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6 The Development of Sentence Coordination

Helen Tager-Flusberg
University of Massachusetts/Boston

Jill de Villiers
Smith College

Kenji Hakuta
Yale University

INTRODUCTION

A fundamental issue that must be addressed in the study of child language is the relationship between linguistic theory and child-language data. There are at least three possibilities that can be identified in current thinking:

1. Data from the way children acquire language should be used as a gauge of linguistic theories; constraints can be set on possible theories of adult language by studying the process of language acquisition. Researchers of many different persuasions have adopted this approach (e.g. Bates, 1976; Bruner, 1975; McNeill, 1970).
2. Child language is no more revealing about the nature of adult language than the wing movements of fledgling birds are to an account of adult bird flight. In both cases, there are such strong biological constraints on the final form that the preparatory attempts do not necessarily play a role in the end product (Chomsky, 1976). This extreme position has not been endorsed by developmental psycholinguists.
3. Linguistic theory provides information for the developmental psycholinguist about how to look at the development of language, what rules children are likely to need, and the hypotheses they might adopt as partial or whole solutions.

During the 1960's, this third approach was by far the most popular, especially in the debate involving the psychological reality of transformational rules. The fate of the simple "derivational theory of complexity" in accounting for adult performance is well known (see Fodor, Bever, & Garrett, 1974), but R. Brown (Brown & Herrnstein, 1975) proposed that in certain areas it may provide an apt description of the acquisition of knowledge rather than the use of it in comprehension or memory tasks by adults. The specific cases Brown had in mind were the acquisition of grammatical morphemes (Brown, 1973) and the development of tag questions (Brown & Hanlon, 1970), both of which seem to involve well-defined prerequisite knowledge. There are, unfortunately, numerous other instances in which the predictions of the derivational theory of complexity fail against data from child language (de Villiers & de Villiers, 1978; Maratsos, 1978).

Subsequent investigations of grammatical development have generally proceeded more independently, without particular linguistic theories guiding them. However, there are three general observations we have distilled from the current child-language literature, some paralleling changes in linguistic theory, which may once again lead to a closer relationship between the two disciplines (see Halle, Bresnan, & Miller, 1978).

1. *Structures may not have the same source in child language that they have in adult language*. Two examples from the current literature illustrate this general point. Ingram (1975) studied the relative clauses produced by children in telling stories, and found that children younger than age 5 or so produce a very limited variety of relative clauses that do not seem to require transformational rules, but instead could result from phrase-structure rules.

Horgan (1978) points to the large number of truncated passives in child speech and the paucity of full passives. She argues that the truncated forms are not plausibly derived from their corresponding full forms because they are grammatically distinct in many ways, and may instead be formed by analogy with predicate adjectives.

2. *Language is more closely tied to context for young children than for adults*. If an adult speaker were asked: Are the following two sentences identical in meaning?

> The dog bites the child.
> The child is bitten by the dog.

she or he would most probably say "yes" with a qualification that the sentences would be used in slightly different circumstances. In particular, choice of one or the other would depend on whether the child or the dog was the focus of attention in the discourse. Children apparently learn constructions such as the passive much more readily when it is presented to them as a motivated construction for highlighting certain topics (e.g., I. Brown, 1976). A reasonable generalization

may be that children learn a variety of constructions to serve a variety of purposes in communication—that is, the formal differences among sentences are used to signal functional differences, or differences in the situation. The child at first may not be able to represent a sentence in isolation from the context in which it is used, and for this reason, may not be attuned to the purely structural similarities and differences among sentences. As a result, the abstract commonalities that linguists observe so readily among different sentence types considered out of context may be much less evident to the language-learning child. Several different investigators have postulated a reorganization of linguistic knowledge that might occur after the child's language is comparatively sophisticated (e.g., Bowerman, 1974; Ingram, 1975), and possibly even coincident with the emergence of metalinguistic awareness. Perhaps only at this point do the relations among sentence types become consolidated.

3. *There appear to be surface structure constraints in child speech and comprehension.* Children's comprehension of passive sentences (Bever, 1970) and relative-clause sentences (de Villiers, Tager-Flusberg, Hakuta, & Cohen, 1979) is characterized by a tendency to interpret noun-verb-noun sequences as agent-action-patient, and a difficulty with noncanonical sequences.

Hakuta (1979) presents evidence from Japanese children that sentence configuration is a major variable influencing comprehension of relative-clause structures, and that this is to a large extent independent of the direction of embedding (i.e., left branching versus center embedded). Children have difficulty comprehending sentences in which noun phrases are "stacked" in a row and this is also reflected in their avoidance of such structures in production tasks.[1]

The particular construction we have chosen to study, sentence coordination, is one of the major hallmarks of syntactic development, marking the beginning of recursivity in the child's language. In this chapter, we discuss the development of the earliest and most frequent form of sentence conjunction—namely, the use of "and" in coordinated phrases and sentences.

LINGUISTIC TREATMENT OF COORDINATION

There are two major forms of syntactic coordination with the conjunction *and*. In *sentential* coordination, both propositions appear in their entirety:

Eliza flew the coop and James had a fit.

and may contain redundant elements:

[1]There is renewed interest in more precise performance models for child language that would incorporate these constraints and make contact with the models proposed for adult-language comprehension and production—for example, Augmented Transition Network models (see Kaplan, 1972).

Eliza washed the dishes and Eliza flooded the kitchen.

The other form of a coordinated sentence, called *phrasal* coordination, contains no redundancy—for example:

James and Philip grew orchids.

In phrasal coordination, many different conjuncts are possible: subjects, as in the preceding example: predicates:

Eliza washed the dishes and flooded the kitchen;

objects:

James grows orchids and petunias,

and so on.

The two main questions within linguistics are:

1. What is the relationship between sentential and phrasal coordination?
2. How many different rules are required to account for the variety of conjoined structures?

Stockwell, Schachter, and Partee (1973) describe three alternative answers to question 1:

1. Phrasal conjunctions are derived from sentential structures in the base by a process called *conjunction reduction*, in which redundant elements are eliminated.
2. Phrasal conjunctions are generated directly in the base by phrase-structure rules.
3. Some phrasal conjunctions are generated directly in the base and others are the result of conjunction reduction.

Conjunction Reduction

In *Syntactic Structures* (1957), Chomsky defined conjunction in transformational terms:

> If S_1 and S_2 are grammatical sentences, and S_1 differs from S_2 only in that X appears in S_1 where Y appears in S_2 (i.e. $S_1 = . . X . .$ and $S_2 = . . Y . .$), and X and Y are constituents of the same types in S_1 and S_2, respectively, then S_3 is the result of replacing X by X + and + Y in S_1 (i.e. $S_3 = . . X + \text{and} + Y . .$) [p. 36].

Gleitman (1965) pointed out certain cases in which *X* and *Y* are not constituents, e.g.

I gave the girl a nickel and the boy a dime.

He took John home and Mary to the station.

Speakers appear to accept these sentences as grammatical, but according to Gleitman, they frequently recall them inexactly, often recalling a sentence that

obeys Chomsky's generalization in having conjoined constituents. Certain other cases of nonconstituent conjunction are almost always rejected by native speakers e.g.

I want to know why John and when Mary are coming.

An intermediate set are marginally acceptable, including:

The man saw and the woman heard the shot fired.

Koutsoudas (1971) reported that French and Italian informants rejected sentences like this latter, except when the subjects were identical; thus:

*Jean a vu et Marie a frappe le chien.
(John saw and Mary hit the dog.)
Marie a vu et Marie a frappe le chien.
(Mary saw and Mary hit the dog.)

It is not clear whether these marginal cases require restrictions on the general schema of conjunction, or result from semantic anomalies or pecularities. Stockwell et al. (1973) propose the latter and believe the advantages that result from a general schema in which all conjunction is derived from a general rule outweigh the difficulties presented by the marginal cases.

Ross (1967) specified a constraint on the conjunction-reduction schema that involves the direction of deletion. If the identical elements are on the left branches of a deep-structure configuration, deletion occurs in a *forward* direction—that is, the second occurrence of the redundant element is deleted; so:

The psychologist solved the problem and the psychologist saved the day.

becomes:

The psychologist solved the problem and saved the day.

not:

*Solved the problem and the psychologist saved the day.

If the elements are on right branches, then deletion is *backward*—that is, the first occurence of the redundant element is deleted:

The psychologist solved the problem and the chimp solved the problem.

becomes:

The psychologist and the chimp solved the problem.

not:

*The psychologist solved the problem and the chimp.

Harries (1973) has subsequently argued that forward reduction is the more basic process on two grounds: backward reduction can be reanalyzed as forward reduction plus regrouping of the constituents, and forward reduction is much more common in the world's languages than is backward reduction.

Ross (1967) argued for two types of rules to derive conjoined structures. The first rule, called *gapping*, reduces coordinated sentences by deleting a verb in the forward direction, e.g.

John hit Harry, and Jim, Michael.

The second rule is conjunction reduction, which accounts for all other kinds of reduced coordinations and consists of several steps: (1) raising an identical con-

stituent; (2) deleting all lower identical repetitions of the same constitutent; (3) pruning non-branching nodes; and (4) relabeling constituents to yield an A-over-A structure.

Even though conjunction reduction remains the most accepted way of dealing with coordinated structures in the standard transformational grammar, there is still debate about the number of separate rules that are needed within that schema. For example, Koutsoudas (1971) argues that gapping and conjunction reduction should be collapsed into a single rule, and the status of gapping remains controversial.

Phrasal Conjunction Basic

Wierzbicka (1967) argued on logico-semantic grounds that conjoined *NP*'s in subject position constitute a single semantic unit, the argument on which a predication is made. So

John and Mary left.

does not contain two separate predicates, one about John and the other about Mary, but a single predication on the conjunct *John and Mary*. Wierzbicka suggests further that conjuncts of this sort must have some semantic denominator, because sentences such as:

The people and tables are all here.

sound peculiar. This common denominator is the subject or argument.

Stockwell et al. (1973) extend this observation to *VP*'s, which also seem to require a common denominator if they are conjoined—for example,

I sing and dance.

?I sing and analyze conjunction.

However, Stockwell et al. do not accept this as an argument that phrasal conjunction is generated in the base.

Dougherty (1967) points out the close behavioral similarity of plurals and conjoined *NP*'s, and argues that because plural *NP*'s are not derived from conjoined sentences, then neither are conjoined *NP*'s derived. Dougherty proposes that all conjunctions of full, single constituents are generated in the base. However, he does admit the need for derived conjunction in cases in which the surface conjuncts are not full, single constituents.

Stockwell et al. (1973) argue against Dougherty's proposal primarily on the grounds that constituents can be conjoined even though they appear at different points in the deep structure. For example, given a transformational account of passivization, the following sentence could not arise from phrasal conjunction in the base because the underlined *VP* would not exist in that form prior to passivization:

The boy was unhappy and *was ignored by everyone*.

In the surface structure the *VP*'s are conjoined, but they could not be conjoined in the deep structure if the second *VP* is the result of applying a passive transformation.

