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CONJUNCTION REDUCTION IN THE LANGUAGE OF YOUNG CHILDREN: STUDIED WITH PARTICULAR CONCERN FOR THE DIRECTIONALITY OF THE DELETION COMPONENT

by

BARBARA LUST

A dissertation submitted to the Graduate Faculty in Developmental Psychology in Partial Fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

1974

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

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INTRODUCTION

A current concern in the field of developmental psycholinguistics is the definition of universal principles of language acquisition. Both the source and the nature of such acquisition principles are at issue. In particular, psycholinguists question the degree to which such principles may be independent of grammatical theory.[1] Alternatively, they question the degree to which specific cognitive systems may explain such principles (Sinclair, in press; Beilin, in press; Slobin, 1970, 1971; Bever, 1970).

Notably, independence of grammar may signify independence of language-specific structures and/or general independence of grammar in both its universal and language-specific aspects. Both alternatives are currently debated. In fact, the question of the degree to which grammar characterizes child language at all is itself debated (Bowerman, 1973; Watt, 1970).

From a linguistic viewpoint, these issues are significant since they appear to question certain fundamental assumptions of the original Chomsky theory of a transformational grammar. For Chomsky (1965) justification of a generative grammar was assumed to consist of both its internal theoretical consistency and its external validity as description of the tacit linguistic knowledge of a speaker-hearer (p. 27).

---

[1]The notion "grammar" in this study will refer specifically to the systematized association of structural descriptions to sentences as defined by a transformational grammar, where the central assumption of this theory is that deep and surface linguistic structures are not identical (Chomsky, 1965).

The question then became important: "What are the initial assumptions concerning the nature of language that the child brings to language learning, and how detailed and specific is the innate schema (the general definition of "grammar") that gradually becomes more explicit and differentiated as the child learns the language?" (p. 27)

In a sense, current questions noted above regarding language acquisition universals repeat these original Chomsky questions regarding an acquisition model, while seeking to define an intersect of the language system with a cognitive system psychologically. The current debates abandon Chomskian assumptions, however, to the degree that they postulate not an intersect between linguistic and cognitive systems but a replacement of the linguistic system by a cognitive system. Such a replacement would deny to a degree both types of justification invoked by Chomsky for generative grammar: its external validity as psychologically relevant and its internal validity as an "explanatory hypothesis about the form of language as such."

Construction of theory to explain principles of language acquisition must take account of these issues. The explanatory adequacy of such theory will depend on the definition of "cognitive universals" as well as of "linguistic universals" and on analysis of the formal relations between these two.[2] At the same time, of course, empirical data on the language acquisition process will be essential to the descriptive adequacy of such theory construction. According to scientific principles, the theory will in fact make empirical predictions regarding these data.

---

[2]The difficulty in theoretical definition of the notion, "linguistic universal" and of specific linguistic universals has been pointed out by Bach (in class, 1973; cf. also Bach, 1974).

This study will consider the issue of the degree to which "language acquisition universals" are grammar-independent by study of a specific language acquisition universal which has been proposed in the psycholinguistic literature (Slobin, 1971) and by experimental consideration of a single set of English language data which has been adduced to support this universal. It will consider the degree to which such a language acquisition universal may be language or grammar-dependent, at the same time that it may be independent of language-specific grammatical characteristics.[3] Thus this study will consider the degree to which the nature of this acquisition universal and the data relevant to it are predicted by a formal model provided by a transformational grammar, where putatively universal properties of this grammar are considered. That is, the considered grammatical aspects are assumedly "the properties of any generative grammar for a natural language" (Chomsky, 1965, p. 28). While this study will not assume a one-to-one mapping of this characterization of a transformational grammar to psychological processes, it will assume a formal or axiomatic relevance of the grammar to linguistic competence.[4]

---

[3]While Slobin (1971) does not deny the relevance of transformational grammar in general to language acquisition processes, he does define this acquisition universal and others as determining "general cognitive-perceptual strategies" which are language-independent. The meaning of "language independence" here is essentially "specific language independent," it would appear, since the strategies are assumed to apply across languages.

[4]The intention here is that a formal grammar be considered to relate to language as formal logic relates to cognition in Piagetian theory. That is, the formalisms (of grammar or of logic) axiomatize principles of behavior while they do not reduce to it or to the psychological processes immediately related to it. The general problem of the relation of the grammar to the psychology of the mind has received some discussion in the past (Katz, 1964; Chomsky, 1965, 1968) and in current work (Katz, 1972). However, theoretical work on these issues has just begun.

The acquisition universal considered in this study concerns the linguistic phenomenon of deletion and the data concern the linguistic structure of conjunction in child language. In particular, the data concern the linguistic phenomenon of conjunction reduction, a process by which, according to transformational theory, certain conjunction structures are derived in grammar by the operation of deletion as well as other grammatical processes. Although specific aspects of conjunction reduction vary from language to language, the phenomenon itself is generally considered to be universal (Schane, 1966). All known natural languages appear to allow some form of conjunction reduction.[5]

In this study, description of conjunction reduction in transformational theory will be considered a formal model for the analysis of the proposed language acquisition universal and for the prediction and explanation of related data. In fact, it appears that the relevant data available at this time are essentially contradictory, unless the linguistic model is invoked in explanation. Furthermore, the model makes specific experimental predictions regarding children's production of sentences with conjunction. Finally, the complex of data collected may be interpreted to provide the reciprocal function of distinguishing between competing theoretical models and thus extending the theory which originated its collection.

The following section of the introduction to this study will define the language acquisition universal to be considered and summarize

---

[5]It should be noted that technically, the conjunction reduction operation has been described as a "schema" rather than a "transformation" (Stockwell et al, 1973, p. 23). The reasons for this distinction are: 1) the strong structure-building power of conjunction reduction; and 2) the involvement of variables over structure indices in the formal description of the rule.

a specific set of data relevant to it. In doing so it will define a specific experimental problem resulting from contradictions in these data. Following sections will then discuss the theoretical implications of the proposed acquisition universal and of the data according to a model provided by transformational theory. Finally, this model will be used to provide an explanation of the data contradictions as well as further empirical predictions regarding the structure of conjunction in child language. These predictions will provide the theoretical motivation for the experiment to be reported in following chapters.

Definition of the experimental problem

According to Slobin (1971, p.359), the universal principles of language development include the following:

> 1. When a child first controls a full form of a linguistic entity which can undergo contraction or deletion, contractions or deletions of such entities tend to be absent.
>
> 2. It is easier to understand a complex sentence in which optionally deletable material appears in its full form.

These complementary principles can be reduced to a single universal applying to both comprehension and production aspects of language, although Slobin does not do so.

