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COMPREHENSION OF CONJOINED SENTENCES BY YOUNG NORMAL CHILDREN

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COMPREHENSION OF CONJOINED SENTENCES BY YOUNG NORMAL CHILDREN

by

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Chapter I

INTRODUCTION

The Problem

Over the past two decades there has been a proliferation of studies of linguistic performance in the developmental psycholinguistic literature. Since the early 1960s considerable focus has been placed on the theoretical and empirical study of both language comprehension and language production in the child.

Children's developing abilities to produce utterances have, however, received far more attention than their abilities to understand them. This probably results from the particular complexities of measuring comprehension. "A major problem in evaluating comprehension is that children's responses are multi-determined--what children do depends on many things in addition to what they hear" (Bloom & Lahey, 1978, p. 237).

As Bloom suggests, children have many sources of information they can use in their attempts to understand utterances. These cues encompass linguistic and nonlinguistic contextual information as well as many other cognitive, semantic and social factors.

There is considerable evidence that children, like adults, have linguistic performance abilities which include strategies that aid them in understanding spoken sentences. Unlike adults, children are more dependent on their strategies to understand

sentences during language learning since they have not yet developed full linguistic competence. During the language acquisition process children may, in fact, misunderstand sentences that violate their strategies. In contrast, adults employ both their knowledge of their language (i.e., competence) and strategies to comprehend spoken sentences.

Within the past decade, developmental psycholinguistic investigations have reflected growing interest in learning more about the linguistic and extralinguistic factors that contribute to the child's attempts to obtain meaning from spoken utterances. This line of study is of particular note in light of some important research that has focused on the role of linguistic performance in the acquisition of linguistic competence--specifically in the child's learning of the structure of his language.

Slobin (1973) has proposed a set of presumably universal operating principles which children employ in acquiring the rules of their native language. One of these language learning strategies defined by Slobin states that, "Underlying semantic relations should be marked overtly and clearly" (Operating Principle E, p. 202). The implication of this operating principle is that grammatical relations that are well marked will be learned earlier. One might consider that the relative ease of comprehending certain linguistic structures may be influenced by these more general predispositions to language processing. Although Slobin does not make specific claims regarding comprehension, Operating Principle E would also seem to predict that in processing individual sentences, marked grammatical relations will be easier for a child to understand.

This study was designed to examine the effects of linguistic and nonlinguistic factors on the ability of young normal children to understand complex sentences. More specifically, this study investigated whether conjoined sentences in which underlying grammatical relations are clearly marked are easier to understand than those in which they are not. Further, these conjoined sentences were presented in varying semantic contexts to determine the influence of extrasyntactic factors on processing linguistically complex sentences.

This introductory chapter will present a consideration of the following theoretical issues: (a) what the child must acquire in learning his language, (b) the nature of the process of learning a grammar, (c) the role of linguistic performance in the acquisition of linguistic competence, and (d) a theory of language acquisition (Slobin, 1973) which incorporates a theory of the relative ease of learning grammatical structures. The influence of certain syntactic and extrasyntactic factors on linguistic performance--specifically sentence comprehension--during the acquisition of language will also be explored. Finally, this chapter will present the focus of the present study.

What Is Acquired

There are many avenues of inquiry in the study of what the child must learn in the course of mastering his native language. Bloom and Lahey (1978) have summarized a three-dimensional view of language that they proposed could be used in describing the development of language. Their description of language includes

the three components of content, form and use. Briefly, language content can be defined as what individuals talk about or understand in messages. Language form is the means for connecting sound with meaning and consists of an inventory of linguistic units and the system of rules for their combination. Language use refers to the reasons why individuals speak and the ways in which speakers choose among alternative forms of a message according to what they know about the listener and the context.

Each aspect of language (as defined by Bloom & Lahey, 1978) has been the focus of empirical study. In addition, investigations have also sought to examine the child's development of the integration of language content, form and use.

The present study is primarily concerned with theoretical predictions concerning the proposed universal aspects of linguistic performance as they relate to language structure (and indirectly to its acquisition). However, the current explosion of research in child language in both language content and use broadens the frame of reference for the discussion of such research in the study of language development and its implications for language disorders.

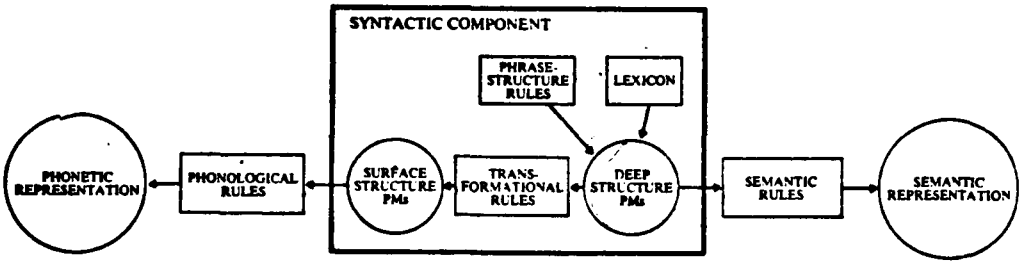
What follows, therefore, is a brief presentation of how and why considerations of language content and use have emerged as important aspects of the study of child language.

From 1957 to the late 1960s, developmental psycholinguistics was strongly influenced by Chomsky's theory of transformational grammar (Chomsky, 1957, 1965). In his generative theory of linguistics, Chomsky adapted from the Swiss linguist Ferdinand de Saussure, the distinction between linguistic competence and

linguistic performance. Linguistic competence refers to the "ideal" speaker/hearer's knowledge of his language, i.e., his grammar. Linguistic performance describes the skills and processes involved in utilizing this knowledge to understand and produce utterances.

Within this theoretical framework, the acquisition of language refers to the child's development of both linguistic competence and linguistic performance. (The relationship between these two in the acquisition process will be explored further in a later section.) With regard to linguistic competence, the child must develop an internal representation of a finite set of rules which provides the ability to produce and comprehend an infinite number and variety of grammatical sentences in his language. The child's acquisition of linguistic competence will also ultimately enable him to make adult judgments about sentences such as, which have similar meanings, which are ambiguous, etc.

Chomsky's generative-transformational theory of linguistic competence (what the native speaker knows about his language, i.e., his grammar) has been schematized by Cairns and Cairns (1976, p. 36) as follows:



As this diagram indicates, the two interpretive sets of rules--phonetic and semantic--are linked by the syntactic component of the grammar. The syntactic component is comprised of abstract deep or underlying structures that are arranged in hierarchical relationships. They serve as input to the semantic component. Through a series of "transformations" deep structure constituents are rearranged, deleted, or permuted into strings of lexical items called "surface structures." These surface structures are transformed by the phonological component into strings of speech sounds.

Therefore, Chomsky's description proposes that every sentence has an abstract underlying (or deep) structure and a surface structure which is the result of the transformations that operate on the underlying structure.

Chomskian theory of grammar placed a strong emphasis on syntax, to what Muma (1978, p. 31) describes as the "virtual exclusion of semantics." Motivated by Chomsky's description of linguistic competence, researchers set out in the early and mid-1960s to describe the child's acquisition of the formal structures of language (Braine, 1963; Brown, Cazden, & Bellugi, 1973; McNeil, 1966; Miller & Ervin, 1964). The research generally described child language beginning at the point where children begin to combine two or more words systematically "within something like a syntax" (Bates, 1976, p. 414).

In the late 1960s and early 1970s developmental studies of language shifted focus from syntactic to semantic and social aspects. These changes in orientation resulted from developments in and influences from several disciplines, including linguistic

theory, the philosophy of language and cognitive psychology, as well as from developmental psycholinguistics itself.

Several linguistic theorists (Fillmore, 1968; Jackendoff, 1972; McCawley, 1968) began to question Chomsky's almost exclusively syntactic description of language. These theorists and others (e.g., Chafe, 1970; Lakoff, 1971; Perfetti, 1972; Postal, 1972) proposed alternative characterizations of language which were more related to the semantic structure of language than to syntax. Descriptions of child language during this period focused on semantic/syntactic analyses of early language development (Bloom, 1970; Bowerman, 1973; Brown, 1973). Also influenced by these theoretical shifts from syntactic to semantic considerations in linguistic theory, were explorations into the application of cognitive-developmental psychology (specifically Piagetian psychology) to language learning (Sinclair de Zwart, 1973; Slobin, 1973).

The developmental psycholinguistic studies of child language have expanded focus from investigations and descriptions of a child's acquisition of linguistic competence, i.e., grammar--to a broader perspective: the analysis of the social context of language acquisition (Bloom, 1970; Cazden, 1970; Nelson, 1973; among others). Developmental psycholinguistics adapted a socio-linguistic view of language development in which the previous notion of "competence" was redefined. In addition to acquiring grammatical competence, a description of what the child must acquire was expanded to include a description of the child's growing "communicative competence," i.e., his knowledge of

"who can say what, in what way, where and when, by what means and to whom" (Hymes, 1971, p. 18). This pragmatic approach to the study of language has been defined by Bates (1976) as a consideration of the "rules governing the use of language in context." Included in this theoretical approach to the study of child language is an interest in the development of functions of language (Antinucci & Parisi, 1975; Ervin-Tripp, 1977; Gruber, 1975; Halliday, 1973; among others), the use of alternative language forms (Bates, 1976; Ervin-Tripp, 1972; Gumperz, 1972; among others), as well as the development of conversational skills (Bloom, Rocissano, & Hood, 1976; Garvey, 1975; Garvey & Hogan, 1973; Keenan, 1974). Recent developmental psycholinguistic research has included the application of speech acts theory (originally introduced by Austin, 1972 and Searle, 1969) to the study of the child's acquisition of the ability to communicate his intentions through the use of language (Bates, 1976; Bates et al., 1975; Bruner, 1975; among many others). John Dore was among the first researchers to describe child language within a speech act framework (1974, 1975, 1976, 1977). Others have studied various aspects of the speech act performance abilities of children (Bates, 1976; Ervin-Tripp, 1977; Mitchell-Kernan & Kernan, 1977).

Current research also reflects an interest in the child's developing ability to participate in conversation, or discourse, with adults as well as with other children (Grice, 1975; Keenan & Schiefflelin, 1976; Shatz & Gelman, 1973; among others).

In summary, the study of child language has been expanded during the past two decades to include descriptions of pragmatic

development in addition to descriptions of phonological, syntactic and semantic development. It has become quite apparent that by defining and studying child language from a variety of perspectives, what will result is a richer description of what children know and will come to know about their language.

The Active Process of Language Acquisition

The prevailing view of language development emphasizes the active participation of the child (Bever, 1970; Bloom, 1973; Bloom, Lightbown, & Hood, 1975; Slobin, 1973). In the process of acquiring the formal system of rules that relate sound and meaning in his language--the grammar--the child is a creative, active discoverer. Along with certain biological determinants of language acquisition, the child interacts with his environment to learn his native language.

It seems clear that humans have some innate capacity or predisposition for language learning. Some of the evidence for this innate capacity comes from the study of language itself as well as investigations of language learning. Linguists have studied languages throughout the world and determined that all languages share certain basic characteristics called language universals. In addition, it appears (primarily through cross-linguistic examination of language learning) that children learn their respective languages in a generic sequence, that is, in a universal pattern of development (Bowerman, 1975; McNeill, 1966, 1970; Slobin, 1966). Many theorists have attempted to specify this biological endowment (Chomsky, 1965; Lenneberg, 1967; McNeill,

1966, 1970). Recent descriptions have been offered by Bever and Slobin. Bever (1970) has proposed that children operate with the knowledge of certain "basic linguistic capacities" in conjunction with "processing strategies" and Slobin (1973) defined a set of "operating principles" that children use to process and learn language.

The child's learning of the structure of his language has been described as his "induction of latent structure" (Brown & Bellugi, 1964, p. 148). This is viewed as an active, ongoing process of hypothesis testing by the child. Through contacts with his language, the child formulates hypotheses--in the form of rules--concerning the regularities that appear in the speech that he hears. It is thought that these hypotheses are guided by his innate capacities. A hypothesis is confirmed if it accounts for the corpus of speech already available and successfully predicts future, i.e., grammatical, sentences. When an hypothesis is verified, the information is incorporated into generically expanding linguistic knowledge. However, if it is not, a new or revised hypothesis is generated. As this process continues throughout childhood, the child's grammars become increasingly more complex until he develops full linguistic competence in his language.

The Role of Linguistic Performance in the Acquisition of Linguistic Competence

Learning the grammar of a language is a dynamic, fluid process in which the child's comprehension and production of

spoken utterances are the means by which linguistic competence is acquired. As his linguistic knowledge increases developmentally, the sentences that the child produces and comprehends will draw more and more upon that competence. However, during language learning, there is a productive interplay between linguistic performance and the child's growing linguistic competence.

In order for the child to learn how various concepts and relationships are expressed by the grammar of his language, he must first be able to derive meaning from the sentences that he hears independently of formal grammatical knowledge (Cairns & Cairns, 1976). Therefore, he develops linguistic performance abilities, in addition to acquiring grammatical competence. These linguistic performance skills allow the child to decode the sentences that he hears so that he achieves some level of understanding. These abilities also allow him to encode his thoughts into meaningful utterances.

The child who is acquiring language, cannot draw upon linguistic competence (as do adults) in sentence comprehension. However, he still appears to understand a greal deal of what is said to him. This largely results from the child's use of comprehension strategies. A comprehension strategy is a performance skill. It is a heuristic procedure that the child develops to determine the meaning of sentences in the absence of full linguistic knowledge (Bever, 1970). Sometimes, the use of such comprehension strategies can result in the child's misunderstanding of certain sentences because he is not able to use all the information in the sentence. Evidence of such comprehension errors indicates that

early on in the language learning process, children develop comprehension strategies that are based solely on their knowledge of the world and their previous experience.

An example from the study of children's comprehension of passive sentences will illustrate. The following are both passive sentences:

1-1 The ice cream cone was eaten by the girl.

1-2 Mommy was kissed by Daddy.

Three-year-old children correctly understand passives such as 1-1. However, at the same time, they may not understand sentences such as 1-2. Therefore, it cannot be assumed that these children have as yet acquired full syntactic knowledge of the passive construction. These children are using a comprehension strategy which is based upon their knowledge of the world (specifically, the probable relationships between ice cream cones and girls) to correctly interpret Sentence 1-1.

In the course of acquiring linguistic competence, the comprehension strategies that children develop change to accommodate their increasing conceptual and social knowledge as well as their growing syntactic knowledge.

In addition to strategies for determining sentence meaning, the child also develops strategies which he uses to determine how his language relates sound to meaning, i.e., to learn his grammar. During the process of language acquisition, children employ specific language learning strategies that represent their hypotheses concerning how various concepts might be encoded by the grammar of the language that they hear. As he induces a particular

linguistic rule, the child adds this to the growing body of knowledge about his language, compares it with his current knowledge, and uses it as he hears and produces sentences. In this manner, he may add, delete, restructure, or confirm his hypotheses as he acquires linguistic competence. The following is an illustration of how a child may use his linguistic performance abilities in relation to the acquisition of linguistic competence. In an effort to communicate the concept of "plurality," the child will attend to the regularities in his language to determine the linguistic expression of that concept. It has been suggested that the ends of words seem to be perceptually salient to the language learner (Slobin, 1973). Since plural inflections are word-final in English, the child may attend to noun suffixes in the contexts in which he recognizes that the semantic notion of number is being communicated. He may formulate an initial hypothesis about the linguistic expression of number in which all words with voiceless consonants are marked by the suffix -s. He might then use this new grammatical rule to code number in the sentences that he produces and to aid in the decoding of sentences that he hears. He may produce utterances which contain forms that include "hats, coats, foots," etc. If listeners accept these forms as correctly expressing number, then his hypothesis would be confirmed. If not, the hypothesis would be modified and/or rejected. In this case, "hats" and "coats" would be accepted but not "foots." The child would then learn how to apply the rule for indicating number differentially depending on the nature of the noun. Additional confirmation of the need to modify this initial hypothesis might

result from hearing number represented in a variety of different sentences and contexts. He may hear "foot" in one circumstance and "feet" in another and determine that, in fact, the correct linguistic expression of number for that noun is "feet" and the proper singular indication is "foot."

In general, learning about grammatical rules is not a one-time learning experience. In each new context in which the structure appears, the child will learn something about the use of that structure and compare it with his existing (and growing) linguistic knowledge. Children add to their competence as they use language to produce and understand sentences.

Slobin's Theory

> In order for the child to construct a grammar: (1) he must be able to cognize the physical and social events which are coded in language, and (2) he must be able to process, organize, and store linguistic information. (Slobin, 1973, pp. 175-176)

This definition represents what Dan Slobin proposed are the cognitive prerequisites for the development of grammar. In his theory, Slobin acknowledges both the primacy of cognitive development and the active, constructive role of the child as he endeavors to master his native language.

Children use language to communicate their ideas about the world around them--about objects, events and the relationships among them. Slobin suggests that all children's cognitions of their environments result from a universal, invariant course of cognitive development--such as that specified by Piaget. Further, Slobin assumes that language is used to express only what the child

already knows.

When a new linguistic form appears in the child's speech, Slobin suggests that it serves "only to code a function which the child has already understood and expressed implicitly" (Slobin, 1973, p. 185). For example, in his study of Adam, Eve and Sarah, Brown (1973) reported that these children demonstrated understanding of the semantics of possession significantly prior to their acquisition of the possessive inflection. Slobin summarized evidence such as this as follows: "New forms first express old functions" (p. 184).

Once a child has developed a <u>new</u> concept, several major questions arise with regard to the linguistic expression of that concept:

(1) How does he initially go about expressing this new meaning?

(2) How does he learn the linguistic device in his language to express this meaning?

(3) What makes some grammatical devices easier to learn than others?

With regard to the first question, Slobin suggests that the child will first attempt to express a newly developed concept by using the linguistic means already available to him. This maxim is phrased as follows: "New functions are first expressed by old forms" (Slobin, 1973, p. 185). To continue the example of Adam, Eve and Sarah's acquisition of inflections, Brown reported that possession was first encoded by word order (e.g., "Mommy dress"--an old form), prior to their discovery of the possessive inflection

-s (e.g., "Mommy's dress"--a new form) (Brown, 1973).

When a child has acquired a new conceptual category and the linguistic structures that he has available for expressing it prove to be inadequate, he must discover new means for encoding that meaning. Based on Slobin's theory, Cairns and Cairns (1976) have described a three-stage sequence which provides insight into the second question that was posed: How does the child learn how his language codes his newly developed concept? They suggest that once the child has developed a particular concept, he begins to construe events in the world in terms of that concept. At this point, however, the child does not have the grammatical device(s) that encode that concept in his language. Therefore, as Slobin described, he may use the linguistic devices that he has available to him (i.e., "old forms") to indicate this new meaning. The child must, at this point, attempt to discover the linguistic forms in his language which code this new concept. The child then actively searches for the new linguistic form by formulating and testing hypotheses about how his language represents this concept. In the final stage of this process, the child discovers the appropriate grammatical device and uses it to communicate his new concept. He has, in fact, added a new bit of linguistic knowledge to his growing linguistic competence.

What makes some grammatical devices easier to learn than others? One might predict a universal pattern of grammatical development based on Slobin's theory which establishes the uniformity and primacy of cognitive development in setting the pace for linguistic development. However, Slobin noted that the

linguistic forms which express the child's developing concepts are not equally accessible across languages. The linguistic structures that express a particular concept vary in psycholinguistic complexity from language to language. As a result, a child learning one language may acquire the linguistic expression of a particular meaning earlier than a child learning to encode that same concept in a different language.

By studying children who were learning two languages, Slobin accumulated information concerning the formal devices that appeared difficult to learn. This research procedure allowed Slobin to compare the development of the formal means of encoding a specific meaning in two languages. Since he was investigating one (bilingual) child, any lag between the child's acquisition of the linguistic form to code a new concept in one language, and his discovery of the form that expressed the same meaning in the other, could be ascribed to differences in the psycholinguistic complexity of the linguistic devices.

Based on these investigations and data from cross-linguistic studies, Slobin identified those (presumably) universal variables that affect the accessibility of various linguistic forms and, therefore, the relative ease of their acquisition. These variables were conceptualized in terms of a set of operating principles which guide the language learner in his search for the linguistic means which express his developing concepts. As described by Slobin, these operating principles ". . . guide the child in developing strategies for the production and interpretation of speech and for the construction of linguistic rule systems" (Slobin, 1973,

p. 194). Slobin characterized these language learning strategies as "self instructions for language acquisition" (p. 191) and suggested that children will more easily learn those linguistic devices which are discoverable by these initial hypotheses about the structure of their language.

To illustrate, one of the operating principles states: "Underlying semantic relations should be marked overtly and clearly" (Operating Principle E, Slobin, 1973, p. 202). Based on Slobin's theory, linguistic devices that conform to this general principle, i.e., those that are well-marked ("regular and perceptually salient," p. 201), will be learned earlier than those that are not. Slobin cites Shugar's (1971) evidence from Polish child language development which suggests a role for perceptual salience in inflectional development:

"The following oppositions emerged: singular vs. plural in nouns, verbs and pronouns; first vs. second person singular in verb endings; nominative vs. accusative case, for feminine nouns; masculine vs. feminine gender both in pronouns and verb endings. Most of the above differentiations seem to rest upon a new phonological acquisition: an acoustically clear differentiation of /a/ and /e/" (p. 202).

An important extension of Slobin's model of the child's cognitive abilities related to learning linguistic structures is a consideration of the relationship between these strategies and comprehension. Linguistic performance has been described as fundamental to the language learning process. As first suggested by Bever (1970), one might postulate the following connection

between sentence comprehension and language learning: a child will learn the grammar for those sentences which he can understand. Therefore, the child will have difficulty learning the grammatical structure for sentences that are hard for him to decode. It would seem that the relative ease of comprehending various sentences may be influenced by the more general predispositions to language processing that Slobin described in the form of operating principles.

For example, this relationship may be described by considering the complexities of understanding sentences with deleted grammatical relations. As previously stated, Operating Principle E indicates that marked grammatical relations will be learned earlier than those that are unmarked. With regard to sentence comprehension, the child may have more difficulty understanding sentences with deleted grammatical relations such as, "Ask Laura what to feed the doll," as compared with sentences such as, "Ask Laura what you should feed the doll." Since the second sentence contains the optionally deleted material missing from the first, the underlying semantic relations of the sentence are more clearly marked in the external structure. Due to the relative ease of understanding sentences with clearly marked grammatical relations, one may predict that children will learn these grammatical relations (and formulate rules to mark them) earlier.

Linguistic Reduction and Sentence Comprehension

One aspect of the very complex process of understanding a sentence is the syntactic analysis which a listener must construct in order to determine the grammatical relations that hold between

the lexical items of that sentence.

In part, to understand a sentence the listener must understand the linguistic elements, i.e., the morphemes of that sentence and determine the basic grammatical relationships among those elements. It is the recovery of the basic grammatical relations among elements in the sentence that will indicate how the meaning of those elements are combined.

Psycholinguistic investigations of sentence comprehension have revealed that listeners use strategies to segment spoken sentences into smaller, clausal units (Bever, Lackner, & Kirk, 1969; Fodor & Bever, 1965; Garrett, Fodor, & Bever, 1966; among others).[1] The internal syntactic organization of these clause-sized units is further analyzed and the grammatical relations that hold between the individual lexical items in the clause are specified. After these grammatical relations are assigned, the meaning of these clausal units is recoded in some abstract (probably syntax-free) form and stored until other clauses in the sentence are analyzed and a meaning for the entire sentence can be assigned (Cairns & Cairns, 1976; Gough, 1972).

Listeners must use a variety of cues to relate superficial linguistic patterns to underlying grammatical relationships. Specifically, the listener scans the spoken sentence for cues to the identification of clausal segments. Bever (1970) has suggested that the listener is guided by "perceptual strategies,"

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[1]It is thought that because clauses in the superficial structure of a sentence signal the existence of simple sentences in the underlying structure, the clause is probably the primary unit of language processing (Cairns & Cairns, 1976).

i.e., comprehension strategies in this process. It is reasonable to assume that the more similar the superficial structure of a sentence is to the underlying structure, the easier it will be to understand. Therefore, any deletion of a cue to the underlying structure should result in a sentence that is more difficult to process and therefore harder to understand. Bever has related such a hypothesis about comprehension difficulty to child language. He suggests "a view of sentence complexity according to which the more internal structure material that is implicit in the external structure, the harder the sentence, since the child must contribute more information to the sentence itself" (Bever, 1970, p. 350). Therefore, in an effort to determine the underlying grammatical relations of an utterance, the listener (child or adult) may be aided in this syntactic analysis by overt grammatical cues to that structure. When these cues are distorted or absent in spoken sentences, listeners will experience difficulty in understanding those sentences.

Extrasyntactic Factors and Sentence Comprehension

Children do not need to depend only on sentence structure to understand the semantic relations among words in the sentences they hear. In fact, there are many studies of child language comprehension that indicate that during language development, children's language comprehension is determined to a large extent by a variety of nonlinguistic factors. The kinds of information children use to understand sentences and the extent to which they use it has been shown to change with development. Only gradually,

through use of comprehension strategies based on their knowledge of the world, do children come to rely more heavily on syntactic information to interpret sentences correctly. The comprehension strategies that children use at different stages in language development have been described by researchers (Amidon & Carey, 1972; Bever, 1970; Chapman & Miller, 1975; Clark, 1971; Ervin-Tripp, 1970; Strohner & Nelson, 1974; among many others). Chapman (1977) summarized these findings in discussion of the strategies that children of different developmental levels might use to respond to spoken sentences.

Very early in the language acquisition process, infants do not actually use comprehension strategies but exhibit response preferences which give the impression of language comprehension in responding to speech. At this initial stage of development, children do not as yet even understand lexical items but appear to understand sentences by playing a variety of communication "games" or play rituals (Bruner, 1975) in which their action responses are really contextually determined. Activities such as "clap hands, clap hands," "peek-a-boo," "wave bye bye," etc., are not linguistically directed, but rather part of a repertoire of context dependent actions.

During the next developmental stage, children apply comprehension strategies to decode sentences which are based on what appears to be the beginning of lexical comprehension. In response to spoken utterances, children can now attend to the objects mentioned in a sentence and either give evidence that they have noticed the object mentioned or do what they usually do

in the situation or with the object. For example, Lewis and Freedle (1973) reported that although one 13-month-old appeared to correctly understand "eat the apple," when she was placed in a play pen (awy from her high chair) and told to "eat the apple," she threw it.