There are a number of similar instances that illustrate the ramifications of proposing that phrasal conjunction is generated directly in the base, *if* one accepts the standard transformational account of other phenomena such as passivization, adjectival phrases, and so on. The implications for conjunction of adopting a different approach to passivization (e.g., Bresnan, 1978) have not yet been worked out. Furthermore, recent changes in the standard theory (e.g., Chomsky, 1977; Fiengo, 1977) have led to a drastic reduction in the number of transformational rules, and an increased reliance on base rules. The status of conjunction reduction remains unclear with these refinements, although some have argued for the complete elimination of conjunction reduction as well as all other transformations (e.g., Grosu, 1979; but cf. Chomsky & Lasnik, 1977; Williams, 1978).

Stockwell et al. see no conflict in Dougherty's second claim about the close similarity of plural *NP*'s and conjoined *NP*'s, because although they do not work it out in detail, they propose that plural *NP*'s also derive from conjoined sentences.

Gleitman (1965) suggested that sentential forms in which a noun phrase is repeated often lead informants to guess that two different referents were intended e.g.

A tall man observed the criminal and a tall man called the police.

When there is no repetition of *NP*'s, informants guess that a repetition of referent occurred:

A tall man observed the criminal and called the police.

With a pronoun replacing the second *NP*, judgments about the identity of the referent are mixed:

A tall man observed the criminal and he called the police.

Presumably, the effect can be manipulated further by changing the second article to a definite one e.g.

A tall man observed the criminal and the tall man called the police.

Nonetheless, the effect seems to be a general one that repetition in a sentential form leads informants to guess nonequivalence, not just for identity of *NP* referents but also for actions, e.g. for:

John jumped and Mary jumped.

versus:

John and Mary jumped.

informants believe the action was simultaneous in the latter case but not necessarily in the former. Jeremy (1978) confirmed this for adults and children as young as 4 years of age.

It is a question of debate whether these differences of intended meaning should be handled by allowing phrasal conjunction to derive from a separate source, or by calling it a question of surface-structure interpretation (Stockwell et al., 1973).

Some Phrasal Conjunction Necessary

The discrepancy in meaning between phrasal and sentential forms reaches its extreme for certain predicates discussed by Lakoff and Peters (1969)—for example, the lack of paraphrase between:

Mary and John are a happy couple.
*Mary is a happy couple and John is a happy couple.
or:
Mary and John are similar.
*Mary is similar and John is similar.

Lakoff and Peters proposed that phrasal conjunctions like these be generated directly in the base because they could not be derived from sentential equivalents, but this is by no means undisputed (Stockwell et al., 1973).

The main purpose of our studies is to investigate how young children produce conjoined structures in speaking. We were interested in the claim that children must have mastered a rule such as conjunction reduction before they produce phrasal conjunctions, and searched for evidence that this was the case. We have also investigated whether children's conjunctions involve conjoining nonconstituents, and whether gapped sentences occur or give children trouble—this is to see if children's schema for conjunction reduction might be restricted in ways that it is not for adults. We have looked for evidence that structures hypothesized to involve backward deletion might be more difficult or later to appear than structures involving forward deletion. Finally, we have searched for clues about how children interpret sentential and phrasal forms, to see if they regard them as synonymous or distinct in meaning.

We report data on coordinating conjunction in young children that reveal the following:

1. Children's earliest phrasal conjunctions are *not* plausibly derived by conjunction reduction, but are most likely generated by directly combining like constituents by phrase-structure rules.
2. There are subtle differences in meaning and use between phrasal and sentential forms that children recognize very early and conform to in speaking and possibly in understanding.
3. Certain configurations of elements in conjoined structures present more problems than others for children to produce and understand. The direction of deletion (forward or backward) is not perfectly correlated with this difficulty.

The criticism can always be raised that a failure to find evidence for the psychological reality of linguistic structures is due to the limitations of studying performance rather than competence. In recognition of the pitfalls of drawing conclusions from a single performance, we have explored four different methods

of investigating the child's knowledge of the syntax of conjunction: longitudinal records of spontaneous speech, elicited production, elicited imitation, and act-out comprehension. The results of our studies complement one another in all important respects, but without the interlocking nature of the data, we could not argue our case. In a later section of the chapter, we return to the methodological issues that must be resolved in studying children's syntax.

SPONTANEOUS-SPEECH ANALYSIS

One of the richest sources of acquisition data comes from longitudinal studies of natural speech. Let us begin by describing coordination data from the spontaneous-speech protocols of Adam, Eve, and Sarah, collected by Roger Brown and his colleagues. The main focus of this study was to find out which forms of coordination were the earliest to develop, and how the different forms enter the child's speech over time.

First, we combed through all the transcripts for each child separately and noted down every utterance that contained an "and." Because of the large number of such utterances, we stopped at the point at which the mean length of utterance (MLU) was 4.25, the beginning of Stage V. We noticed that many of the earliest coordinations were simple *noun* + *noun* phrases, such as:

milkshake and poopoo (from Sarah: 28 months).
Fraser and Cromer (from Eve; 23 months).

We were, however, more interested in the well-formed coordinations that could be classified into the different syntactic types. Sentences containing *and then* of which there were very few, were excluded, and the remaining well-formed coordinations were divided into the following five categories: forward phrasals (*FP*), forward sententials (*FS*), backward phrasals (*BP*), backward sententials (*BS*), and sentential coordinations with no potential for deletion (*S*) e.g.

Why I going in front of it and de man's not home yet? (from Adam; 41 months)

A total of 360 sentences were categorized and the number and percentage of each of the five types from each child are shown in Table 6.1. For all three subjects, over half the coordinations were *FP*, most of these involving conjoined objects. For example:

He having carrots and peas (from Eve, 26 months).

The most interesting aspect of this longitudinal data is the developmental progression of the different types of coordination. For each monthly time period, we plotted the proportion of each of the four main types of coordination (*FP*, *FS*,

TABLE 6.1
Number and Percentage of Different Coordination Types in the Spontaneous Speech of Adam, Eve, and Sarah

	FP	*BP*	*FS*	*BS*	*S*	*Total*
Adam						
(20 months)	113	7	27	14	26	187
%	60	4	14	8	14	
Sarah						
(17 months)	52	7	16	2	5	82
%	63	9	20	2	6	
Eve						
(7 months)	47	26	6	7	5	91
%	52	28	7	8	5	

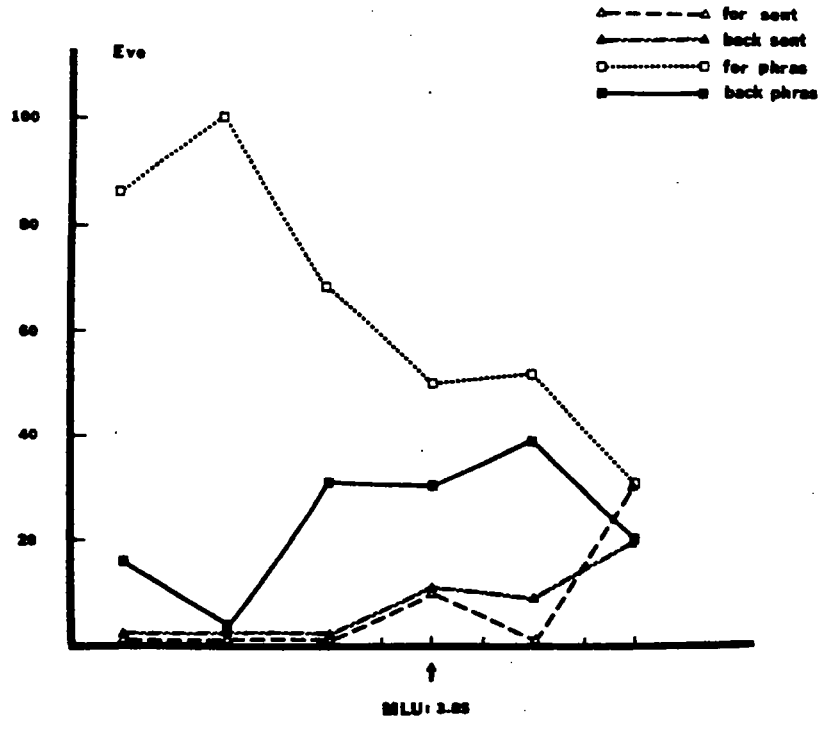

Fig. 6.1. Graph showing the developmental course of the main forms of coordination in Eve's speech.

BP, BS) classified earlier, relative to the total number of such coordinations produced during that month. Thus, for each child, there is a graph depicting the development of the syntactic forms, and the degree to which each category dominates at different points during the acquisition of coordination. Figs. 6.1, 6.2, and 6.3 show the graphs from Eve, Sarah, and Adam, respectively.

The striking feature of the graphs from all the children is the almost exclusive use of *FP* forms in the early months. Sentential coordinations with or without potential deletion do not appear until midway through Stage IV, in which the MLU is around 3.80. Across the three subjects, there are 92 phrasal coordinations before the point where sententials begin to be produced. Even when the sententials do begin, there is still a preponderance of phrasal coordinations in the children's speech.

Another interesting finding from this spontaneous-speech data is that clearly the majority of coordinations produced are forward phrasals and sententials. There are, however, some differences among the three children. For Adam and Sarah, only 12% and 11% of their coordinations are backward forms, yet for Eve, the percentage is three times higher, 36%. Almost all the backward phrasals

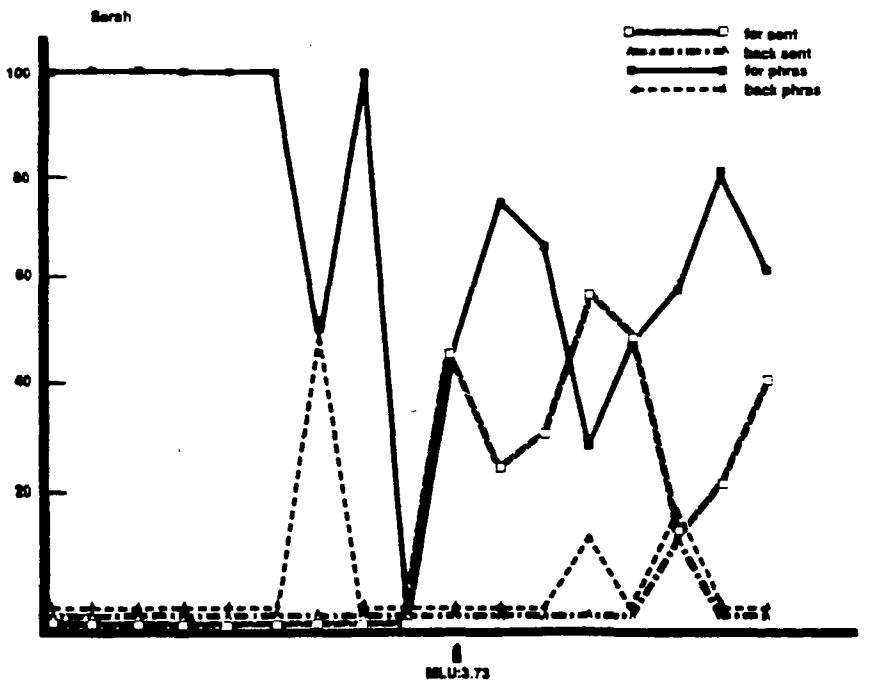

FIG. 6.2. Graph showing the developmental course of the main forms of coordination in Sarah's speech.