> 3. It is easier both to understand and to produce sentences in which optionally deletable material appears (in surface structure) in its full form.

("Easier" here signifies developmental precedence and developmental precedence here is determined by the order of appearance of different language structures in the acquisition process.) Slobin defines these principles as "language processing strategies" which "every child brings to bear on the problem of language acquisition" (p. 347). As such, they

are defined as "based on general perceptual and information processing principles" (p. 345); rather than on principles of linguistic structure (see footnote 3 above).

Slobin supports this universal by longitudinal data consisting of the imitation of conjoined sentences by a child (Echo) during the age span of 2.3.2-2.5.3 (age in years, months, weeks)(Slobin & Welsh, 1971).[6] Echo, at 2.3.2, when asked to imitate a conjoined structure of the following type:

4. The red beads and brown beads are here

responded with:

5. brown beads here an' a red beads here

Linguistically, Echo's statement represents transformation of the conjunction structure from [NP+NP] in #4 to [S+S] in #5. In other words, Echo's utterance represents transformation from a phrasal to a sentential conjunction form.[7] In addition, when she was administered sentential conjunction forms, Echo often imitated these full forms rather than producing phrasal conjunctions and thus performing an inverse transformation. For example, Echo (2.3.3), hearing #6 below, produced #7 and not #8:

6. The red beads are here and the brown beads are here

7. brown beads are over here; red beads over there

---

[6]Slobin supports this universal with data relevant to other grammatical structures also, e.g., non-contraction of auxiliary verbs, non-deletion of relative pronouns. This study, however, will consider only the conjunction data.

[7]Phrasal conjunction signifies a conjunction of simple constituents, e.g., the NP. If generated in deep structure, this conjunction is represented by a phrase structure rule of the following type: NP→ and NP NP* (Stockwell et al, 1973, p. 296). Sentential conjunction signifies the conjunction of sentences rather than simple constituents: S→ and S S*.

8. The red [beads] and brown beads are here

Psychologically, an elaboration mechanism is evident in this imitation behavior of Echo. According to Slobin, such elaboration was characteristic of much of Echo's conjunction imitation at this age.

Imitation of conjoined sentences was also elicited by Beilin and Lust (1973). These data, contrary to Slobin's, showed that when two- and three-year-olds were administered a sentence of the following form:

9. Give me the girls and give me the boys

92.3% of the two-year-olds' attempted imitations (N=8, 13 items) and 56.3% of the three-year-olds' (N=5, 16 items) were a form of the following type:

10. [Give me the] girls and boys

Linguistically, this transformation represents a conversion of the administered sentential conjunction (#9) to the phrasal or NP conjunction (#10), no two-year-old responses and only 6% of three-year-old responses (by one child) showed the inverse response, elaboration to sentential conjunction (based on 15 responses for two-year-olds, 18 responses for three-year-olds). Psychologically a reduction mechanism (the inverse of elaboration) is suggested by these data.

Ostensibly the Beilin & Lust data contradict the Slobin & Welsh data and the language acquisition universal defined above (#3). This apparent contradiction raises the general empirical issue of whether or when elaboration or reduction best characterizes language acquisition. Several specific theoretical issues are implicit in this problem, however.

Theoretical Significance of the Experimental Problem: Linguistic Theory of Conjunction

Conjunction reduction. Chomsky (1965) proposed that grammatically, the underlying syntactic structure of conjunction is sentential in form. Phrasal conjunction (i.e., conjunction of non-sentential constituents such as NP, VP, adj., etc.) was described as derived from underlying sentential conjunction by a transformation since termed "conjunction reduction." Thus, according to Chomsky, the rules of the base include: S → S#S#...#S (1965, p. 225, fn. 11); and the general rule for conjunction reduction is the following:

> if XZY and XZ'Y are two strings such that for some category Z, X is an A and Z' is an A, then we may form the string X⌢Z⌢and⌢Z'⌢Y, where Z⌢and⌢Z' is an A (1965, p. 212, fn. 9).

The conjunction reduction rule thus generally 1) deletes repetitions of identical constituents in conjoined sentences (X and Y in the above rule); and 2) groups corresponding constituents which remain (Z and Z' in the above). The application of these operations (with or without further modifications) results in a single matrix sentence containing a conjunction of non-sentential constituents.

For example, according to this linguistic theory, the 'b' sentences in #11 and #12 below are derived from the 'a' sentences by the deletion and grouping processes of conjunction reduction:[8]

11. a. The red beads are here and the brown beads are here.
    b. The red beads and brown beads are here.

12. a. Give me the girls and give me the boys.
    b. Give me the girls and the boys.

Since Chomsky (1965), linguistic theory has questioned both the grammatical

---

[8] As the conjunction rule above suggests (S →S#S#S...#S), conjunction is an infinitely recursive device. This study will be concerned solely with conjunction of binary conjuncts, however.

existence of conjunction reduction and its description. The existence of this transformation has been questioned in particular on the grounds that phrasal conjunction may in fact be basic (i.e., generated in deep structure by phrase structure rules), thus obviating a conjunction reduction transformation (Dougherty, 1970, 1971, 1973; Dik, 1972). While a number of linguists have defended both the grammatical viability of conjunction reduction and the exclusion of phrasal conjunction from deep structure (Tai, 1969, 1971; Stockwell, et al., 1973), the issue remains open (Langendoen, personal communication).[9]

Given the acceptance of conjunction reduction in the grammar, moreover, current linguistic theory questions the proper description of this transformation in terms of its component processes, grouping and identity deletion.[10] In particular, linguistic theory has attempted to define directionality constraints on the deletion process.

Directionality principle of conjunction reduction. The following principle, termed the "directionality principle" has been found to

---

[9]The conjunction reduction transformation has also been questioned on the grounds that a semantic rather than a syntactic operation accomplishes the putative grammatical reduction (Postal cited by McCawley, 1968; McCawley, 1968; Wierzbicka, 1967; Harnish, 1972). Since this study is concerned with the syntactic aspects of conjunction reduction (and since these aspects persist whether or not such semantic theory is additionally invoked) it will not deal directly with this issue.

[10]Regarding grouping, it is not clear whether it is necessary, unnecessary (Koutsoudas, 1968, 1971) or optional (Harries, 1973; Tai, 1969, 1971) as a component process of conjunction reduction; what form this process should take; or in what order it applies relative to deletion. This study will concentrate specifically on the deletion operation of conjunction reduction.