As lexical comprehension continues to develop, children may process one, two or perhaps three words of a sentence, but may base their response behaviors on the knowledge of the conventional use or location of the objects and the usual actions related to them (Clark, 1973; Wilcox & Palermo, 1975). Therefore, children at this stage may run to the bathroom and try to climb in the tub in response to "Do you want a bath?" or "Can you find the brush?" may result in the child brushing her hair (Chapman, 1977; Parisi & Antinucci, 1970). Using a "child as agent" strategy, a child may be still decoding individual words but comply with "Make the cow kiss the horse" by kissing the two animals himself. If he is directed not to act as agent, the child may in response to the same command randomly pick up one of the animals or choose a particularly large or attractive toy and demonstrate the action without regard to the semantic relationships of the test sentence (Chapman & Miller, 1975; deVilliers & deVilliers, 1973). Even when presented with declarative sentences that do not require a response, children at this developmental level appear to process a few words of the sentence--usually those with obvious situational referents--and use an action strategy to respond (Shatz, 1975).

Between the ages of 2 and 4 years, children continue to apply some early comprehension strategies (such as probable location and conventional use strategies) to understand sentences and develop new strategies to replace others. The children no longer act as agent in demonstrating test sentences, but acquire the ability to use toys as agents. For example, in acting out the test sentence "The boy throws the ball," the boy doll as opposed to the child would throw the ball (Chapman & Kohn, 1977; deVilliers & deVilliers, 1973). In the absence of situational cues and/or context, children begin to use a "probable event" strategy to determine sentence meaning. As their knowledge of the usual relations between objects, people and events increases, children interpret events that are described in sentences as their past experience makes most probable (Bever, 1970; Chapman & Miller, 1975; Strohner & Nelson, 1974). To illustrate, 3 year olds correctly act out the improbable sentence "The ball carries the wagon" less than 30% of the time. In contrast, these same children consistently demonstrate the correct interpretation of the probable sentence "The girl feeds the baby" (Strohner & Nelson, 1974). The probable event strategy is applied in a slightly different form by children attempting to respond to questions containing interrogative words that they cannot as yet comprehend. Drawing upon their past experience and general knowledge, children often incorrectly answer questions, supplying the most probable missing element. For instance, in response to the questions "Why is the deer drinking?" or "How is the deer eating?" 2 to 3 year olds answer "water" or "food" (Ervin-Tripp, 1970b).

Many investigators have reported that between the ages of 3 and 5 years, English-speaking children learn to use word order as a cue to assign meaning (specifically agent and object of action) for simple active sentences (Chapman & Miller, 1975; Clark, 1971; deVilliers & deVilliers, 1973; Ferreiro & Sinclair, 1971; Owing, 1972). There is evidence that a word order strategy may be over-generalized in comprehending more complex sentences. For example, Bever (1970) has described the use of a strategy in which any NVN sequence in a sentence is assumed to refer to an actor-action-object sequence. By employing such a strategy to understand reversible passives (e.g., "The girl is kissed by the mother.") children assign the first N as actor, regardless of the actual grammatical relations of the sentence. In this example, the child may act out the above sentence by having the girl kiss the mother (Beilin, 1975; Bever, 1970; deVilliers & deVilliers, 1973; Maratsos, 1974; Maratsos & Abromovitch, 1975). In addition, when faced with more complex sentences, children may also rely on their past experience, particularly the probable relations of events, to interpret them. For example, sentences with late developing conjunctions such as "because" are difficult for children to correctly interpret. Epstein (1972) reported that children in elementary school may understand "I broke my balloon because I cried" as having happened in the reverse order.

In summary, the strategies that children employ in their efforts to understand spoken sentences change developmentally. There is evidence that children first rely totally on context to respond to the utterances of others. As they develop, their

comprehension strategies are based on lexical understanding, the situation and their general knowledge. The children use their increasing knowledge of the relations among people, objects and events as a means for obtaining the meaning of sentences. Only gradually are children able to use linguistic cues in the sentence to determine its meaning. There is evidence that at least during the language learning years, children have several comprehension strategies available to them during any given period. Further, the strategies that children use at different developmental levels may overlap and continue in similar or altered forms in later stages.

Summary

This introductory chapter has presented a consideration of some important aspects of language acquisition, the role of linguistic performance in this process, as well as a definition of some of the factors which affect the linguistic performance abilities of children during the language learning years.

Language learning is characterized as a dynamic, constructive process. The child is viewed as an active participant who, through interaction with his environment and experience with his language, formulates and tests hypotheses about how his language relates sound and meaning.

The child acquires linguistic competence by using his linguistic performance skills, i.e., by understanding and speaking. The importance of comprehension strategies in language development is underscored in light of the child's efforts to determine

sentence meaning prior to the development of adult linguistic competence.

Slobin has defined a set of presumably universal operating principles which children employ in learning the grammar of their language. These language learning strategies represent general predispositions to language processing which, it is hypothesized, may influence the relative ease of comprehending various linguistic devices. In addition to the influence of linguistic factors on sentence processing difficulty, this chapter defines some of the nonsyntactic factors that contribute to the child's understanding of spoken utterances.

The preceding sections have summarized the relevant theoretical considerations related to the present study. The final section of this chapter will present the focus of this investigation.

The Focus of the Proposed Study

This study explores the relationship between the presumably inherent predispositions which underlie the abilities to process language (described by Slobin, 1973) and the relative ease of understanding linguistic structures that conform to these universal biases. Specifically, this study focused on Slobin's prediction that clear marking of underlying semantic relations would facilitate sentence comprehension, and that sentences with deleted grammatical relations would be more difficult to understand than those in which the material was present.

Young children (aged 3-5 years) were presented with complex, conjoined sentences and asked to act out the sentences with toys. The conjoined sentence type was selected since the grammatical structure of these sentences provided redundant linguistic forms which were optionally deletable. This allowed for a comparison of sentence processing difficulty between sentences with overtly marked underlying semantic relations and sentences with fewer superficial cues to underlying meaning. This investigation also sought to examine the influence of extrasyntactic factors on the comprehension strategies used by the children in their efforts to understand these linguistically complex sentences.

Chapter II

REVIEW OF RELATED LITERATURE

Introduction

Much of the current literature in developmental psycholinguistics reflects an interest in the influence of both linguistic and nonlinguistic factors on children's understanding of spoken sentences. This chapter will review relevant literature concerning the syntactic and extrasyntactic cues that normal developing children may rely on to obtain sentence meaning. To facilitate this review, the chapter is divided into three main sections. First, the data related to Slobin's prediction concerning the effects of a particular linguistic variable--linguistic reduction--on the relative ease of sentence comprehension will be presented. The following section will examine the development and use of nonlinguistically based comprehension strategies. Since this study focuses on the normal child's comprehension of conjoined sentences, the final section will present research related to conjunction in child language.

Linguistic Reduction and Sentence Comprehension

As suggested by Slobin (1973), children employ universal

language learning strategies as they endeavor to learn the structure of their native language. These putative operating principles include the following: "Underlying semantic relations should be marked overtly and clearly" (p. 202). Based upon this principle, Slobin predicts a general developmental universal of sentence comprehension: "It is easier to understand a complex sentence in which optionally deletable material appears in its full form" (p. 203).

Although the support for this comprehension universal is derived primarily from research in developmental psycholinguistics, Slobin cites several studies with adult subjects which indicate that linguistic reduction increases the psycholinguistic complexity of certain complex sentence constructions.

Comprehension studies with adults have indicated that understanding sentences with multiple self-embedded clauses is made easier when each embedded clause is marked by a relative pronoun (Fodor & Garrett, 1967; Hakes & Cairns, 1970; Hakes & Foss, 1970). For example, "The pen which the author whom the editor liked used was new" is significantly easier to understand than "The pen the author the editor liked used was new." Although these studies employed a variety of measures of psycholinguistic complexity (including paraphrase accuracy[1] and the phoneme monitoring task[2]), their overall findings indicate that unreduced

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[1]"Paraphrase accuracy"--in this procedure a subject hears a sentence and is required to rephrase it without altering its meaning.

[2]"Phoneme monitoring task"--as developed by Foss (1969), this procedure requires a subject to listen for a word in a test sentence that begins with a specified phoneme, and to press a

[continued]

versions of sentences with relative clauses are easier for adult subjects to process than reduced versions of those sentences. It appears that, for adult subjects, the relative pronoun facilitates a particular strategy for interpreting multiple embedded sentences --namely, that in a sequence of noun-relative pronoun-noun-transitive verb the first noun is the object and the second the subject of the following verb (Slobin, 1973).

Additional evidence of the effects of linguistic reduction on adult comprehension was provided by Hakes (1972). Hakes used the phoneme monitoring task to compare the psycholinguistic complexity of complex sentences that contained the complementizer "that" with sentences from which "that" was deleted. Using sentences such as "Everyone who was at the party saw (that) Ann's date had made a complete fool of himself," Hakes found that the latency to monitor the d in "date" was longer if the complementizer was deleted. This suggests that the deletion of complementizers, as well as relative pronouns, increases the psycholinguistic complexity of certain complex sentences for adult listeners.

Recent studies in child language provide much of the data cited by Slobin to illustrate the difficulty in processing sentences with deleted grammatical relations. As part of a longitudinal study of the linguistic development of one child named Echo, Slobin and Welsh (1971) elicited 1000

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button as soon as he hears it. The subject's monitor latency is the time which elapses between the occurrence of the target phoneme and his pushing the button. The longer the latency, the greater the complexity of decoding activity.

imitations[3] which were collected when Echo[4] was between 2 years 3 months and 2 years 5 months of age.

They reported that Echo's imitations of sentences with one embedded clause preserved the meaning of those sentences when the embedded clause was marked by a relative pronoun. For example:

2-1 Model: "The man who I saw yesterday got wet."

2-2 Echo: "I saw the man and he got wet."

At the same stage of development, Echo's imitations of sentences with embedded clauses from which the relative pronoun was deleted, did not indicate that she understood the appropriate underlying relations. In fact, Slobin and Welsh note that Echo's imitations suggest that the model sentence was treated as a word list. For example:

2-3 Model: "The boy the book hit was crying."

2-4 Echo: "Boy the book was crying."

Slobin and Welsh conclude that sentences such as 2-3 are difficult for children to understand because optionally deletable material does not appear in the surface form of the sentence. It is difficult to retrieve the underlying structure of Sentence 2-3 because the embedded clause ("The book hit the boy.") is not cued by a relative pronoun (e.g., "who").

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[1]"Elicited imitations"--Slobin defines these imitations as " . . . the child's repetition of a model sentence presented in a context calling for imitation, as opposed to the child's spontaneous imitation of adult utterances" (Slobin & Welsh, 1971, p. 486).

[2]Echo was described by these researchers as "a precocious first child of graduate student parents" (Slobin & Welsh, 1971, p. 486).

As part of a 1968 study, Olds discovered that older children (aged 7, 9, 11) were able to follow instructions which contained optionally deletable relative pronouns more quickly than instructions in their corresponding reduced form. For example, 2-6 was easier to process than 206 due to the presence of the relative pronoun "that" in the former:

2-5: "The piece that your opponent moved may be moved two spaces."

2-6: "The piece your opponent moved may be moved two spaces."

Additional studies of linguistic reduction have focused on deletable linguistic structures other than relative pronouns which also appear to aid the child in processing complex sentences. One of the first was a study conducted by Carol Chomsky (1969) with children between the ages of 5 and 10. The experimental procedure used by Chomsky was an interview situation in which two children who knew each other well were instructed by the experimenter to carry out certain tasks, play games, and answer questions. Only one of the children was actually being tested in each pair with the second child providing a conversation partner for the test subject. Using this technique, Chomsky tested the comprehension of a variety of complex sentence constructions, which she predicted would be late acquisitions based on their linguistic complexity.

Among those test structures were sentences which contained the verbs "ask" and "tell" in the form:

2-7: "Ask Laura what you should feed the doll."

2-8: "Ask Laura what to feed the doll."

2-9: "Tell Laura what she should feed the doll."

2-10: "Tell Laura what to feed the doll."

Sentence 2-8 is a reduced version of Sentence 1-7 as the subject of the verb "feed" (i.e., "you") in Sentence 2-8 is no longer explicitly represented. Similarly, Sentence 2-10 is a reduced version of 2-9. Chomsky found that children had greater difficulty understanding the reduced form of this sentence type with "ask." While responding correctly to sentences of this type with "tell," they frequently treated "ask" in this instance as if it meant "tell," and replied "ice cream" instead of asking Laura.[5] The psycholinguistic complexity of Sentences 2-8 and 2-10 is increased because certain elements crucial to the understanding of those sentences are omitted from its superficial structure, and must be supplied by the listener.

Similar findings were also reported by Olds (1968). Like Chomsky, Olds found that children were less likely to misinterpret the verb "ask" when a pronoun indicated the underlying subject of an embedded sentence. When asked to follow the following instructions:

2-11: "Ask your opponent which piece you should move one space."

2-12: "Ask your opponent which piece to move one space."

Olds's subjects correctly comprehended more instructions like 2-11 in which the subject of the verb "move" (i.e., "you") was explicitly stated.

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[5]A further consideration of the difficulties of comprehending sentences with complement verbs will be presented with regard to the use of the Minimal Distance Principle as a comprehension strategy.

To summarize, Slobin's prediction that the deletion of superficial cues to underlying meaning in complex sentences will increase the difficulty of understanding those sentences has been observed in psycholinguistic studies of sentence comprehension. Complex sentences with deleted grammatical relations are generally more difficult to comprehend than sentences in which the underlying grammatical relations are clearly marked in surface structure.

A great deal of the evidence reported in this section is derived from studies of older children and adults and has focused upon a limited number of optionally deletable linguistic forms. The final section of this chapter reviews studies of the effects of linguistic reduction on younger children's abilities to process particular complex sentence types--i.e., linguistically conjoined constructions.

Nonlinguistic Comprehension Strategies in Children

Many nonlinguistic factors contribute to the child's understanding of the speech he hears. This section will describe some of the comprehension strategies that children at different developmental levels employ that depend not on sentence structure, but on the semantics of individual lexical items, the child's growing awareness of relations among people, objects and events, and cues from the superficial linguistic characteristics of sentences.

Lexical Comprehension and the Semantic Relations among Lexical Items

Conventional Use or Location

Several studies have provided evidence for the early use of a comprehension strategy in which the child employs lexical (as opposed to syntactic) comprehension coupled with a "do what you usually do" strategy. The use of such a strategy has been particularly identified in the study of children's comprehension of sentences with locative prepositions. Clark (1973, 1974) hypothesized that younger children's comprehension of the locative terms "in," "on," and "under" (prior to their acquisition of complete semantic knowledge of them) was based to some degree upon the use of nonlinguistic strategies. Her subjects, aged 1 year 6 months to 6 years, were asked to place small toy animals "in," "on," or "under" six different reference points which included a box, tunnel, truck, crib, and other objects. The majority of the children over the age of 3 responded correctly to all three prepositions. Clark reported that the performance of the younger children (1 year 6 months to 3 years) appeared to indicate that "in" is acquired developmentally prior to "on" which is acquired before "under." In an effort to explain the pattern of errors of youngest children, she specified two hierarchically ordered non-linguistic strategies that she hypothesized guided the children's processing of directions containing the test prepositions:

> Rule 1: If the stationary object is a container, the moveable object goes inside it.
>
> Rule 2: If the stationary object has a horizontal, surface, the moveable object goes on it.

It is her hypothesis that these nonlinguistic strategies are derived from the child's perception of the normal or expected spatial relations that may hold between objects in the world.

Wilcox and Palermo (1975) questioned Clark's results, arguing that the error pattern which emerged from the responses of the youngest children may have been a contextually determined artifact of the particular objects she used. They indicated that the stationary objects used by Clark were biased towards placement of the toys "in" or "on" them. They argued that "the contextual support from linguistic statements presented to the children by Clark was such that the children had no alternative to the specific nonlinguistic strategies which the children in the study selected when they did not know how to respond to the statement including 'on' and 'under'" (p. 247). Wilcox and Palermo suggested that by altering the contextual support of the linguistic statements used by Clark, they might better assess the influence of non-linguistic factors on the comprehension of locative terms. Their study tested comprehension of "in," "on" and "under" with children between the ages of 1 year 6 months and 2 years 11 months using a procedure similar to Clark's, but these investigators presented the instructions in three contextually congruent tasks and three contextually incongruent tasks. Contextually congruent instructions were those in which contextual bias was exploited, e.g., "Put the boat under the bridge." Contextually incongruent instructions were those in which subjects were required to arrange objects in ways not easily predicted from normal contextual relationships, e.g., "Put the boat on the bridge." Their results replicated those of

Clark only when the context and linguistic instructions were congruent. They demonstrated that when language and context were incongruent that their subjects' error pattern resulted from more general nonlinguistic comprehension strategies than defined by Clark. They suggest that their subjects' errors were based upon: (1) the tendency to make the simplest and easiest motor responses (which they attribute mainly to their younger subjects) and (2) the tendency to put the objects in their most normal contextual relationship. These investigators conclude that the way in which young children comprehend a word in a particular situation as they acquired semantic knowledge is "a complex function of the context and a number of linguistic and non-linguistic strategies" (p. 253).

Child-As-Agent

Another example of the use of lexically cued meaning is evident in the young child's use of a "child-as-agent" strategy. Several investigators have noted that when presented with semantically reversible[6] sentences, children (who are beginning to use appropriate word order in their two-word productions) may invoke a comprehension strategy based on lexical meaning in which word order is ignored.

deVilliers and deVilliers (1973) studied the comprehension of semantically reversible active (2-13) and passive (2-14) instructions with children aged 19 to 37.5 months:

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[6]"Reversibility" refers to the semantic aspects of sentences. A "reversible" sentence is one in which the object of the action can also serve as subject ("The girl pushes the boy."); in nonreversible sentences, the objects cannot normally do so ("The boy washes the car.").

2-13: Make the dog bite the cat.

2-14: Make the dog be bitten by the cat.

Each child was given two toys--for example, a dog and a cat--and was instructed to "make the dog bite the cat," or its semantic contrast. The results of the study were reported with the children grouped according to MLU. The labels assigned to these groups generally corresponded to the same MLU divisions identified by Brown, Cazden and Bellugi (1969). deVilliers and deVilliers reported that the majority of all responses (i.e., to both active and passive sentences) in early Stage I (MLU 1.00-1.50, age 19-24 months) were of the type "child-as-agent," where the child performed the action as the agent of the verb; e.g., when told to "make the cow kiss the horse," the child kissed the cow or the horse or both. There was no tendency to prefer either the first or second noun as an object. One third of the responses to passive test sentences by children in late Stage I (MLU 1.50-2.00, age 19.5-27 months) resulted from a "child-as-agent" strategy. The researchers commented that by Stage II (MLU 2.00-2.50, age 25-31 months) responses of this type were relatively infrequent to semantically active and passive sentences. However, further inspection of the performance levels for Stages II and III reveals that "child-as-agent" responses actually represent 16.2% of the responses to reversible active sentences in Stage II, and 17.6% of the responses to reversible passives at that stage. While only 2.4% of the responses to active sentences at Stage III (MLU 2.50-3.00, age 21-32 months) are of this type, 14.3% of the responses to passives at this stage resulted from a "child-as-agent" strategy.

These data suggest that although this semantic strategy is most often used by children in Stages I and II, children in later stages of development still apply the "child-as-agent" strategy, particularly in their attempts to comprehend reversible passive sentences. In addition, the number of refusals to act out the test sentences decreased markedly after Stage I, but refusals were far less numerous at all stages than responses of the type "child-as-agent."

deVilliers and deVilliers suggest that the large number of "child-as-agent" responses, particularly in Stage I, result from a possible semantic interpretation of the test sentences in which the verb is processed first as in the imperative form. Then there are three possible agents: the two toys and the child as an implicit agent. Since the three agents are all equally probable in the performance of the children in early Stage I, and the children do not perform just any arbitrary actions but use the objects and the action named in the sentence, this interpretation appears quite plausible.

Sinclair and Bronckart (1972) asked French-speaking children between the ages of 2 years 10 months and 7 years to act out (using toys) three-word combinations without syntactic markers. These lexical sequences consisted of two nouns and a verb (in the infinitive), or one noun and two verbs. Verbs were either transitive or intransitive. The two-nouns-plus-transitive-verb combinations translated into semantically reversible (i.e., boy push girl) or nonreversible (boy open box) sentences. All three-word combinations were presented in the six possible word orders. The responses to the semantically reversible, transitive items

(consisting of two nouns and one transitive verb) are of particular interest. The researchers expected that the six different word orders for such items (e.g., boy push girl; girl push boy; boy girl push; girl boy push; push boy girl; push girl boy) would all lead to interpretations where one of the nouns would act on the other. They found that many of the responses to these test items were characterized by the child performing the role of the agent and acting on both toys as the recipients of the named action.

The "child-as-agent" strategy illustrated by these responses is one of two primitive strategies used by the youngest children in this study to decode the various lexical combinations that were tested. Sinclair and Bronckart further define the "child-as-agent" strategy by suggesting that the utterance (i.e., their three-word test combinations) is considered as consisting of two parts only: a word expressing an action and the name of the person (or persons) on whom this action is performed. Sinclair and Bronckart describe the development of subsequent strategies in which the utterances are considered to consist of three parts: an agent, an action and a recipient of that action. Although the "child-as-agent" strategy was primarily characteristic of some of the responses of the youngest children, use of this strategy was reported for some subjects in all age groups for some of the test combinations.

Probable Event

As the child's general knowledge of the world expands, he uses his past experiences to determine likely relationships among

people or objects that are referred to in the sentences he hears. Several experimental studies have demonstrated that children's early comprehension strategies are very often based on event probabilities. Bever (1970) suggested that a sentence will be easier to comprehend if the events it describes are probable rather than improbable. He hypothesized that a basic strategy for understanding sentences is to combine the lexical items in the most plausible way when it is possible to do so, i.e., when the probable relations among lexical items in a sentence are semantically constrained. Specifically, it would seem that if young children used such a probable event strategy to interpret an improbable event sentence in which the actor-action-object sequence refers to events that rarely actually occur (e.g., "The baby feeds the girl.") they might interpret such a sentence as if the sequence referred to the more probable event sequence--object, action, actor (e.g., "The girl feeds the baby.").

Some of the evidence of the use of such strategies may be found in the studies of the comprehension of semantically reversible and nonreversible passives by Bever, Mehler, and Valian (1970), deVilliers and deVilliers (1970), and Slobin (1966). Their findings indicated that at a particular point during language development, young children correctly process nonreversible passive sentences, while consistently misinterpreting reversible passives. These errors suggest that these children have not as yet acquired complete syntactic knowledge of the passive transformation.[7]

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[7]Studies of the passive construction will be discussed further with regard to the child's use of word order strategies to comprehend reversible passives in a later section of this chapter.

It appears that there is a stage in the acquisition of the passive transformation when the child processes nonreversible passives on the basis of a semantic strategy in which he assigns the most plausible semantic interpretation of subject, verb, and object while ignoring the actual syntax of the sentence. For example, "The hot dog is eaten by the boy" might be correctly demonstrated with toys by a child who may also incorrectly demonstrate the reversible passive, "The cow is kissed by the horse," by having the cow kiss the horse.

Bever (1970) examined the development of such a semantic strategy which involves probablistic constraints. He asked young children (aged 2-5 years) to act out simple active sentences that either followed (2-15) or did not follow (2-16) probable semantic constraints:

2-15: The mother pats the dog.

2-16: The dog pats the mother.

His results indicate varying sensitivity to semantic constraints at different ages. The results for 3, 4 and 5 year olds were consistent with some use of a probable event strategy. Two year olds appeared to be relatively unaffected by semantic probabilities. Bever explained this finding by suggesting that very young children (i.e., two year olds) do not have enough relevant experience to know what the semantic probabilities are, and therefore cannot fully depend on their knowledge of the world to tell them what sentences mean.

Strohner and Nelson (1974) hypothesized that in the child's development of sentence comprehension, the impact of event

probability changes markedly between the ages of 2 and 5 years, as the child's knowledge both of events and of syntactic structure increases. They suggested that if the probable event strategy were consistently applied by young children to decode semantically constrained sentences, they would always misinterpret improbable sentences, such as "The mouse chases the bear." In order to determine when children began to use the probable event strategy and how the probability of its use changes with development, they asked children between the ages of 2 and 5 years to act out the meaning of semantically probable and improbable sentences. Three year olds, in acting out the test sentences, demonstrated minimum use of syntactic information and maximum use of the probable event strategy. These children misinterpreted 90-100% of sentences that referred to improbable actor-action-object sequences (e.g., "The baby feeds the girl.") as if they referred to the opposite sequence (e.g., "The girl feeds the baby."). Conversely, these same children correctly acted out 100% of the semantically probable sentences (e.g., "The boy throws the ball."). Interestingly, unlike Bever, Strohner and Nelson reported that the results for the 2 year olds were very much like those for 3 year olds. The 2 year olds were always correct on the probable sentences and usually wrong on the improbable sentences. These findings suggest the frequent use of a probable event strategy before age 3.

Four year olds did also misinterpret more improbable sentences as compared with probable sentences. However, the difference between the performance levels for probable and improbable sentences was not as great as the difference in these

performance levels for the 3 year olds. Strohner and Nelson suggest that these data indicate that 4 year olds use the probable event strategy but with less consistent application than 3 year olds.

By age 5, Strohner and Nelson report that the subjects almost always appeared to rely on the syntactic information in sentences rather than upon semantic strategies. Even though 5 year olds know more about event probabilities than do younger children, Strohner and Nelson conclude that this information only occasionally leads the 5 year old to make errors in interpreting semantically improbable sentences.

Chapman and Miller (1975) have studied the comprehension of semantically reversible sentences and identified the use of a lexical semantic strategy for sentences that lack referential support which is in some ways similar to a probable event strategy. Their subjects were children between the ages of 1 year 8 months and 2 years 8 months, and were grouped according to their mean lenght of utterance (MLU). The sentences in this study were simple active constructions in which the transitive verbs would permit either animate or inanimate subjects and objects in the following manner:

Subject / Object	Sentence
+Animate / +Animate	The boy is hitting the girl.
+Animate / -Animate	The dog is chasing the car.
-Animate / +Animate	The boat is hitting the girl.
-Animate / -Animate	The truck is pulling the boat.

Using a comprehension task in which the children were required to act out the sentences with toys, the authors found that the comprehension of sentences with animate subjects and inanimate objects

was near 100$ for all subjects tested. The two younger age groups (with MLU less than 2.5) responded correctly at less than chance level with sentences with an inanimate subject and an animate object indicating that these children were demonstrating the reverse word order for the majority of these sentences. The results for sentences with either animate subject and object or inanimate subject and object were intermediate. These sentences were generally easier to comprehend than sentences with inanimate subject and animate object but more difficult to process than sentences with animate subject and inanimate object. Chapman and Miller suggest that many of the sentences that the young child hears are of the form animate subject/inanimate object, which may influence the development of a semantic sentence processing strategy in which the animate noun is assigned as the subject and the inanimate noun as the object of an incoming sentence. The authors hypothesize that this strategy may be employed when sentences lack contextual support, however it may be abandoned if the events in context directly bias subject assignment of a sentence. These results may also be considered to support a probable event strategy. These results may also be considered to support a probable event strategy. Chapman and Kohn (1977) suggest that when a sentence contains an animate and inanimate noun, past experience frequently dictates that the particular animate noun mentioned is the agent. However, Chapman and Kohn report that these same children will also show preferred interpretations in which inanimate nouns are agents or instruments, e.g., the boat usually carries the horse. In this case, children are using their knowledge of the usual relations between the

particular objects tested, rather than a general semantic rule "animate nouns are agents" as a cue to the sentence's meaning.