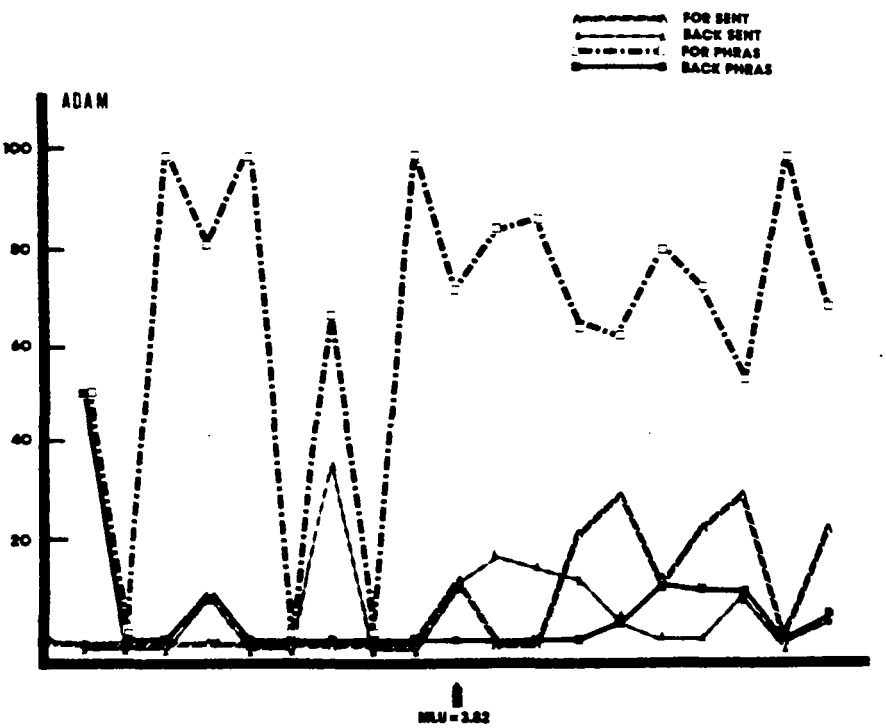

FIG. 6.3. Graph showing the developmental course of the main forms of coordinated in Adam's speech.

involved conjoined subjects, and subjects are known to be either absent or very simple in child speech, which might account for why there are so few examples of backward phrasals in Adam's and Sarah's transcripts. Looking closely at Eve's conversations, one notices that she constantly speaks of "Fraser and Cromer"—the two experimenters who taped her spontaneous speech. Coordinations with "Fraser and Cromer" as the conjoined subject make up the majority of Eve's backward forms, and this particular coordination may well be a routine.

The main findings, then, from the longitudinal speech data are that phrasal coordinations appear earlier than sentential coordinations, and forward forms are much more frequent than backward forms. The conjunction-reduction hypothesis described previously, interpreted by the derivational theory of complexity, actually predicts the opposite: that sentential forms should develop earlier than phrasals because they are derivationally less complex.

Lust and Mervis (1980) report a cross-sectional study of spontaneous production of coordination in which they argue that their data support the standard theory, because sententials have primacy over phrasals. Their data are somewhat

limited in that from 32 children ranging in age from 24 to 37 months, they collected only 68 examples of well-formed coordinations. Of these, the majority (40) they consider sentential, whereas they count only 28 phrasals. The main problem we have with Lust and Mervis' data is in the nature of the sentential coordinations they report. They include anaphoric reference, as in:

Some brown on my shirt and it was an accident.

Lust and Mervis also include various meaningless sentences that look like the child is just repeating himself or herself:

He sitting up and he sitting up.

Perhaps most problematic of all is the inclusion of sentences in which the child uses the same term but for two different referents, e.g.

That's a mama and that's a daddy.
There is a bigger boat and there's a truck.

(The preceding are all examples from Table 5.) Lust and Mervis argue that they did not have enough contextual information to decide on the issue of coreference in the sentential examples, but it seems highly likely that the child in such cases was pointing to two different things. A phrasal conjunction would be inappropriate in such circumstances, so it is misleading to present these sententials as an argument for the primacy of sententials over phrasals. In our study, these sentences were in the minority. In contrast, approximately one half of the sententials reported by Lust and Mervis appear to fall into this latter category. There remain too few cases to argue that children find it easier to produce sententials rather than phrasals.

Bloom, Lahey, Hood, Lifter, and Fiess (1980) reported the development of syntactic connectives in four children studied longitudinally, and found that phrasal conjunction emerged at the same time as sentential conjunction for three of the children, and earlier for the fourth subject. At this point, then, evidence in favor of the primacy of sententials over phrasals in development is equivocal.

Could this failure to support the conjunction-reduction hypothesis result from performance variables such as MLU limitations? For example, it has been argued that a length constraint is operating at the earliest stages of coordination production (cf. Lust & Mervis, 1980). Because the minimum length of well-formed sentential coordination is five words, compared to four in a phrasal coordination, this might explain why sentential forms do not appear until later stages. To check this possibility, we calculated the average length of Eve's phrasal coordinations, which were produced in the period before any sentential coordinations appeared. The MLU of these sentences was 6.40, higher than the five necessary for sentential coordination. Only 25% of these phrasals were four words or less in length. Thus, it does not appear that length alone is constraining the form of coordination at the earliest stages. This view is consistent with other findings in language acquisition (cf. Bloom, Miller, & Hood, 1975).

No linguistic theory offers an explanation for the earlier emergence of phrasal conjunctions and so we have explored three alternative interpretations for our longitudinal data.

A Syntactic Account

In previous papers (de Villiers, Tager-Flusberg, & Hakuta, 1976, 1977) we proposed that coordination develops in the following way: The earliest forms of conjunction in the child's speech are groupings of parts of speech, such as *noun + noun* phrases. These are then slotted into a sentence frame to produce a well-formed phrasal coordination. Over time, the conjoined parts of speech become more and more complex until ultimately, complete propositions are coordinated, yielding sentential coordinations. We argued that at this point the child has the option to conjoin phrases in phrasal coordination, or complete propositions in sentential coordination, and that perhaps the child then might indeed use deletion rules to derive phrasal coordinations from corresponding sentential forms.

In support of this argument, we find that all the early well-formed phrasal conjunctions involve the conjunction of simple constituents, such as subjects, objects, and predicates, but never nonconstituents. Furthermore, the variety of elements that are conjoined is much less than the variety of elements that would require reduction in the conjunction-reduction schema.

The Input to the Children

We explored the input provided by the children's mothers for clues about the process of coordination development (cf. de Villiers et al., 1977). We followed the same procedure described earlier. All the well-formed coordinations were categorized as *FP*, *BP*, *FS*, *BS*, or *S* (with no potential deletion). For all three mothers, the proportions of the different coordination types were very similar to those of their children. *FP*'s were the most frequent forms used and backward coordinations made up only a small proportion of the total sample. None of the children were imitating their mother's coordinations, nor was the specific content of the mother's and child's coordinations the same.

There exist a number of alternative explanations for this close matching of syntactic form in the input and child's speech. One possibility is that the parents and children are highly sensitive to the syntactic form of the coordinations in their conversations and either mother or child is responding to the forms each hears in the other's speech. Alternatively, the same contextual constraints operate on both mothers and children. For example, Jeremy (1978) found that events separated in time favor sentential forms, which are rare in the spontaneous-speech data. We know from other input studies that mothers tend to speak about events taking place in the "here and now" (Cross, 1977; Snow, 1971), which would perhaps favor phrasal coordination.

Contextual Constraints

The third possibility, then, is that the forms have different frequencies in child speech because the eliciting contexts have different frequencies. Let us consider separately the difference between forward versus backward forms, and phrasal versus sentential.

Forward Versus Backward. Forward phrasals were many times more frequent in the children's speech than backward phrasals. Consider what is conjoined in these sentences: Forward phrasals are predominantly object or predicate conjunctions, in which the children made reference to multiple toys or foodstuffs that they were acting upon. Backward phrasals are predominantly subject conjunctions, but the children's subjects were mostly self-referent and frequently pronominal (see also Limber, 1973). The children seemed to have little need to refer to multiple subjects, and only Eve used subject conjunction with any frequency. As we remarked earlier, she made frequent reference to "Fraser and Cromer", who, from Eve's perspective at least, always appeared together and engaged in the same activities.

Forward reduction has been argued to be more basic than backward reduction (Harries, 1973), and Lust (1977) used this to account for her subjects' superior imitation of forward phrasals than backward phrasals. If children had trouble with backward reduction, one would expect a high frequency of backward sententials—that is, forms that they failed to reduce—in their speech. As can be seen from our data, backward sententials were also quite rare, adding force to our contextual-frequency explanation of these data.

Sentential Versus Phrasal. As mentioned earlier, phrasal conjunction may be more frequent than sentential conjunction because the latter is used, for example, when events are separated in time and space (Jeremy, 1978), and those contexts are quite rare as topics for children's discourse. In discussing Lust and Mervis' data, we pointed out a second constraint on the production of phrasal conjunction versus sentential conjunction. Sentential conjunction is used when two identical *NP*'s are not identical in reference, e.g.

John$_1$ went home and John$_2$ took a photograph.
could not be expressed as
John went home and took a photograph.
Similarly,
Jane went to school$_1$ and Sue went to school$_2$.
could not be expressed as:
Jane and Sue went to school.
Without implying something different.

Perhaps children reserve sentential conjunction for just such cases of nonidentical referents, and use phrasal conjunction for cases in which the *NP* ref-

erents are identical. It would be our guess that opportunities for sentential conjunction of this type would be quite rare except when the child is pointing and labeling different objects, as in:

There's one and *there's* another one.

or

That's mine and *that's* yours.

We are suggesting that phrasal and sentential conjunctions are not functionally equivalent but are used in different kinds of contexts. Jeremy (1978) demonstrated that 4 year olds, as well as adults, respect the contextual constraints she identified (see also Greenfield & Dent, 1979). This opens up the possibility that children as young as Adam, Eve, and Sarah were sensitive to the different conditions of use of sententials and phrasals, and to the extent that these conditions varied in frequency, so also did their use of the forms.

These interpretations remain speculations, however, because we do not know the context for every utterance, nor do we have control over the opportunities for producing the different forms in spontaneous-speech data. Without such data, we do not know whether young children could identify and respect the pragmatic constraints such as referential identity/nonidentity that might operate on coordination.

ELICITED PRODUCTION OF ENGLISH AND JAPANESE COORDINATIONS

There were two primary motives for conducting this study. First, we wanted to test our hypothesis that there were various contextual reasons why children produced few sentential coordinations. The specific constraint we had in mind in this study was the case in which there were two examples from the same class of referents. For example, a picture of a frog and a turtle watching a single television might tend to be described by a phrasal sentence; the same picture with the frog and the turtle watching their own respective television sets would set the stage for a sentential coordination. We refer to this variable of whether a single or double referent is pictured as the referential context. Our second reason for this production study was to control and equalize opportunities for producing backward forms of coordination, which rarely appeared in the spontaneous-speech samples.

