were in the predicted direction. Thus, grammar types which were identified on the basis of the revised classification system were significantly related to both age and DSS scores.

Table C summarizes the percentage of children obtaining each c-command score according to grammar type.

Table C
Percentage of Children Obtaining Each C-Command
Score According to Grammar Type

Grammar Types	N	C-Command Scores						
		0	1	2	3	4	5	6
Object Oriented	30	7	30	23	17	7	13	3
Mixed Subj.-Obj.	19	0	0	16	16	10	32	26
Approaching Adult	10	0	0	0	0	0	10	90
Adult	2	0	0	0	0	0	0	100
Unclassifiable	2	0	0	0	0	0	50	50

Note. N = number

According to the revised system, the c-command constraint becomes operational with respect to locative prepositional phrases during the mixed subject-object stage as well as the object oriented stage. The reclassification of several unclassifiable children as mixed subject-object children is primarily responsible for this result. In general, reclassification did not affect other aspects of the results that are reported in chapter V.

In order to avoid the possibility of confounding, future research on the five grammar types should use only non-preposed complements following direct objects to compute the critical subject control scores. The present study indicates that constructions II-A and III-A will discriminate between children manifesting the different grammar types.

In view of the fact that twelve sentences seem to be a reasonable number for computing the critical subject and object control scores, two additional constructions should be added to the classificatory criteria. Goodluck's (1978) research suggests that constructions such as (1) and (2) are interpreted in a manner similar to constructions II-A and III-A.

(1) 'While' adverbial clause

The lion hits the bear while climbing up the ladder

(2) 'Before' adverbial clause

The lion hits the bear before climbing up the ladder

Table D summarizes a set of constructions and criteria which are suggested as a classification system for future research on the five grammar types.

Table D
Recommended Criteria for Classification of
Children According to Grammar Type

Construction Types	Number of Tokens	Grammar Type				
		s	o	s-o	A-A	A
II-A ^a , III-A ^a , <u>while</u> & <u>before</u>	12					
Critical Subject						
Control Score		Min 9	Max 3	4-8	Min 9	Min 10
Critical Object						
Control Score		Max 3	Min 9	75% ^b	Max 3	Max 2
OS Relative Clauses	6					
Subject Responses		Min 4	Max 2	—	Max 2	Max 1
Object Responses		Max 2	Min 4	—	Min 4	Min 5
Sentential Subject Sentences	6					
ONP Responses		—	—	—	Min 4	—
2nd NP Responses		—	—	—	—	Min 5

Note. s = subject oriented; o = object oriented; s-o = mixed subject object; A-A = approaching adult; A = adult; Min = minimum; and Max = maximum

^aSee Figure 1 and Appendices A and B for examples.

^bSeventy-five percent of the remaining responses must be object responses (see section 1.3.3, chapter III for an explanation).

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