In addition, conjunction reduction is structurally constrained by a number of constituency restrictions (e.g., Sanders & Tai, 1972; Tai, 1969) both within and across languages. Although this study will not be specifically concerned with these restrictions, they will be acknowledged in the design of this study to the degree that they interact with the deletion process.

constrain the deletion process of conjunction reduction:

> When identical constituents are on right branches, deletion operates backward; when identical constituents are on left branches, deletion operates forward.

This constraint, which was first noted for verb deletion by Ross (1970) has since been observed to apply to other constituents as well, providing an "empirical fact" about natural languages (Sanders, 1970). This directionality constraint is exemplified by the following sentences. In #13 below, the 'b' form, backward deletion, and not the 'c' form, forward reduction, is grammatical, since the predicate is right-branched:

13. a. The red beads are here and the brown beads are here.
    b. The red beads and the brown beads are here.
   *c. The red beads and the brown beads are here.

In #14, however, deletion operates forward (the 'c' form) since the predicate is left-branched to begin with:

14. a. Give me the girls and give me the boys.
   *b. the girls and give me the boys
    c. Give me the girls and the boys.

This directionality constraint has been proposed in fact to be universal since it also explains deletion pattern differences across languages. In Japanese, for example, which is a verb final language (it has an underlying SOV order), the sentences in #14 are represented as follows:[11]

15. a. Watashi-ni onnanoko-o kudasai soshite watashi-ni
          (me) (girls) (give) (and) (me)

       otokonoko-o kudasai
         (boys) (give)

    b. Watashi-ni onnanoko to otokonoko-o kudasai
   *c. Watashi-ni onnanoko-o kudasai to otokonoko-o

---

[11] The Japanese sentences are due to the kindness of Tatsuko Kaneda.

Here the backward reduction ('b') is grammatical and the forward reduction ('c') is ungrammatical since the verb is right-branched in the Japanese structure.

Ross (1967; reviewed by Tai, 1969) redefined the Chomsky conjunction reduction rule to acknowledge this directionality constraint. Depending on whether the identical constituent is right-branched or left-branched, he specified that rule 'a' or 'b' applies, respectively:

16. a. $[_{1}\text{and} \text{ --- } [_{2}\text{X--A}]^{n}_{3\,B} \;]_{B} \longrightarrow \; [1 \;\; 2 \;\; \emptyset] \;\; \#3$

b. $[_{1}\text{and} \text{ --- } [_{2}\text{A--X}]^{n}_{3\,B} \;]_{B} \longrightarrow \; 2\# \;\; [1 \; \emptyset \; 3]$

(where A refers to a category constituent identical from conjunct to conjunct and the rule specifies that all occurrences of A are superimposed and Chomsky adjoined to the conjoined node B; and where the rule applies to any number of conjuncts independently.)[12]

Since the Ross proposal (which was developed by Stockwell et al., 1972) however, two counter-positions on the directionality constraint have been proposed. One represents a meta-theoretical consolidation of the Ross rules (Langacker, 1969), the other a revision of the rules to account for a wide range of data across languages (Harries, 1973).

Langacker (1969) has proposed that the two Ross rules be conflated to a single mirror-image rule of conjunction reduction wherein a mirror-image notation (*) reflects the fact that the structure indices and output sequences of two rules are identical except that the order of

---

[12]It should be noted here that Ross's formalization of a conjunction reduction rule incorporates the directionality principle into the regrouping component of the rule. An ostensibly equivalent proposal is to incorporate it into the deletion component (as does Tai, 1969).

the terms is exactly reversed:

17. * [[A,X]^{n}] ⟶ 1 # [Ø,2]
SC S 1 2 S SC SC SC

The mirror-image rule then specifies bidirectionality and can apply equivalently either from right to left or from left to right.[13]

Rejection of the mirror-image thesis: proposal of conjunction reduction deletion as a forward operation. Harries (1973) on the other hand, having inspected conjunction reduction data in fifteen languages, has concluded that the directionality constraint as proposed by Ross, Sanders and others, and generalized by Langacker, is wrong. Rather, she suggests that conjunction reduction deletion always operates forward (i.e., it always operates on non-initial conjuncts). When surface orders suggest that backward reduction has in fact applied, e.g. #13b above, Harries claims, a regrouping rule has applied subsequent to the forward deletion rule. In the example above (#13), then, Harries claims that a forward deletion first applies, yielding a structure like #13c (SV + SV ⟶ SV + S).[14] A regrouping rule then applies to group the subject constituents (SV + S ⟶ (S+S)V). Harries' primary data in support of forward deletion comes from the fact that a phenomenon called "split conjunction" actually exists in natural languages. Number 13c above in fact represents an example of split conjunction in English. To the

---

[13] As is obvious from #17, Langacker has found it necessary to revise the Ross rules in certain other ways which he considers "minor." In particular, the conjunction morpheme appears as a feature on the coordinate node (SC) rather than as a separate formative positioned in the linear order of elements.

[14] The terms S, V, and O will be used in this study to refer to 'subject', 'verb' and 'object', respectively. (S is occasionally also used to refer to 'sentence'. Context should resolve the ambiguity.)

degree that such sentences are considered grammatical, the original Ross directionality constraint does not hold.

Although split conjunctions are now little tolerated in English, they were common in early and middle Old English (Visser, 1970; Traugott, 1972). Thus such constructions as "He took the stick and broke Δ" (SVO+$V∅)(cited by Visser, p. 525) and "Christ slept and his apostles" (SV+S∀) (cited by Traugott, p. 97) were previously commonly found in English. Visser finds that "after having been extremely common in the old and middle periods . . ."split conjunction," "almost suddenly, and for no perceptible reason [no grammarians are known to have found fault with it]--becomes very rare . . . in the course of the 16th century and totally disappears subsequently" (p. 525). Traugott interprets the historical split conjunction phenomenon as the effect of a deletion operation applied without a subsequent regrouping operation (p. 148).

Harries, in addition, inspects a number of conjunction patterns in Russian (where word order is more free than in English) and concludes that in this language in all cases where backward reduction had apparently applied, the grammar also allowed forward reduction. Moreover, there are languages, such as Bolivian Quechua and Cherokee, which allow only forward reduction, i.e., in these languages the left-most conjunct is always unreduced (Pulte, 1971). Finally, Harries claims that the acceptance of a uniquely forward deletion process would provide an apt analogy to the independent grammatical fact that pronominalization appears basically to operate forward in conjoined structures (cf. Langacker, 1969; cf. also Delisle, 1973). Harries claims then that forward deletion be considered the universal conjunction reduction deletion rule.