The task involved asking children to describe a series of pictures presented to them in a portable slide viewer. In an earlier pilot study (de Villiers et al., 1977), we found this an extremely successful task in eliciting coordinations in young children when the slides depict compound events such as two animals doing something together, or one animal doing a number of things.

Thirteen different types of pictures were created for this experiment. One example of each is described in Table 6.2. Four examples of each type were

TABLE 6.2
List of Pictures Used in Elicited Production Study

1. *FP* (SVO + O) object conjoined/subject-verb reduced; single referent
   A rabbit holding an umbrella and a balloon.
2. *FS* (SVO + SVO); double referent
   A rabbit holding an umbrella and another rabbit holding a balloon.
3. *BP* (S + SVO) subject conjoined/verb–object reduced; single referent
   A frog and a turtle watching television.
4. *BS* (SVO + SVO); double referent
   A frog watching television and a turtle watching another television.
5. *FP* (SVO + VO) verb–object conjoined/subject reduced; single referent
   A rabbit riding a bike and flying a kite.
6. *FS* (SVO + SVO); double referent
   A rabbit riding a bike and another rabbit flying a kite.
7. *BP* (SV + SVO) subject–verb conjoined/object reduced; single referent
   A fox pulling and a cat pushing a wagon.
8. *BS* (SVO + SVO); double referent
   A fox pulling a wagon and a cat pushing another wagon.
9. *FBP* (SV + VO) verb conjoined/subject–object reduced; single referents
   A cat painting and driving a car.
10. *FP*(*BS*) (SVO + VO) verb–object conjoined/subject reduced; single agent
    A cat painting a car and driving another car.
11. *BP*(*FS*) (SV + SVO) subject–verb conjoined/object reduced; single object
    A cat painting and another cat driving a car.
12. *FBS* (SVO + SVO); double referents
    A cat driving a car and another cat painting another car.
13. *FP* (SVO + SO) gapping–verb reduced
    A horse eating a banana and a cow an apple.

drawn, giving a total of 52 pictures from which slides were made. These slides were divided into two sets of 26, with two examples of each type in each set. The sets were crossed with each other such that a picture used for a phrasal form in one set (single referent) had its corresponding sentential form, with the same lexical items, in the other set (two referents). Thus, Set *A* contained the picture described in example 1 in Table 6.2, whereas example 2 was in Set *B*.

Our sample for this study included a group of Japanese children as well as American children, because Japanese provided some interesting contrasts to English. Briefly, Japanese is a case-inflected language with a predominant subject–object–verb order. As in English, the subject-conjoined coordination could be described as a backward reduction (SØV + SOV), but the object-conjoined coordination is both backward and forward (SOV + SØV).[2] Unlike English, in which the morpheme "and" is used in both phrasal and sentential coordinations, in Japanese, different morphemes are used. Because Japanese is not the primary focus of this chapter, however, we omit details of grammar

[2]Therefore, to make the terminology comparable across both languages, when necessary, we also refer to the sentences in terms of which elements are conjoined.

TABLE 6.3
Number and Percentage of Coordinated Sentences Produced by American Children in the Elicited-Production Study

	Age Group		
	3	*4*	*5*
Number of children in group	18	14	17
Number of sentences containing "and"	241	276	358
% of total number of sentences produced	53%	76%	81%

except when relevant for our discussion. The interested reader is referred to other sources on Japanese grammar (cf. Kuno, 1973).

Forty-nine American children participated in this study. There were 18 3 year olds, 14 4 year olds, and 17 5 year olds, balanced with respect to the between-subjects variables of sex and set of pictures they were shown. The Japanese sample consisted of 36 children from a day-care center in Tokyo. These subjects were distributed into three age groups: 3;6–4;5, 4;6–5;5, and 5;6–6;5, also balanced with respect to the between-subjects variables.

Children were shown the portable slide viewer and were told they would see some pictures in it. They were asked to describe to the experimenter, who could not see into the viewer, everything they saw happening in the slide. If a child was unwilling to offer a response, he or she was gently prompted. The slides were shown in random order, and the whole session, which lasted about 15 minutes, was taped. At no time was the child asked to use the word "and." The tapes were later transcribed onto individual coding forms.

The scoring scheme used to code the sentences was quite elaborate, involving numerous categories. First, all sentences were excluded from further analysis if they did not contain the morpheme "and." Table 6.3 shows the number of sentences that did contain "and" obtained from American children in each age group. Across all these subjects, about 70% of the responses contained "and," showing the success of this task in yielding coordinated sentences.

We were most interested in the type of well-formed coordinations subjects produced for the different pictures. Well-formed was defined as the presence of at least one subject-noun phrase, verb, and object-noun phrase in each coordination, thus excluding sentences in which transitive verbs were expressed as intransitives; for example:

The owl and the bear are hammering.[3]

[3]In all, there were 72 such intransitives, or 8.2% of the total number of "and" sentences. The children were most likely to omit mention of the object for particular verbs such as *driving*, *painting*, and *hammering*, so that the distribution of intransitives was uneven across the pictures. Nonetheless, we subjected them to an identical analysis and the results on this subset of sentences are equivalent in essential respects to those on the full set discussed in the text.

Also, only sentences that conformed closely to a description of the relevant picture were considered.

The main categories used for classifying the sentences included:

	Example from English
1. *FP* forward phrasal	A rabbit is holding a balloon and umbrella. (object conjoined)
2. *FS* forward sentential	A rabbit is holding a balloon and a rabbit is holding an umbrella.
3. *BP* backward phrasal	A raccoon and a pig is hitting a drum. (subject conjoined)
4. *BS* backward sentential	A pig is playing a drum and a raccoon is playing a drum.
5. *FBP* forward backward phrasal	A cat is painting and driving a car. (verb conjoined)
6. *FBS* forward backward sentential	One cat is painting a car and one cat is driving a car.
7. *G* Gapping	A cow is eating a banana and a horse an apple.
8. *PRO* anaphoric reference	A fox is pulling a wagon and a kitty is pushing it.

First consider the English data from pictures 1 to 4 (see Table 6.2). These pictures were designed to elicit, ideally, *FP*, *FS*, *BP*, and *BS* coordination respectively, when the action is the same in both propositions.

The overall number of coordinations produced was lower for the backward coordinations (pictures 3 and 4) than for the forward ones: 72% compared to 83%. Looking closely, in fact, this was true for the 3's and 4's, but not for the 5 year olds. The younger children either ignored the second subject in the backward pictures or referred to two subjects collectively; for example;

They are watching TV (picture 3).
They are hammering nails (picture 4).

One cannot easily avoid using "and" in this way for the first two pictures.

The first concern with the data is whether children tend to use phrasal and sentential forms of coordination differentially with respect to the referential context. The summary data for the American sample appear in Table 6.4, represented as the percentage of phrasal forms used over the sum of phrasal and sentential forms. Thus, a low percentage indicates predominant usage of sententials. As can be readily seen, for the object-conjoined (forward) and the subject-conjoined (backward) pictures with single referential contexts, the descriptions

TABLE 6.4
Percentage Phrasals (over Phrasals Plus Sententials) for American Children for Pictures 1 to 8 in Elicited-Production Study

	Pictures 1 and 2 Object Conjoined Subj–Vb Reduced	*Pictures 3 and 4 Subject Conjoined Vb–Obj Reduced*
Referential Context		
Single	95% (52/58)	75% (30/40)
Double	11% (6/57)	27% (13/48)
	Pictures 5 and 6 Vb–Obj Conjoined Subject Reduced	*Pictures 7 and 8 Subj–Vb Conjoined Object Reduced*
Single	86% (25/29)	7% (2/27)
Double	5% (2/39)	3% (1/31)

were predominantly phrasal (95% and 75% respectively). But when there were two referents, the descriptions were primarily sentential in form. This effect was robust across the three age levels, with a slight tendency for the younger children to use more phrasal forms in describing the double referential pictures. Thus, the data so far support the notion that children differentially use the two forms of coordination depending on referential context.

The hypothesized effect of referential context was less striking for subject-conjoined (backward) sentences than for object-conjoined (forward) sentences. However, because the children produced approximately equal numbers of phrasal and sentential coordinations, it was not the case that sentential forms predominated. There was also an age effect: The younger children (3 year olds) showed slightly less sensitivity to referential context than the older subjects (4 and 5 year olds), 67% to 76%.

A similar analysis was carried out on the next four pictures, 5 to 8, which were also designed to elicit *FP* (verb–object conjoined), *FS*, *BP* (subject–verb conjoined), and *BS* coordination, respectively. These pictures illustrated the agent(s) doing two different actions to the object(s). The summary data are in the bottom half of Table 6.4.

For pictures 5 and 6, the data look much like the data presented earlier for pictures 1 and 2, with 86% phrasals on the single, and only 5% phrasals on the double referential contexts. But for pictures 7 and 8, very few phrasals were produced for either referential contexts (7% of single and 3% of double referential contexts). Picture 7, depicting two animals doing two different things to one object, thus did not elicit phrasals of the form SV + SVO. From the perspective of the conjunction hypothesis, this phrasal involves the conjunction of subject-

verb, which is not a true constituent, and the data indicate that the children are sensitive to this structural constraint.

A general difference between the data from this group of pictures and the sentences produced in response to the first four pictures is that there was a higher proportion of anaphoric references: 28 such responses compared to only 1.

The corresponding data for the sentences considered thus far for the Japanese children appear in Table 6.5. The children produced a large proportion of phrasal forms for the subject-(picture 3) and object-conjoined (picture 1) pictures with single referents (96% and 94% respectively). As in the English data, the sententials tend to cluster on the pictures with two referents, although less strongly so for the Japanese children. Across age, for subject-conjoined descriptions, 75% were phrasal, and for the object-conjoined descriptions, 24%. It should be emphasized that for Japanese, phrasal forms in the double referential context are not incorrect, but rather in these contexts sentential forms become more likely. There was a strong age effect for the Japanese children, with the younger children heavily favoring phrasal forms. The preference for sentential forms on the double referential pictures is comparable to that of the English sample by the time the children are in the oldest age group. It is likely that the preference of the younger Japanese children to use the phrasal forms results from the fact that sentential coordination in Japanese requires a morphological change on the verb of the first sentence, which can be quite complex. Phrasal coordination does not require such a change, and younger children may in fact find this form easier to produce than sententials. One can conclude from this part of the Japanese data that the children almost categorically prefer the phrasal form in describing single ref-

TABLE 6.5
Percentage Phrasals (Over Phrasals plus Sententials) for Japanese Children for Pictures 1 to 8 in Elicited-Production Study

	Pictures 1 and 2 Object Conjoined Subj–Vb Reduced	*Pictures 3 and 4 Subject Conjoined Vb–Obj Reduced*
Referential Context		
Single	94% (51/54)	96% (49/51)
Double	24% (8/33)	75% (36/48)
	Pictures 5 and 6 Vb–Obj Conjoined Subject Reduced	*Pictures 7 and 8 Subj–Vb Conjoined Object Reduced*
Single	100% (41/41)	0% (0/15)
Double	25% (9/36)	0% (0/12)

erential pictures, and that sentential forms are produced with increasing frequency on the double referential pictures as the children grow older.