In summary, the study of sentence processing in children has revealed that some of the earliest comprehension strategies that children develop are based on lexical comprehension and the child's knowledge of the world. While first efforts to determine sentence meaning are tied rather directly to context, as children acquire sufficient experience, they can free themselves from the immediate situation and construct probable event interpretations for sentences they hear which lack contextual support. Although these nonlinguistically based strategies develop during language learning, there is some evidence to suggest that the use of some of these heuristics may continue even past the time when children can employ syntactic strategies to aid in the decoding of complex sentences.

Superficial Linguistic Characteristics of Sentences

Word Order

Bever (1970) has suggested that one of the first and most pervasive comprehension strategies that young children employ to understand sentences (in which there are no semantic constraints) is based on their expectation that the order of elements in an utterance can be related to underlying semantic relations. Bever has summarized this strategy as follows: "Any Noun-Verb-Noun (NVN) sequence within a potential internal unit in the surface structure corresponds to 'actor-action-object' (p. 248). Therefore, if the child hears a sentence such as "The truck bumped the car," he

assigns the first noun (i.e., "truck") as the actor, the verb (i.e., "bumped") as the action and the second noun (i.e., "car") as the object.[8] By examining errors in processing sentences which violate standard word order in English, researchers have been able to identify the primacy of this strategy, both in its early development and general application to many incoming sentences.

Studies of comprehension of passive sentences have provided many examples of the use of this strategy. In English, the passive construction is one structure which deviates from canonical word order of English, i.e., the surface order of lexical items in passive sentences fails to preserve the NVN = actor-action-object property of English. For passives, the NVN surface order corresponds to an object-action-actor sequence. Slobin (1966), Bever, Mehler, and Valian (1970) and deVilliers and deVilliers (1973), among others, have studied children's comprehension of reversible and nonreversible passive constructions.

A "reversible" passive is a sentence such as "The cat is chased by the dog," in which it is semantically acceptable for either the first noun, or the second noun, to be performing the action. In this case, it is plausible for either the cat or the dog to be doing the chasing. A nonreversible passive is one such as "The pony is ridden by the girl," in which the first noun could not be the actor (i.e., ponies do not ride girls). These investigators were able to identify use of the first noun strategy

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[8]This word order strategy is often referred to in the literature on child language comprehension as the "agent-action-object" or "first noun" strategy.

by examining the comprehension errors made by the children on the reversible passives. Although very young children (age 2) performed at about chance level on these passives,[9] slightly older children (3-4 year olds) consistently interpreted the first noun as the agent and therefore systematically reversed the meaning of these passive sentences. For example, the sentence, "The boy is hit by the girl," was interpreted as agent ("boy")-action ("hit")-object ("girl").

As part of a study of the development of sentence comprehension, Strohner and Nelson (1974) studied comprehension of reversible active and passive sentences by children ranging in age from 2 to 5 years. Using a toy manipulation task, Strohner and Nelson reported that 3 year olds in their study consistently employed an actor-action-object strategy in their efforts to understand all reversible sentences regardless of sentence voice. These children correctly acted out 80% of the reversible actives and only 27% of the reversible passives. Although the general pattern for the 2 year olds on both reversible active and passive sentences was similar to that of the 3 year olds, identification

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[9]Bever (1970), deVilliers and deVilliers (1973) and Strohner and Nelson (1974) note that 2 year olds easily understand a semantically reversible active sentences. When they are asked to act out these sentences, they do so with 95% accuracy. If this performance were based on the consistent assignment of the first noun as the actor in any type of sentence, it would be expected that they would also systematically misunderstand passives. It appears, then, that their ability to use word order information develops first for the comprehension of active sentences. Their almost random performance on passive sentences is evidence that 2 year olds have at least some primitive notion of different sentences structures--Bever (1970) suggests, "they can at least distinguish sentences they can understand from sentences they cannot understand" (p. 304).

of any consistent use of an actor-action-object strategy was questionable especially for reversible passive sentences since the performance of the 2 year olds on these sentence types was closer to 50% than that of the 3 year olds. Unlike the 3 year olds, the 4 year olds did not usually employ an actor-action-object strategy and misunderstand reversible passives--instead, they correctly acted out such sentences 67% of the time. Their generally higher performance on reversible actives than reversible passives was similar to that of the 3 year olds, suggesting some use of an actor-action-object strategy. By age 5, the subjects in the study appeared to rely almost always on the syntactic information in test sentences rather than upon any ad hoc comprehension strategy. This is reflected in the minimal number of errors in comprehending both reversible active and passive sentences.

Evidence from studies of semantically reversible sentences suggest that at a certain stage in language development (the focal point of which appears to approximate age 3½ years or MLU 3.0-3.5) children are especially likely to use an actor-action-object strategy in attempting to understand complex sentences which lack semantic constraints.

Additional evidence of the overgeneralized use of the first noun strategy can be observed in the errors which children make in their efforts to process "cleft" sentences. Bever (1970) reported that children, who are at the stage where they misinterpret reversible passives, tend to process "actor-first" cleft sentences (2-17) correctly while incorrectly assigning the first noun as the subject of "object-first" cleft constructions (2-18):

2-17: It's the cow that kisses the horse.
("actor-first")

2-18: It's the horse that the cow kisses,
("object-first)

Carol Chomsky (1969), Cromer (1970) and Kessel (1970) have studied older children's comprehension of sentences in which the deep structure relations are not directly expressed in surface structure by means of word order. In sentences such as:

2-19: John is eager to please.

the standard order of grammatical relations in English is represented in the surface structure so that a correct interpretation of that sentence assigns "John" (the first noun) as the subject of "please." However, the surface structure of the following sentence does not directly express the grammatical relations by the order of the words as in sentence 2-19:

2-20: John is easy to please.

In this sentence, "John" is not the subject, but the object of "please." In fact, in the surface structure of Sentence 2-20, the subject of "please" (the indefinite pronoun "someone") is not even present. The investigators hypothesized that children will have more difficulty comprehending constructions such as 2-20 in which word order differs from the Standard English pattern of subject-verb-object. Chomsky studied children who were aged 5-10 years. She placed a blindfolded doll in front of the child and asked, "Is the doll easy to see or hard to see?" This sentence constuction is similar to 2-20 as the subject of the sentence is not the first noun (i.e., the doll). Chomsky selected this construction with

the assumption that it provided no semantic constraints, i.e., "The doll is easy to see" can be interpreted correctly to mean that someone else sees the doll or incorrectly to mean that the doll is doing the seeing. Chomsky's results indicated that before attaining mastery of this construction, children as old as 7 years misinterpreted the sentence by assigning the first noun, "the doll," as the subject of the verb "see." This was determined by having the child "make the doll easy to see," whereupon he removed the doll's blindfold.

Cromer (1970) and Kessel (1970) took issue with Chomsky's results for children younger than 7 years based on their hypothesis that many of the errors for these test constructions were the result of nonlinguistic factors. Arguing, in part, that children may feel a necessity to see the eyes of the doll for it to be "easy to see," Cromer improved the test procedures to have children ranging in age from 5 to 7 years old act out the test sentences with puppets. Cromer demonstrated that children did, until age 6½, remain largely dependent upon a comprehension strategy based upon word order to assign meaning to these constructions. Kessel (1970) replicated Cromer's findings using a different task in which children chose between pictures stimuli which illustrated the meaning of the test sentences. However, both Cromer and Kessel were able to show that children acquired the ability to process exceptions to this strategy correctly at a faster rate than reported by Chomsky.

Minimal Distance Principle (MDP)

Another comprehension strategy which is based on a general principle of English has been identified by Carol Chomsky (1969).

In English, sentences with infinitival complement verbs such as "John told Bill to leave," where "leave" is the complement verb, can accurately be analyzed by a principle that states: "The implicit subject of the complement verb is the noun phrase most clearly preceding it" (Chomsky, 1969, p. 10). Chomsky has termed this the Minimal Distance Principle (MDP).

Chomsky hypothesized that since the MDP applies very generally in English to determine the assignment of the subject of complement verbs in sentences such as described above, children will learn it and apply it extensively in decoding these sentences. In order to identify the MDP as a comprehension strategy, Chomsky presented sentences for the children to process in which a correct interpretation would require a violation of the MDP. Consider Sentence 2-21:

2-21: John promised Bill to shovel the driveway.

In this sentence, the syntactic characteristics of the main verb "promise" make sentences such as 2-21 one of the few exceptions to the MDP. Instead of "Bill" being the subject of the infinitival complement verb "to shovel" as the MDP would idicate, "John" is, in fact, the subject who is to shovel the driveway. In addition, there are certain sentences with complement verbs that may or may not have a second noun phrase. If there is a second noun phrase (such as in 2-21), it is the subject of the complement verb. If not, as in Sentences 2-22, the first noun phrase is the subject:

2-22: John wanted to leave.

Recall that results that were previously reported for the ask/tell constructions tested by Chomsky (1969). In the reduced

versions of the particular constructions with "wh" clauses that were reported (2-8 and 2-10), "ask" is an exception to the MDP, though "tell" is not. In a similar manner, the MDP accurately describes the assignment of the first noun phrase "John" as the subject of the complement verb "to do" in 2-23:

2-23: Tell John what to do.

i.e., Sentence 2-23 means, "Tell John what he should do."

In contrast, the MDP does not accurately assign the subject of the complement verb "to do" (the deleted pronoun "you") in Sentence 2-24 because "ask" is an exception to the MDP in this type of construction:

2-24: Ask John what to do.

i.e., Sentence 2-24 means "Ask John what you should do." In this instance, the first noun phrase "John" is not the subject of the complement verb. Therefore, sentences such as 2-24 are difficult for children to comprehend because they are both linguistically reduced and exceptions to a general principle (i.e., the MDP) that describes the relation between deep and surface levels.

Chomsky used the interview technique previously described to test older children's (5-10 years of age) comprehension of a variety of sentences which violated the MDP. She demonstrated that there is a stage of linguistic development prior to the mastery of sentences with complement verbs, when children consistently misassign the subject of the complement verb in sentences which are exceptions to the MDP. These results indicate a continuing dependence on the MDP as a comprehension strategy in processing sentences with infinitival complement verbs.

To summarize, it seems clear that children develop, as part of their linguistic performance abilities, comprehension strategies that are based on the superficial linguistic characteristics of spoken sentences. Some comprehension strategies such as the first noun strategies appear quite early as children go about the task of trying to determine the meaning of the sentences they hear. This strategy is applied quite extensively (although not always consistently) to a wide variety of incoming sentences.[10] Other strategies like the MDP develop later in the language acquisition process, as children endeavor to decode sentences of increasing complexities.

It is also apparent that children overgeneralize the use of these heuristics in their efforts to understand sentences. Sentences which are exceptions to such strategies--e.g., those that violate Standard English word order, or are exceptions to the Minimal Distance Principle for assigning meaning to complex sentences with complement verbs--are more difficult to understand. Perhaps they are acquired later. This seems plausible in light of the considerable evidence that indicates that a child who has mastered sentences that conform to general principles may first interpret sentences that are exceptions as if they did not violate these general principles.

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[10]However, it is interesting to note that there is considerable support for the view that the young English-speaking children's use of word order information in comprehension as a cue to subject and object status is limited and acquired late in contrast to his observance of subject-object word order in his speech.

Conjunction in Child Language

There is a very small body of data concerning conjunction in child language. This section will include a brief linguistic description of sentence conjunction and conjunction reduction, followed by relevant acquisition data for these linguistic structures--specifically related to the prediction of the developmental primacy of unreduced linguistic forms.

Linguists have described the coordination of simple sentences to express complex meanings (Chomsky, 1957; Jacobs & Rosenbaum, 1968). In English, two or more simple sentences can be conjoined with "and." Some early examples of conjoined sentences produced by Adam, Eve and Sarah were reported by Brown (1973):

"You snap and he comes."

"I did this and I did that."

"You have some and I have some."

Each sentence is complete and could stand alone. These are referred to as full coordinations or unreduced conjoined sentences. When two (or more) simple sentences have corresponding linguistic elements that are identical, one may be deleted. These elements (or conjuncts) must be not only identical in form but also in reference. "Billy ate" and "Billy drank" can be transformed into "Billy ate and drank" only if the two occurrences of "Billy" refer to the same individual. The absence of the redundant linguistic element in the surface form of the conjoined sentence is the result of a deletion transformation.

Sentence coordinations appear late in development than simple sentences for children learning English (and Brown [1973] suggests, possibly for children learning all languages). Although sentence coordination (with deletion) presupposes the knowledge required for simple sentences; in addition, children must also acquire the linguistic abilities specific to coordination. That ability includes being able to increase the size of the linguistic unit to be planned, and recognizing identical and nonidentical linguistic elements that are syntactically matched.

Conjoined sentences have been first observed in the speech of children whose MLU was approximately 3.5-4.0, but full mastery of this linguistic structure is not achieved until much later in development. Studies of English-speaking children report that "and" is the first connective that children use[11] (Beilin, 1975; Clark, 1970; Hood, Lahey, Liffer, & Bloom, 1978; Limber, 1973). This is corroborated from evidence reported in studies of children learning languages other than English--for example, Swedish (Johansson & Sjolin, 1975) and Italian (Clancy, 1974).

It has been claimed that reduced coordinated sentences appear later in children's speech than complete sentences conjoined by "and." Some of the evidence for this comes from spontaneous speech, but other evidence is from elicited imitation studies.

Menyuk (1964, 1979, 1971) reported that unreduced sentences occur developmentally prior to conjoined sentences with deletions.

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[11] Researchers (Brown, 1973; Dale, 1976; among others) have noted that the first appearances of coordinated sentences in child language are simply groupings of two sentences without a conjunction: "You lookit that book; I lookit this book."

Of her observations of the natural speech of about 150 children, from 2 years 10 months to approximately 7 years, Menyuk observed that conjunction reduction is used with greater frequency at older ages ("I want the pencil and crayon." vs. "I want the pencil and I want the crayon." [1971, p. 142]). At the young nursery school age (2 years 10 months - 3 years 1 month) she found that conjoined sentences were used by seven-eights of the subjects, conjunction deletion by five-eighths (1964). The latter percentages rises in older age groups.

Reporting data from the observation of the speech of three children, Limber (1973) found that unreduced sentence conjunction first appeared about age 2 years 3 months and conjunction reduction at about age 2 years 9 months.

In contrast, Brown (1973) did not find any evidence to suggest that full conjoined sentences precede the deleted forms in the spontaneous speech data from Adam, Eve and Sarah. In fact, the deleted forms were observed in the children's speech before any full coordinated sentential forms.

In addition to the analyses of sentence conjunction in the spontaneous speech of children, elicited imitation studies provide a significant portion of the available data regarding conjunction reduction in child language.

Carlotta Smith (1970) found that 3 to 4 year olds imitated linguistically reduced sentences with conjoined subjects (e.g., "Sam and Harry build the house.") or conjoined objects (e.g., "Bill ate the apple and orange.") correctly in 92% of their responses. Only 5.4% of their responses to conjoined subject

models and 2.6% of their responses to conjoined object models showed serious error. However, Smith did not compare elicited imitation of unreduced conjoined sentences with her reported data for reduced conjoined sentences. In addition, the high percentage of correct imitations for reduced conjoined sentences may be partially due to the fact that these sentences were generally very short (six words with six to eight syllables) and may not have sufficiently taxed the child's immediate processing constraints (in particular short-term memory).

Slobin and Welsh (1971) investigated Echo's imitation of a number of conjoined sentences. Echo, at age 2 years 3 months, was asked to imitate a reduced conjoined structure of the following type:

2-25: The red beads and brown beads are here.

Echo frequently imitated such model sentences by supplying optionally deleted linguistic elements:

2-26: Brown beads here and a red bead here.

In addition, when she was administered unreduced (full coordinated) sentences (2-27), Echo usually did not reduce the redundant elements, but maintained a version of the full form of the sentence (2-28). Slobin and Welsh reported the following examples:

2-27: Mommy ate the candy and Mommy ate the ice cream.

2-28: Mommy eat the ice cream and Mommy eat a candy.

Imitation of conjoined sentences was also elicited by Beilin and Lust (1973). Reporting data from 13 subjects ranging in age

from 2 years 3 months to 3 years 11 months, these researchers found that when their subjects were administered sentences of the following form:

2-29: Give me the girls and give me the boys.

most imitations were of the following type:

2-30: Give me the girls and (the) boys.

These data, contrary to Slobin's, showed that when 2 and 3 year olds were presented with unreduced conjoined sentences, their imitations showed the deletion of redundant elements. Further, when these subjects were administered sentences in linguistically reduced form, they usually did not supply the redundant linguistic forms.

Lust (1974, 1977) conducted a number of elicited imitation studies which were undertaken in an effort to provide an explanation of the apparent contradiction between the Slobin and Welsh (1971) and Beilin and Lust (1973) data. These studies addressed the general issue of the developmental primacy of unreduced conjoined sentences in early child language. Lust used a generative transformational grammatical description of different types of conjunction reduction to explain the ostensible data contraction. This grammatical model was also used to construct stimuli to test the hypothesis of a correlation between the linguistic form of conjoined sentences and the nature of children's elicited imitations of these forms.

According to the formal linguistic description of conjunction reduction, it is assumed that reduced (or phrasal) coordinations are derived from their unreduced (or sentential) counterparts. Within

this model, redundant constituents are deleted and the remaining constituents are grouped together (Chomsky, 1965). Thus, Sentences 2-32 and 2-34 are derived from Sentences 2-31 and 2-33 by the deletion and grouping processes of conjunction reduction:

2-31: The red beads are here and the brown beads are here.

2-32: The red beads and the brown beads are here.

2-33: Give the girls and give me the boys.

2-34: Give me the girls and the boys.

The deletion process of the conjunction reduction schema has been further specified to include a universal deletion rule which only operates forward, that is, on noninitial conjuncts (Harries, 1973). Thus, object noun phrase coordinations are derived as in 2-35:

2-35a: Give me the girls and give me the boys.

2-35b: Give me the girls and ~~give me~~ the boys.

2-35c: Give me the girls and the boys.

Sentence 2-35a is an unreduced sentential coordination. 2-35b describes the basic forward deletion operation, where redundant elements have been deleted from the noninitial conjunct. The resulting reduced coordination (2-35c) is therefore characterized by a surface forward deletion pattern.

Reduced coordinations which are characterized by the surface appearance of initial conjunct deletion are believed to result from a more complex operation in which the universal forward deletion of redundant elements is supplemented by an additional

rearrangement of the linear order of elements. Thus, subject noun phrase coordinations are derived as in 2-36:

2-36a: The red beads are here and the brown beads are here.

2-36b: The red beads are here and the brown beads ~~are here~~.

2-36c: The red beads and the brown beads are here.

Sentence 2036a is an unreduced sentential coordination. 2-36b describes the deletion of redundant elements as constrained by the Harries model. The deletion process is supplemented by an additional regrouping process resulting in 2-36c. Although 2-36c is characterized by a backward surface deletion pattern (i.e., deletion appears to have occurred in the initial conjunct), the Harries model specified that it, in fact, results from the forward deletion operation.

Lust applied this model of conjunction deletion to her analysis of the imitation data reported by Beilin and Lust and Slobin and Welsh. She found that in the Beilin and Lust study sentences to which subjects frequently gave reduction responses were always a forward deletion pattern, e.g., "Give me the X and (give me) the Y." In contrast, in the Slobin and Welsh study, the reduced sentences which Echo imitated by adding any deleted elements were backward deletion patterns, e.g., "The red beads (are here) and the brown beads are here." Lust also noted that when Echo was presented with reduced conjoined sentences and did not add the deleted material, the model sentences were forward

deletion patterns, e.g., "The boy is eating and crying." Based upon the re-examination of the elicited imitation studies reported by Beilin and Lust and Slobin and Welsh, Lust suggested that a correlation may exist between the linguistic form of coordinate sentences and the reductive or elaborative nature of their imitation by young children.

Lust extended this hypothesis to predict that since backward reductions (such as subject noun phrase coordinations) require an additional more complex grouping process which permutes the linear order of elements, they would be attained later than coordinations with forward deletion patterns.

In a series of four studies using an elicited imitation task, 60 2 and 3 year olds, grouped by MLU, were studied by Lust to evaluate their imitations of coordinate conjunctions.[12] The linguistic forms of the conjoined sentences was varied according to conjunction structure (unreduced and reduced sentences) and according to the pattern of redundancy deletion in conjunction reduction (forward or backward patterns). The conjoined sentences which Lust presented for imitation in her first two studies were simple conjoined sentences that contained two or three grammatical relations as summarized below (see diagram on p. 64).

The results of the first two studies indicated that overall, children correctly imitated more unreduced conjoined sentences than

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[12]Only the first three studies are of direct relevance to the present investigation. Lust's fourth study investigated a specific linguistic question regarding whether deletion directionality should be considered a deep structure or surface structure effect.

Forward Deletion Patterns

Unreduced	Reduced
(SV + ⧸V):	(SV + ⧸V):
1a Babies laugh and babies cry.	1b The teddy bear walks and sleeps.
(VO + ⧸O):	(VO + ⧸O):
2a Eat ice cream and eat cookies.	2b Eat the crackers and the cake.
(SVO + ⧸VO):	(SVO + ⧸VO):
3a Daddy played baseball and Daddy sang a song.	3b Mommy cooked the dinner and ate the crackers.
(SVO + ⧸⧸O):	(SVO + ⧸⧸O):
4a Sarah likes the cats and Sarah likes the dogs	4b The Daddy ate the crackers and the ice cream.

Backward Deletion Patterns

Unreduced	Reduced
(S⧸ + SV):	(S⧸ + SV):
1a Mommies jump and babies jump.	1b The kitties and the dogs hide.
(VØ + VO):	(VØ + VO):
2a Blow bubbles and catch bubbles.	2b Push and hug the kitty cat.
(SVØ + SVO):	(SVØ + SVO):
3a Mommy cooked the lunch and baby ate the lunch.	3b The Mom fed and the Dad washed the kitty cats.
(S⧸Ø + SVO):	(S⧸Ø + SVO):
4a The bunnies eat grass and the squirrels eat grass.	4b The girl and the Mommy baked a birthday cake.

conjoined sentences which contained the optional deletion of redundant linguistic elements. Lust found that reduced coordinations with forward deletion patterns were not uniformly easier to imitate than those with backward deletion patterns. She reported that the simple (i.e., SV + ⧸V and VO + ⧸O) reduced coordinations with forward

deletion patterns (e.g., "The teddy bear walks and sleeps.") were significantly easier for the children to imitate correctly than those with backward deletion patterns (e.g., "The kitties and the dogs hide."). Further, there were no significant differences in correct imitations of both the unreduced and reduced conjoined sentences of this type when they were characterized by forward deletion patterns.[13] This was not the case with the SVO coordinations which she tested. For these constructions, Lust reported that deletion patterns of greater scope were easier, that is, double unit deletions such as SVO + SVO (e.g., "The Daddy ate the crackers and the ice cream.") were easier than single unit deletions such as SVO + SVO (e.g., "Mommy cooked the dinner and ate the crackers."), but that deletion directionality did not differentiate successful imitation of these conjoined sentences.

With regard to the children's "reductive imitations" (Lust, 1977, pp. 262-263), Lust indicated that the children preferred to reduce the redundancy of unreduced sentences when that deletion would produce a forward deletion pattern rather than a backward deletion pattern.

Lust's third study explored more complex conjoined structures--specifically those with expanded subject noun phrases (the NP now included an adjective modifier, i.e., "the big bear"). The following are examples of these unreduced and reduced structures:

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[13]It is difficult to interpret this particular finding as Lust describes unreduced versions by the directionality of deletion as well as the reduced versions. To this investigator, it is unclear as to how unreduced versions can be so described.

Forward Deletion Pattern

Unreduced	Reduced
aSV + aSV: Little bunnies run and little bunnies hop.	aSV + aSV: The happy kitty cat meows and dances.

Backward Deletion Pattern

Unreduced	Reduced
aSV + aSV: The silly clowns laugh and the happy girls laugh.	aSV + aSV: The soft kitties and the brown teddy bears sleep.

The results of this study again indicated that the unreduced conjoined sentences were easier to imitate than reduced conjoined sentences and that forward deletion patterns were easier than backward deletion patterns. However, Lust reported that the adjective structures were extremely difficult for her subjects and that the overall mean number of correct imitations for adjective nominal structures were significantly less than the mean number correct for the complex (i.e., SVO + SVO) structures.

In the discussion of her results, Lust viewed her findings as providing general support for what she describes as Slobin's "putatively cognitive perceptual universal of language development: 'it is easier to both understand and to produce sentences in which optionally deletable material appears (in surface structure) in its full form'" (1977, p. 265). It should be noted that she combined two of Slobin's predictions regarding both the comprehension and production of sentences which contain linguistic forms which can

be optionally deleted. Lust cited her subjects' "preference for sentential conjunctions (unreduced conjoined sentences) rather than phrasal conjunctions (reduced conjoined sentences)" (p. 264), as support for Slobin's predictions, but noted that ". . . the acquisition universal did not hold across grammatical manipulations of linguistic form" (p. 265). Lust concluded by suggesting that the results of her study suggest that the universal is constrained in cases where a grammatical model would predict that it would be constrained, in particular with regard to deletion directionality.

The number of studies that related linguistic reduction and the comprehension of conjoined sentences is quite limited. All of these studies employed elicited imitation as the measure of sentence comprehension. Although Slobin and Welsh (1971) assert that "studies of elicited imitation make it quite clear that imitation does work through comprehension" (p. 464), they also caution that elicited imitation must be coupled with collections and analyses of spontaneous speech. Other researchers' (including Bloom, 1974; Bloom & Lahey, 1978; Bellugi & Brown, 1963; Lackner, 1968; Prutting & Connolly, 1976; Smith, 1970) use or discusson of elicited imitation makes it rather unclear as to the effectiveness of this procedure for determining what knowledge a child has about the meaning of the adult modeled utterance. Therefore, it is questionable as to whether elicited imitation data should be viewed as a primary source of information regarding sentence comprehension.

A review of the data related to conjunction in child language from the studies of spontaneous speech reveals the following:

1. The claim that unreduced conjoined sentences appear developmentally prior to reduced conjoined sentences has not received consistent support.
2. The findings of the majority of these studies are based on general developmental analysis of a limited number of children.
3. The linguistic form of the observed conjoined sentences is generally not specified.