Langendoen (1974) has recently supported the proposal that the conjunction reduction deletion component is a forward operation (for English), and has specified formal constraints that must govern its application. He constrains the forward deletion operation by two principles which provide the forward deletion thesis with the explanatory adequacy of the directionality principle (for English). 1) The non-left peripheral noun phrase constraint (NLPNPC) states that the deletion operation must delete no non-left peripheral string that contains NP. This constraint explains the ungrammaticality of a number of forward deletion patterns, which the directionality principle alternatively explains, e.g., the forward deletion of an object in (*SVO+SV∅) as in:

*18. Jackendoff admires basoonists and McCawley admires []
(Langendoen's example)

2) Regrouping constraint. Deletion must necessarily be supplemented by regrouping if the application of conjunction deletion would result in reduction of non-initial conjuncts to a single constituent other than VP, e.g., S, as in the split conjunction form, *SV+S∅:[15]

19.* Buzhardt objected strenuously and St. Clair
(Langendoen's example)

Constraints 1 and 2 also predict the deletion patterns *VO+V∅ and *SVO+S∅∅ to be ungrammatical, as does the directionality principle.[16,17]

---

[15]According to Langendoen, this constraint also predicts reduction to 0 as in SVO+S∅O to be ungrammatical in its unregrouped form, i.e., before SV[0+0]. Notably, in the reduction to right conjunct 0, however, neither the forward deletion thesis (Langendoen), nor the directionality principle descriptively justifies the grammaticality of the form, since the surface structure is not ungrammatical.

[16]It would appear that Langendoen's constraint 2 would also apply in #18 above where reduction is to a double constituent other than VP (i.e., SV). Chomsky (1957), however, considers the application of regrouping in this case ([SV+SV]O) to be ungrammatical or at least questionable,

Notably, both of the above proposals regarding the nature of the conjunction reduction deletion process can be theoretically questioned. The mirror-image proposal (Langacker) has been questioned by Ross (1971) on the grounds that it is too strong and predicts bidirectionality where it does not exist; and has been questioned by Hankamer (1972) on the grounds that forward and backward deletion have distinct grammatical correlates which do not allow them to be conflated to a single rule. The forward reduction proposal (Harries, Langendoen) on the other hand, while it simplifies the split conjunction data, requires the additional grammatical specification that most languages always (e.g., Japanese) or sometimes (e.g., English) require the application of grouping in addition to deletion, and may require a large

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since it coordinates units which cross constituent boundaries. Langendoen holds that if this form is not considered ungrammatical then it must involve an additional rule, "node-raising", in the reduction process (personal communication).

[17] Regarding the regrouping component in conjunction reduction, Langendoen specifies that it "either precedes or applies simultaneously" with deletion (p. 9; cf. also p. 22, fn. 2). Langendoen points out that "the structural analyses of the two rules (deletion and regrouping) can be collapsed" and he therefore formalizes them as equivalent parts of a single "conjunction reduction" rule (see p. 9). It would seem to follow from constraint #2 above, however, that a) the two operations must in fact be simultaneous (rather than regrouping precedent) at least in some cases, since regrouping could not precede deletion in those cases specified by constraint #2, i.e., where regrouping was necessitated and thus invoked by deletion's output (i.e., precisely those cases where forward deletion would result in reduction to a non-VP); b) that regrouping is however in fact not a necessary component of the conjunction reduction operation in general, since it is not necessitated by deletion reducing to VP. Regrouping would not thus be a component of the conjunction reduction process which results in subject deletion (and VP coordination) in English, i.e., SVO + $VO. (Langendoen is in accord with Hankamer [1973] in the treatment of conjunction reduction in this form [SVO+$VO] as a simple deletion operation, as opposed to other conjunction reduction applications [e.g., SVO+$VO]). Given this conclusion it would appear necessary to restate that conjunction reduction is not a unitary process, albeit simultaneous (cf. Crockett, 1972).

number of specific language constraints on the deletion process. (The latter issue remains to be considered in terms of the specific constraints proposed by Langendoen.) Since conjunction reduction has been consistently considered a universal rule (Harries, etc.) both explanatory and descriptive adequacy of its description would seem to require cross-language study.

In summary, then, both the grammatical viability of the conjunction reduction transformation and the grammatical form of this rule are currently at issue in linguistic theory. Two particularly salient issues are: 1) the primacy of phrasal as well as, or in addition to, sentential conjunction in deep structure; 2) the accuracy of the directionality constraint on the conjunction reduction deletion process.

Relevance of linguistic theory to language acquisition and to the experimental problem described above

In general, it may be assumed that acquisition data may both inform the theory of a grammar and restrict it. Thus, for example, if acquisition data were to validate the developmental primacy of sentential conjunction forms in child langauge, these data might be interpreted as supporting the notion that sentential conjunction is at least relevant to the grammar in general, if not primary (as Chomsky proposed).

Moreover, acquisition data is restrictive of formal grammatical theory in a way which has been stated by Katz (1974, personal communication) and implied by Chomsky (1965, 1971). As Katz explains, to assume the grammatical viability of conjunction reduction is to postulate a much simpler grammar for the child to acquire. That is, in this case the grammar to be acquired includes the (infinitely recursive) sentential conjunction rule (S $\longrightarrow$ S#S...#S) and the independently motivated deletion

rule. In the case of a grammar defined without the conjunction reduction rule, however, a total set of independent phrasal conjunction rules (NP ⟶ NP#NP...#NP; V⟶ V#V..V; adj⟶adj#adj...#adj; etc.) as well as the sentential conjunction rule and the deletion rule must be acquired. Obviously then, a much simpler and therefore more cogent explanation of language acquisition is provided by the conjunction reduction grammatical model. Reciprocally, to the degree that the adult grammar must be acquirable, the simpler acquisition model, if validated, may restrict the linguist's choice among more or less complex models of the adult grammar.

In a somewhat similar way, the deletion directionality hypothesis might be expected to relate to language acquisition data. As Langacker proposed regarding his mirror-image convention: "Implicit in this convention is the claim that the existence of pairs of similar rules (differing only in directionality) . . . is not fortuitous, but that the human child is innately equipped to expect this kind of regularity" (1969, p. 576).

These general principles of relation between grammatical theory and acquisition data are specifically exemplified in terms of the conjunction imitation data in the experimental problem described above. The relation between the subjects' responses and the stimulus sentences in the Beilin & Lust study discussed above (i.e., where full conjoined sentences were heard, and phrasal conjunctions were produced, #9 and #10 accordingly) is formally described by the conjunction reduction transformation. The relation between the elaborative responses and the phrasal conjunction stimulus sentences in the Slobin and Welsh study (where phrasal conjunctions were heard and sentential produced, #4 and #5

accordingly) is formally described as the inverse of this transformation. The fact that both types of response to conjunction (elaborative and reductive) appear to occur in two-year-old language, suggests the relevance of the conjunction reduction transformation to the grammar of the child at this age.[18] The present study will thus assume that the experimental problem in this data (apparent contradiction in types of response to conjunction forms) can be formally described and analyzed in terms of the linguistic theory describing the conjunction reduction transformation.[19]

In summary, linguistic theory (specifically the theory of conjunction reduction) will be used as an analytic and explanatory model in the investigation of the structural nature of conjunction in child language (in particular, of conjunction imitation data). Reciprocally, acquisition data will be viewed as informative and restrictive of competing grammatical sub-theories of the structural description of conjunction, such as those briefly reviewed above.