The data for the subject-verb (pictures 7 and 8) and the object-verb conjoined (pictures 5 and 6) pictures closely resemble the English data. For object-verb conjunctions, the data look similar to those just described, with a high preference for phrasals on the single referential pictures (100%) and a low preference on the double referential pictures (25%). Subject-verb is not a constituent in Japanese either, and this is respected by the Japanese children in that all sentences produced for pictures 7 and 8 were sentential, irrespective of the referential context. Thus, the Japanese data strongly corroborate the English result that referential context is an important factor in determining whether coordinations are phrasal or sentential, but that structural factors must be considered as well. Nonconstituents cannot be conjoined.

It is of some interest to note that there was a consistent difference within the double referential pictures across languages. A higher proportion of phrasals were produced on the subject-conjoined than on the object-conjoined items for both English and Japanese. The reason, we suspect, is psychological rather than linguistic. Our pictures by necessity had animate subjects, and mostly inanimate objects. A subject-conjoined, double referential picture might be that of an owl hammering a nail and a bear hammering another nail. An object-conjoined, double referential picture might be of a gorilla eating an apple and another gorilla eating a banana. Assuming that children see the distinction between animates as more psychologically significant than the distinction between inanimate objects, they would be more likely to collapse inanimates into a single term of reference, resulting in a phrasal form. This suggests yet another nonlinguistic constraint on the form of coordination that future investigation might elucidate by separating animacy and grammatical role.

Further analysis of the structural constraints on coordination can be performed by looking at differences between the various forms of single referential contexts. In the English data, a comparison of the subject-conjoined and the object-conjoined sentences shows that children produced a higher proportion of phrasals on the object-conjoined (95%) than on the subject-conjoined (75%) sentences. Notice that this trend is in the opposite direction from what was found for the double referential contexts, where there was a higher proportion of phrasals on the subject-conjoined pictures. Thus, we infer a structural constraint favoring the conjoining of objects over the conjoining of subjects. This result is to be expected given the combination of the surface configurational properties of the sentence and a left-to-right processing model. Because the constituent *subject + subject* by necessity appears at the beginning of the sentence, it must be planned in advance, whereas *object + object* can be formed by a process of concatenation at the end of the simple sentence without advance planning. The way to produce subject-conjoined sentences given failure to plan in advance is to use the sentential form, which accounts for why more sententials in fact appeared in the data.

We suggest that subject-conjoined sentences are more difficult to produce than object-conjoined sentences in the phrasal form because the former require conjoining of constituents in advance, whereas the latter, by nature of the left-to-right properties of the language, can be formed through concatenation.

The Japanese data, coded into the categories phrasal and sentential, show no difference between the subject-conjoined and object-conjoined descriptions. Ninety-six percent of the subject-conjoined sentences were phrasal, whereas 94% of the object-conjoined were phrasal. However, in this particular case, coding the data with respect to percent phrasal obscures an interesting fact: Of the 51 instances of phrasal coordination in the object-conjoined descriptions, 13, or 25%, of them took the form SOV + OV, when the same verb was repeated. Thus, in actuality, of the total number of relevant utterances for the object-conjoined pictures, only 70% (38/54) were of the form SO + OV. In the English data, a comparable analysis revealed that there were only three instances when the verb was repeated, resulting in SVO + VO. Thus, unlike American children who find the subject-conjoined form relatively more difficult than the object-conjoined form, Japanese children find the reverse.

The English and Japanese data are summarized graphically in Fig. 6.4. The American children, as mentioned earlier, use the sentential form in describing the subject-conjoined pictures more frequently than in the object-conjoined pictures. This was attributed to the S + SVO form's requiring advanced planning whereas SVO + O could be formed through concatenation. The SVO + VO option is rarely taken, because it is not a structurally motivated redundancy of the verb. The Japanese children, on the other hand, do not produce sententials for either

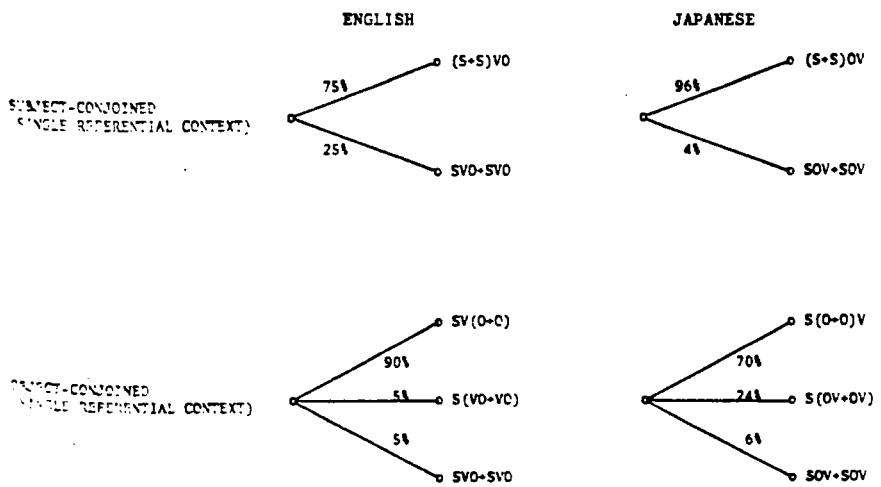

FIG. 6.4. Percentage that various forms were used for subject- and object-conjoined descriptions, for English and Japanese samples.

subject-conjoined or for object-conjoined descriptions. For subject-conjunctions, even if they presumably require advanced planning, they almost categorically opt for the phrasal form. This may reflect the overall finding that Japanese children tend to use more phrasals. But for the object conjunctions, the SOV + OV option, whose analogous SVO + VO is not produced by American children, is quite frequently employed. The Japanese children seem to avoid constructions in which the conjoined constituent is placed in sentence-medial position, and to produce sentences by concatenation of OV + OV at the expense of repeating the verb. It is a structurally motivated redundancy.

But how can we be sure that the difference between the Japanese and American children reported here is the result of structural differences between the languages, and not simply the result of the Japanese children's more frequently repeating items in general? There are other sentences that can be compared in which the reverse prediction is made. When verbs are conjoined, as in the case of a cat driving and painting a car, the following forms are possible:

ENGLISH	SV + VO	sentence-internal conjunction
	SVO + VO	concatenation
JAPANESE	SOV + V	concatenation
	SOV + OV	concatenation

In this sentence, one would predict that the American children would choose the form involving concatenation, in which the object is repeated, avoiding sentence-internal conjunction. No such preference should be found for the Japanese children.

Pictures with this type of sentence as a target were used (see Table 6.2, picture 9), but with less success than the sentences we have been discussing earlier. It is difficult to depict a single agent performing two distinct actions to a single object, a highly improbable event. Nevertheless, we can try to milk the data, if only to see if it disconfirms the predictions. In the English data, there were seven sentences that took the form SVO + VO in which the object was repeated. In addition, there were six sentences in which the object was not repeated but in which there was an anaphoric pronoun, thus taking the form SVO + VPro. Finally, there were only three instances of complete phrasals, of the form SV + VO. One might summarize these data by saying that 19% (3/16) of the phrasals produced took the alternative of sentence-internal conjunction, whereas the reaminder (81%) were formed through concatenation. The Japanese data look even sparser. There were only seven sentences of relevance to this question, primarily because the particular lexical items chosen by the children did not conform well to our target. However, of the seven sentences produced, six involved no repetition of the object and took the form SOV + V. Thus, the data are consistent with the view that children favor sentence-final concatenation over conjunction internal to the sentence.

The response to the group of four pictures related to and including picture 9 (9, 10, 11, and 12) were not so easily categorized. For English, overall there were fewer coordinations—only 55%—as children tended to ignore parts of the pictures. There was also a high proportion of anaphora, an average of 11% PRO responses to each picture. Children often misinterpreted the pictures or chose to report irrelevant information. Sometimes, they used quite complex constructions (passives, embeddings, etc.) or long-winded descriptions, reflecting the trouble they had in understanding the event.

In more general terms, the data from the American children on these four pictures conform to the data obtained from the other pictures discussed. The pictures designed to elicit *FBP* (picture 9) and *FP* (picture 10) elicited almost no sentential responses ($n = 5$), whereas the other two pictures, the *BP* (picture 11, subject-verb conjoined) and *FBS* (picture 12) elicited primarily sentential coordinations ($n = 39$).

Finally, it is worth noting the results from the American children on picture 13, which showed two animals carrying out the same action on different objects. In English, this could elicit a phrasal coordination of the form SVO + SO, involving forward deletion of the verb, gapping. Ninety percent of the responses obtained contained the morpheme "and"; however, there were only two phrasal coordinations compared to 52 sententials (4%). Again, we find this is a phrasal form that the children avoid. Notice that this sentence cannot be derived by conjoining like parts of speech, which may explain its absence. We do not know what proportion of adult responses would be phrasal rather than sentential for these pictures.

The results of this study indicate that there are referential contexts that will differentially elicit phrasal versus sentential coordinations even for 3 year olds. The effect was more compelling when the animate subject was involved than when inanimate objects were the focus of attention. The effect was present in both English and Japanese, although Japanese children showed an overall preference for phrasal coordinations. Detailed comparison of key sentences revealed a preference for concatenation of final elements rather than sentence-internal conjunction in both languages.

Two types of phrasal coordination were not readily produced by English-speaking children. The first is a backward phrasal of the form SV + SVO, which can be described as backward object deletion, or conjunction of subject-verb. The second is the forward phrasal form SVO + SO, involving forward deletion of the verb (gapping). Both forms may be rare in adult spoken language. In addition, the first type involves conjunction of subject-verb, not a true constituent, and the second type cannot be derived by conjunction at all. This might explain their absence, if indeed children form coordinations by conjoining constituents rather than via conjunction reduction, as we proposed in earlier papers (de Villiers et al. 1976, 1977). We have no evidence supporting the view that sententials are more readily produced at any age than phrasal forms in this study.

ELICITED IMITATION STUDY

In order to assess the generality of our findings from the production studies described earlier, we also collected data on coordination processing in young children using two other performance measures: imitation and act-out comprehension. We investigated the same set of sentences that our production task had been designed to elicit (see Table 6.2).

Imitation of coordination has been the subject of a number of other studies on coordination development, notably Slobin and Welsh (1973) and Lust (1977). Both these studies report findings that are consistent with the standard theory of conjunction reduction. Sentential coordinations were imitated better than phrasal coordinations, and the error data showed that forward coordinations were more primary than backward coordinations (Lust, 1977). Our study on imitation was an attempt to replicate this earlier research utilizing a more extensive set of test sentences.

The subjects for this experiment included 13 3 year olds, 20 4 year olds, and 17 5 year olds, approximately half male and half female within each group.

Two similar sets of 18 sentences were constructed to control for lexical preference. All the sentences were of the basic SVO + SVO syntactic structure, exhausting all the well-formed forward, backward, sentential, and phrasal coordinations at all levels of redundancy, by which we mean the number of repeated items in a sentence. Table 6.6 gives examples of the 18 sentences used in this experiment. All the sentences were irreversible and proper names were used in subject position to ensure all the sentences were the same length—namely, 11 syllables.