A consideration of the elicited imitation studies of conjoined sentences, with the exception of Lust's 1977 studies, reveals the following:

1. The data are based on an extremely limited number of children.
2. The Slobin and Welsh (1971) study varied both conjunction form (both unreduced and reduced conjoined sentences were used) and linguistic form (a variety of sentential constituents were conjoined), however these were not experimentally controlled.
3. Beilin and Lust also varied conjunction form, but they used only a single linguistic form (i.e., imperative: "Give me the X, and [give me] the Y."). In addition, the reduced versions were shorter in length than the unreduced conjoined model sentences used in this study.
4. Smith's data do not compare unreduced conjoined sentences to the reduced versions that she tested.

5. The evidence for the relative ease of comprehending conjoined sentences as compared with reduced conjoined sentences has received some support in several of these studies and is disconfirmed in others.

Lust's (1974, 1977) elicited imitation studies, which controlled for conjoined form, directionality of deletion in conjoined reduced, as well as linguistic form, provides the most persuasive evidence of an increase of sentence processing difficulty for conjoined sentences as a result of linguistic reduction. However, her results also suggest that for the sentences that she tested, the effects of linguistic reduction are sensitive to particular grammatical manipulations--specifically, deletion directionality, deletion scope and complexity of the NP.

One additional study of coordination in child language has appeared in the developmental psycholinguistic literature since the completion of the present investigation. Ardery (1979) assessed both comprehension and production of a variety of coordinate structures with 60 children ranging in age from 2.5 to 6.0 years. While Ardery did not test conjoined sentences which contained redundant elements, she did compare ease of comprehension (and production) of sentential coordinations with that of reduced coordinations. Using a toy manipulation task to assess comprehension, she asked the children to act out examples of the following conjoined sentence types:

Sentence Type	Example
1. Sentential Coordinations:	
a. transitive	a. The turtle pushed the dog and the cat kissed the horse.
b. intransitive	b. The dog ran and the cat fell.
2. Verb Coordinations:	
a. transitive	a. The tiger pushed and kissed the giraffe.
b. intransitive	b. The dog ran and fell.
3. Gapped Verb Coordinations:	
a. with particle	a. The horse jumped into the cat and the dog into the turtle.
b. without particle	b. The giraffe kissed the horse and pushed the tiger.
4. Verb Phrase Coordinations:	The dog kissed the horse and pushed the tiger.
5. Noun Phrase Coordinations:	
a. subject	a. The tiger and the turtle bumped into the dog.
b. object	b. The giraffe bumped into the tiger and the cat.
6. Gapped Object Coordinations:	The cat kissed and the turtle pushed the dog.

Guttman scale analysis (Proctor, 1970) was used to rank children according to their "mastery" of the coordinate structures tested. Ardery reported that each of the ten coordinate structures tested occurred in two or four sentences. If a test structure occurred in two sentences, two correct responses by a child was considered mastery of that structure; if a structure occurred in

four sentences, three correct responses was considered mastery of that structure. Guttman analysis provides a tabuler scaling of test constructions from least difficult to most difficult, and a mean age for mastery of each structure as well as all structures higher on the table. It also shows the total percentage of children who correctly comprehended each of the coordinate structures. The results of this analysis are presented below:

Guttman scaling of coordinate structures	Mean age in each Guttman category	Percentage comprehending each coordinate structure
Intransitive verb	3;11	100
Object noun phrase	4;0	99
Sentential intransitive	4;3	97
Verb phrase	4;5	95
Subject noun phrase	4;9	75
Sentential transitive	5;0	67
Gapped verb (with particle)	5;0	42
Transitive verb	5;2	24
Gapped verb (no particle)	5;7	10
Gapped object	5;9	4

This analysis revealed that intransitive verb, object noun phrase, sentential intransitive and verb phrase coordinations were the easiest of those tested for the children to correctly enact. Further statistical manipulations also revealed that there was no significant discrimination among the four easiest structures, but there was a high discrimination among the six most difficult structures tested as well as between any of the six most difficult and any one of the

four easiest. As can be seen from inspection of the results of this analysis, the mean ages of children correctly comprehending each construction increases as the constructions increase in difficulty. Notable in these results was the finding that certain sentential coordinations were more difficult for children to understand than a number of reduced coordinations.

In her second experiment, Ardery also employed a toy manipulation task to assess the production of the same set of coordinate structures. The same children were asked to describe the actions of the toys which the experimenter manipulated as indicated in the test sentences. She reported that intransitive verb, object noun phrase, sentential intransitive, and verb phrase coordinations were produced with extremely high frequency; where reduction was possible, children only rarely produced a coordination of two full sentences with no reduction. No gapped verb coordinations or gapped object coordinations were produced. Ardery reported that instead, children overwhelmingly produced coordinations of two full sentences with no reduction.

In comparing her results from the comprehension and production experiments, Ardery reported that coordinate structures which were determined by the Guttman scaling to be relatively difficult for children to comprehend were produced only rarely, if at all. She noted that children chose to produce paraphrases which were structurally simpler. She did find, however, that sentential transitive coordinations were produced more often than they were correctly comprehended.

Many of Ardery's findings are not consistent with those reported by Lust. As was indicated previously, the unreduced conjoined structures tested by Lust, using an elicited imitation procedure, included those which contained redundant linguistic elements while Ardery's sentential coordinations did not. However, it is notable that Ardery did not find sentential coordinations to be consistently easier for her subjects to process than reduced coordinations. Further, Ardery reported that certain reduced conjoined sentences with forward deletion patterns were more difficult for her subjects to understand than were those with backward deletion patterns (verb gapped coordinations and subject noun phrase coordinations respectively).

This most recent investigation into coordination in child language suggests that Lust's predictions regarding the effects of linguistic reduction on conjoined sentence comprehension which were based on a theoretical linguistic model, and appeared to be supported by her elicited imitation study, may not be generalizable to all conjoined sentences.

In summary, there still remain many unresolved issues with regard to the effects of linguistic reduction on conjoined sentence comprehension in young children. The paucity of experimental task variation in the study of conjunction reduction and comprehension points to a need for additional study of the effects of linguistic reduction on the comprehension of complex, conjoined sentences. Further, recent studies of linguistic reduction suggest that it remains an empirical question as to the impact of the deletion of redundant linguistic elements on young children's comprehension

of a wide variety of complex stence types. Most specifically, to date there has been no systematic study of the relative difficulty of comprehending unreduced conjoined sentences which contain a variety of different redundant elements as compared with their reduced versions.

Summary

The literature in developmental and adult psycholinguistics provides evidence that the reduction of linguistic information from the superficial structure of certain complex sentences increases the comprehension difficulty of those sentences. For adults, that generally results in an increase in processing time. Children often misunderstand such sentences. Since the acquisition of adult linguistic competence is largely dependent on the child's abilities to comprehend the sentences he hears, it is particularly important to specify the factors that contribute to sentence processing difficulty. Those linguistic structures that are difficult to comprehend may be just those aspects of the child's grammar that will be acquired late.

While syntactic complexity affects sentence processing, studies of children's language point to other, extrasyntactic factors that also influence sentence comprehension. Children appear to be sensitive to a variety of semantic cues as they attempt to assign meaning to the sentences they hear in their linguistic environment. When semantic constraints are absent (or perhaps beyond the cognitive capabilities of the listener) children may adopt comprehension strategies by which underlying grammatical

relations are assigned on the basis of the superficial arrangement of the lexical components of a sentence. The different comprehension strategies that children employ change developmentally; however, there is also evidence to support the notion that some of these strategies are not necessarily mutually exclusive.

On the basis of the developmental data reviewed in this chapter regarding conjunction in child language, it would appear that further empirical study of a variety of optionally deletable, complex conjoined sentences is needed to determine the universality of the effects of grammatical reduction on sentence processing in young children.

The Present Research

The present study was designed to examine the young normal child's comprehension of complex, conjoined sentences. The goals of this research are threefold:

1. to determine whether conjoined sentences which contain optionally deletable linguistic material are easier to understand when that material appears in its full form than when those redundant linguistic elements have been deleted;
2. to identify the comprehension strategies used by children to understand these sentences; and
3. to identify the extrasyntactic factors which may affect the strategies used by children to understand these sentences.

This study was a specific focus for the more general investigation of a proposed linguistic performance universal related to an operating principle proposed by Slobin (1973).

The operating principle states: "Underlying semantic relations should be marked overtly and clearly" (p. 203). The related developmental universal of sentence comprehension specifies that: "It is easier to understand a complex sentence in which optionally deletable material appears in its full form" (p. 203). A variety of conjoined sentence types were chosen for study in which the optional reduction of redundant linguistic elements provides for a comparison of comprehension difficulty when syntactic elements are deleted.

Understanding complex conjoined sentences was tested with regard to the influence of extrasyntactic factors--by means of manipulating the semantic contexts of the test sentences--as well as the influence of linguistic form. This was motivated by the abundant evidence from studies of child language comprehension for the influence of nonlinguistic variables on young children's efforts to understand spoken sentences.

Chapter III

METHODS AND PROCEDURES

Introduction

This study was designed to assess the influence of syntactic and extrasyntactic factors on young children's comprehension of complex conjoined sentences. A toy manipulation task was used to test the children's comprehension of six different conjoined sentence types which contained optionally deletable linguistic elements. All test sentences were presented in three different semantic contexts.

This chapter will present a description of the experimental stimuli and materials which were used in this study. Following is the description of pilot testing and pretest screening in addition to subject selection. The next section will detail the experimental procedures used in this study.

Experimental Stimuli and Materials

Linguistic Constructions

Six different complex sentence types were chosen for examination in this study. These consisted of conjoined sentences in which redundant linguistic elements were optionally deletable. When optionally reduced, these conjoined sentences contained: (1) conjoined subject noun phrases; (2) conjoined object noun

phrases; (3) conjoined verb phrases; (4) verb gapping; (5) conjoined noun phrases and verb phrases; and (6) conjoined objects of prepositional phrases. Table 1 provides examples of the six conjoined sentence types in both syntactically unreduced and optionally reduced versions.[1] Three examples of each of the six sentence types were constructed in both their unreduced and optionally reduced forms. Thus, there were a total of 36 test sentences, 18 reduced and 18 unreduced.

Two matched sets of test sentences were prepared so that each subject heard only one version of each test sentences. The unreduced and reduced versions of each sentence were counterbalanced across the two material sets. All sentences used in this study are listed in Appendix A.

Unreduced and reduced versions of the test sentences were equated for syllable length. This was accomplished by adding adjectives and functors, such as articles, to the reduced versions of the test sentences. For example, Sentence Type 1, conjoined subject noun phrase:

Unreduced version: Jim jumps over the brush and Sue jumps over the brush.

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[1] If in the ensuing analysis significant differences in performance are found between the unreduced and reduced versions of each sentence type, it would be necessary to analyze the six sentence types as actually being 12 different sentence types--six unreduced conjoined sentence types and six optionally reduced conjoined sentence types. If, however, there are no significant differences between unreduced and reduced versions of each type, then the six levels of the sentence type variable would be maintained for all subsequent analyses. In the event that significant differences between unreduced and reduced versions within sentence types are found for selected sentence types, then we will further explore the relations which are operating within those sentence types.

Table 1

Examples of Unreduced and Reduced Versions of Test Sentence Types[a]

Conjoined sentence type	Unreduced	Reduced
1	Dad sits on the towel and Jim sits on the towel.	Daddy and Jim sit on the pretty yellow towel.
2	Sue pushes the towel and Sue pushes the comb.	Sue pushes the yellow towel and the blue comb.
3	Mommy can sit and Mommy can jump.	The pretty Mommy can sit and jump.
4	Jim steps on the brush and Daddy steps on the towel.	Jim steps on the small blue brush and Daddy the towel.
5	Daddy kisses Sue and Mommy kisses Jim.	The Daddy and the Mommy kiss Sue and Jim.
6	Mom puts the towel on the brush and Mom puts the towel on the comb.	The Mommy puts the pretty towel on the blue brush and the blue comb.

[a]Sentence Type 1 = Conjoined subject noun phrase; 2 = Conjoined object noun phrase; 3 = Conjoined verb phrase; 4 = Gapped verb; 5 = Conjoined noun phrase and verb phrase; 6 = Conjoined objects of prepositional phrases.

Reduced version: Happy Jim and happy Sue jump over the blue brush.

All adjectives which were added were redundant with respect to the description of the toys in each semantic context, e.g., in the group of toys presented for the above sentences, there was only one (blue) brush and only one boy doll. The addition of adjectives did not, therefore, require the listener to use the modifiers to discriminate among similar toys in the nonlinguistic context.

Semantic Contexts

To test the influence of extralinguistic factors in processing unreduced and reduced conjoined sentences, the test sentences were presented in three different semantic contexts:

Semantic Context 1: "The Family"--sentences in this context describe the actions of a mother, father, daughter and son.

Semantic Context 2: "The Farm"--sentences in this context describe farm animals and their activities.

Semantic Context 3: "Unrelated Inanimate Objects" --sentences in this context describe a variety of common objects which are not usually grouped together.

In an effort to avoid facilitating the use of specific pragmatic comprehension strategies, the sentences for each context were constructed so that relationships between the objects which might be predictable (on the basis of past experience) were not exploited. Sentences in the "farm" set, for example, which

contained the lexical items "chick," "cat," and "food" were constructed so that neither the "chick" nor "cat" "eat the food," but rather "the chick and the cat sit on the food."

Each semantic context consisted of 12 test sentences--one example of each of the six conjoined sentence types in both unreduced and reduced versions.

The order of presentation of the three semantic contexts (i.e., "the family," "the farm," and "unrelated inanimate objects") was randomized with the restriction that within each age group of 10 children each semantic set appeared at least once in first and last test positions. The remaining two semantic contexts were randomly presented. The 12 test sentences within each semantic context were randomly ordered before each presentation.

Each subject, then, heard 36 sentences: 12 "farm" sentences--six unreduced and six reduced; 12 "family" sentences--six unreduced and six reduced; and 12 "unrelated inanimate object" sentences--six unreduced and six reduced.

Toy Materials

To enable subjects to act out all test sentences, the materials for this study consisted of familiar toy people, animals and objects. A different group of toys was provided for each semantic context. The toys for each context were proportionally sacled in size to one another. For example, in the "family" context, the mother doll was taller than the boy doll and a comb was appropriately smaller than the toy people. Appendix B lists the toys used for each semantic context.

Pilot Study

A pilot study was conducted to pretest the experimental task and materials and to ascertain the youngest age at which a child could perform the task. Performance on the pilot study indicated that children younger than 3 years of age could not adequately perform the task of acting out conjoined sentences with toys. In addition, pilot testing revealed that a majority of the children, regardless of age, tended to play with the toys provided for the test sentences before they heard each sentence. Therefore, it was necessary to cover the toys with a clear lucite dome so that the children could see the toys, but would be unable to manipulate them until the experimenter removed the dome. Several toys were changed for the actual experiment when it became apparent that they were too small and/or fragile for the children to handle easily. This necessitated some vocabulary changes in the test sentences, but did not require that any of the test constructions be deleted or altered.

Due to the changes in the procedure and materials for the actual study, no pilot subjects were used in the experiment.

Subject Selection

Pretest Screening

The receptive portion of the Northwest Syntax Screening Test (NSST) was administered individually to all potential subjects prior to the presentation of any test stimuli. This standardized test was developed by Laura Lee (1969) and designed to identify

any children whose receptive language skills might be delayed. All children who participated in this study received scores on this instrument that indicated appropriate language comprehension performance for their age.

Subjects

The subjects were 40 children ranging in age from 3.0 to 4.11 years: 10 aged 3.0-3.5, 10 aged 3.6-3.11, 10 aged 4.0-4.5, and 10 aged 4.6-4.11. The subjects attended nursery schools and nursery school day camps in the Queens, New York area. The facilities used for testing included Pomonok Nursery School, Midland-Hillcrest Nursery School and Camp, and Bayside Day Camp. The 22 male and 18 female children were predominantly from middle class backgrounds, and all subjects were native English speakers. Subjects were selected whose school records and reports from teachers indicated overall normal development, and who showed no language, speech or hearing handicaps.

Experimental Procedure

The children in each age group were randomly assigned to one of two presentation groups. Each subject tested individually for a period of approximately 30 minutes of two successive days. In each test center, the experimenter was seated across a table from the child in a small, quiet room. After the administration of the receptive portion of the NSST, the child was given a short break. The experimenter then presented the toys for the first set of test sentences which the child was asked to identify. Once

assured that the child was familiar with all the stimuli, the experimenter said: "I would like you to help me act out some stories about these toys. I will read you a little story about some of these toys and I want you to show me what the story says."

The experimenter then removed all toys except those to be used in the first practice sentence. A clear lucite dome was placed over the toys so the child could not manipulate them before he heard the entire sentence: "Now listen carefully. I will read you the story two times. Then I will take this cover off the toys and you show me what the story says." If the child correctly acted out the first practice sentence, a second practice sentence was read about different toys in the semantic set. Practice sentences were discontinued as soon as the child demonstrated his ability to understand and perform the task.[2] The child was then presented with the test sentences for the first semantic set.

On the second day the task was reviewed with the child and the toys for the semantic set to be tested were presented to the child for identification. At least one practice sentence was presented to the child for the first semantic set to be tested that day. Upon completion of the first set, the child was given a short break. The final set of test sentences was presented in a similar manner to the first two.

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[2]Any child who could not perform the experimental task after several practice sentences and repeated explanation of the task was dropped from the study. Three children, one in the 3.6-3.11 age group and two in the 4.0-4.5 age group, were dropped after task training because they were unable to act out the sentences which were read to them.

After testing, the child was praised, thanked and returned to the classroom. At the completion of testing at each test center, the experimenter provided an ice cream party for all children, regardless of their participation in the study.

Experiment Observer

A trained observer[3] was present during all test sessions. The observer was seated a short distance from the experimenter with an unobstructed view of all test activity. It was the observer's responsibility to record (in narrative form) each child's verbal and nonverbal responses to the test stimuli. Appendix C presents the data sheet used by the observer.

At the conclusion of each test session, the experimenter and observer reviewed the data sheets to be certain that all of the child's responses and comments during testing were accurately recorded.

Scoring

Each of the 40 subjects heard three examples of each of the six conjoined sentence types in both linguistically unreduced and reduced forms. This provided 1440 sentences for analysis.

A sentence was scored as correct if all its grammatical relations were appropriately acted out. The order in which the

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[3]This observer was a senior level student in the Communicative Disorders Program at Queens College (The City University of New York). She was familiar with data collection, and was specifically instructed prior to and during the pilot testing of this experiment how to score correct and incorrect responses to the test stimuli and other relevant information.

subjects acted out the clauses in each sentence was noted but a sentence was not scored as incorrect if the order of mention did not match the order of action. Sentences were scored as incorrect if the subject: (1) did not demonstrate all of the grammatical relations in each test sentences, or (2) incorrectly acted out any of the grammatical relations, e.g., made the object of the sentence the actor, demonstrated the wrong verb, etc.

Quantitative and qualitative analyses were performed on the data. The design and results of these analyses are presented next in Chapter Four.

Chapter IV

RESULTS

The results of this study will be presented in two major sections: (1) a quantitative analysis, in which all statistical procedures will be presented; and (2) a qualitative analysis in which the results of an analysis of the error responses will be presented. In the quantitative results section, the findings regarding the effects of syntactic variables will be followed by a report of the findings related to the effects of nonsyntactic variables on the subjects' enactments of complex conjoined sentences. Error responses on the unreduced and reduced conjoined sentences will be reported and classified according to the types of syntactic and extrasyntactic strategies employed by the subjects to interpret these constructions.

The Effects of Syntactic Variables on Correct Enactments of Conjoined Sentences

The conjoined sentence data were analyzed with a 4 x 6 x 3 x 2 (age x sentence type x context x reduction) analysis of variance[1] with repeated measures on the last three factors. The age factor

[1]The conjoined sentence data were initially analyzed with a 4 x 2 x 2 (age x material sets x reduction) analysis of variance. No significant difference was found for the material sets factor which represented the counterbalanced stimuli. Therefore, the data for all subjects within an age group were pooled for the subsequent analyses.

was defined by four levels: Age I (3.0-3.5 years), Age II (3.6-3.11 years), Age III (4.0-4.5 years), and Age IV (4.6-4.11 years). The sentence type factor was defined by six levels: (1) conjoined subject noun phrase, (2) conjoined object noun phrase, (3) conjoined verb phrase, (4) gapped verb, (5) conjoined noun phrase and verb phrase, and (6) conjoined objects of prepositional phrases.[2] The context factor was defined by three levels: family, farm and inanimate. The reduction factor was defined by two levels: unreduced and reduced. The group means and standard deviations are presented in Appendix D. A summary of the results for the main effects and interactions is presented in Table 2.

A significant main effect was found for the age factor--$F(3,36) = 6.929$, $p < .001$ (Table 3). Inspection of the means for each age group reveals a general trend of improved performance with an increase in age. This trend is consistent across each successive age group. Multiple means comparison tests showed the Age I group mean to be significantly lower than the means for Age Groups III and IV ($p < .05$).[3] No other statistically significant differences were found for the main effect of age.

The main effect of reduction was not statistically significant. That is, when average across age, sentence type and

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[2]To facilitate the readability of the results, the six levels of the sentence type factor will be referred to hereafter by sentence type number, i.e., 1 = conjoined subject noun phrase, 2 = conjoined object noun phrase, 3 = conjoined verb phrase, 4 = gapped verb, 5 = conjoined noun phrase and verb phrase, 6 = conjoined objects of prepositional phrases.

[3]Unless otherwise indicated, all post hoc means comparisons were conducted using Scheffé procedures.

Table 2

Summary Table for the Age x Context x Sentence Type x Reduction Analysis of Variance

Source of variance	SS	df	MS	F	p	Percent of total variance	Percent of explained variance
Age	9.474	3	3.158	6.929	.001***	3.32	10.18
Context	11.754	2	5.877	28.656	.001***	4.11	12.60
Sentence type	32.473	5	6.495	42.549	.001***	11.36	34.83
Reduction	0.584	1	0.584	3.430	.073	0.20	0.61
Age x Context	0.757	6	0.126	0.615	.500	0.26	0.80
Age x Sentence type	4.080	15	0.272	1.782	.041*	1.43	4.38
Age x Reduction	0.424	3	0.141	0.831	.486	0.15	0.46
Context x Sentence type	18.029	10	1.803	14.853	.001***	6.31	19.34
Context x Reduction	1.060	2	0.530	2.678	.076	0.37	1.13
Sentence type x Reduction	2.995	5	0.599	4.416	.001***	1.05	3.22
Age x Context x Sentence Type	5.326	30	0.178	1.463	.059	1.86	5.70
Age x Context x Reduction	1.060	2	0.530	2.678	.076	0.34	1.04
Age x Sentence type x Reduction	1.280	15	0.085	0.629	.500	0.45	1.38
Context x Sentence type x Reduction	1.024	10	0.102	0.812	.500	0.36	1.10
Age x Context x Sentence type x Reduction	3.010	30	0.100	0.796	.500	1.05	3.22
Total						32.62	100.00

*$p < .05$ **$p < .01$ ***$p < .001$

Table 3

Mean Percentage of Correct Responses by Age, Reduction, and Sentence Type[a,b,c]

Age			
I	II	III	IV
(3.0-3.5 yrs)	(3.6-3.11 yrs)	(4.0-4.5 yrs)	(4.6-4.11 yrs)
60.8	70.8	76.1	83.1

[a] $\underline{n}$ = 10 per age group. Each subject heard 36 sentences

Reduction	
Unreduced	Reduced
74.7	70.7

[b] $\underline{n}$ = 40. Each subject heard 18 unreduced and 18 reduced sentences.

Sentence type					
Conjoined subject NP[d]	Conjoined object NP	Conjoined VP	Gapped verb	Conjoined NP and VP	Conjoined objects of PP
1	2	3	4	5	6
92.1	82.9	87.1	54.2	60.0	60.0

[c] $\underline{n}$ = 40. Each subject heard six examples of each sentence type.

[d] NP = noun phrase, VP = verb phrase, PP = prepositional phrase.

context, no significant differences were found for the unreduced and reduced levels of the reduction variable.

Although the overall age x reduction interaction was not statistically significant, an examination of the groups means for each condition (Table 4), suggest that within each age group, scores on unreduced sentences were generally higher than scores on reduced sentences. Age I showed a slight inversion of this pattern. There were, however, no statistically significant differences within any of the four age groups for the two levels of the reduction variable. Within the unreduced condition, there were no significant differences in scores across any two successive age groups. However, significant differences in performance were found between Ages I and III ($p < .05$) and Ages I and IV ($p < .05$). Within the reduced condition, Age I scores were significantly lower than those of Age IV ($p < .05$). No significant differences in performance were found between any two successive age groups within the reduced condition.

In the presentation of the results concerning the sentence type factor, the first consideration will be the important reduction x type interaction (see Chapter Three). The significant reduction x type interaction--$F(5,180) = 4.416$, $p < .001$--is presented in Table 5 and Figure 1. A means test comparison for the unreduced versions and reduced versions within each sentence type indicated no significant differences between these versions for Sentence Types 1, 2, 3, and 6. Within Sentence Types 4 and 5, however, scores for the reduced versions were significantly lower than for the

Table 4

Mean Percentage of Correct Responses
by Age and Reduction[a]

Age	Reduction	
	Unreduced	Reduced
I	60.0	61.7
II	73.9	67.8
III	78.3	73.9
IV	86.7	79.4

[a] $\underline{n}$ = 10 per age group. Each subject heard 18 sentences for each level of reduction.

Table 5

Mean Percentage of Correct Responses
by Reduction and Type[a]

Sentence type	Reduction	
	Unreduced	Reduced
1	95.0	89.2
2	84.2	81.7
3	85.0	89.2
4	64.2	44.2
5	64.2	55.8
6	55.8	64.2

[a] $\underline{n}$ = 40. Each subject heard three examples of each sentence type for each level of reduction.