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[18] A transformation is by definition non-directional, in the same sense that a mathematical operation is non-directional. Thus the fact that both the direct form of the transformation (deep → surface) and the inverse form (surface → deep) appear to be evidenced in child language (Beilin & Lust data and Slobin & Welsh data respectively) supports the suggestion that the formal structure of the transformation is so evidenced. However, see footnote 24 below for some discussion of some of the complexities involved in the interpretation of this imitation data.

[19] This does not mean that this study will assume a version of the psycholinguistic "derivational theory of complexity" wherein the conjunction reduction transformation is assumed to describe a unique psychological process which occurs mentally (and thus is identical to Ss' imitation responses). Rather a transformation such as conjunction reduction is viewed as a formal relation between two linguistic structures; and as a description of the structure of the grammatical competence of a language-user (Katz, 1964). Language behaviors may be "explained" by their relation to this competence structure without being identical to it. (One might see Bach, 1974, in particular p. 238, for some discussion of these issues.)

Review of relevant acquisition data. The small amount of acquisition data available on conjunction supports a thesis of developmental primacy of sentential conjunction. The Slobin & Welsh elaboration data (from Echo) suggests that Ss' processing of phrasal conjunction forms includes a sentential conjunction component. This is the sense of the universal (#3 above) when this universal is interpreted in terms of conjunction. The Beilin & Lust data, although reductive in nature, supports Ss' comprehension of sentential conjunction forms (to the degree that the reductions were semantically appropriate). Although Beilin & Lust found that three-year-olds (N=5) imitated 33% of derived (or phrasal) conjunction sentences correctly, and only 5% of sentential conjunction structures correctly, derived sentences were shorter than sentential (7 vs 9 words) and a large percentage of errors on sentential conjunction forms consisted of the reduction error (56%) as suggested above. Menyuk has provided independent evidence to support a notion of sentential conjunction as developmentally prior (1964, 1969, 1971). Of her observations of natural speech in about 150 children, from 2,10 to about 7 years, Menyuk observes that conjunction deletion is used with greater frequency at older ages ("I want the pencil and crayon" vs "I want the pencil and I want the crayon")(1971, p. 142). In general, however, she reports that 89% of the children use conjunction deletion where subject and verb are deleted and objects are grouped (1969, pp. 93-94). At the young nursery school age (2,10-3,1) she found that conjoined sentences are used by 7/8 of the Ss, conjunction deletion by 5/8 (1964). The latter percentage rises in older age groups. Limber (1973) has made a similar suggestion. He finds sentence conjunction to develop about 2,3; reduction about 2,9 (N=3).

Smith, on the other hand, found 3-4 year-olds (exact age not reported) imitated structures with (phrasal) conjunction in the subject or the object position (e.g., "Sam and Harry built the house" or "Bill ate the apple and orange") correctly (or nearly correctly) in 92% of their responses (1970). Only 5.4% and 2.6% of their responses showed "serious error or inadequate response" respectively in these sentences. These data would suggest that by the 3-4 year age, children's ability for production of phrasal conjunctions is developed.

Finally, Brown (1973) discusses the conjunction reduction transformation and theoretically designates some of its formal parameters. Brown here describes conjunction development as primarily characteristic of level V (MLU 4.00); although he provides no data on this issue in this work. (His 1973 work deals mainly with stages I and II.) Brown previously reported conjunction to appear in child speech only at or after MLU reaches 3.5, his stage IV (1970, p. 115). (In summary, little work exists on conjunction in the earliest stages of language development, although one might see Greenfield et al (in press) for an initial consideration.)

These data, however, are extremely limited. Slobin and Welsh data are based on one child. In addition, although their study varied conjunction form (both sentential and phrasal) and linguistic form (SVO, SV and other forms using adverb and adjective were conjoined), these were not linguistically specified and experimentally controlled. The Beilin & Lust data are also based on a small number of Ss (2-year-olds N=8; 3-year-olds N=5). Although these authors systematically varied conjunction form, they used only a single linguistic form (i.e., the imperative, "Give me the x and [give me] the y"). Menyuk's data are essentially descriptive,

as are Limber's, and the generalizations made are thus not precisely related to the data. Smith's data on the other hand do not relate sentential conjunction forms to the phrasal conjunctions she tests and the high success rate on derived conjunctions which her data show is probably at least partially due to the fact that these sentences were generally very short (6 words with 6-8 syllables) and thus did not sufficiently tax immediate memory processing constraints; imitations thus would not (through errors) reveal the structure of Ss' processing of conjoined sentences.

Specific developmental constraints on the conjunction reduction transformation in language have not been investigated. They are suggested, however, by the difference in the Slobin & Welsh and the Beilin & Lust data reported above. An inspection of these data in terms of the formal linguistic description of the conjunction reduction transformation reviewed above reveals that Beilin & Lust sentences were always of a VO+∅O form (i.e.,"Give me the x and [give me] the y"). Thus they were always of a forward deletion pattern. A summary of the Slobin & Welsh data, on the other hand, reveals that three of the four reported sentences to which Echo gave an elaboration response were backward reductions (e.g.,"The red beads and brown beads are here," S∅+SV); in addition, two of the three derived sentences which Echo did not elaborate were forward reductions (e.g.,"The boy is eating and crying," SV+∅V). Menyuk (1970, p. 154) comments on the Slobin data that "conjunction deletions are repeated, but only if the subjects match." Notably, given an SVO order in English, identity of subjects produces a forward deletion pattern since the subject is left-branched. The two explanations of the reduction behavior of Echo are thus confounded. That subject redundancy

is not effective here alone, however, and that directionality may be more important, is suggested by the Beilin & Lust data (where the predicate was redundant) and by the following data from Echo. Slobin & Welsh report that Echo (2,3,3) reduced #20a below to #20b;

20. a. Here is a brown brush and here is a comb
    b. Here's a brown brush an' a comb

Number 20a is a VS+#S form, where adverb-preposing has resulted in subject-verb inversion in surface structure. The subject here thus becomes right-branched rather than left-branched and in #20b forward reduction has occurred without subject redundancy.