Children were always tested individually. They were introduced to a parrot puppet who repeated everything spoken to it. They were asked to play the role of the puppet and all children readily agreed. Three practice trials were given when the subjects learned they were to imitate sentences spoken by the experimenter. Then, the 18 sentences from the assigned set were presented at a normal speaking rate, in random order. The session was tape recorded and later transcribed. The subjects in each age group were about equally divided between the two sets of sentences (sex was also balanced).

The subjects' responses were scored into the following categories: correct; incorrect; elaboration (when the response contained elements that had been deleted from the surface structure of the model sentence); or reduction (when the response had elements deleted that had been present in the model sentence).

The data were analyzed using a series of mixed-model ANOVAs. In all the ANOVAs, three between-subjects variables were specified: age, set, and sex. Different repeated-measures factors were tested in three separate ANOVA's because not all the factors were crossed with each other in the sentences because of grammatical restrictions. For the purposes of these analyses, elaboration and reduction responses were counted as incorrect, following Lust.

TABLE 6.6
List of Sentences Used in Elicited Imitation Study

1. *S* (SVO + SVO)
   Jim writes a letter and Jim writes a letter.
2. *S* (SVO + SVO)
   John ate a cookie and George rode a donkey.
3. *FS* (SVO + SVO) subject redundant
   Barry pushed a train and Barry pulled a truck.
4. *FS* (SVO + SVO) verb redundant
   Paula climbed a tree and Sally climbed a fence.
5. *FS* (SVO + SVO) subject-verb redundant
   Rosy flies a kite and Rosy flies a plane.
6. *BS* (SVO + SVO) object redundant
   Sammy wiped the floor and Billy swept the floor.
7. *BS* (SVO + SVO) verb–object redundant
   Judy sent a note and Philip sent a note.
8. *FBS* (SVO + SVO) subject–object redundant
   Roger washed a cup and Roger dropped a cup.
9. *FP* (SVO + VO) verb–object conjoined/subject reduced
   Joey played the piano and beat the drum.
10. *FP* (SVO • SO) gapping: verb reduced
    Bobby drank the milk and Jane the lemonade.
11. *FP* (SVO + VO) verb–object conjoined/subject reduced; verb redundant
    Susy bought a necklace and bought a bracelet.
12. *FP* (SVO + O) object conjoined/subject-verb reduced
    Marion chased the rabbit and the hamster.
13. *BP* (SV + SVO) subject-verb conjoined/object reduced
    Hilary made and Laurie wrapped a sandwich.
14. *BP* (SV + SVO) subject-verb conjoined/object reduced; verb redundant
    Charlie fixed and Tommy fixed the cabinet.
15. *BP* (S + SVO) subject conjoined/verb–object reduced
    Anthony and Melanie cooked a hotdog.
16. *BP FS* (SV + SVO) subject-verb conjoined/object reduced; subject redundant
    Mickey rode and Mickey fed an elephant.
17. *FP/BS* (SVO + VO) verb–object conjoined/subject reduced; object redundant
    Stephen chased the balloon and hit the balloon.
18. *FBP* (SV + VO) verb conjoined/subject-object reduced
    Benjamin painted and drove a motorboat.

The first ANOVA tested *form*—sentential or phrasal; *direction*—forward or backward; and *scope* of redundancy/deletion—whether one element or two were redundant/deleted (sentences 3, 5, 6, 7, 9, 12, 13, 15). Age was the only significant between-subjects variable, F (2,38) = 6.73, $p < .01$, with 4 year olds imitating better than 3 year olds, and 5 year olds performing best of all. Neither form [F (1,38) = .01] nor direction [F (1,38) = .02] were significant; however, scope was highly significant [F (1,38) = 36.15 $p < .001$]. Overall, single-element redundancies/deletions were harder than double element (mean

scores were .42 and .67 respectively). The only other significant result was the three-way interaction between form, direction, and scope [F (1,38) = 12.37, $p < .01$], which is difficult to interpret in the absence of strong main effects for two of these factors.

Lust (1977) reported an identical ANOVA carried out on data from sentences with the same syntactic structure. The only conflict between Lust's findings and ours is that form was a significant main effect in her ANOVA, sententials being easier than phrasals. We should point out that Lust's subjects were younger than ours, although 3 year olds participated in both these studies and neither found interactions of main effects with age. The only other difference between the studies lay in the particular lexical items used. Lust used some words like *Mommy* and *Daddy*, some animal names, and some given names. We chose all given names to minimize variation in salience. However, the given names undoubtedly also vary in their familiarity for individual children and some of the variation in imitation is due to memory problems caused by unfamiliar names. We introduced a minimal control for this problem by having two sets of sentences with different lexical items. However, it is still possible in either study that lexical differences accounted for a greater part of the variance than syntactic differences, because neither Lust's study nor ours considered sentences as a random variable (Clark, 1973). It is possible, then, that lexical variation was a factor obscuring or confounding the effects of syntactic form per se and creating the discrepancy in the results.

In a second ANOVA, form was tested again, along with single *constituents*—subject, verb, or object, which were either redundant or deleted (sentences 3, 4, 6, 9, 10, 13). Age was significant [F (2,38) = 3.93, $p < .05$], but sex and set were not. Neither form [F (1,38) = .27] nor constituent [F (2,76) = .82 were significant main effects; however, the interaction between them was at the 5% level [F (2,76) = 4.18] An inspection of the means for these sentences showed that for the sentences involving redundant/deleted *subjects*, the phrasal form (sentence 9) was superior to the sentential form (sentence 3), whereas for the redundant/deleted *object* sentences, the sentential form was superior (sentence 6) compared to the phrasal (sentence 13). The means obtained on the sentences involving a redundant or deleted verb (sentences 4 and 10) were about the same.

The last ANOVA examined various *sentence types* with two redundant/deleted elements (*SV*, *VO*, or *SO*) and the number of actual *deletions*—none (sentential), 1, or 2 (complete phrasal) (sentences 5, 7, 8, 11, 12, 14, 15, 16/17, 18). Because the *SO* forward-backward sentence had two alternative one-deletion sentences, 16 or 17, two separate ANOVAs were conducted, once including sentence 16, once sentence 17. The results were virtually identical; therefore, we report the *F values* from the first ANOVA only. Once again, age was significant [F (2,38) = 8.91, $p < .001$], but not sex or set. Sentence type was not significant [F (2,76) = 1.09], but deletion was [F (2,76) = 9.21, p

$< .001$]. The means for the three deletion patterns—0, 1, or 2—were .69, .48, and .61, respectively. Although the difference between the sentential and complete phrasal coordinations was not significant, sentences with one element deleted were significantly poorer than either none or two (using the Scheffé test at .05 significance level). These one-element-deleted sentences (sentences 11, 14, and 16/17) sound rather unnatural, and many of the errors produced by subjects in all three age groups consisted of elaborations or reductions. Across these four sentences, there were 15 elaborations and 17 reductions, making up over 40% of these two responses obtained across all the sentences (see Table 6.7).

The two repeated-measures factors, sentence type and number of deletions, interacted significantly [F (4, 152) = 5.57, $p < .001$]. This interaction is probably due to the poor performance on sentence 18, a forward-backward phrasal, compared to the other two-deletion phrasal sentences.

Looking at Table 6.7, which shows the distribution of the elaboration and reduction responses, we confirm Lust's finding that there are no reductions on backward sententials. However, only 4% of the responses to all sentential forms were reduction errors, compared to 8% in Lust's data. Most of the elaboration errors on phrasal sentences occurred on the single-deletion sentences discussed earlier, and sentence 10, which involved gapping. Thirty-six percent of the responses to this sentence were elaborations.

The main findings from this experiment were that in imitation, there were no overall differences between sententials and phrasals, forward and backward forms. The sentences that were the hardest to imitate were the ones with scope of one deletion, or scope of two, with only one unit actually deleted:

e.g., 11. Susy bought a necklace and bought a bracelet.

Included in this group are those sentences that do not involve the conjunction of like constituents in their phrasal forms:

e.g., 13. Hilary made and Laurie wrapped a sandwich.

Despite our attempt to control for sentence length in syllables, it is evident that those phrasal sentences that are shorter in number of words were easier to imitate. Also easy were sentential forms with two redundant elements, despite their extra length in number of words:

TABLE 6.7
Number of Reduction and Elaboration Responses in Elicited Imitation Study

	Sentence Type						
	FS	*BS*	*FBS*	*FP*	*BP*	*FBP*	*Total*
Reductions	7	0	5	10	8	0	30
Elaborations	0	0	0	39	5	4	48

e.g., 5. Rosy flies a kite and Rosy flies a plane.

Most difficult were sentences that were intermediate in word length with little redundancy:

e.g., 10. Bobby drank the milk and Jane the lemonade.

These latter include sentences that adults regard as questionably grammatical (Gleitman, 1965; Koutsoudas, 1971).

In contrast to our findings, Lust's study of elicited imitation of coordination did show a main effect of syntactic form, with sententials being easier to imitate than phrasals. One explanation for this difference could be the choice of sentences in both the studies. A major drawback of both Lust's experiment and our own is that neither of us considered language as a random variable (cf. Clark, 1973) and so we cannot rule out from either study confounding lexical factors. A second criticism against both imitation studies is in the choice of performance measure. In a recent paper, Hood and Lightbown (1977) point out that elicited imitation is a very complex task attended to in different ways by different children. As a performance measure, it assesses not only language processing, but memory factors, motivation, understanding of task requirements, among other nonlinguistic variables.

ACT-OUT COMPREHENSION STUDY

One task that has proven consistently more informative than elicited imitation is act-out comprehension. In the final study reported here, we investigated how children interpret coordinated sentences they hear. Specifically, the conjunction-reduction hypothesis would predict that sentential forms in which all the information is explicit in the surface form should receive a more correct interpretation than phrasal forms in which information has been deleted. However, if our earlier data are correct, children should have no more difficulty with phrasal than sentential forms, but may balk at certain constructions that involve the conjunction of nonconstituents.

The subjects for this experiment included 42 children, 14 in each of three age groups: 3's, 4's, and 5's. Half the children in each group were male, half female. None of these subjects had participated in the imitation experiment.

Two sets of 18 sentences were constructed using the same types of sentences employed in the imitation experiment. These sentences, however, were reversible in meaning, with assorted animals playing the roles of agent and patient. The length of the sentences ranged from 13 to 15 syllables. Table 6.8 lists one of the sets of sentences used in this study.