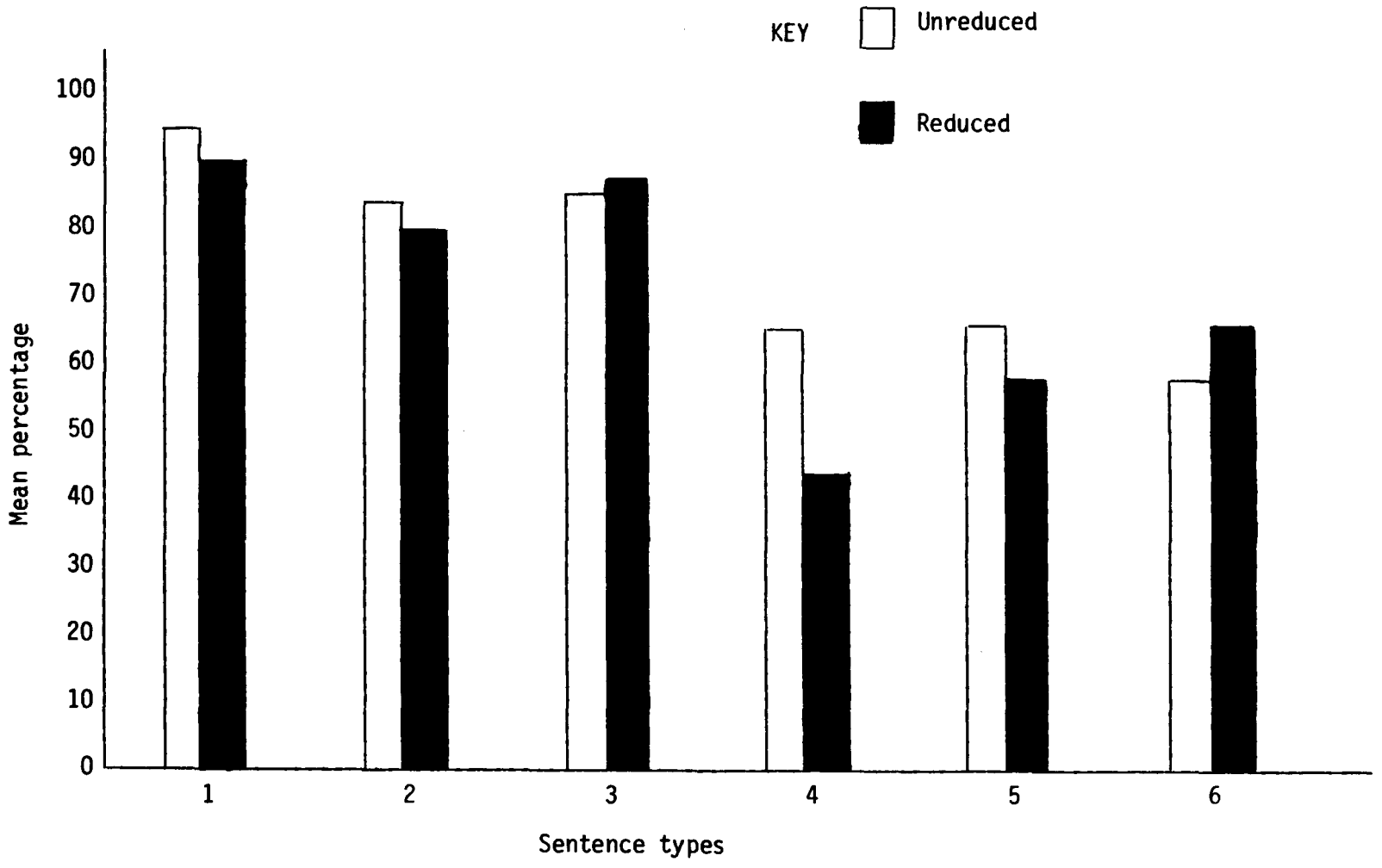

Figure 1. Conjoined Sentence Type Performance by Reduction

unreduced versions ($p < .05$).[4]

When the means for each sentence type were inspected within the unreduced condition, scores for Sentence Type 1 were found to be significantly higher than those for Sentence Types 4, 5, 6 ($p < .05$). However, scores for Sentence Type 1 were not significantly different from the scores for Sentence Types 2 and 3. Scores for Sentence Type 6 were significantly lower than those for Sentence Types 1, 2 and 3 ($p < .05$), but not significantly different from the scores for Sentence Types 4 and 5. There were no significant differences between the scores for Sentence Types 2, 3, 4, and 5 within the unreduced condition.

When the means for each sentence type are examined within the reduced condition, the scores for Sentence Types 4 and 5 are both significantly lower than for Sentence Types 1, 2 and 3 ($p < .05$) but not significantly different from Sentence Type 6. Further, performance levels for Sentence Types 4 and 5 are not

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[4]As was noted previously in Chapter Three, p. 78, if significant differences were found between unreduced and reduced versions of the sentences comprising each sentence type, further differentiation of each sentence type would be considered. The results reported above suggest only eight levels of the sentence type variable: Sentence Types 1, 2, 3, and 6, and unreduced versions of 4, reduced versions of 4, unreduced versions of 5, and reduced versions of 5. Since the latter four levels are qualitatively different from the first four (and comprise only two of the sentence types), we will pool the unreduced and reduced scores for each sentence type, resulting in the original six levels. This will facilitate comparisons among the sentence types, while slighlty increasing the error associated with these comparisons. It is felt that this slight increase in error will be more than offset by the gain in the analysis and interpretability of the data. However, in those instances where differences occur concerning Sentence Types 4 and 5, they will be further analyzed with regard to possible differential effects of reduction.

significantly different from each other. In addition, within the reduced condition, performance levels for Sentence Types 1, 2, 3, and 6 are not significantly different from each other.

A significant main effect was found for the sentence type factor--$F(5,180) = 42.549$, $p < .001$ (Table 3). Statistical comparisons showed that scores for Sentence Types 1, 2, and 3 observed across age, context, and reduction are not significantly different from each other. Similarly, scores for Sentence Types 4, 5, and 6 are not significantly different from each other. However, scores for Sentence Types 1, 2 and 3 are each significantly higher than those for any one of Sentence Types 4, 5 and 6 ($p < .05$), suggesting a cluster effect.

The age x type interaction was significant--$F(15,180) = 1.782$, $p < .05$ (Table 6). To determine the relation between the age and sentence type variables, the data were first examined with regard to the effects of sentence type on the performance levels within each age group. Within Age I, the overall clustering of Sentence Types 1, 2, 3 and 4, 5, 6 described above was statistically significant ($p < .05$). That is, Sentence Types 1, 2 and 3 were not significantly different from each other, and Sentence Types 4, 5 and 6 were not statistically different from each other. However, performance levels for any one of Sentence Types 1, 2 and 3 were significantly higher than for any one observed for Sentence Types 4, 5 or 6 ($p < .05$). This interaction was statistically significant only for Age I. However, a similar clustering effect, i.e., (1, 2, 3) > (4, 5, 6) held true for all age groups. It is also of interest to note that, although the performance levels

Table 6

Mean Percentage of Correct Responses by Age and Type[a]

	Sentence type					
Age	1	2	3	4	5	6
I	86.7	80.0	80.0	35.0	38.3	45.0
II	90.0	85.0	85.0	53.3	61.7	50.0
III	93.3	83.3	90.0	60.0	63.3	66.7
IV	98.3	83.3	93.3	68.3	76.7	78.3

[a] $\underline{n}$ = 10 per age group. Each subject heard six examples of each sentence type.

for 1, 2 and 3 differ (i.e., they are generally higher) from 4, 5 and 6 for all age groups, a decrease in the magnitude of the difference between the performance levels of these two clusters can be observed for successive age groups (see Figure 2).

Looking at the different levels of the sentence type variable across age, a general pattern of improved performance emerges with an increase in age for each sentence type. Means comparison tests revealed no statistically significant differences in scores for any sentence type across different age groups. However, inspection of Figure 2 indicates that the average rate of improvement across age is greater for Sentence Types 4, 5 and 6 (viewed as a group) as compared with Sentence Types 1, 2 and 3 (viewed as a group).

Since the reduction x type interaction established that scores for the reduced versions of Sentence Types 4 and 5 were significantly lower than for the unreduced versions of these sentence types, the age x type x reduction interaction (although not statistically significant overall) was examined to determine if this reduction effect (i.e., reduced < unreduced within Sentence Types 4 and 5) held true across age. This effect for Sentence Type 4 was observed at each age but was most pronounced at Age IV. Although not statistically significant, the largest difference between scores for unreduced and reduced versions of Sentence Type 4 was apparent at Age IV. Further, performance on the reduced versions of Sentence Type 4 was notably lower for Age IV than the reduced scores for any other sentence type at that age.

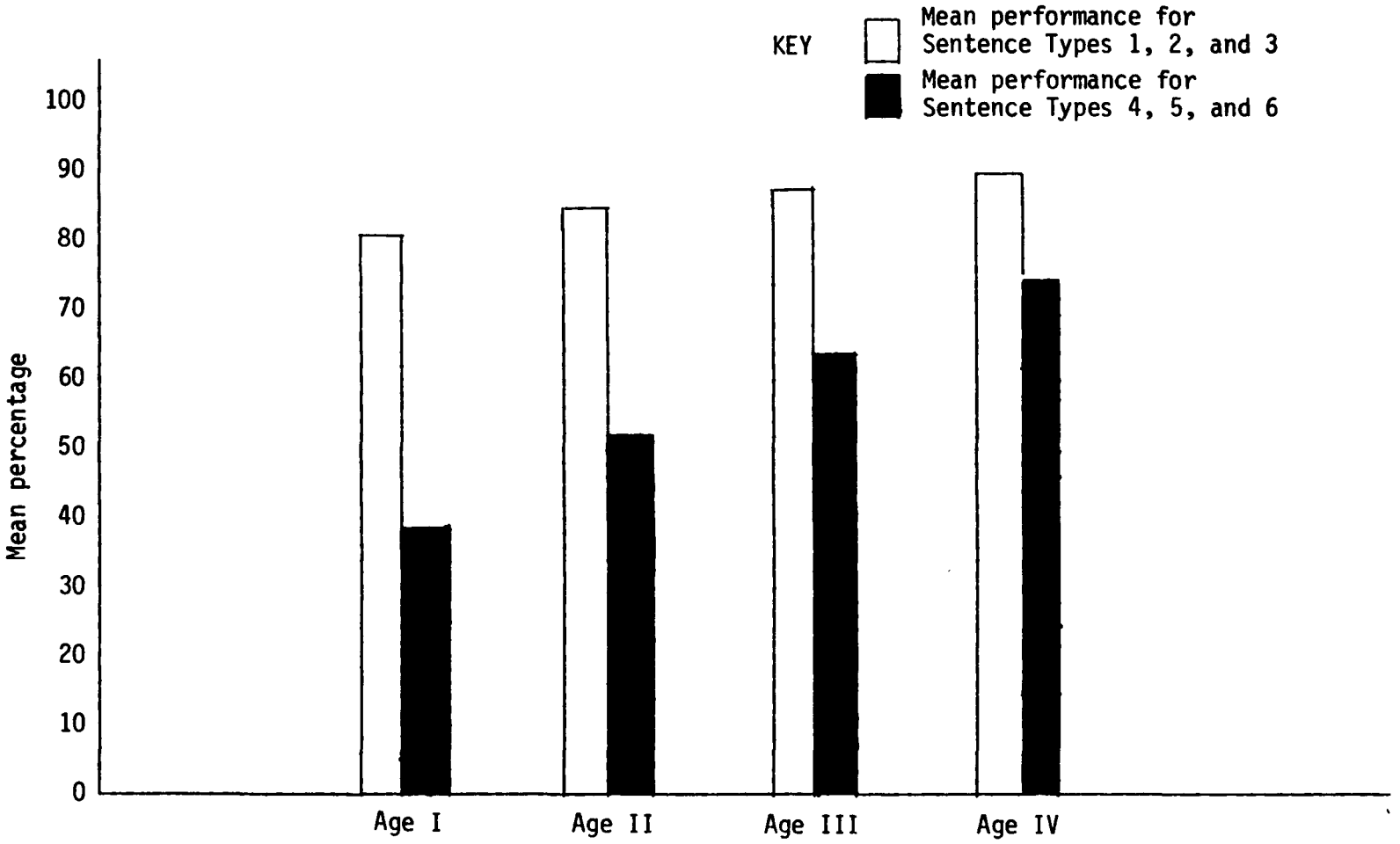

Figure 2. Performance for Conjoined Sentence Types 1, 2, and 3 as Compared with Performance for Conjoined Sentence Types 4, 5, and 6

For Sentence Type 5, differences between unreduced and reduced versions were observed at each age. These differences were more apparent for Ages III and IV. However, even at Ages III and IV, the magnitude of difference between performance levels for unreduced and reduced versions of Sentence Type 5 was not as great as those differences found for Sentence Type 4.

Following is a brief summary of the results presented thus far:

(1) There was a general trend of improved performance from Age I (3.0-3.5 years) to Age IV (4.6-4.11 years), with significant differences in performance between Age I and both Ages III and IV.

(2) The main effect of reduction was not significant, but within Age Groups II, III and IV scores on the unreduced sentences were generally higher than scores on the reduced sentences. This was not the case for Age I, in which performance levels were higher for reduced sentences. Further, within the unreduced condition, significant differences in performance were found between Age I and both Ages III and IV. Within the reduced condition, only the performance of Age IV was significantly higher than the performance of Age I.

(3) Performance levels for Sentence Types 1, 2 and 3 (sentences with conjoined subject noun phrases, conjoined object noun phrases, and conjoined verb phrases) were significantly higher than performance levels for Sentence Types 4, 5 and 6 (sentences with gapped verbs, conjoined noun phrases and verb

phrases, and conjoined objects of prepositional phrases). This cluster effect, (1, 2, 3) > (4, 5, 6), was observed for all age groups, but was found to be statistically significant only for Age Group I. A general pattern of improved performance emerged as age increased across all sentence types. However, the rate of improvement was greater for the group consisting of Sentence Types 4, 5 and 6, as compared with the group consisting of Sentence Types 1, 2 and 3.

(4) Although the overall effect of reduction was not significant, it did differentially interact with conjoined sentence type. Specifically, performance levels for reduced versions of Sentence Types 4 and 5 (sentences with gapped verbs and sentences with conjoined noun phrases and verb phrases) were significantly lower than the performance levels for unreduced versions of those conjoined sentence types. This reduction effect held true across all ages for Sentence Types 4 and 5, although the magnitude of difference between the performance levels for unreduced and reduced versions of Sentence Type 5 was not as great as those differences found for Sentence Type 4.

The Effects of Nonsyntactic Variables on Correct Enactments of Conjoined Sentences

The main effect for the context variable was statistically significant--$F(2,72) = 28.656$, $p < .001$ (Table 7). An inspection of the means for each context suggests that overall, performance levels were higher for sentences in the family context than in both the farm and inanimate contexts, and that performance levels in the

Table 7

Mean Percentage of Context Responses by Context[a]

Context		
Family	Farm	Inanimate
85.2	68.7	64.2

[a] $\underline{n} = 40$. Each subject heard 12 sentences in each context.

farm were generally higher than in the inanimate context. Means comparisons indicated that when averaged across age, sentence type and reduction, performance levels were significantly higher when the test sentences were presented in the family context than when they were presented in the farm or inanimate contexts ($p < .05$). No significant differences were found in performance levels for sentences presented in either the farm or inanimate contexts (i.e., family > farm/inanimate).

Although the age x context interaction was not statistically significant, it is of interest to note that when scores within each context are compared across age, a general pattern emerges in which performance levels within the family and farm contexts improve with an increase in age. This pattern is not apparent within the inanimate context, where an inversion in performance levels between Age Groups II and III was found. That is, Age II scores are higher than Age III scores within the inanimate context. When performance levels are compared within each age group, a general trend is observed in which scores are higher in the family context than in both the farm and inanimate contexts. Generally, scores in the farm context are slightly higher than in the inanimate context. However, in Age Group II, this hierarchy is altered so that scores in the family context remain higher than scores in the farm and inanimate contexts, but the inanimate scores are higher than the farm scores. Therefore, by examining performances within each context (and across age) as well as within each age group (and across contexts), it is noted that the Age II inanimate score is higher than expected.

One of the findings of most interest in this study was the significant interaction between the type and context factors--$F(10,360) = 14.853$, $p < .001$ (Table 8, Figure 3). An analysis of the performance levels within each sentence type (across the three contexts) reveals that for Sentence Types 4 and 5, scores in the family context were significantly higher than scores for the farm and inanimate contexts ($p < .05$). There were no significant differences between the scores in the farm and inanimate contexts for these sentence types. Comparison of means across the three contexts for Sentence Type 6 indicates that performance levels in the family are not significantly different from those in the farm and inanimate contexts, but that performances in the farm are significantly higher than in the inanimate context ($p < .05$). These results suggest particularly high performance levels in the farm context for Sentence Type 6. For Sentence Types 1 and 2, performance levels in the family context are also higher than in the farm or inanimate contexts, but these differences are not statistically significant. In addition, the performances within the farm and inanimate contexts are not significantly different from each other for Sentence Types 1 and 2. Statistical comparisons across contexts for Sentence Type 3 indicate essentially the same performance levels within all three presentation contexts.

As described above, explanation of the overall ordering of context difficulty (i.e., family > farm/inanimate) is most strongly provided by the performance for Sentence Types 4 and 5. Examination of the context x type x age interaction (which was not statistically significant) shows that within each age group

Table 8

Mean Percentage of Correct Responses
by Type and Context[a]

Sentence type	Context		
	Family	Farm	Inanimate
1	98.7	97.5	80.0
2	98.7	73.7	76.2
3	85.0	85.0	91.2
4	80.0	33.7	48.7
5	86.2	42.5	51.2
6	62.5	80.0	37.5

[a] $\underline{n} = 40$. Each subject heard two examples of each sentence type in each context.

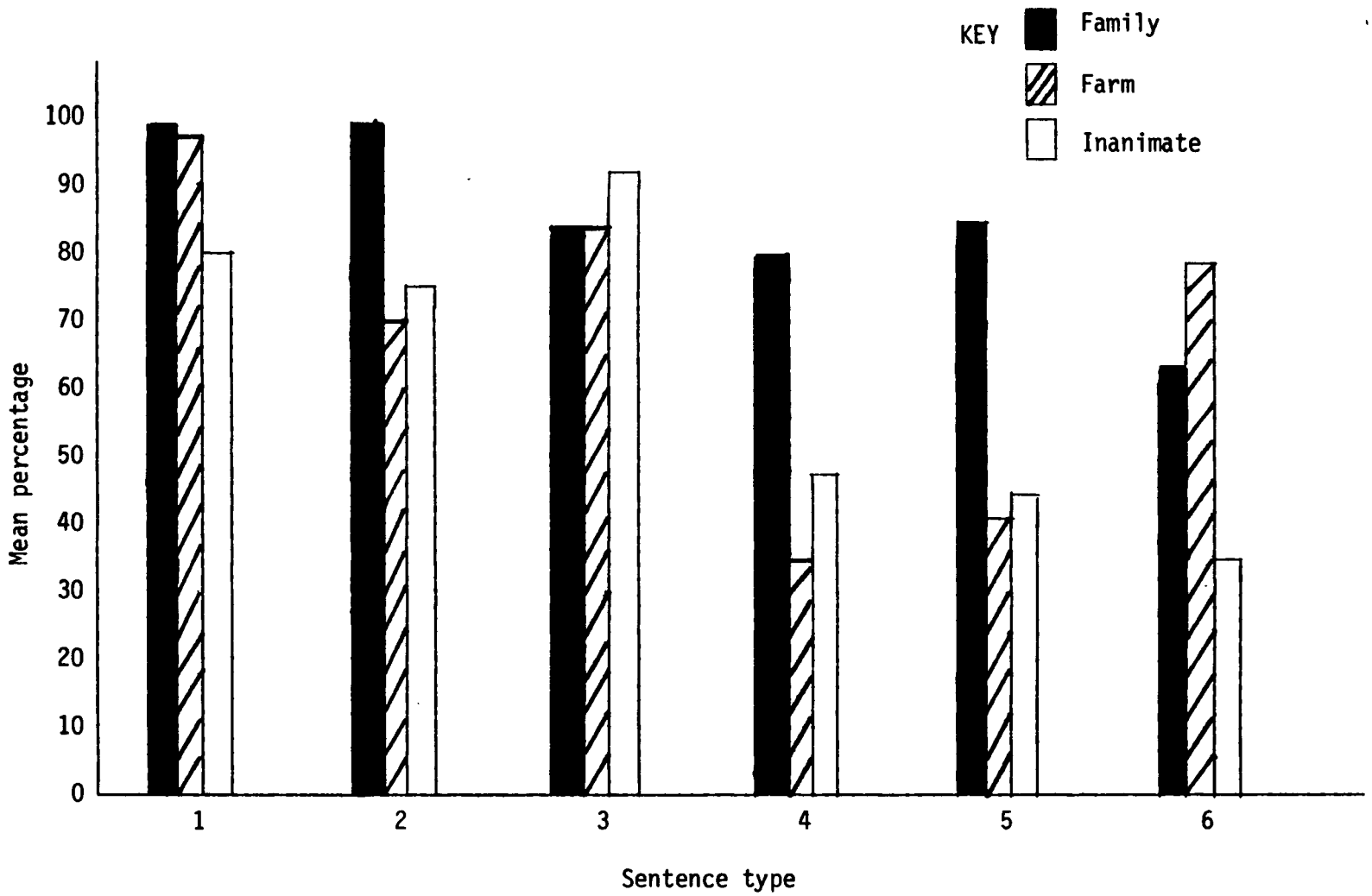

Figure 3. Conjoined Sentence Type Performance by Context

performance levels for Sentence Types 4 and 5 in the family context were consistently greater than performance levels in both the farm and inanimate contexts. But, when performance levels in the farm context were compared with performance levels in the inanimate context, no consistent pattern within each age group was discernible for these sentence types. Interestingly, in viewing the nonsignificant context x type x reduction interaction, it was observed that reduction did not differentially affect the context relation for sentence pairs 4 and 5. That is, the same ordering of context difficulty, i.e., family > farm/inanimate, was observed for unreduced and reduced versions of Sentence Types 4 and 5.

Further examination of the significantly high scores for Sentence Type 6 observed in the farm context revealed that, in general, farm performance for Sentence Type 6 remained high for each age group (as indicated by the context x type x age interaction). Further, inspection of the context x type x reduction interaction revealed high scores for both unreduced and reduced versions of Sentence Type 6 in the farm context. This indicates that reduction did not differentially affect performance in the farm context for Sentence Type 6.

In summary, analysis of the type x context interaction revealed that Sentence Types 4 and 5 provide the most explanation of the overall ordering of context difficulty. Additional explanation is found in performances for Sentence Types 1 and 2. In the presentation of the main effect of context it was observed that although performance levels in the farm and inanimate contexts were not statistically different, performance levels were, overall,

higher in the farm context. Analysis of the type x context interaction suggests that the significant difference in performance between the farm and inanimate contexts for Sentence Type 6 is the strongest contributor to the overall higher farm scores.

Recall that examination of the context x age interaction revealed that for Age II, performance levels for sentences presented in the inanimate context were high. This is of interest since it represents a change in the overall developmental pattern of performance which was observed within each context. Inspection of the context x type x age interaction suggests that it is Sentence Types 2, 4 and 5 which lend explanation to this discrepancy. A consideration of the context x type x age x reduction interaction reveals that reduction does not differentially affect the higher scores observed for Sentence Types 4, 5 or 2 in the inanimate context for Age Group II.

The context x reduction interaction (Table 9) did not reach overall significance. However, since a priori theoretical considerations render important any differences in performance levels within the three presentation contexts due to the effects of linguistic reduction, individual comparisons were made of certain specific pairs of means to further analyze these effects (Linton & Gallop, 1975, p. 299). Results of these comparisons indicated that scores for reduced sentences were significantly lower than scores for unreduced sentences when they were presented in the inanimate context ($\underline{t} = 2.61$, $\underline{p} < .01$, one-tailed). The differences between unreduced and reduced scores in the family and farm contexts were not statistically significant. Inspection

Table 9

Mean Percentage of Correct Responses
by Context and Reduction[a]

	Reduction	
Context	Unreduced	Reduced
Family	85.0	85.4
Farm	69.2	68.3
Inanimate	70.0	58.3

[a] $\underline{n} = 40$. Each subject heard six sentences for each level of reduction in each context.

of the age x context x reduction interaction (which was not statistically significant) indicates that the higher performance levels for unreduced sentences in the inanimate context was maintained for each age.

Since the type x reduction interaction established that Sentence Types 4 and 5 are significantly affected by reduction, the context x type x reduction interaction was examined to determine if Sentence Types 4 and 5 contributed significantly to the overall effect of reduction observed in the inanimate context (i.e., *unreduced > reduced*). No statistically significant differences were found comparing unreduced scores with reduced scores for each sentence type within the inanimate context. However, some explanation of the reduction effect was found in the magnitude of difference between unreduced and reduced scores for Sentence Types 4 and 5 and, interestingly, for Sentence Types 1 and 2 as well. These differences were not found for Sentence Types 3 and 6. Consideration of the context x type x age x reduction interaction indicates that, for each sentence type there is minimal contradiction of the general pattern of higher unreduced scores in the inanimate context across age. The strongest support for this pattern comes from Sentence Types 4 and 5 due to the consistently higher performance levels for unreduced sentences in the inanimate context across age.

To summarize the results of this section:

(1) A significant main effect of context was found, with significantly higher performance levels for sentences presented in the family context than for sentences presented in either the farm

or inanimate contexts. No significant differences were found between performance levels for sentences presented in the farm and inanimate contexts.

(2) Performances for certain conjoined sentence types were significantly affected by the contexts in which they were presented. Specifically, performance levels for Sentence Types 4, 5 and 6 (sentences with gapped verbs, conjoined noun phrases and verb phrases, and conjoined objects of prepositional phrases) were differentially affected by the family, farm and inanimate presentation contexts. The same ordering of context difficulty (family > farm/inanimate for Sentence Types 4 and 5; farm > inanimate with scores in the family context not significantly different from those in the farm and inanimate contexts for Sentence Type 6) was found for unreduced and reduced versions of these sentence types. These context relations were generally maintained across age groups for these sentence types.

(3) Performance levels for reduced sentences presented in the inanimate context were significantly lower than unreduced sentences presented in that context. This reduction effect was observed for each age group and was most pronounced for Sentence Types 4 and 5.

Analysis of Error Data

The distribution of errors made by each age group is presented according to context, sentence type and reduction in Appendix E. Of the 393 errors made, Table 10 reveals that subjects in Age I made the most errors, accounting for 36% of the total

Table 10

Frequency Distribution of Errors
by Age and Reduction

	Reduction		
Age	Unreduced	Reduced	Total
I	73	68	141
II	47	58	105
III	40	46	86
IV	24	37	61
Total	184	209	

Table 11

Frequency Distribution of Errors
by Age and Sentence Type

	Sentence type						
Age	1	2	3	4	5	6	Total
I	8	13	12	38	38	32	141
II	6	9	9	28	23	30	105
III	4	10	6	24	22	20	86
IV	2	10	4	18	14	13	61
Total	20	42	31	108	97	95	

errors. Age Groups II and III accounted for 27% and 22% of the total errors respectively. Subjects in Age IV made the fewest errors accounting for only 15% of the total errors. It is noted that Age Groups II, III and IV all made more errors on reduced sentences. However, the youngest subjects in this study (Age I) did not follow this general pattern. More errors were made on unreduced sentences by Age I.

When the total errors made by each age are analyzed by sentence type (Table 11) the distribution of errors is notable for the generally higher error rates for Sentence Types 4, 5 and 6 across age, although the errors for Age IV are more evenly distributed across all sentence types.