The above analyses suggest both that 1) conjunction reduction (i.e., the structural relation of sentential and phrasal conjunction in the grammar) may be a viable component of the child grammar; 2) constraints on production of reduced conjunction structures may exist dependent upon the directionality of the conjunction deletion process. No study has systematically investigated conjunction reduction as an aspect of early child grammar either in general terms of developmental primacy of sentential vs phrasal conjunction forms or in more specific terms of possible developmental constraints on specific aspects of this transformation. Differences between the Slobin & Welsh and the Beilin & Lust data may be due to any of several factors: differences in directionality of deletion processes in conjoined structures, differences in Ss' developmental language level, differences in linguistic form of conjoined sentences, differences in general processing constraints created by various lengths of sentences.

Purpose of this study

This study explored the experimental problem discussed above (i.e.,

differences between the Slobin & Welsh and the Beilin & Lust conjunction imitation data) in terms of the general issue of the developmental primacy of sentential conjunction in very early child language (two-and three-year olds). More specifically, it attempted to define specific constraints on the production of conjunction-reduced forms in child grammar, where these constraints are determined by the linguistic form of English sentences containing conjunction. For this purpose it inspected the effects of the location and directionality of deletion (i.e., forward and backward deletion of redundant elements) in the conjunction reduction transformation. Such constraints by linguistic form on conjunction reduction were interpreted as providing evidence that a general language acquisition universal such as Slobin's (#3 above) must be modified by reference to the grammar.

An elicited imitation technique, as in the Slobin & Welsh and the Beilin & Lust studies was used as the methodological instrument for analysis of these issues. Given this task, imitation of sentential conjunctions was compared to that of phrasal conjunctions; imitation of forward reduction patterns to that of backward. With regard to the linguistic theory briefly reviewed above, it was hypothesized that correct imitation of sentential conjunction forms would be developmentally prior to or synchronous with that of phrasal conjunction forms, but that phrasal conjunction forms would not be correctly imitated before their sentential correlates. These acquisition data were expected to support the linguistic theory which asserts primacy of sentential conjunction in the grammar.

In terms of the directionality issue, it was assumed that developmental primacy of imitation of forward reduced conjunction forms would support the linguistic model of conjunction reduction deletion processes

as essentially forward grammatically (Langendoen, 1974, and Harries, 1973, reviewed above) and would provide counter-evidence to a mirror-image deletion model (Langacker, 1969).[20] A finding of no difference between forward and backward deletion patterns was assumed, on the other hand, to support the mirror-image deletion model.[21]

Further and more specific evaluation of this directionality issue was provided by inspection of errors on forward and backward reduction forms, where errors were interpreted as revealing processing of conjunction structures. In errors on this imitation task, it was hypothesized that reduction responses (cf. Beilin & Lust study above) to sentential forms might be correlates of forward deletion patterns; elaboration responses to derived forms (cf. Slobin & Welsh study above) might be correlates of backward deletion patterns. This finding would suggest a constraint on production of backward-reduced conjunction forms in early child grammar and provide further support of a forward deletion description of conjunction reduction in the grammar. This study tested the

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[20]The assumption here is that if forward reductions are basic grammatically (Harries, 1973 for example) backward reduction requires an additional grouping process in the grammar; it is thus more complex and complexity may be revealed by developmental delay. (As Langendoen has pointed out, however, some forward reductions also require regrouping, e.g., SVO+SVO; although this regrouping does not result in permutation of linear order of elements.)

[21]It should be noted that, in order to simplify the issues, the "mirror-image" conjunction reduction model is being used in this study as a generalization of a model which permits bidirectional deletions equivalently. In terms of linguistic theory itself, however, there are in fact, three general deletion model possibilities: 1) consistent forward deletion directionality; 2) deletion bidirectionality via a mirror-image rule which conflates order-reversed structure indices and rule outputs to a single rule; 3) and bidirectionality via rule statement which is not mirror-image; i.e. does not treat the directional applications of deletion as structural equivalents. The last two possibilities have been conflated in this study.

hypothesis of this correlation between structural types of conjunction reduction (differentiated by directionality) and error type.

Controls necessary to this research purpose

Experimental investigation of these issues (sentential vs phrasal conjunction structure and directionality of conjunction reduction deletion processes) required control of: 1) grammatical constituency of conjoined structures; 2) deep structure-surface structure differences in constituent order; and 3) developmental language level of Ss. The first control (constituent structure) was an issue because, for example, a right-conjunct object (O) is not equivalent in constituent structure to a left-conjunct subject (S) and deletion of these constituents may interact not only with their directionality differences but with their constituent structure differences. A subject is an immediate constituent of a sentence (as is a verb phrase) while an object, a sub-constituent of the verb phrase, is not.[22] Control #2 of deep structure-surface structure

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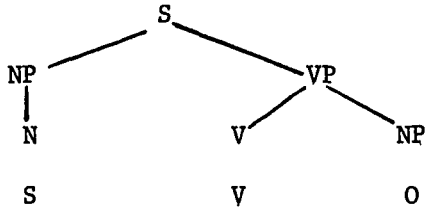
[22]The tree diagram of an English SVO sentence pattern makes this clear:



It is interesting to note regarding conjunction reduction, that all known natural languages appear to allow identical S deletion and identical VP deletion (VO). A number of languages do not allow deletion of individual subconstituents of the VP, i.e., V or O (e.g., Mandarin Chinese) (Sanders & Tai, 1972). Moreover, if a language disallows deletion of one subconstituent (V or O) it also disallows deletion of the other (Koutsoudas, 1971). This has been explained in terms of a language-specific Immediate Dominance Condition on conjunction reduction; this is a restriction against the deletion of any constituent which is not immediately dominated by a conjunct sentence (Sanders & Tai, 1972, p. 165). It is not known to what degree such structural hierarchy effects may be involved in the development of the conjunction reduction transformation in child language.

differences in constituent order was important because directionality of deletion must be specified as surface structure or deep structure directionality. That is, it must be indicated whether deletion (e.g., of a subject) is operating on a basic or on a derived order of grammatical relations. In other words, this control was necessary in order that some specification be made as to whether directionality is a deep structure or a surface structure effect. The third control (developmental level) was necessary because it is not clear to what degree the Slobin & Welsh, and the Beilin & Lust data differences are due to developmental differences between the Slobin & Welsh subject and the Beilin & Lust Ss, and more generally, because it is unknown to what degree development interacts with the issues of sentential vs phrasal conjunction or direction of conjunction reduction deletion. These three controls were incorporated into the design of this study and are discussed below.

Before the design is presented, however, the elicited imitation technique will be briefly defined and its assumptions stated.