Each child was tested individually in separate sessions on both sets of sentences. First, the child was asked to name all the animals that were to be used in the experiment. Then, the child was told to act out on a small stage the event described by the experimenter. Three practice trials were given with simple

TABLE 6.8
List of Sentences Used in Act-Out Comprehension Study

1. *S* (SVO + SVO)
   The turtle bumped the zebra and the turtle bumped the zebra.
2. *S* (SVO + SVO)
   The elephant kissed the giraffe and the horse touched the turkey.
3. *FS* (SVO + SVO) subject redundant
   The sheep licked the gorilla and the sheep pushed the kangaroo.
4. *FS* (SVO + SVO) verb redundant
   The camel hit the elephant and the pig hit the turtle.
5. *FS* (SVO + SVO) subject-verb redundant
   The zebra kicked the turkey and the zebra kicked the camel.
6. *BS* (SVO + SVO) object redundant
   The gorilla touched the sheep and the kangaroo pushed the sheep.
7. *BS* (SVO + SVO) verb–object redundant
   The pig kicked the giraffe and the turkey kicked the giraffe.
8. *FBS* (SVO + SVO) subject–object redundant
   The horse kissed the turtle and the horse hit the turtle.
9. *FP* (SVO + VO) verb–object conjoined/subject reduced
   The gorilla bumped the camel and licked the zebra.
10. *FP* (SVO + SO) gapping; verb reduced
    The sheep patted the kangaroo and the pig the giraffe.
11. *FP* (SVO + VO) verb–object conjoined/subject reduced; verb redundant
    The elephant touched the horse and touched the turkey.
12. *FP* (SVO + O) object conjoined/subject-verb reduced
    The alligator patted the turtle and the horse.
13. *BP* (SV + SVO) subject-verb conjoined/object reduced
    The camel kissed and the pig bumped the kangaroo.
14. *BP* (SV + SVO) subject-verb conjoined/object reduced; verb redundant
    The sheep hit and the zebra hit the alligator.
15. *BP* (S + SVO) subject conjoined/verb–object reduced
    The gorilla and the elephant kicked the giraffe.
16. *BP/FS* (SV + SVO) subject-verb conjoined/object reduced; subject redundant
    The zebra pushed and the zebra licked the alligator.
17. *FP/BS* (SVO + VO) verb–object conjoined/subject reduced; object redundant
    The sheep touched the gorilla and pushed the gorilla.
18. *FBP* (SV + VO) verb conjoined/subject–object reduced
    The alligator patted and kissed the kangaroo.

noncoordinated sentences. Then, the 18 test sentences were presented in random order by one experimenter, while a second experimenter wrote down exactly what the child did. For each sentence, the experimenters selected the animals needed to act out the sentence and placed them on the stage. If less than three were needed, additional distractor animals were added, so that on each trial a minimum of three animals occupied the stage. The responses were coded as correct or incorrect. Because each child received both sets of sentences, for each sentence type, a maximum score of 2 could be obtained.

The data were analyzed using the same ANOVA models as in the imitation experiment. Age and sex were the two between-subject variables.

In the first ANOVA, there were three repeated-measures factors: *form* (sentential or phrasal), *direction* (forward or backward), and *scope* of redundancy deletion (one or two). Age was significant at the 1% level [F (2,39) = 6.44]. As in the imitation experiment, only scope was significant among the repeated measures [F (1,39) = 89.94, $p < .001$]. Sentences with scope of two were understood better than sentences with scope of one. Scope interacted significantly with direction [F (1,39) = 24.17, $p < .001$] and form [F (1,39) = 8.46, $p < .01$], and also with direction and form [F (1,39) = 12.41, $p < .01$]. These interactions are explained by the selective poor performance on the backward single-scope coordinations of the form SVØ + SVO (sentences 6 and 13).

In the second ANOVA, *form* and *constituent* (S, V, or O) were the two repeated-measures factors analyzed. All three main effects were significant: age [F (2,39) = 5.37, $p < .01$], form [F (1,39) = 6.34, $p < .05$], and constituent [F (2,78) = 21.05, $p < .001$]. There were no significant interactions. Sentences with verb or object redundant/deleted were harder to understand than those in which the subject was redundant/deleted, particularly in their phrasal forms. The object-reduced sentence is of the form SV + SVO in which the child has difficulty capitalizing on an initial NVN clause corresponding to subject-verb-object. In fact, 62% of the errors made on this sentence included making the subject of the first clause act on the subject of the second clause—that is, taking the first NVN and interpreting it as agent-action-patient. The verb-deleted (gapping) sentence of the form SVO + SO was also very difficult to understand. Generally, the first clause was acted out correctly, but then children did not know what to do with the remaining two nouns. These two sentences, which were so poorly understood, correspond to the two phrasal forms children hardly ever produced, again pointing to a difficulty in processing these forms that do not involve conjunction of constituents.

The third and fourth ANOVA's tested *deletion* (none, 1, or 2) by sentence *type* (SV, VO, or SO) with sentence 16 and 17 as the one-deletion SO sentence respectively. Age was significant at the 1% level [F (2,39) = 5.36/5.49]. Deletion was significant in both ANOVA's [F (2,78) = 31.64, $p < .001$/F (2,78) = 4.94, $p < .01$]; however, sentence type was significant only when sentence 16 was included [F (2,78) = 6.65, $p < .05$], but not with sentence 17 [F (2,78) = .61]. The interaction between the two repeated-measures factors was highly significant ($p < .001$) in both ANOVA's [F (4,156) = 9.6/15.61]. As in the imitation experiment, the deletion effect is due to the fact that the sentences with one element deleted were worse than either the complete phrasals or sententials. The other significant effects were due to the relatively poor comprehension of sentence 16—which is also the object-reduced form SV + SVO—and sentence 18, SV + VO. Seventy-one percent of the errors on sentence 16 involved the intital clause, making the subject of the first clause act on a distractor object

TABLE 6.9
Proportion of correct Responses Involving Simultaneous Action in Act-Out Comprehension Study

	Sentence		
	15	*14*	*7*
3 year olds	55	40	21
4 year olds	63	42	20
5 year olds	68	33	25

rather on than the correct object. Although sentence 18 was comprehended better than sentence 16, children sometimes only acted out one of the two actions specified, or included a distractor animal as the object of the first clause (accounting for 70% of the errors on this sentence).

In general, these results closely support the findings from the other experiments we conducted. We found no overall effect of sentential or phrasal form, nor of backward or forward direction of deletion. Sentences that were difficult to understand were backward phrasals of the form SV + SVO, forward phrasals involving gapping of the form SVO + SO, and forward-backward phrasals, SV + VO. None of these forms were readily produced in the elicited-production experiment, and they were relatively difficult for children to imitate. Ardery (1979) has conducted a similar comprehension study, using the same act-out procedure, and with many of the same sentence types. Her results confirm our findings in every respect.

In the comprehension data, we also found evidence that phrasals were interpreted as meaning something different than corresponding sententials. For example, in the group of backward coordinations with scope of two—sentences 7, 14 (one deletion), and 15—we obtained two types of correct responses. In one, the two agents act on the object successively; in the other, they act simultaneously. Table 6.9 shows the proportion of *simultaneous* responses relative to the total number of correct responses for each of these sentences. It is clear that the complete phrasal (sentence 15) was most frequently interpreted as simultaneous action, whereas sententials (sentence 7) were primarily understood as successive action. This finding supports Jeremy's (1978) study on temporal constraints on coordination production. It was not possible to determine whether other groups of sentences were also interpreted differently depending on syntactic form, because one could not act out other sentences in different ways.

Unfortunately, we did not include in this experiment the possibility of interpreting two identical *NP*'s as being nonidentical reference. For example, for a sentence such as:

The giraffe kicked the elephant and the giraffe pushed the turtle.

we only had available a single giraffe, precluding the possibilty that the child could demonstrate to us the same contextual constraints as we discovered in the elicited-production study. The proper experiment on comprehension thus remains to be done.

PERFORMANCE VARIABLES

Before turning to the major conclusions of this chapter, we would like to address one important issue in child-language research—namely, the effects of different tasks on performance. In the course of our investigations into this particular area of syntactic development, we uncovered numerous methodological pitfalls in all the measures we used. Taking our studies as an example, it is worth describing these difficulties to illustrate the importance of adopting a varied methodology in research on child language.

Spontaneous-Speech Samples

The difficulties in drawing conclusions from spontaneous-speech data fall into three major categories:

1. Unless a transcript is richly supported with contextual notes, or videotape methods are used, it is often very difficult to study the referential context of the speech. In our study, we wanted to know not only which contexts produced which types of coordinated sentence (phrasal versus sentential), but also how contexts themselves varied in frequency. For example, did opportunities for subject conjunction occur quite often, but did the children avoid talking about them? Or, were opportunities for subject conjunction as rare as the sentences involving subject conjunction? Spontaneous speech is one of the richest sources of data on child language, offering no artificial constraints on the child's performance. Unfortunately, this lack of constraint means that the context is out of the control of the researcher, and a child's failure to produce some construction could result from either a lack of knowledge or a lack of opportunity.

2. Given a sample of spontaneous speech, how can one make inferences about the child's linguistic knowledge? We encountered two difficulties that are representative of this problem. First, we were sensitive to the criticism that children might have failed to produce sentential conjunctions because they had low MLU's. The argument was that although they derived phrasal conjunctions from an underlying sentential form, they never actualized sentential forms in speaking because of a length constraint. It is difficult to counter speculation of this type because any failure of the predictions of a theory could reasonably be

assigned to a performance deficit. In this particular case, we were able to show that the child's phrasal conjunctions were longer than the minimum needed to produce a sentential form. Thus, although in general the MLU was low, the absence of sentential coordinations was not due simply to a length constraint.

Second, there is the problem of the correct level of analysis for the sentences. It is tempting to borrow the terminology of adult linguistics and refer to sentences as involving "subject conjunction" or "deletion of the predicate," but these sentences are being produced at an age when there is very little evidence that the child *has* abstract grammatical categories like subject at all (Bowerman, 1973). Conjunction has been proposed as a reasonable test of whether or not sentence elements are constituents (Chomsky, 1957), but one can hardly apply that reasoning to the earliest forms that children produce, at least not without considerably more evidence than we have available. Thus, researchers in child language who are interested in syntactic development face a dilemma: either to start at the beginning of speech, justify categories and rules on conservative grounds as the evidence becomes available in the child's language, and gradually build from there; or to use the less conservative method and assign adult-like structural descriptions as early as possible.

3. Because of the time and effort involved in collecting transcripts of spontaneous speech, usually only a small number of children participate in such studies, particularly if they are longitudinal. Given the limited sample size, one might reasonably question how representative the data obtained would be for the population at large. Although in general there has been considerable consistency across different studies of spontaneous speech (e.g., Brown, 1973), with respect to the development of coordination, we found some important individual differences. Whereas our own data from Adam, Eve, and Sarah indicated the primacy of phrasal coordinations, Bloom et al. (1980) report that for some of their subjects sentential and phrasal forms entered their speech at the same time.

Elicited Production

This type of task has not been exploited to any great extent in developmental psycholinguistics, though it has the advantage over spontaneous speech that the experimenter can control the context and equalize opportunities for different types of constructions. The main difficulties with this methodology are as follows:

1. There are limits to what can be drawn or acted out successfully for the child to describe. Some of these limitations are relatively superficial; only certain events can be depicted clearly, thus limiting the semantic content of the pictures. In our study, we also found that some of our pictures were rather implausible, such as the one of a bear simultaneously painting and sawing a piece of wood. We struggled to draw pictures that would compel the child to use certain con-

structions, and discovered that the rarity of a construction in spontaneous speech was due to the implausibility of the event's ever occurring.