When the errors for each sentence type are combined across age, of the total errors made, 5% were made on Sentence Type 1; 11% on Sentence Type 2; 8% on Sentence Type 3; 27% on Sentence Type 4; 25% on Sentence Type 5, and 24% on Sentence Type 6. Note that this distribution indicates that three-quarters of the total errors made were errors on Sentence Types 4, 5 and 6.

An analysis of the error responses was undertaken to discover the processing heuristics the subjects employed in their efforts to interpret both the unreduced and reduced conjoined sentences. Examination of the error data identified many different categories of errors and a wide variety of error patterns.

It was observed that in virtually all instances subjects enacted at least one SVO relationship. Most responses, however, were multiple SVO enactments. These included errors that resulted

from the use of both syntactic and extrasyntactic processing strategies. An analysis of these errors for each age group and for all conjoined sentence types suggest two processing strategies which account for the most salient error patterns: (1) conjunction strategy and (2) simplification strategy.

The conjunction strategy describes responses in which the recognition of coordination was explicitly demonstrated. In these responses, subjects acted out the appropriate number of SVO sequences for each sentence type. Excluded from these responses were enactments which appeared to be nonlinguistically motivated.

The simplification strategy describes responses which reflect subjects' efforts to simplify the syntactic complexity of the test sentences. Although some multiple clause enactment errors are included in this strategic category (resulting from experimental constraints and the apparent use of nonlinguistic processing strategies), the primary characteristic of these responses is the focus on a one clause SVO enactment.

The proposed conjunction and simplification strategies are more parsimonious descriptions of specifically defined categories of unreduced and reduced error responses. The strategies account for general error tendencies observed for each conjoined sentence type as well as an overall developmental change in error patterns. In order to facilitate the presentation of the qualitative strategic analyses, the analysis of error responses for the unreduced conjoined sentences will be reported first, followed by the analyses of error responses for the reduced sentences.

Unreduced Errors

Of the 393 errors made, 184 (or 47%) were made on the unreduced sentences. Table 12 presents the distribution of unreduced errors by age and sentence type. Of the total unreduced errors, Age I accounted for 40%. Ages II and III accounted for approximately equivalent proportions of these errors with 25% and 22% respectively. Age IV accounted for only 13% of the unreduced errors.

When the distribution of unreduced errors is viewed by sentence type, it is apparent that Sentence Type 6 accounted for the greatest number of errors (29%). Sentence Types 4 and 5 accounted for an equal proportion of the unreduced errors (23% each). Similarly, an almost equal proportion of these errors were accounted for by Sentence Types 2 and 3 (11% and 10% respectively). Only 3% of the unreduced errors were made on Sentence Type 1.

Preliminary Analysis of Unreduced Errors by Clause Enactment

Since the unreduced sentences were coordinations of complete clauses (as opposed to coordinations of constituent elements), a preliminary examination of the unreduced errors focused on differential patterns of clause errors. The unreduced errors were analyzed with respect to clause enactment for each of the conjoined sentence types for all conditions and for each age group. Following are definitions of each error category used in this analysis.

Two-clause enactments. Both clauses of the conjoined sentences were enacted with errors occurring in either the first-

Table 12

Frequency Distribution of Errors on Unreduced Sentences by Age and Sentence Type

	Sentence type						
Age	1	2	3	4	5	6	Total
I	3	9	8	18	18	17	73
II	1	3	4	11	11	17	47
III	1	5	4	10	8	12	40
IV	1	4	3	4	5	7	24
Total	6	21	19	43	42	53	184

heard clause or second-heard clause. This category also describes errors occurring in both classes:

(1) First Clause Error (FCE): child performed the second clause correctly, but incorrectly enacted the first clause.

(2) Second Clause Error (SCE): child performed first clause correctly, but incorrectly enacted the second clause.

(3) Two Clause Error (BCE): child incorrectly enacted both clauses.

One-clause enactments. Only one clause of the conjoined sentence was enacted with errors as well as omissions characterizing these single clause enactments:

(1) First Clause Omission (FCO): child correctly enacted the second clause, but did not act out the first clause.

(2) Second Clause Omission (SCO): child correctly enacted the first clause but did not act out the second clause.

(3) First Clause Omission, Second Clause Error (FCO/SCE): child incorrectly enacted the second clause but did not act out the first clause.

(4) Second Clause Omission, First Clause Error (SCO/FCE): child incorrectly enacted the first clause but did not act out the second clause.

(5) SVO Simplification Error (SVO): child acted out one complete SVO relation which was neither first nor second clause of the stimulus sentence. For example:

Stimulus Sentence:

Daddy kisses Sue and Mommy kisses Jim.

Child's Enactment:

Jim kisses Sue.

Included in this category (SVO) are instances in which multiple subjects acted upon a single object, or a single subject acted upon multiple objects. In these responses, the child randomly chose one NP (most often the first or last) as either the subject or object, leaving the other NP(s) to act or receive the intended action. In these particular types of SVO simplification errors all toys placed in front of the child for a particular test sentence were used in the enactment. A typical example of this type of SVO error is:

Stimulus Sentence:

The cow bites the horse and the dog bites the pig.

Child's Enactment:

The cow bites the horse, the dog and the pig.

Table 13 presents the categorical analysis of one-clause and two-clause enactment errors distributed by age and conjoined sentence type.[5]

When all two-clause enactment errors are pooled across sentence types for each age and compared with one-clause enactment

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[5]To facilitate the presentation of the qualitative analysis of unreduced errors, the most salient error tendencies revealed by the preliminary examination of these responses by clause enactment are summarized in Appendix F. While these trends are of interest, the subsequent strategic analysis of errors provides more insight into the predominant error patterns observed for the unreduced sentences.

Table 13

Categorical Distribution of Clause Enactment Errors on Unreduced Sentences by Age and Sentence Type

	Age I						Age II						Age III						Age IV					
	Sentence type						Sentence type						Sentence type						Sentence type					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Two-clause enactment errors																								
FCE	0	0	0	5	3	0	0	0	0	5	1	3	0	1	0	1	4	3	0	1	0	0	2	0
SCE	0	2	2	1	1	0	0	0	1	1	1	1	1	4	0	1	2	1	1	2	2	0	1	1
BCE	0	1	1	2	3	11	0	0	0	0	2	8	0	0	1	3	2	6	0	0	0	3	2	4
One-clause enactment errors																								
FCO	1	1	5	4	1	1	1	1	1	1	1	1	0	0	1	1	0	0	0	1	1	0	0	0
SCO	2	2	0	2	1	0	0	0	2	0	0	1	0	0	2	1	0	0	0	0	0	0	0	0
FCO/SCE	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
SCO/FCE	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
SVO	0	2	0	4	7	5	0	1	0	3	5	2	0	0	0	2	0	1	0	0	0	1	0	2
No response	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

errors similarly pooled across sentence type for each age, the pattern of error responses displayed in Table 14 emerges.

Examination of this analysis reveals that one-clause enactments predominate unreduced errors for Age I. Age II errors are evenly distributed between one-clause and two-clause sentences. An interesting shift in error distribution is notable for Age III and Age IV responses. For the two oldest age groups, two-clause enactment errors account for at least three-quarters of their total unreduced errors.

Strategic Analysis of Unreduced Errors

The error data were further analyzed and error patterns characteristic of the use of the conjunction or simplification strategies were identified. (To facilitate the presentation of these analyses, the conjunction strategy and simplification strategy will subsequently be referred to as CS and SS respectively.) The data were particularly examined to identify those responses which may have resulted from use of extrasyntactic processing strategies and/or responses which may have resulted from experimental task constraints. Following are definitions of each error category used for this strategic analysis of unreduced errors presented first for CS errors and followed by a similar breakdown for SS errors:

CS Errors.

(1) One clause correct, one clause incorrect (+CL/-CL): One complete clause was correctly enacted. The incorrect clause enactment was characterized by incorrect NP assignment including

Table 14

Frequency Distribution of One-Clause and Two-Clause Enactment Errors on Unreduced Sentences by Age

Age	Clause enactment			Total
	One-clause	Two-clause	No response	
I (3.0-3.5 years)	39	32	2	73
II (3.6-3.11 years)	23	23	1	47
III (4.0-4.5 years)	10	30	0	40
IV (4.6-4.11 years)	5	19	0	24

either subject error, object error, or subject and object error (extrapolated from FCE and SCE enactments).

(2) Two incorrect clause enactments (-CL/-CL): Both clauses were characterized by incorrect NP assignment including subject error, object error, or subject and object error (extrapolated from BCE errors).

SS Errors.

(1) One clause was correctly enacted (+CL): Included FCO and SCO errors.

(2) One clause was incorrectly enacted (-CL): This enactment was characterized by single or multiple incorrect NP assignments. (Included were FCO/SCE and SCO/FCE and SVO simplification errors.)

(3) One clause correctly enacted; nonlinguistically based enactment errors (+CL/NL): One clause was correctly acted out. The remaining incorrect SVO enactment(s) resulted from nonlinguistically based strategies[6] (extrapolated from FCE and SCE errors). Typical of this type of error was:

Stimulus Sentence:

The cat falls on the chick and the dog falls on the food.

Child's Enactment:

The cat falls on chick and the dog eats the food.

---

[6]Those nonlinguistically based enactments observed in this study included: (1) probable event: child acted out likely relationships among objects that were referred to in the test sentences although these relationships were not stated; and (2) conventional location: child placed the objects referred to in the test sentences in their most normal contextual relation, or simply put objects into containers whenever that was possible.

(4) Any enactments were nonlinguistically based (NL) (extrapolated from BCE, FCO/SCE, SCO/FCE errors): Typical of this type of error was:

Stimulus Sentence:

Mommy sits on the towel and Sue sits on the mirror.

Child's Enactment:

Mommy wipes Sue with the towel.

Table 15 presents the categorical breakdown of CS and SS errors distributed by age and conjoined sentence type. When all SS errors are pooled across sentence type for each age and compared with all CS errors similarly pooled across sentence type for each age, interesting patterns of strategy use emerge (Table 16). While one might have considered the two-clause enactment errors as representative of use of conjunction strategy, further analysis of those errors reveals that many of the multiple enactment errors actually represented the use of a simplification strategy, suggesting that:

(1) Although the test sentences were constructed so that predictable pragmatic relationships between the objects were not exploited, when complexity was escalated, some children did in fact ignore the syntax of the sentence and enacted pragmatically based interpretations of sentences.

(2) Since all (and only) those toys needed for the enactment of each test sentence were presented, some children adapted an experimental strategy whereby all the toys available were in some way used in the enactment.

Table 15

Frequency Distribution of Categories of CS and SS Errors According to Age and Unreduced Sentence Type

Age	Conjunction Strategy Errors		Simplification Strategy Errors				
	+CL/-CL	-CL/-CL	+CL	-CL	+CL/NL	NL	No response
I (3.0-3.5 years)							
1	0	0	3	0	0	0	0
2	2	1	3	2	0	0	1
3	2	0	5	1	0	0	0
4	6	2	6	4	0	0	0
5	2	2	2	8	2	1	1
6	0	9	1	5	0	2	0
Total	12	14	20	20	2	3	2
II (3.6-3.11 years)							
1	0	0	1	0	0	0	0
2	0	0	1	2	0	0	0
3	1	0	3	0	0	0	0
4	5	0	1	3	2	0	0
5	2	2	1	6	0	0	0
6	3	8	2	2	1	0	1
Total	11	10	9	13	3	0	1
III (4.0-4.5 years)							
1	1	0	0	0	0	0	0
2	5	0	0	0	0	0	0
3	0	1	3	0	0	0	0
4	0	3	2	4	1	0	0
5	3	1	0	2	1	1	0
6	4	5	0	2	0	1	0
Total	13	10	5	8	2	2	0
IV (4.6-4.11 years)							
1	1	0	0	0	0	0	0
2	3	0	1	0	0	0	0
3	2	0	1	0	0	0	0
4	0	3	0	1	0	0	0
5	2	2	0	0	1	0	0
6	1	3	0	2	0	1	0
Total	9	8	2	3	1	1	0

Table 16

Frequency Distribution of Conjunction Strategy (CS) and Simplification Strategy (SS) Errors on Unreduced Sentences by Age and Sentence Type[a]

	Strategy type		
Age	CS	SS	No response
I (3.0-3.5 years)	26	45	2
II (3.6-3.11 years)	21	25	1
III (4.0-4.5 years)	23	17	0
IV (4.6-4.11 years)	17	7	0

	Strategy type		
Sentence type	CS	SS	No response
1	2	4	0
2	11	9	1
3	6	13	0
4	19	24	0
5	16	25	1
6	33	19	1

[a]Sentence Type 1 = conjoined subject noun phrase; 2 = conjoined object noun phrase; 3 = conjoined verb phrase; 4 = gapped verb; 5 = conjoined noun phrase and verb phrase; 6 = conjoined objects of prepositional phrases.

It is apparent that further definition of the error responses reveals a shifting pattern of strategy use with an increase in age. The SS described the majority of error responses for Ages I and II. However, it is of interest to note that the magnitude of difference between the SS and CS errors is greater for Age I than for Age II. The CS described the majority of error responses for Ages III and IV. Interestingly, the magnitude of difference between the CS and SS errors is greater for Age IV than for Age III.[7]

When the CS and SS errors are viewed by sentence type (Table 16) it is noted that Sentence Types 1, 3, 4 and 5 were characterized by more SS errors. A greater number of CS as compared with SS errors were made on Sentence Types 2 and 6. As Table 17 idicates, a developmental shift from the predominance of SS to the predominance of CS errors occurs for all sentence types except Sentence Type 6 in which all ages demonstrated a greater number of CS errors.

When viewing the distribution of CS and SS errors for each sentence type by age, the following patterns are noted:

(1) For Sentence Types 1 and 2: Ages I and II made more SS errors while Ages III and IV made more CS errors. The overall greater number of CS errors is explained by Age III subjects who made no SS errors on this sentence type.

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[7]Of the 184 unreduced errors, only three were "no response (NR) errors. Age I accounted for two "no response" errors, and Age II for one. No "no response" errors were made by Ages III and IV.

Table 17

Frequency Distribution of Strategic Errors on Unreduced Sentences for Each Sentence Type by Age and Strategy Type[a]

Sentence type		Strategy		
		CS	SS	No response
1				
	Age I	0	3	0
	II	0	1	0
	III	1	0	0
	IV	1	0	0
	Total	2	4	0
2				
	Age I	3	5	1
	II	0	3	0
	III	5	0	0
	IV	3	1	0
	Total	11	9	1
3				
	Age I	2	6	0
	II	1	3	0
	III	1	3	0
	IV	2	1	0
	Total	6	13	0
4				
	Age I	8	10	0
	II	5	6	0
	III	3	7	0
	IV	3	1	0
	Total	19	24	0
5				
	Age I	4	13	1
	II	4	7	0
	III	4	4	0
	IV	4	1	0
	Total	16	25	1
6				
	Age I	9	8	0
	II	11	5	1
	III	9	3	0
	IV	4	3	0
	Total	33	19	1

[a]Strategy type: CS = conjunction strategy; SS = simplification strategy.

Table 18

Frequency Distribution of Strategic Errors on Unreduced Sentences for Each Age Group by Sentence Type and Strategy Type[a]

Age	Strategy		
	CS	SS	No response
I (3.0-3.5 years)			
1	0	3	0
2	3	5	1
3	2	6	0
4	8	10	0
5	4	13	1
6	9	8	0
Total	26	45	2
II (3.6-3.11 years)			
1	0	1	0
2	0	3	0
3	1	3	0
4	5	6	0
5	4	7	0
6	11	5	1
Total	21	25	1
III (4.0-4.5 years)			
1	1	0	0
2	5	0	0
3	1	3	0
4	3	7	0
5	4	4	0
6	9	3	0
Total	23	17	0
IV (4.6-4.11 years)			
1	1	0	0
2	3	1	0
3	2	1	0
4	3	1	0
5	4	1	0
6	4	3	0
Total	17	7	0

[a]Strategy type: CS = conjunction strategy; SS = simplification strategy.

(2) For Sentence Types 3 and 4: only Age IV made more CS errors.

Strategic Analysis of Reduced Errors

Table 19 presents the distribution of errors on reduced sentences by age and sentence type. Of the 209 reduced errors made, subjects in Age I accounted for the most, with 32%. Age II accounted for 28%, Age III for 22% and Age IV for 18%. Note that there are small decreases in error rates for successive age groups, with the largest difference occurring between Ages I and IV.

An examination of the distribution of reduced errors by conjoined sentence type indicates that similar to the error distribution for unreduced sentences, Sentence Types 4, 5 and 6 accounted for the greatest number of reduced errors. However, Sentence Type 4 accounted for the most errors on reduced sentences (31%). Sentence Type 5 accounted for more errors than Sentence Type 6 (26% and 20% respectively). Sentence Type 2 accounted for 10% of the total reduced errors. Error rates for Sentence Types 1 and 3 were essentially equivalent (7% and 6% respectively).

Since the reduced sentences used in this study were coordinations of constituent elements (and not complete clauses), the definition of error response categories for these sentences were necessarily different than those previously described for the unreduced sentences. To facilitate the identification of processing heuristics for reduced sentences, the error responses were coded into the following categories described by the conjunction and simplification strategies:

Table 19

Frequency Distribution of Errors on Reduced Sentences by Age and Sentence Type

	Sentence type						
Age	1	2	3	4	5	6	Total
I	5	4	4	20	20	15	68
II	5	6	5	17	12	13	58
III	3	5	2	14	13	9	46
IV	1	6	1	14	9	6	37
Total	14	21	12	65	54	43	209

CS Errors.

(1) One SVO correct, 1 SVO incorrect (+SVO/-SVO): Some appropriate SVO relationship was correctly enacted. The incorrect SVO enactment was characterized by incorrect noun phrase assignment including either subject error, object error, subject and object error or, in a very few instances, verb error.[8]

(2) Two incorrect SVO enactments (-SVO/-SVO): Both SVO enactments were characterized by single or multiple incorrect noun phrase assignment(s), or one of the enactments was characterized by a verb error.

SS Errors.

(1) One SVO relation was correctly enacted (+SVO).

(2) One SVO was incorrectly enacted (-SVO): Only one SVO was enacted which was characterized by single or multiple noun phrase assignment errors. As described in the unreduced error analysis, some of these errors also included instances in which multiple subjects acted upon a single object or a single subject acted upon multiple objects.

(3) One SVO correct, nonlinguistically based enactment error(s) (+SVO/NL): One SVO relation was correctly acted out, the remaining incorrect SVO enactment(s) resulted from the application of extrasyntactic processing strategies.

(4) One SVO incorrect, nonlinguistically based enactment error (-SVO/NL): One SVO was enacted with single or multiple

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[8]All reduced errors which were characterized by verb error were made only on reduced versions of Sentence Types 4 and 6--sentences with gapped verbs and sentences with conjoined objects of prepositional phrases.

incorrect noun phrase assignment(s) and additional enactment(s) resulted from nonlinguistic strategies.

(5) Any enactment(s) were the result of extrasyntactic processing strategies (NL).

The categorical breakdown of CS and SS errors distributed by age and conjoined sentence types is displayed in Table 20. Table 21 presents all SS errors pooled across sentence type for each age and compared with all CS errors similarly combined. Examination of this table reveals that SS errors accounted for 63% of Age I errors on reduced sentences and 59% of Age II errors. Interestingly, CS and SS errors were about evenly distributed for Age III (48% and 50% respectively). However, CS errors accounted for 65% of Age IV reduced errors.[9] These results describe a developmental shift from a predominance of SS errors for the younger age groups (I and II) toward a predominance of CS errors for the oldest age group (IV). When this distribution of error responses is compared with the distribution of unreduced errors, it is of interest to note that the developmental change in strategy use occurred earlier for the processing of unreduced conjoined sentences as compared with reduced conjoined sentences. Ages III and IV subjects made more CS than SS errors on unreduced sentences, while a similar distribution of reduced errors was only observed for Age IV subjects. Further, as subsequent analyses indicate, even Age IV subjects did not maintain a consistent pattern of more CS

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[9]Of the 209 reduced errors, only seven were "no response" errors. Age I and Age II accounted for three "no response" errors each and Age III accounted for one. No "no response" errors were made by Age IV.

Table 20

Frequency Distribution of Categories of CS and SS Errors According to Age and Reduced Sentence Type[a]

Conjunction Strategy Errors			Simplification Strategy Errors					
	+SVO/ -SVO	-SVO/ -SVO	+SVO	-SVO	+SVO/ NL	-SVO/ NL	NL	No response
Age I (3.0-3.5 years)								
1	0	0	5	0	0	0	0	0
2	3	0	0	1	0	0	0	0
3	0	0	4	0	0	0	0	0
4	10	0	0	8	1	0	1	0
5	3	2	4	6	1	1	1	2
6	4	0	2	7	0	0	0	1
Total	20	2	15	22	2	1	3	3
Age II (3.6-3.11 years)								
1	0	1	3	1	0	0	0	0
2	2	0	1	2	0	0	0	1
3	1	0	4	0	0	0	0	0
4	8	0	2	5	1	0	1	0
5	2	2	0	5	1	0	1	1
6	2	3	3	3	0	0	1	1
Total	14	6	13	16	2	0	3	3
Age III (4.0-4.5 years)								
1	1	0	1	1	0	0	0	0
2	2	1	1	1	0	0	0	0
3	0	1	1	0	0	0	0	0
4	4	2	1	4	3	0	0	0
5	4	2	1	2	1	0	2	1
6	2	3	1	2	0	0	1	0
Total	13	9	6	10	4	0	3	1
Age IV (4.6-4.11 years)								
1	0	1	0	0	0	0	0	0
2	6	0	0	0	0	0	0	0
3	1	0	0	0	0	0	0	0
4	5	0	2	5	2	0	0	0
5	6	1	0	2	0	0	0	0
6	1	3	1	0	1	0	0	0
Total	19	5	3	7	3	0	0	0

[a]Sentence Type 1 = conjoined subject NP; 2 = conjoined object NP; 3 = conjoined VP; 4 = gapped verb; 5 = conjoined NP and VP; 6 = conjoined objects of prepositional phrases.

Table 21

Frequency Distribution of Conjunction Strategy (CS) and Simplification Strategy (CS) Errors on Reduced Sentences by Age and Sentence Type[a]

	Strategy type		
Age	CS	SS	No response
I (3.0-3.5 years)	22	43	3
II (3.6-3.11 years)	21	34	3
III (4.0-4.5 years)	22	23	1
IV (4.6-4.11 years)	24	13	0

Sentence type	CS	SS	No response
1	3	11	0
2	14	6	1
3	3	9	0
4	29	36	0
5	22	28	4
6	18	23	2

[a]Sentence Type 1 = conjoined subject noun phrase; 2 = conjoined object noun phrase; 3 = conjoined verb phrase; 4 = gapped verb; 5 = conjoined noun phrase and verb phrase; 6 = conjoined objects of prepositional phrases.

errors for all reduced conjoined sentences.

Examination of the strategic errors for each sentence type (Table 21) reveals that all sentence types, except Sentence Type 2, were characterized by more SS than CS errors. As Table 22 indicates, the greater number of CS errors for Sentence Type 2 is explained in part by Age IV responses. This age made no SS errors on this sentence type.

Further examination of the distribution of CS and SS errors for each sentence type by age reveals the following error patterns:

(1) For Sentence Type 1: Ages II, II and III made more SS errors. Only Age IV made more CS errors.

(2) For Sentence Type 2: A slightly different developmental pattern characterizes the error distribution for this sentence type. Ages I, II and IV made more CS errors (with Age IV making no SS errors). Age II made more SS errors.

(3) For Sentence Types 3 and 5: The transition from a predominance of SS to CS errors is most apparent. Ages I and II made more SS errors. In fact, Age I made no CS errors on Sentence Type 3. Age III errors were evenly distributed between the two strategic error types and Age IV made more CS errors on Sentence Type 5 and none on Sentence Type 3.

(4) For Sentence Type 4: An equal distribution of CS and SS errors characterizes Age I responses. All other subjects (Ages II, III and IV) made more SS errors.

(5) For Sentence Type 6: Ages I and II made more SS errors, while Ages III and IV made more CS errors.

Table 22

Frequency Distribution of Strategic Errors on Reduced Sentences for Each Sentence Type by Age and Strategy Type[a]

Sentence type		Strategy type		
		CS	SS	No response
1				
	Age I	0	5	0
	II	1	4	0
	III	1	2	0
	IV	1	0	0
	Total	3	11	0
2				
	Age I	3	1	0
	II	2	3	1
	III	3	2	0
	IV	6	0	0
	Total	14	6	1
3				
	Age I	0	4	0
	II	1	4	0
	III	1	1	0
	IV	1	0	0
	Total	3	9	0
4				
	Age I	10	10	0
	II	8	9	0
	III	6	8	0
	IV	5	9	0
	Total	29	36	0
5				
	Age I	5	13	2
	II	4	7	1
	III	6	6	0
	IV	7	2	0
	Total	22	28	4
6				
	Age I	4	10	1
	II	5	7	1
	III	5	4	0
	IV	4	2	0
	Total	18	23	2

[a]Strategy type: CS = conjunction strategy; SS = simplification strategy.

Consideration of the distribution of CS and SS errors for each age group by sentence type (Table 23) reveals that for Age I only Sentence Type 2 has more CS errors (although it is noted that there were only a total of four errors made by this age group on Sentence Type 2) and Sentence Type 4 has an equal number of CS and SS errors. Age II has consistently more SS errors; however, the magnitude of difference between the SS and CS error rates is smaller for Age II when compared with Age I. Age III appears to be a transitional group, with strategic errors rather evenly distributed for each sentence type except for Sentence Type 4, in which more SS errors were made. Of interest is the distribution of errors for Age IV. A consistent pattern of more CS errors is observed for each sentence type except for Sentence Type 4. In fact, no SS errors were made on Sentence Types 1, 2 and 3 for this age group. The error pattern for Sentence Type 4 is the only instance in which a greater number of SS errors were made by Age IV subjects.

As described above, both CS and SS errors included responses in which some SVO relation was correctly enacted. In an effort to identify the most salient aspects of reduced versions of the six conjoined sentence types, the following breakdown by sentence type specifies which SVO sequence subjects did correctly enact most often:

Sentence Type 1. In 90% of these responses the first NP was omitted with the following NVN sequence correctly enacted. For example:

Daddy and Jim sit on the pretty yellow towel.