Elicited imitation technique

In general, the elicited imitation task is defined as one wherein imitation is directly requested of a subject, as opposed to a situation where a child spontaneously imitates. The general assumptions of this technique as used here are that 1) a child's active repetition of a stimulus sentence reflects input of the sentence to both his comprehension and his production systems; 2) the grammatical structure of the stimulus sentence is relevant to this processing. Thus, it is assumed, as Slobin suggests, "A fine-grained analysis of repeated imitations of systematically

varied model sentences can reveal aspects of the child's theory of syntax . . ." (Slobin, 1967, p. 24). Thus errors as well as correct responses in children's imitations are assumed to reflect the structure of their language system.[23]

Technically, the elicited imitation task is only effective to the degree that it appropriately taxes Ss' immediate processing constraints (in particular short term memory and specific language constraints such as mean length of utterance [MLU]). It must do so, however, so as to extend past rote memory capabilities and thus induce active structuring of the sentence, and 2) so as to avoid so completely surpassing processing capabilities as to totally inhibit this structuring. It may be assumed that both length (e.g., Miller, 1973) and grammatical structure (Menyuk, 1969; 1971) interact to tax these constraints. The task then requires precise programming of sentences relative to processing constraints in terms of both length and structure; and length must be equated across structural variations. The specific length parameters adopted for items in this study are described below under control #4 (methodology section).

No precise imitation model is provided here for the elicited imitation task, beyond the premises articulated above (common to both the Slobin & Welsh and the Beilin & Lust studies cited above).[24] Furthermore,

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[23]Notably, although the elicited imitation technique has been used by several researchers, e.g., Smith, 1966; Menyuk, 1963; Keeney & Smith, 1971; Freedle et al., 1970; Scholes, 1970; Rodd & Braine, 1970; Clay, 1971, all do not share the same assumptions regarding the meaning of the task.

[24]It should be noted, however, that the "contradiction" between the Slobin & Welsh and the Beilin & Lust data must be qualified by a distinction between comprehension and production aspects of the imitation process. In fact, neither the Slobin & Welsh data, nor the Beilin & Lust data, by virtue of their elicited imitation task, allow direct conclusions

no position is being taken on the general issue of the role of imitation in language development (cf. Bloom, 1974; Ervin, 1964; Kemp & Dale, no date ; Nakanishi & Owada, 1973; Ryan, 1973).

METHOD

Design

The elicited imitation task was used to investigate young children's responses to sentences whose linguistic structure was systematically varied according to conjunction structure (sentential or phrasal conjunction) and according to direction of conjunction reduction deletion (forward or backward deletion pattern).

Sentential and phrasal conjunction structure and directional deletion pattern were defined in terms of linguistic form consisting of well-formed symmetric sets of the basic grammatical relations, S, V and O (subject, verb and object).[25] Conjunction of simple subsets of these

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regarding comprehension. Imitation data (i.e., the actual utterance of the S) is *per se* production data. Since both Slobin & Welsh and Beilin & Lust accept an imitation model, however, which provides for input of the imitation process to the comprehension system, implications for comprehension do follow indirectly from the elicited imitation task. Specifically, in the Beilin & Lust data when a child performed a structurally appropriate "derivation" of a conjoined sentence form to a NP conjunction form, it seems safe to conclude that S has"comprehension" of the full conjoined sentence form, although his production might be limited to generation of a phrasal conjunction form. Likewise, in the case of Slobin data, when a child elaborated a phrasal conjunction form, it seems safe to conclude comprehension of the phrasal form, with a production requirement for sentential form. The degree to which comprehension and production systems interact in imitation is a critical issue here. Construction of a formal model of imitation processing would require detailed consideration of these issues (cf. Slobin, 1971).

[25]As Bach (1971) has suggested, while S,V,O terms are "handy labels" they are not totally adequate since the notions subject and object are extremely difficult to define, especially in cross-language contexts as language-independent constructions. In addition, there is

forms (SV&SV and VO+VO) as well as complex subsets (SVO&SVO) were inspected.

Within these sets of conjunction forms, grammatical forward and backward deletions were tested in both conjoined sentence (sentential conjunction) and derived sentence (phrasal conjunction) form. Table 1 specifies these complete sets of deletion patterns and exemplifies them in both conjoined sentence and derived sentence conjunction structures.[26]

Insert Table 1

about here.

As the examples show, for a particular deletion pattern (e.g., SV&$V) the slash notation indicates a redundant element in a conjoined sentence form, or a deleted element in a derived sentence form.

These sets of deletion patterns allow the comparison of sentential and phrasal conjunction structure within each form and across forms.

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a basic question as to the nature of their relation to grammar. Chomsky (1965) had proposed that these basic grammatical relations were structurally definable by the syntactic branching rules of deep structure. "Subject of" was defined as [NP,S], etc. Postal, in a recent (1973) lecture at Queens College, suggested that these relations are not originally structurally defined but semantically defined. At the same time he proposes that these relations are "basically relevant to grammar," i.e., to syntax, to a degree beyond that recognized by Chomsky.

[26]Simple verb deletion has not been included in this set of grammatical deletion patterns on complex forms (e.g., SVO&S$O), e.g. Mary loves John and Sam loves Sue). This is because it allows no straightforward directionality predictions within the theoretical framework of this study. Linguistic theory has questioned the relation of a V deletion structure such as "Mary loves John and Sam, Sue" (termed "gapping") to the conjunction reduction transformation (cf. Tai, 1969; 1971). If conjunction reduction includes deletion + regrouping, then gapping is a partial operation, consisting of deletion only.

Within each conjunction structure they allow the following principled comparisons according to the theory of deletion directionality reviewed above:

a. SV + $\not{S}$V $\geq$ S$\not{V}$ + SV
b. VO + $\not{V}$O $\geq$ V$\not{O}$ + VO

c. SVO + $\not{S}$VO $\geq$ SV$\not{O}$ + SVO
d. SVO + $\not{S}\not{V}$O $\geq$ S$\not{V}\not{O}$ + SVO

where $\geq$ signifies easier than or equal to in terms of developmental success, or more than or equal to in terms of error type. Comparisons are possible in terms of correct imitation responses as well as in terms of structured errors, i.e., reduction on conjoined sentence forms, elaboration on derived sentence forms. This thesis makes no principled predictions regarding comparisons among forward or among backward reduction forms, or between them in ways other than those formalized here. (Although of course it would allow a number of ad hoc or alternatively principled comparisons among the data.[27]

Evaluation of the above comparisons, however, requires a number of design controls. Before design specifics are reported, these controls will be briefly described.