2. The second problem is more pervasive: Children vary in how much they will say under these circumstances. We had four warm-up slides in which we encouraged children to describe everything they saw, ideally in complete sentences. However, some children, especially the younger 3 year olds, persisted in saying the minimum until prompted. For example:

Child: "A bear."
E: "And what else?"
Child: "Wood."
E: "Anything else?"
Child: "Painting it."

and so forth, and these responses could not be counted. Motivational problems were quite rare in the population we tested; the reverse problem we encountered was a child's saying much more than we intended. For example:

Child: "Two elephants . . . one eating a apple and . . . two elephants, and one has pink on and one's . . . no, their pants, one's pants are blue and one's green and one of the coats . . . one is yellow and one is pink, and the gray, and one's eating a apple and riding a bike."

Elicited Imitation

Slobin and Welsh (1973) believed that elicited imitation was an excellent way of assessing a child's linguistic knowledge as the child appeared to filter sentences through his or her own grammar while still preserving the meaning. However, more recently, this method has come under attack for the following reasons:

1. Because the usual procedure is to present sentences in the absence of context, the data obtained could seriously underestimate what a child is capable of producing in a context in which the sentences might be plausible (Bloom, 1975). Elicited-imitation studies of constructions that are highly sensitive to contextual constraints, like coordination, would be especially vulnerable to such criticism.

2. Children may "parrot" sentences within their immediate memory span and hence appear to process sentences they could not themselves produce (Hood & Lightbown, 1977). It may be better to introduce a delay between presentation and imitation.

3. Length and redundancy of items are two factors known to influence short-term memory, yet they covary with some of the more interesting linguistic variables and thus may contaminate results. For example, in coordination, sentential forms are longer than corresponding phrasals. If one controls for length, then sentential forms have the advantage of more repeated items. Controlling for length in number of words is not possible without adding grammatical complexity—for example, including adjectives to the phrasal coordinations

(e.g., Lust, 1977)—but length in syllables may not be a psychologically real dimension. Fortunately, certain results that emerged in our study—namely, the difficulty of some types of sentences and the lack of a difference between backward and forward coordinations—cannot be explained away by appeal to differences in length or redundancy.

Act-Out Comprehension

We chose act-out comprehension in preference to picture-cued comprehension because the latter is much more restricted by the alternatives that can be presented. Nevertheless, there are problems with this method:

1. Even our task limited the kinds of interpretations a child could show us, as we pointed out earlier. Thus, we could not demonstrate whether children differentiated the meaning of sentential and phrasal coordinations with respect to referential context. Potentially, one could do so by adding duplicate animals; however this would increase the difficulty of the task considerably.
2. Perhaps the most serious shortcoming of this task is the restricted lexical variety in the sentences that can be used. Reversible sentences preclude a child from using semantic strategies of interpretation, and yet this may lead to a false picture of the child's interpretative strategies. Maratsos, Kuczaj, Fox, & Chalkley (1979) have shown that children who understand the passive voice with action verbs like *hit* or *push* fail to understand it with mental verbs like *know* or *remember*. The use of action verbs in comprehension tasks may thus overestimate the child's general comprehension of a construction.

Not one method currently used in child-language research is free of criticism. Even if the shortcomings just outlined *could* be eliminated, the data obtained from a single method would still only be a measure of one aspect of the child's linguistic performance, and not a clear reflection of underlying competence. To reduce the problems and limitations inherent in assessing performance, we advocate the use of diverse tasks whenever possible.

There are two major advantages in using several performance measures in child-language research: The first is that when there is overlap in the data from several experiments, this increases confidence in the results obtained. In the present study, for example, the imitation task produced results that were very close to those obtained from the comprehension task in most respects; the correlation between the difficulty ranking of the 18 sentence types used in the two tasks was .73. This occurred despite the lack of precise control over sentence length in the comprehension task, the extra requirements of acting out an event, and the fact that the sentences were irreversible for imitation and reversible for comprehension.

Secondly, different tasks will often produce complementary findings: thus, while the elicited-production study highlighted the importance of contextual variables in sentence coordination, the spontaneous-speech data illustrated the developmental course of sentence coordination.

THE DEVELOPMENT OF SENTENCE COORDINATION

The major question this chapter set out to answer is how sentence coordination develops in young children. Based on the data from four studies we described earlier, we propose the following model: Children in the age range we have studied, from 2 to 6 years old, process coordinated sentences in a relatively simple way, by directly conjoining like constituents in a sentence. In addition, certain psychological processing constraints operate within this model so that the site where the conjoined elements are placed affects the difficulty in producing different forms of coordination. Specifically, because spoken language is processed in a left-to-right manner, conjunction of elements at the end of a sentence is easiest, at the beginning is harder, and in the middle is hardest.

Our first piece of evidence in favor of this model comes from the spontaneous-speech data, which shows that phrasal and sentential forms of coordination are not derived from one another. In our study, phrasal coordinations were developmentally earlier than corresponding sentential forms. Bloom et al.'s data (1980) are in close agreement with our own, although in three of their subjects, phrasals and sententials appeared at about the same time, whereas in the fourth child, phrasals came in earlier. In addition, we found that the very earliest conjunctions to appear were not in well-formed sentences, but consisted of simple *noun* + *noun* or *verb* + *verb* phrases that probably form the basis for later phrasal coordinations. Although these data strongly indicate that in child language, phrasal and sentential coordinations have separate roots, we do not dismiss the possibility that for the adult, the different forms come from the same source (we return to this issue in a later section). As we pointed out in the Introduction, there are other examples in the literature that illustrate that syntactic structures may have different roots for children and adults.

The second piece of evidence in favor of this model is that very early on, children are sensitive to the different contextual constraints on the form of coordination. Thus, in the study of elicited production in English and Japanese, we found that even the youngest subjects respected referential identity/nonidentity as a powerful constraint on the use of phrasal or sentential form. Again, this argues for the separate roots of sentential and phrasal coordinations, as right from the start children consider that the different forms have different meanings.

The third piece of evidence comes from the kinds of sentences that the children in all the studies had the most difficulty with. The forms most rarely

produced, correctly imitated and understood, were two phrasals of the form: SV + SVO and SVO + SO. The first type, a backward phrasal, involves, from the perspective of a conjunction model, the conjoining of subject and verb, as in:

The rabbit is holding and the cat is hitting the drum.

This type of sentence does not involve the conjunction of a true constituent and would therefore not be generated within a conjunction model. The second type of sentence cannot be described by conjunction. It can only be described in terms of deletion of the verb (gapping) as in:

The cow is eating the apple and the horse the banana.

Almost no examples of these types of sentences were found in the production data. They were also difficult to understand and imitate correctly.

The second part of our proposed model of the development of sentence coordination addresses the issue of processing constraints within a surface-structure model. Because in such a model, left-to-right processing of language is a central factor, the place in the sentence where the conjoined elements are situated will affect the difficulty of the sentence. Placing extra elements at the end of a sentence poses the least load, and requires the least advanced planning; thus, in English, object conjunctions of the form:

The rabbit is holding the umbrella and the balloon.

are the easiest phrasal coordinations to produce in the elicited-production task. There is also a preponderance of such sentences in the spontaneous-speech data, although as we pointed out earlier, this may be because there are more opportunities for such sentences rather than because of any syntactic constraints. In English, we found that these object conjunctions were more frequently produced in the phrasal form than subject conjunctions like:

The frog and the turtle are watching television.

Placing conjoined elements at the end of a sentence is perhaps easier than at the beginning. An alternative explanation might be that the grammatical role affects the processing difficulty; thus, objects may be easier to conjoin than subjects irrespective of their place in the sentence. We ruled out this explanation by looking at data from Japanese children in the elicited-production task. In Japanese, both object and subject conjunction are backward, but subjects are placed at the beginning of the sentence, whereas objects are placed in the middle. Japanese children found it easier to produce the subject-conjoined sentences rather than the object-conjoined, thus showing that it is not a question of grammatical role, but rather where the conjoined elements are placed. Furthermore, this Japanese data shows that placing conjoined elements in the middle of a sentence is harder than doing so at either end.

THE RELATION BETWEEN LINGUISTIC THEORY AND CHILD LANGUAGE

In the first part of this chapter, we laid out the two major alternative linguistic models of sentence coordination. In the standard transformational theory, sentential and phrasal coordinations share a common deep structure, but phrasals are more complex, as they involve conjunction reduction in deriving their surface forms. In the second model, phrasal coordinations are not derived from sentential coordinations, but are generated directly by conjoining like elements.

Until recently, the conjunction-reduction model has enjoyed the greatest support among linguists (e.g., Stockwell et al., 1973) and psychologists (e.g., Lust, 1977, Lust & Mervis, 1980). However, as we pointed out earlier, with the changes now taking place in linguistic theory, the status of conjunction reduction is uncertain. The general trend has been towards reducing the transformational component and allowing for more direct generation of complex forms in the base. Although no one to our knowledge has recently worked out a detailed alternative to conjunction reduction within this new framework, the conjunction model originally proposed by Dougherty (1967, for one example) seems to correspond to the proposal that some phrasal forms would be generated in the base, rather than being derived from sententials via deletion and regrouping.

The model for the development of sentence coordination outlined earlier is compatible with Dougherty's conjunction model; we find that children only process well coordinations involving the conjunction of like constituents, and have the greatest difficulty with those phrasal coordinations that cannot be derived by conjunction. On the other hand, we have no data to support the conjunction-reduction schema; we do not find that children in the age range we studied derive phrasals from corresponding sententials, and sentential forms are not the earliest to appear in children's speech.

Clearly, at some point, the psychological data and linguistic theory must be compatible. At present, though there is a wealth of evidence from child-language data in favor of the conjunction model (see also Ardery, 1979; Bloom et al., 1980; Greenfield & Dent, 1979; Jeremy, 1978), the issue is still controversial among linguists. This asymmetry could be resolved in a number of ways.

One possibility would be that the conjunction-reduction schema is the correct model for the way adults process coordination. This would imply that at some point in development, a reorganization takes place in the child's linguistic system and there is a shift from phrase-structure rules for conjunction to conjunction reduction. We suggested this possibility in earlier papers (de Villiers et al., 1976, 1977); however, the evidence on which we based that argument now appears inadequate. Specifically, we argued that at about 4 years of age, it appeared that children were confusing sentential and phrasal forms in memory, and in the imitation task produced many elaborations and reduction errors. This coincided with the point when sententials appeared in the spontaneous-speech protocols.

We have now collected imitation data from more subjects and the 4 year olds look no different from the other children. Also, Bloom et al.'s (1980) spontaneous-speech data show that sententials can begin earlier than we originally thought. There are no comparable psycholinguistic data on coordination processing in older children or adults from the same performance measures that we have used with preschoolers. This means that there is no evidence to support the hypothesis of a syntactic reorganization in later childhood (see also Maratsos, 1978).

The alternative would be that the conjunction model is the correct description for both children's and adults' coordination processing. Given the evidence we have described in this chapter, this possibility appears the most parsimonious. Linguistic models that aim to achieve psychological reality can look towards data from child language to resolve theoretical conflicts. In the case of sentence coordination, the developmental research points to a close-to-the-surface model, with different forms of coordinated sentences being generated by phrase-structure rules rather than by conjunction reduction.

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