Table 23

Frequency Distribution of Strategic Errors on Reduced Sentences for Each Age Group by Sentence Type and Strategy Type[a,b]

Age	Strategy type		
	CS	SS	No response
I (3.0-3.5 years)			
1	0	5	0
2	3	1	0
3	0	4	0
4	10	10	0
5	5	13	2
6	4	10	1
Total	22	43	3
II (3.6-3.11 years)			
1	1	4	0
2	2	3	1
3	1	4	0
4	8	9	0
5	4	7	1
6	5	7	1
Total	21	34	3
III (4.0-4.5 years)			
1	1	2	0
2	3	2	0
3	1	1	0
4	6	8	0
5	6	6	1
6	5	4	0
Total	22	23	1
IV (4.6-4.11 years)			
1	1	0	0
2	6	0	0
3	1	0	0
4	5	9	0
5	7	2	0
6	4	2	0
Total	24	13	0

[a]Sentence Type 1 = conjoined subject noun phrase; 2 = conjoined object noun phrase; 3 = conjoined verb phrase; 4 = gapped verb; 5 = conjoined noun phrase and verb phrase; 6 = conjoined objects of prepositional phrases.

[b]Strategy type: CS = conjunction strategy; SS = simplification strategy.

Sentence Type 2. 93% of the correctly enacted clauses were the first NVN. For example:

Mommy kicks the little blue brush and the towel.

Sentence Type 3. 55% of the correctly enacted SV relations were the first-heard NV sequence. For example:

The pretty white cat can jump and sit.

Sentence Type 4. 85% of the correctly enacted SVO sequences were the first-heard NVN. For example:

The pig falls on the yellow chick and the dog the food.

Sentence Type 5. 44% of these correct SVO enactments were the middle NVN sequence, 37% was the first-heard subject NP, main verb and first-heard object NP. For example:

The red clay and the glass drop on the plane and the tree.

Sentence Type 6. 67% of the correctly enacted sequences were the entire first clause, including the prepositional phrases. For example:

The beautiful tree pushes the red clay into the glass and the plate.

Analysis of Hierarchy of Context Difficulty

Table 24 presents the frequency distribution of the total number of errors by context. Examination of this breakdown reveals that 43% of the total errors were made on sentences presented in the inanimate context, 39% on sentences presented in the farm context, while errors made on the sentences presented in the family context accounted for only 18% of the total errors made

Table 24

Frequency Distribution of
Errors by Context

Context		
Family	Farm	Inanimate
72	151	170

Table 25

Test Sentences Presented in Family and Farm
Contexts Defined by Animacy of Subject
and Object (Percentage[a])

Context		
Subject - Object	Family	Farm
+Animate +Animate	8	42
+Animate -Animate	58	17

[a]Percentage totals for family and farm contexts do not equal 100% because Sentence Types 3 and 6 cannot be defined by these categories.

in this study.

As presented in Chapter Two, earlier studies have provided evidence that young children employ comprehension strategies to interpret the sentences they hear which are based on lexical comprehension and their growing knowledge of the world. As they attempt to understand sentences which lack referential support, children may invoke a semantic processing strategy in which animate nouns are assigned agent status and object of action status is assigned to inanimate nouns. Therefore, the interpretation of sentences will be facilitated in which the correct assignment of the subject and object relations conforms to these general extra-syntactic processing heuristics.

To determine if such semantic factors within the test sentences may have contributed to the overall ordering of context difficulty (family > farm/inanimate) observed in this study, the test sentences which were presented in the family and farm contexts were examined with respect to the animacy of the subject and object relations in each sentence.[10]

Table 25 presents the percentages of test sentences in each of the family and farm presentation contexts defined by the animacy of their subjects and objects.[11] Interestingly, this

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[10]Sentences presented in the inanimate context were not included in this analysis since all potential subjects and objects were inanimate nouns.

[11]Recall that two material sets were developed to allow for the counterbalancing of unreduced and reduced versions of the test sentences. This analysis, then, included an examination of the family and farm contexts in which there were two examples each of the unreduced and reduced versions of every conjoined sentence type. Therefore, a total of 12 unreduced and 12 reduced test sentences were analyzed for each of the family and farm contexts.

breakdown reveals that 58% of all test sentences presented in the family context were characterized by animate subjects and inanimate objects, while only 17% of the sentences presented in the farm context had similar subject and object animacy relations. Further, only 8% of sentences in the family context had both animate subjects and objects, while 42% of the sentences in the farm context had such animacy relationships. In addition, recall that all sentences presented in the inanimate context have both inanimate subjects and objects. Thus, when the overall ordering of context difficulty is viewed with regard to the animacy relations of the subjects and objects to the test sentences, the error patterns are similar to those reported by Chapman and Miller (1975), i.e., subjects made the fewest errors on sentences presented in the family context in which the majority of sentences had animate subjects and inanimate objects.

An Analysis of Context Differences for Conjoined Sentence Types 4, 5 and 6

As was reported earlier, performance levels for Sentence Types 4 and 5 were found to be significantly higher when those sentence types were presented in the family context than when they were presented in either the farm or inanimate contexts. When the animacy relations of the subjects and objects in these sentence types are examined (see Appendix A), it is interesting to note that when presented in the family context, examples of Sentence Type 4 in both material sets were characterized by the more facilitating animate subject, inanimate object relation. However,

in one material set, the example of Sentence Type 4 presented in the farm context was characterized by both an animate subject and object, while the subject and object relations of this sentence type in the second material set were such that the first clause had both an animate subject and object while the second clause was characterized by an animate subject and inanimate object. Of course, all subjects and objects in the inanimate context were inanimate nouns.

A similar analysis for Sentence Type 5 reveals that in both material sets, examples of this sentence type presented in the farm context had both animate subjects and objects. In one material set, the example presented in the family context was also characterized by both an animate subject and object while in the second material set, it was characterized by an animate subject and an inanimate object. For some subjects, the correct assignment of subject and object relations for Sentence Type 5 may have been facilitated in the family context. Therefore, similar to the findings of the analysis of overall hierarchy of context difficulty, a breakdown of the animacy relations of Sentence Types 4 and 5 indicates that more errors were made on sentences with both animate subjects and objects than on sentences with animate subject and inanimate objects.

The overall ordering of context difficulty for Sentence Type 6 indicated that performance levels were significantly higher when that sentence type was presented in the farm context than in the family or inanimate contexts. Sentence Type 6--conjoined objects of prepositional phrases--allows for a consideration of the

the animacy relations of the subjects, objects of the main verb and objects of the prepositional phrase. The examples of Sentence Type 6 presented in the farm context (in both material sets) were characterized by animate subjects, inanimate objects of the main verb, and animate objects of the prepositional phrases. The animacy relations of one example of this sentence type presented in the family context was similar to those presented in the farm context. However, in one of the material sets the example of Sentence Type 6 that was presented in the family context was characterized by an animate subject with inanimate objects of both the main verb and prepositional phrase. Therefore, more errors were made on sentences in which there were objects of both the main verbs and prepositional phrases when both objects were inanimate nouns.

Summary

An analysis of the error data revealed the following:

(1) Two processing strategies, a conjunction strategy (CS), and a simplification strategy (SS), account for the most salient error patterns observed in this study.

(2) The conjunction strategy describes error responses in which the recognition of coordination (clausal or constituent) was explicitly demonstrated. The simplification strategy describes responses which reflect subjects' efforts to simplify the complexity of the test sentences. These responses focused on an enactment of a single SVO relation with any additional enactments resulting from the apparent use of nonlinguistically based heuristics.

(3) Although the application of both strategies was apparent for all age groups, a developmental shift from the predominance of SS errors in the younger subjects' responses to a predominance of CS errors for the older subjects was noted. This developmental change in strategy use was observed earlier for unreduced conjoined sentences than for reduced conjoined sentences.

(4) An examination of the overall ordering of context difficulty (family > farm/inanimate) was suggested by the analysis of animacy of the subject and object relations of the test sentences presented in the family and farm contexts. The majority of sentences in the family context were characterized by animate subjects and inanimate objects thereby facilitating correct NP assignment by application of a nonlinguistically based probable event strategy. Similar explanations of ordering of context difficulty observed for Sentence Types 4, 5 and 6 were suggested, based upon an analysis of the animacy of the subject and object relations of these conjoined sentence types.

Chapter V

DISCUSSION

This investigation explored the influence of both linguistic and nonlinguistic factors on young children's understanding of complex, conjoined sentences. The discussion of the results of this study will be organized to address the major goals of this investigation. First, the findings related to the effects of linguistic reduction on the comprehension of different conjoined sentence types will be considered with respect to Slobin's predicted comprehension universal. A discussion of the hierarchy of difficulty among sentence types will be followed by a consideration of the linguistic and extralinguistic heuristic strategies used by the subjects in their attempts to understand those sentences. Finally, the implications of this research for developmental psycholinguistics and language disorders in children will be presented.

Effects of Linguistic Reduction on the Comprehension of Conjoined Sentences

The results of this study demonstrated that linguistic reduction did not have a uniform effect of increasing processing difficulty of conjoined sentences for young children. Of the six different conjoined sentence types tested, only two were found to be significantly more difficult to understand in their reduced

versions. Further, the significantly lower performance levels for reduced sentences presented in the inanimate context contrasted with the lack of differentiation in performance levels for unreduced and reduced sentences presented in the family and farm contexts. Thus, the results of this study disconfirm Slobin's putative comprehension universal that it is easier to understand a complex sentence in which optionally deletable linguistic material appears in its full form.

The findings in the present study relate specifically to the effects of the deletion of various redundant linguistic forms from conjoined sentences. That the appearance of optionally deletable redundant linguistic material did not significantly facilitate comprehension for the children tested in this investigation, appears to contradict the findings of others who reported that the surface appearance of pronouns, relative pronouns and complementizers did make certain complex sentences easier to understand than corresponding sentences from which these structures had been deleted (Chomsky, 1969; Kessel, 1970; Olds, 1963; among others).

The apparent contradiction may be resolved by viewing Slobin's prediction from another perspective. It is suggested that it is not, in fact, the <u>appearance</u> of optionally deletable linguistic elements that necessarily facilitates the processing of complex sentences, but rather, that it is the <u>deletion</u> of certain linguistic structures that may increase the difficulty of comprehending those complex sentences. The increase in processing difficulty may not, then, relate to the linguistic

reduction of all optionally deletable elements per se, but rather to the effects of deleting particular linguistic forms necessary for meaning and to the effects of multiple constituent deletion. A correlate to this prediction is suggested by the performance levels observed in this study for Sentence Types 3 and 6. It appears that, in some cases, the deletion of redundant linguistic elements actually facilitates comprehension to some extent, as evidenced in the slight inversion of unreduced and reduced scores for those sentence types.

Perhaps future research of different kinds of redundancy reduction will provide additional evidence to support these hypotheses. Clearly, semantic and pragmatic considerations are integral to the study of these observed phenomena.

The observed differences in performance levels for unreduced and reduced sentences in the inanimate context (in which reduced scores were significantly lower than unreduced scores) is an interesting finding. Since sentences presented in this context generally lacked semantic constraints, the influence of linguistic variables was most apparent. Having to depend upon syntactic cues alone to interpret the conjoined sentences, the absence of those cues from the surface form increased processing difficulty. Therefore, from a purely linguistic perspective, Slobin's hypothesis regarding the facilitating effects of explicit surface information appears to be supported. However, the absence of a consistent deleterious effect of linguistic reduction on sentence processing in this study indicates that Slobin's prediction lacks universality.

The data presented here are not consistent with the findings reported by Lust (1977). It seems likely that the discrepancies might be the result of differences in the specific focus of the studies, the sentence structures tested, and, most importantly, task demands. The present study specifically tested whether the deletion of redundant linguistic information increased sentence processing difficulty. In so doing, comprehension performance of unreduced versions of particular conjoined sentences was compared with that of the reduced versions of those same sentences. Although the unreduced sentences used by Lust also contained redundant linguistic elements, those unreduced sentences were not the more elaborated versions of the reduced coordinations which she tested--that is, Lust compared unreduced and reduced versions of different sentences.

Using an elicited imitation procedure, Lust reported that unreduced (sentential) coordinations were easier to imitate correctly than were reduced coordinations. In addition to differences in the age of subjects in both studies (children in the present study were older), and differences in the conjoined sentence types tested, certainly at issue is the need to differentiate correctness of imitation from the issue of comprehension. Further, the developmental psycholinguistic literature provides abundant evidence that the influence of a particular syntactic variable may be reflected differently in different performance tasks. In the case of conjoined sentences, it is suggested that redundancy of linguistic elements may provide some facilitating effects for imitation--perhaps some form of "phonetic redundancy"

that aids in the repetition of a model sentence--but that the appearance of optionally deletable redundant linguistic elements in conjoined sentences does not uniformly facilitate comprehension as measured by sentence enactment task.

Ardery's (1979) recent investigation of coordination in child language presents additional evidence that sentential (unreduced) coordinations are not invariably easier than reduced coordinations. However, it should be noted that Ardery's sentential coordinations did not contain redundant (and therefore optionally deletable) linguistic elements, as did Lust's and those unreduced conjoined sentence types tested in the present study.

In summary, cross-study comparisons of the most recent experimental studies of coordinations in child language suggest that while sentential coordinations which contain redundant elements may be easier for children to imitate, there is not consistent support for the facilitating effects of the presence of this linguistic material in a comprehension task. Certainly, caution must be observed in interpreting the results of the present study with those of Ardery because of the differences in the linguistic structures tested. However, it does appear that all sentential coordinations (with and without redundancy) are not inherently easier for young children to understand than reduced coordinations.

Hierarchy of Sentence Type Difficulty

The overall order of difficulty among the conjoined sentence types indicated that Sentence Types 1, 2 and 3 were

not significantly different from each other in correct performance. Further, performance levels for Sentence Types 4, 5 and 6 were not significantly different from each other and were, overall, lower than performance levels for Sentence Types 1, 2 and 3. When the cluster effect of Sentence Types 1, 2 and 3 was considered across the remaining variables, it was found that there was a homogeneity of performance across age and context for these sentence types. Moreover, performance levels for these conjoined sentence types were not significantly affected by reduction; that is, there were no significant differences in performance for the unreduced and reduced versions of these sentences.

It is apparent that both unreduced and reduced versions of Sentence Types 1, 2 and 3 posed little difficulty for any of the subjects. The similarity of performance for these sentence types suggests that sentences with initial (subject noun phrase) or final coordinations of a single constituent (object noun phrase, verb phrase) are not more difficult to comprehend than their more fully elaborated versions, nor is any one of those types of coordinations significantly harder to understand than any other.

Considered as a group, Sentence Types 4, 5 and 6 were more vulnerable to error for all subjects. The greater number of different noun phrases in these sentences, as compared with Sentence Types 1, 2, and 3, may have increased the likelihood of an incorrect noun phrase assignment in interpreting Sentence Types 4, 5 and 6. As a consequence, some children may have had increased difficulty in correctly selecting and manipulating the appropriate toys for each SVO enactment. While expansion of the

verb phrase to include the addition of a prepositional phrase by itself may have increased processing difficulty of Sentence Type 6, the increase in the relative length that this prepositional phrase added to this conjoined sentence type may have also contributed to the difficulty children had in correctly interpreting these sentences. This explanation gains support in light of the finding that the unreduced and reduced versions of this sentence type were equally difficult for the children to understand.

Consideration of the overall cluster effect that was observed for Sentence Types 4, 5 and 6 revealed that unlike Sentence Types 1, 2 and 3, performance levels for these sentence types were not consistently similar across all other variables. While all three of these sentence types were the most difficult for all age groups to understand, only two (4 and 5) were significantly differentiated by reduction, and although performance levels for all three sentence types were significantly affected by the context in which they were presented, Sentence Type 6 demonstrated a different hierarchy of context difficulty than did 4 and 5. Therefore, it appears that within the cluster of more difficult sentence types, each may be relatively more difficult to understand (as compared with Sentence Types 1, 2 and 3) for different reasons. Consider first, the influence of linguistic reduction. The significant difficulty of processing the reduced versions of Sentence Types 4 and 5 appear to result from different factors. A consideration of Sentence Type 4--sentences with gapped verbs--suggests several possible explanations. A comparison of error rates for the unreduced versions of Sentence Types 4, 5 and 6

(which accounted for at least three-quarters of the errors) reveals that sentences with gapped verbs were the most dififcult for all age groups to understand. In fact, more errors were made on the reduced versions of Sentence Type 4 than on any other sentence type in this study. Most errors that were made on sentences with gapped verbs were the result of the children's inability to interpret the second conjunct as an independent clause, presumably due to the absence of an overtly expressed verb. The deletion of the main verb from the second clause of these constructions apparently renders the remaining two noun phrases of the second conjunct uninterpretable as a clause for young children.

In addition to syntactic considerations, it is obvious that gapped verb constructions are fairly unusual and stylized sentences that children may not hear with any great frequency. It may be the case that this structure is one of those "laundered" sentence types that provides interesting insights into sentence processing, but may be absent from the language environments of most young children (with the probable exception of children of psycholinguists).

The nature of the increased processing difficulty of sentences with conjoined noun phrases and verb phrases (Sentence Type 5), may reflect the degree of linguistic conjunction in these sentences. In the present study, Sentence Type 5 is the only construction in which more than one constituent was conjoined. Since the subject noun phrases and object noun phrases were both conjoined, four different alternatives were available for subject and object assignment of each component clause. Although the single coordinations of subject noun phrases (Sentence Type 1), object

noun phrases (Sentence Type 3) or simple verb phrases (Sentence Type 3) were not particularly difficult for the subjects to process correctly, increasing the number of constituent coordinations (i.e., the coordination of both noun phrases and verb phrases) was probably a major factor in the difficulty the subjects demonstrated in correctly comprehending these sentences.

When the error patterns of sentences with conjoined noun phrases and verb phrases (Sentence Type 5) were compared with those in which only subject noun phrases (Sentence Type 1) or object noun phrases (Sentence Type 2) were conjoined, an interesting locus of error was noted. Sentences in which only object noun phrases were conjoined were generally more difficult (although not significantly so). In addition, more errors on Sentence Type 5 were made on the conjoined object noun phrases than on the conjoined subject noun phrases. Both these trends suggest slightly better performance in this study on conjoined subjects than conjoined objects.

Linguistic reduction did not significantly affect performance for Sentence Type 6. Unlike Sentence Types 4 and 5, in which reduction operated to obfuscate the assignment of grammatical relations for one or both clauses, the accessibility of the basic relations of who-did-what-to-whom was preserved in the conjunction of the expanded verb phrase in Sentence Type 6. The major source of difficulty in correctly interpreting and enacting this construction apparently inhered in the children's limited short-term processing capacities and not in the deletion of surface information.

The significant interaction between context and sentence type that was found for Sentence Types 4, 5 and 6 indicates that the context factor affected Sentence Type 6 differently from Sentence Types 4 and 5. A by-sentence analysis of the test items for all three sentence types indicated that the same hierarchy of context difficulty that was observed for Sentence Types 4 and 5 was most likely due to similar semantic constraints regarding subject and object assignment that were operating within the family, farm and inanimate contexts for each of those sentence types. The absence of a context x type x reduction interaction is notable in light of the significant interaction between reduction and Sentence Types 4 and 5. This suggests that reduction did not operate as a unitary variable to affect the relative difficulty of comprehending these two sentence types.

The presence of the prepositional phrase in Sentence Type 6 necessitated an examination of different semantic constraints for these sentences (specifically focused on the animacy of both the object of the main verb and the object of the preposition). This revealed different facilitating patterns for correct object assignment in the three contexts and therefore different relative ordering of context difficulty for Sentence Type 6. Thus, the observed effects of context on Sentence Types 4, 5 and 6 as a group, appear related to similar extrasyntactic factors, while differences in the hierarchical ordering of context difficulty for 4 and 5 compared with 6 result from the necessarily different syntactic considerations (i.e., the addition of the prepositional phrase) for Sentence Type 6.

Cross-Study Comparisons

Where comparisons between the ranking of sentence difficulty reported in Ardery's study and the present investigation are justified, the patterns of relative comprehension difficulty for similarly conjoined sentnece types are generally equivalent. That is, in both studies sentences with gapped verbs were among the most difficult to understand while sentences with conjoined intransitive verbs and object noun phrases were among the easiest.

It would appear that subjects in the present study performed slightly better on sentences with conjoined subject noun phrases than did the children in Ardery's investigation. Guttman scale analysis indicated that the mean age of the children who correctly interpreted those conjoined sentences in the Ardery study was 4 years 9 months, whereas even the youngest children in this study (3.0-3.6 years) correctly enacted a mean of 83% of conjoined subject noun phrase sentences. However, the Guttman scaling indicated that overall, 75% of Ardery's subjects had "mastered" the subject noun phrase construction (i.e., correctly enacted both examples of these test constructions). Since Ardery's subjects also included children younger than those tested in the present study (2 years 6 months) the slight differences in performance on this construction may reflect the poorer performances of those children. Moreover, all Ardery's sentences were semantically reversible which may have increased processing complexity and generally depressed performance levels for many of her younger subjects.

The relative ordering of sentence type difficulty observed in this study differed from those patterns which were reported by Lust. It will be recalled that based upon a particular linguistic model of redundancy deletion, Lust hypothesized that conjoined sentences characterized by forward deletion patterns in their surface forms would be easier than those with backward deletion patterns. Results of her elicited imitation studies indicated that reduced coordination with forward deletion patterns were easier for her subjects to imitate than were those reduced coordinations with backward deletion patterns (i.e., "Kitties hop and run" was easier for 2 and 3 year olds to imitate than "The kittens and the dogs hide"). While sentences with conjoined verb phrases and conjoined object noun phrases were quite easy for the children in this study to comprehend, not all conjoined sentences with forward deletion patterns tested in the present investigation were as easy. The predicted ease of interpeting sentences with forward deletion patterns was contradicted by the significant difficulty the children demonstrated in correctly interpreting sentences with gapped verbs and sentences with conjoined expanded verb phrases (Sentence Types 4 and 6). Further, sentences with conjoined subject noun phrases, which are characterized by backward deletion patterns, were among the easiest to understand in this investigation.

Further contradictory evidence for the presumed influence of surface deletion directionality was reported by Ardery. As in this study, Ardery found that sentences with gapped verb coordinations were among the most difficult for her subjects

to understand and that these sentence types were more difficult than sentences with conjoined subject noun phrases. Therefore, the deletion directionality hypothesis proposed by Lust appears to lack generality in comprehending all conjoined sentences, and clearly cannot explain the difficulty children demonstrate in interpreting coordinations which are characterized by both forward and backward deletion patterns (i.e., Sentence Type 5--conjoined noun phrase and verb phrase in the present study and transitive verb coordination tested by Ardery).

Heuristic Strategy Use: The Influence of Syntactic and Extrasyntactic Factors

One of the most interesting aspects of language acquisition is the child's development of the ability to understand complex sentences. In analyzing the errors which the subjects in this study made on one general class of complex constructions--conjoined sentences--it is apparent that children within the age range tested are guided by certain semantic as well as linguistic processing heuristics.

In viewing the error data, the patterns of errors observed for different age groups and conjoined sentence types suggested that the children in this study employed a simplification strategy and a conjunction strategy to process both unreduced and reduced conjoined sentences. In general, the preponderance of strategic errors for the younger subjects pointed to their reliance on a simplification strategy in which the focus of their interpretations of the conjoined sentences was on one SVO relation. A closer

examination of the nature of their multiple clause enactment errors revealed that many of those enactments were not based on the decoding of grammatical relations in the test sentences, but rather resulted from the application of nonlinguistically based comprehension strategies. In contrast, the proponderance of strategic errors for the older subjects appeared to reflect their application of a conjunction strategy, in which the recognition of linguistic coordination was explicitly demonstrated. Although some use of both processing strategies was apparent for all age groups, the frequency of use of the simplification strategy decreased with an increase in age as the greater frequency with which the conjunction strategy was applied paralleled an increase in age. A comparison of strategic errors for unreduced and reduced sentences revealed that the developmental shift in strategy use (from simplification strategy to conjunction strategy) occurred earlier for the children's processing of unreduced sentences than for their efforts to understand reduced sentences.

Linguistic Factors

A primary finding in the analysis of the error data was the subjects' consistent and dominant preference for enacting at least one SVO relation. The errors the subjects made on both the unreduced and reduced conjoined sentences in this study suggest that children within this age range may employ a general comprehension strategy which is based on the simple sentence (i.e., a SVO relation) as the main unit of comprehension.

Part of the complexity of decoding conjoined sentences for the young child may be that both unreduced and reduced versions of these sentences present sequences which appear to satisfy this basic organizational strategy prematurely, making correct comprehension of all component clauses more complex. In the case of unreduced conjoined sentences, which present two easily discriminable SVO ordered clauses, either the first or second clause may be decoded as an independent sentence. The initial NVN sequences in most reduced conjoined sentences and those noninitial, but continuous NVN sequences in others, also conform satisfactorily to the assignment of a single SVO relation.

As the child matures in his abilities to handle sentences with more than one internal clause, it would seem to follow that he would initially process complex sentences in which those clauses were most salient with greater facility. This explanation would account for the developmentally earlier shift in strategy use from the focus on single clause to multiple clause enactments that was observed for unreduced sentences in the present study.

One must, however, also consider the influence of short-term type processing limitations which may also constrain young children's abilities to decode (and then enact) conjoined sentences. As was discussed in a previous section, psycholinguistic evidence indicates that during sentence processing, memory storage occurs for each clause as its interpretation is completed. For the adult listener, the meaning of these clausal units is stored until other clauses in the sentence are analyzed and a meaning for the entire (complex) sentence can be assigned. However, for children, performance

limitations as well as diminished knowledge of the nature of complex sentences, may initially limit the actual number of clauses which can be processed and/or limit the retrieval of clausal information for a post-comprehension response, such as the enactment of a sentence. Further, for the young child, the retrieval of clausal information from memory may not accommodate a comparison of linguistic information from both clauses of unreduced coordinated sentences, thus reducing any potential facilitating effects of redundancy.

As is apparent from the foregoing discussion, unlike the explicit and orderly display of component clauses in unreduced conjoined sentences, the component clauses of linguistically reduced sentences are not as perceptually accessible. The analysis of error patterns for the reduced sentences suggests that when extracting (at least) a single SVO relation for enactment from a reduced sentence, the subjects invoked a perceptual strategy such as that proposed by Bever in which any NVN sequence was interpreted as the agent-action-object of that sentence. The children in this study chose initially to enact the first heard continuous NVN sequence and thus assigned the noun phrases that immediately preceded and followed the main verb as subject and object respectively of the verb.

As was apparent from the discussion of the difficulty children in this study demonstrated in processing sentences with gapped verbs, the verb is clearly a primary identifier of a clausal unit for the young child. The predilection for enacting just one SVO relation for reduced sentences by the younger subjects

may then also be related to their assigning single clause status to sentences in which only one verb is mentioned. From a broader perspective, these constructions may be particularly difficult since they are linguistic forms that constitute exceptions to the children's demonstrated general procedures for sentence processing. That is, if in their efforts to understand spoken sentences they have an a priori expectation of an overtly expressed verb in a SVO relation, then absence of that element would obviously hinder the identification of a clause.

The general patterns of strategic errors observed in this study were compared with those reported in Ardery's recent investigation. Ardery proposed two processing strategies, a linear sequencing requirement and a coordination strategy to explain the relative ordering of difficulty her subjects demonstrated in their comprehension and production of sentential and reduced coordinations. The linear sequencing requirement (LSR) prposes that for declarative sentences in English, children initially expect a sentence-initial object to be immediately followed by a verb and that verb (when transitive) to be immediately followed by an object. Ardery hypothesized that children expect both the subject-verb relation and verb-object relation to be overtly marked by means of linear ordering.

The LSR appears to be a more specified version of Bever's NVN segmentation strategy. The LSR is of value because it does, to some extent, account for errors which are specific to the particular coordinated sentence types tested by Ardery (for example, sentence-medial coordinations).

The more elaborate error classification system used in this study allows us to see the diversity and richness of the young child's efforts to understand the sentences he hears--by the marshalling of both his linguistic and extralinguistic knowledge. The simplification strategy describes the general error tendencies observed in this study for both unreduced and reduced conjoined sentences, of which errors described by a Bever-type parsing strategy (or the more sentence-specific LSR) are only a part. For example, the LSR is not sufficient to account for many errors observed in the present study in which single SVO enactments did not exploit any linear sequencing cues, but conformed only to the pervasive phenomenon of at least one complete SVO enactment. Indications of the overuse of such a requirement is evident in some "child-as-agent" responses which were enacted in response to sentences with conjoined verb phrases. In this study, those conjoined elements were intransitive verbs, e.g., "The small yellow chick can hop and scratch." In their efforts to assign a subject to the second conjoined verb, some of the younger (Ages I and II only) children intruded themselves as agent and "scratched the chick," creating a SVO enactment. Further, the SS also accounts for nonlinguistically based strategic errors which were observed in the present study.

Ardery proposed a coordination strategy to describe the processing abilities which children must develop in order to correctly interpret all coordinations, although this strategy does appear to provide more explanation for the processing of reduced coordinations than sentential coordinations. Specifically,

this strategy states that any sequence of two or more elements joined by and with the same constituent structure and function should be interpreted as a single larger constituent that has the same function as the elements joined by and. Ardery hypothesized (based upon the Guttman scaling of her test constructions) that the coordination strategy is developmentally applied in the following manner: first for sentence-final coordinations, then for sentence-initial coordinations, and lastly for sentence-medial coordinations. She acknowledged that the coordination strategy cannot be applied for gapped coordinations and suggested that in order to correctly comprehend those structures, children must develop the ability to recover the element that has been deleted.

Certainly the ability (as described by Ardery) to recognize constituent units that perform identical syntactic functions is crucial to the child's ability to correctly comprehend reduced coordinations. But, perhaps even more fundamentally, with regard to the correct interpretation of all coordinations, children must first recognize that some structures may be comprised of more than one simple sentence and that those component clauses may not be explicitly displayed and/or linearly ordered.

The strategies proposed by Ardery and those proposed in the present study are not, however, mutually exclusive. The simplification strategy and conjunction strategy present the advantage of observing developmental changes in basic strategy use (for both unreduced and reduced sentences, and for specific types of conjoined sentences), as well as enumerating the syntactic

and extrasyntactic heuristics which young children employ as they endeavor to reduce sentence processing difficulty for conjoined sentences. The linear sequencing requirement and coordination strategy are specifically linguistic and are particularly descriptive of the constraints on children's processing of complex, coordinated sentences in which the conjoined elements are in sentence-medial position. Although the developmental progression from sentence-final to sentence-initial to sentence-medial application of the coordination strategy was not apparent in the present study for Sentence Types 1, 2 and 3, when the syntactic complexity of the coordinated structure was escalated, sentence-final coordination (e.g., Sentence Type 6) did appear to be easier to process than multiple coordinations and gapped constructions.

Therefore, to summarize, in contrast to Ardery's hypotheses, the SS and CS present a more global picture of young children's (age 3 to 5 years) efforts to interpret complex, conjoined sentences. The children can be viewed as progressing through several stages: a stage where they employ a lexical semantic strategy which exploits <u>any</u> available probablistic constraints on interpretation in tandem with a reliance on a basic knowledge of sentence structure which leads them to interpret incoming conjoined sentences as simple declarative sentences. During the next stage, with increased linguistic knowledge about the nature of complex sentences and recuced performance limitations, the children demonstrate their recognition of conjoined structures (first for complete clauses and then for conjoined constituent elements) but do not rely in large measure on syntactic information alone to interpret these

constructions. Finally, for the oldest subjects tested in this study, correct comprehension of conjoined sentences could be accomplished (and facilitated) by syntactic cues to meaning. However, the findings of this study provide evidence that these children rely on a combination and (perhaps ordered) set of non-linguistic and linguistic comprehension strategies.

Effects of Extrasyntactic Factors

The present study demonstrates that young children employ extrasyntactic strategies independent of and parallel with syntactic strategies in their efforts to comprehend complex sentences. The subject's strong tendency to exploit nonsyntactic cues for functional assignment of lexical items was clearly apparent in the discrepancies in performance across the three presentation contexts. It will be recalled that, overall, sentences presented in the family context were significantly easier for all subjects to understand than those that were presented in the farm and inanimate contexts. Although one might have predicted that sentences presented in more familiar contexts (i.e., the family and the farm) might be easier to comprehend, this effect of context was of particular interest since the test sentences were developed so as to avoid correct interpretation based solely on easily predictable semantic relations among the constituents. Moreover, the equivalent performances for sentences presented in the farm and inanimate contexts contradicts an explanation of context difficulty based on a familiarity hypothesis. However, as evidenced in the post hoc analysis of

the animacy relations of the subjects and objects of sentences presented in each context, differeing degrees of semantic constraint were indeed operating in the family, farm and inanimate contexts. Of the three presentation contexts, only the sentences in the inanimate context presented the subjects with no semantic basis upon which to make functional assignments of the lexical items. Although the performance of all age groups essentially maintained the basic hierarchy of context difficulty (family > farm/inanimate), the virtually random performance by children in Age I on sentences presented in the inanimate context (51% correct) suggested their minimum use of syntactic information and maximum use of a lexical semantic strategy in processing the test sentences.

The children in Age Groups II and III (ages 3.6-4.5 years) demonstrated an increased ability to use linguistically based strategies (66% and 65% correct respectively for sentences in the inanimate context). Age IV children (4.6-4.11 years) appeared to rely even more on syntactic information and correctly enacted 75% of the sentences presented in the inanimate context. As we have seen in Chapter Two, a great deal of evidence indicates that during the language learning years, several different comprehension strategies may be available to the child at any one time. The findings of this study also support the notion that children may invoke these different strategies to interpret similar sentence types in different situations. It appears that even the oldest children tested in this study employed extrasyntactic heuristics in their efforts to understand the conjoined sentences. Although performance levels were generally higher overall for

the older subjects, relatively more sentences were correctly enacted by these children in which use of a lexical semantic strategy could facilitate processing; that is, in the family (and, to a lesser degree, the farm) contexts.

Another phenomenon observed in the error responses of some subjects was the interpretation of test sentences based solely on their past experience. The error responses of the younger children suggested that whether initially or after some attempt to assign functional relations on the basis of syntactic information, some of their incorrect enactments reflected that they were using their knowledge of the usual relations between the particular objects tested (rather than the semantic strategy of assigning animate nouns as subjects) to act out at least a portion of the test sentences. In some cases, these pragmatically based enactments were the sole response to a test sentence. Although these responses were more prevalent for reduced sentences, probable event and/or conventional location enactments were demonstrated for unreduced sentences as well (particularly on Sentence Types 4, 5 and 6).

The specific parameters of the enactment task employed in this study may have, to some extent, influenced pragmatically based simplification errors. Since all and only those toys that were mentioned in a test sentence were available for acting out that sentence, an experimental strategy was adopted by some children in which some manipulation of all toys, even if it was unrelated to the meaning of the test sentence, was demonstrated. This was not, apparently, a strategy used by all subjects, since in many of the simplification errors, some toys were not utilized

in any manner. Interestingly, the frequency of these pragmatically based enactments decreased with an increase in age for both unreduced and reduced conjoined sentences. Despite the fact that older children know more about the probable relations among objects based on their past experience and knowledge of the world, very few of the simplification errors made by the older children in this study reflected a pragmatic interpretation completely independent of the actions described in the test sentences.

The comprehension of certain conjoined sentence types also seemed to be affected more by the contexts in which they were presented than others. It will be recalled that the number of correct enactments for Sentence Types 4 and 5 was significantly higher when those sentence types were presented in the family context than when they were presented in the farm or inanimate contexts. Further, a significant effect of context was found for Sentence Type 6 in which more sentences of this conjoined type were correctly enacted when they were presented in the farm context. Upon examination of the animacy of the subject and object relations of those three sentences types, an explanation of the observed context effects was offered based upon the children's apparent use of a semantic strategy for assignment of agent and object status. What is of particular interest is the noticeable absence of significant differences in performance across contexts for Sentence Types 1, 2 and 3. While the lexical make-up of the examples of these sentence types presented in the family, farm and inanimate contexts displayed varying degrees of semantic constraint, the level of comprehension of each of these sentences

was essentially equivalent for each presentation context. Since Sentence Types 1, 2 and 3 were found to be generally easier to understand than Sentence Types 4, 5 and 6 overall, it appears that as the syntactic complexity of complex sentences is escalated, the relative importance of semantic constraints also increases. This further underscores the important influence of the interaction of syntactic and nonsyntactic factors upon sentence processing for the young child.

In summary, a comparison of the performance of children between the ages of 3 and 5 years suggests a progression in strategy use characterized by changes in the relative reliance on semantic and linguistic heuristics. It is clear that younger children within this age range demonstrate a dependency on their knowledge of the semantic properties of individual lexical items (e.g., animacy) and possible relations between them to interpret particularly complex conjoined sentences. The older children studied demonstrated at least preferred use of semantically based processing strategies. However, their reduced performance limitations and increased linguistic knowledge of complex sentences enabled them to invoke syntactically based heuristics when there was no basis for the prediction of the most likely assignment of constituent relations. Further, with an increase in the ability to derive meaning from linguistic form alone, it is apparent that when syntactic cues to meaning are deleted, the correct interpretation of complex sentences will be more difficult. This was evidenced in the present study by the increasingly greater difference between performance levels for unreduced and reduced sentences

that was found for each successive age group. However, these findings regarding age-related changes in strategy use do not preclude the possibility that more sensitive grouping measures would reveal changes linked more to language skill (as measured by MLU, for example) than age, per se.

Implications for Developmental Psycholinguistics and Language Disorders in Children

The major finding of this study of the comprehension of complex, conjoined sentences was the variable influence of both syntactic and extrasyntactic factors on comprehension in the young child. Each of the factors examined exerted an influence on comprehension--in some instances to enhance comprehension and in others to depress comprehension performance. Several areas for future psycholinguistic investigation are suggested.

The study of coordination in child language presents many interesting avenues for future study. Certainly inherent in the comparison of comprehension difficulty between sentential coordinations which contain redundancy and their reduced versions is the consideration that such sentence pairs share the same meaning. The synonymy of these two coordinations is based upon the syntactic relation between them. Further research may provide some insight into the language learner's judgments of the equivalence or nonequivalence of meaning of linguistically unreduced and reduced sentences in a variety of tasks and contexts. It may be the case, for example, that the conjoining of particular constituents serves to change the focus of attention and may thus influence the storage

and/or retrieval of the meaning coded by these variously conjoined sentences.

With our limited knowledge of conjunction in child speech, we do not have a clear picture of whether or not there is any systematic variation of the use of coordinations with redundancy or coordinations with redundancy reduction in child language. One might ask if there are particular sentence types and/or situations in which those sentence types appear which are more difficult to understand because of the appearance of redundant elements? Some seminal evidence of this was found in the slightly higher performance levels for reduced versions of Sentence Types 3 and 6 as compared with their more elaborated versions in the present study. How justified are we, then, in predicting complexity of sentence processing for children based on an adult linguistic model of complexity?

A critical, and as yet unexplored, issue regarding coordination in child language is the identification of how children use conjunction for communication. To paraphrase Rees (1978), the study of children's comprehension must take into account that communication is an interactive process, thus necessitating serious consideration of the pragmatic aspects of linguistic performance. Therefore, study of children's interactions with other children as well as with adults may reveal how the use of coordination (with or without redundancy) is influenced by various pragmatic factors including situational variables, relevant linguistic and nonlinguistic contexts, functional considerations, developing abilities to establish

or sustain a topic, etc. There is, obviously, much left to learn about coordination in child language.

This study of linguistic performance has underscored the complexity and interaction of a variety of factors that affect comprehension during the language learning years. Evidence in this study points to extensive use of lexically based processing strategies, although an increase in the use of syntactic information appears to emerge in older preschool children. It would be of interest to determine to what extent children of different developmental levels are dependent upon extrasyntactic cues to meaning; how pervasive these nonsyntactic strategies are in the older child. Perhaps additional investigation will also define individual differences (both qualitative and quantitative) in the availability and application of sentence processing heiristics.

Of particular note was the variable comprehension performance demonstrated by the subjects in this study across different examples of similar sentence types. If a child has several comprehension strategies available to him, on what basis does he choose which heuristic to apply? What are, for example, the differential demands of various situations that might influence comprehension strategy use? One might explore the change in relative importance of particular kinds of linguistic and extralinguistic information from experimental to social situations. While it seems likely that the nonlinguistic cues identified in this study are but a small sample of contextual and probability variations that have impact on children's comprehension, given the observed influence of these factors,

it seems unwise to infer a child's comprehension (or knowledge) of syntactic structure from his performance in only one situation or on a limited number of sentences.

Such considerations also have important implications for the study of the comprehension abilities of children with language impairments. To what extent can, and do, language impaired children exploit a variety of different cues in their efforts to interpret the sentences that they hear? The relation those abilities have to the development of the semantic system--particularly semantic-syntactic knowledge of verbs and the selectional restrictions on nouns as subjects and objects--may be particularly important to define for the language impaired child.

The identification of a comprehension strategy repetoire as well as strategy preference may facilitate decisions regarding clinical intervention. While normative developmental data have proven to be useful in planning aspects of clinical intervention, the use and variety of sentences processing heiristics may differ, not only between normally developing children and language disordered children, but also within those populations.

Certainly much study of the syntactic skills of language disordered children has focused upon possible disruptions in their acquisition of complex language structures. Some investigators of normal language development suggest that the development of coordinations provides a foundation for the development of other complex structures. For both the normally developing child and for the language impaired, the appearance of coordination may signal a transition from the early stages of syntactic development

to the beginnings of more complex grammatical abilities. Therefore, careful, systematic study of the comprehension (and use) of conjoined sentneces may provide insight into the development of complex sentence structures. Careful variation of semantic constraints within a large sample of conjoined structures may aid in assessing abilities to decode syntactic versus semantic manipulations of increasing complexities.

An interesting aspect of this issue refocuses attention on linguistic redundancy. Future investigations of the effects of linguistic redundancy and redundancy deletion on the ease of comprehending complex, conjoined sentences with clinical populations may identify a hierarchy of difficulty of conjoined structures. It would not be surprising to discover differential effects of linguistic reduction (particularly related to the deletion of different constituents) across different clinical populations.

With regard to language intervention, certainly data from the use of coordinations in the speech of normally developing children might help to predict which conjoined structures might be most functional for the language impaired child. Although the adult linguistic model provides alternate forms of coordination (i.e., unreduced and reduced coordinations), only specific study of the psycholinguistic complexity of those forms coupled with pragmatic considerations will determine if it is really in the best interests of the language disordered child to teach them all.

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Appendix A

TEST SENTENCES

Unreduced and Reduced Versions of Test Sentences
Presented in the Family Context
(Material Sets A and B)

Sentence type	Unreduced	Reduced
1	(A) Jim jumps over the brush and Sue jumps over the brush. (B) Dad sits on the towel and Jim sits on the towel.	(A) Happy Jim and happy Sue jump over the blue brush. (B) Daddy and Jim sit on the pretty yellow towel.
2	(A) Mommy kicks the brush and Mommy kicks the towel. (B) Sue pushes the towel and Sue pushes the comb.	(A) Mommy kicks the little blue brush and the towel. (B) Sue pushes the yellow towel and the blue comb.
3	(A) Daddy can dance and Daddy can wave. (B) Mommy can sit and Mommy can jump.	(A) The happy Daddy can dance and wave. (B) The pretty Mommy can sit and jump.
4	(A) Mommy sits on the towel and Sue sits on the comb. (B) Jim steps on the brush and Daddy steps on the towel.	(A) Mommy sits on the pretty towel and Sue the comb. (B) Jim steps on the small blue brush and Daddy the towel.
5	(A) Jim pushes the brush and Sue pushes the comb. (B) Daddy kisses Sue and Mommy kisses Jim.	(A) Jim and Sue push the blue brush and the blue comb. (B) The Daddy and the Mommy kiss Sue and Jim.
6	(A) Jim pushes the towel to Dad and Jim pushes the towel to Sue. (B) Mom puts the towel on the brush and Mom puts the towel on the comb.	(A) Jim pushes the beautiful yellow towel to his Daddy and Sue. (B) The Mommy puts the pretty towel on the blue brush and the blue comb.

Unreduced and Reduced Versions of Test Sentences
Presented in the Farm Context
(Material Sets A and B)

Sentence type	Unreduced	Reduced
1	(A) The chick steps on the food and the pig steps on the food. (B) The cat sits on the food and the chick sits on the food.	(A) The yellow chick and the nice pink pig step on the food. (B) The nice white cat and the nice brown horse sit on the food.
2	(A) The cat pushes the dog and the cat pushes the cow. (B) The cow kisses the pig and the cow kisses the cat.	(A) The little cat pushes the grey dog and the white cow. (B) The pretty cow kisses the pink pig and the white cat.
3	(A) The chick can hop and the chick can scratch. (B) The cat can jump and the cat can sit.	(A) The small yellow chick can hop and scratch. (B) The pretty white cat can jump and sit.
4	(A) The pig jumps on the dog and the cow jumps on the horse. (B) The pig falls on the chick and the dog falls on the food.	(A) The pink pig jumps on the nice dog and the cow the horse. (B) The pig falls on the yellow chick and the dog the food.
5	(A) The cow hits the horse and the cat hits the chick. (B) The cow bites the horse and the dog bites the pig.	(A) The cow and the cat hit the horse and the chick. (B) The cow and the dog bite the horse and the pig.
6	(A) The cat gives the food to the pig and the cat gives the food to the dog. (B) The dog brings the food to the cow and the dog brings the food to the chick.	(A) The pretty little cat gives the food to the pink pig and the grey dog. (B) The grey dog brings the food to the white cow and the yellow chick.

Unreduced and Reduced Versions of Test Sentences Presented in the Inanimate Context (Material Sets A and B)

Sentence type	Unreduced	Reduced
1	(A) The glass falls on the clay and the plane falls on the clay. (B) The clay rolls on the tree and the glass rolls on the tree.	(A) The plastic glass and the little plane fall on the clay. (B) The red ball of clay and the tall glass roll on the tree.
2	(A) The clay falls in the glass and the clay falls in the plate. (B) The plane flies in the plate and the plane flies in the tree.	(A) The red clay falls in the tall glass and the pretty plate. (B) The blue airplane flies in the pretty plate and the tree.
3	(A) The clay can roll and the clay can bounce. (B) The tree can bend and the tree can shake.	(A) The pretty red clay can roll and bounce. (B) The beautiful tree can bend and shake.
4	(A) The cup drops on the flower and the plane drops on the tree. (B) The cup falls on the flower and the plane falls on the glass.	(A) The small cup pushes the white flower and the plane the tree. (B) The cup falls on the pretty flower and the plane the glass.
5	(A) The cup covers the tree and the glass covers the clay. (B) The clay pushes the plane and the cup pushes the tree.	(A) The cup and the tall glass cover the tree and the clay. (B) The red clay and the glass drop on the plane and the tree.
6	(A) The tree pushes clay in the glass and the tree pushes clay in the plate. (B) The plane drops the clay in the cup and the plane drops the clay in the glass.	(A) The beautiful tree pushes the red clay into the glass and the plate. (B) The little blue airplane drops the red clay into the cup and the glass.

Appendix B

TOY MATERIALS

TOY MATERIALS

The Family	The Farm	Unrelated inanimate objects
Jim	chick	glass
Sue	pig	clay
Mommy	cat	plane
Daddy	dog	cup
brush	horse	plate
comb	cow	tree
towel	food	flower

Appendix C

RESPONSE FORM

Response Form

Name: _____ Testing location: _____

Age: _____years _____months Teacher: _____

Sex: _____ Date: _____

Test Sentence	Set A/B	U	R	Context	Enactment	Cr.	Incr.	NR	Comments
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									
11.									
12.									

Appendix D

MEANS AND STANDARD DEVIATIONS FOR PERFORMANCE ON CONJOINED SENTENCES

Means and Standard Deviations for Performance on Conjoined Sentences by Age[a,b]

Age	Context											
	Family				Farm				Inanimate			
	Unreduced		Reduced		Unreduced		Reduced		Unreduced		Reduced	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
I (3.0-3.5 yrs)												
1	.900	.316	1.000	0	1.000	0	1.000	0	.800	.422	.500	.527
2	.900	.316	1.000	0	.400	.516	.800	.422	.900	.316	.800	.422
3	.700	.483	.800	.422	.700	.483	.800	.422	.900	.316	.900	.316
4	.700	.483	.700	.483	.200	.422	.100	.316	.300	.483	.100	.316
5	.500	.527	.700	.483	.300	.483	.200	.422	.400	.516	.200	.422
6	.500	.527	.500	.527	.500	.527	.900	.316	.200	.422	.100	.316
II (3.6-3.11 yrs)												
1	1.000	0	1.000	0	.900	.316	.900	.316	1.000	0	.600	.516
2	1.000	0	1.000	0	.700	.483	.600	.516	1.000	0	.800	.422
3	.800	.422	.700	.483	.900	.316	.900	.316	.900	.316	.900	.316
4	.800	.422	.800	.422	.400	.516	.200	.422	.700	.483	.300	.483
5	.900	.316	.900	.316	.300	.483	.300	.483	.700	.483	.600	.516
6	.500	.527	.600	.516	.600	.516	.800	.422	.200	.422	.300	.483

(continued)

	Context											
	Family				Farm				Inanimate			
	Unreduced		Reduced		Unreduced		Reduced		Unreduced		Reduced	
Age	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
III (4.0-4.5 yrs)												
1	1.000	0	1.000	0	1.000	0	1.000	0	.900	.316	.700	.483
2	1.000	0	1.000	0	.900	.316	.700	.483	.700	.483	.700	.483
3	1.000	0	.900	.316	.800	.422	.900	.316	.800	.422	1.000	0
4	1.000	0	.700	.483	.400	.516	.400	.516	.600	.516	.500	.527
5	1.000	0	.900	.316	.600	.516	.500	.527	.500	.527	.300	.483
6	.600	.516	.700	.483	.800	.422	.800	.422	.500	.527	.600	.516
IV (4.6-4.11 yrs)												
1	1.000	0	1.000	0	1.000	0	1.000	0	.900	.316	1.000	0
2	1.000	0	1.000	0	.800	.422	1.000	0	.800	.422	.400	.516
3	.900	.316	1.000	0	.900	.316	.900	.316	.900	.316	1.000	0
4	1.000	0	.700	.483	.800	.422	.200	.422	.800	.422	.600	.516
5	1.000	0	1.000	0	.700	.483	.500	.527	.800	.422	.600	.516
6	.700	.483	.900	.316	1.000	0	1.000	0	.600	.516	.500	.527

[a] $\underline{n}$ = 10 per age group. Range = 0-1.

[b] Sentence Type 1 = conjoined subject noun phrase; 2 = conjoined object noun phrase; 3 = conjoined verb phrase; 4 = gapped verb; 5 = conjoined noun phrase and verb phrase; 6 = conjoined objects of prepositional phrases.

Appendix E

FREQUENCY DISTRIBUTION OF ERROR DATA

Frequency Distribution of Errors for Each Age by Context, Sentence Type[a] and Reduction

	Context					
	Family		Farm		Inanimate	
Age	Unreduced	Reduced	Unreduced	Reduced	Unreduced	Reduced
I (3.0-3.5 yrs)						
1	1	0	0	0	2	5
2	1	1	5	1	3	2
3	3	2	4	1	1	1
4	3	3	8	8	7	9
5	5	3	8	8	5	9
6	5	5	5	1	7	9
II (3.6-3.11 yrs)						
1	0	0	1	1	0	4
2	0	0	3	4	0	2
3	2	3	1	1	1	1
4	2	2	6	8	3	7
5	1	1	7	7	3	4
6	5	4	4	2	8	7

(continued)

Age	Context					
	Family		Farm		Inanimate	
	Unreduced	Reduced	Unreduced	Reduced	Unreduced	Reduced
III (4.0-4.5 yrs)						
1	0	0	0	0	1	3
2	0	0	1	3	4	2
3	0	1	2	1	2	0
4	0	3	6	6	4	5
5	0	1	4	9	5	3
6	4	3	2	2	5	4
IV (4.6-4.11 yrs)						
1	0	0	0	0	1	1
2	0	0	2	0	2	6
3	1	0	1	1	1	0
4	0	3	2	7	2	4
5	0	0	3	5	2	4
6	3	1	0	0	4	5

[a]Sentence Type 1 = conjoined subject noun phrase; 2 = conjoined object noun phrase; 3 = conjoined verb phrase; 4 = gapped verb; 5 = conjoined noun phrase and verb phrase; 6 = conjoined objects of prepositional phrases.

Appendix F

ANALYSIS OF UNREDUCED ERRORS BY CLAUSE ENACTMENT

Summary of Findings of the Preliminary Analysis of Unreduced Errors by Clause Enactments

The preliminary analysis of unreduced errors by clause enactments reveals the following error tendencies:

(1) Ages I and II accounted for more than three-quarters of those errors in which only the first-heard or second-heard clause was enacted.

(2) All ages omitted the first-heard clause in their enactments more often than the second-heard clause (see FCO, SCO, FCO/SCE, and SCO/FCE error distributions). This pattern is most apparent for Age I.

(3) More errors were made on the first-heard clause for Sentence Types 4, 5 and 6, while the second-heard clause was more often in error for Sentence Types 1, 2 and 3.

(4) Sixty percent of the errors made on both clauses of a conjoined sentence type were made on Sentence Type 6. The remaining BCE errors were distributed across Sentence Types 2, 3, 4, and 5 with the latter two sentence types accounting for an additional 25% of these errors.

(5) Of the total SVO simplification errors, Age I accounted for 51%, Age II for 31% and Ages III and IV for 9% each.

(6) Although Sentence Types 4, 5 and 6 accounted for 91% of the SVO simplification errors, it is noted that the greatest number of these errors was made on Sentence Type 5.