Constituent structure (control #1). Interpretation of the individual comparisons (a-d) above must allow for the interaction of constituent structure with directionality. For example, comparison 'c' above concerns a constituent (S) deletion and a subconstituent (O) deletion. Comparison 'd' concerns a constituent (VP) deletion with a

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[27] In particular, a thesis based on the nature of the groupings rather than the deletion directions involved in these forms remains a viable alternative theory for the interpretation of such conjunction data. This thesis has not been designed to test such a theory specifically.

cross-constituent deletion (SV).[28] It is possible that one deletion pattern in these pairs would be easier than another because of the interaction of its constituent structure with deletion directionality rather than because of its directionality alone.

To handle this problem, the form (SVO +$VO) could be compared to (S∅ + SVO) where forward and backward deletions apply only to immediate constituents (SVO + $VO) ≷ (S∅ + SVO). However, adequate control of this comparison requires extension of the subject constituent equivalent to the extension of the predicate constituent (VP → V + O). An extension of the S constituent is provided by (NP → adj + N). Thus subject and predicate constituent deletions could be compared in the following form (where (aS) refers to modification of the subject noun by an adjective):

$$aSVO + \not{a}\$VO \gtrless aS\not{\emptyset} + aSVO$$

Here deletion applies to immediate constituents and these constituents are each complex (NP or VP). (Because such forms are necessarily quite long, they were not tested in this study, however.)

Moreover, comparisons of SVO deletion patterns (where only [VO] is a complex constituent) can be related to comparisons of (aS)V patterns (where only [aS] is a complex constituent):

$$aSV + \not{a}\$V \gtrless aS\not{\emptyset} + aSV$$

These additional structures can be tested in the comparisons below:

c'. SVO + $VO ≷ aS∅ + aSV
d'. aSV + ā$V ≷ S∅ + SVO

[28]The groupings (specified in parentheses on Table 1) created by these deletion patterns also vary in constituent structure. Thus, comparison 'c' concerns a constituent (VP+VP) grouping and a cross-constituent (SV+SV) grouping. The latter in fact has been claimed by Chomsky (1957) to be ungrammatical. Comparison 'd' concerns a constituent (S&S) and a subconstituent (O+O) grouping.

Here deletions within a comparison refer to elements equivalent in constituent structure.[29] These comparisons were incorporated in the present study. Table 2 specifies the additional 'aS' conjunction forms and exemplifies them.

Insert Table 2

about here.

Deep structure-surface structure order of elements (control #2). The above design programs deletion of specific grammatical relations. Grammatical relation, however, is confounded with linear or surface position in the utterance. (For example, S is always in utterance-front position and O always in an utterance-terminal position.) Effects due to deletion of positional variants are not necessarily due to deletion of grammatical relations.

Another and related aspect of this problem is that since the English sentences in the deletion patterns above maintain the putative underlying order (SVO) in their surface structure, effects of directionality on deletion of grammatical relations may be due to either deep or surface orders of grammatical relations (Langendoen, 1974, personal communication). A directionality effect might thus be either a surface

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[29] Here it should be noted that the extension of a subject NP by adjective modification is not equivalent in terms of deep structure or in terms of derivation, to an extension of the VP by (V+O). The adjective results from the deep structure presence of another sentence in the NP, which is then converted to an adjective modifier by a series of transformations: relative clause formation, relative clause reduction, and modifier shift (Burt, 1971, p. 80). The structural equivalence attained here is thus specifically a surface structure equivalence.

structure phenomenon or a deep structure phenomenon, wherein conjunction reduction deletion is acting in linear fashion on an ordered base.

For these reasons, it is necessary to test the directionality phenomenon with reference to linguistic forms which permute their underlying SVO order in surface structure. Although certain transformations, e.g., passive, topicalization, do achieve such permutation in English, the grammar of young children typically does not possess them. Thus conjunction reduction of these forms cannot be tested in this study. One transformation, however, "there insertion," does permute subject-verb relations in surface structure (Burt, 1971, p. 80; Langendoen, 1973, p. 716) and is simple enough to expect its control by children.[30] This transformation can be applied to either an SV+SV or an aSV + aSV structure giving VS+VS or VaS+VaS respectively, each allowing forward deletion, e.g., VS+$\not{V}$S, VaS+$\not{V}$aS (e.g., there are pencils and there are crayons → there are pencils and crayons; there are white bunnies and there are brown bears → there are white bunnies and brown bears, respectively, in conjoined sentence and derived sentence forms).

Supplementary testing of these there-insertion forms would allow for the analysis of the conflicting theories above (i.e., surface vs deep effects on directionality of conjunction reduction). A theory that the order of underlying grammatical relations was the source of a directionality effect would predict that the VS+$\not{V}$S form would in fact be equivalent in difficulty to a S$\not{V}$+SV form (thus the surface order difference in backward and forward deletion patterns is predicted to be non-significant in this case) (VS+$\not{V}$S ≡ S$\not{V}$+SV). A theory that the surface order of

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[30]Although Paula Menyuk has suggested that 'there insertion' is not primitive in the productive grammar of young children (1964, 1969).

grammatical relations was in fact determinant of a directionality effect would, however, predict the S∅+SV form to be more difficult than the VS+∅S form (VS+∅S>S∅+SV) (since the first is a backward reduction and the latter a forward reduction in surface structure, although in underlying structure they are equivalent.) A similar set of predictions is possible for the VaS+∅aS and aS∅+aSV forms. This study thus incorporated testing of these surface order reversal forms to allow for the following comparisons:

e. VS+∅S > S∅+SV
f. VaS +∅aS > aS∅ + aSV

These comparisons can be inspected both in terms of correct responses and in terms of error types.

Developmental level of Ss (control #3). Since the elaboration-reduction phenomenon (i.e., these different error types) had been found to characterize very early child speech (the Slobin & Welsh subject was 2.3-2.5; the Beilin & Lust Ss ranged from 2.3-3.11) this study tested Ss of the 2-3 year age range (2.0-3.11). However, since age is not an adequate predictor of language level during this early language period and since elaboration-reduction data are only interpretable with reference to developmental language level, it was necessary that Ss be differentiated by an index of developmental language level. The MLU was used for this purpose, to provide comparability with the current psycholinguistic literature and to provide a developmental standard for interpreting the results (although it is recognized that MLU alone is not a sufficient index of developmental level).

It it assumed, as Brown proposes (1972, 1973) that MLU correlates with structural language development, in particular with overt conjunction

production. Developmental levels were inspected according to this gross MLU categorization as follows: 1) pre-conjunction (MLU equal to or below 2.9, Brown's level 1-111); 2) conjunction-onset (MLU 3.0-3.75, Brown's level IV); 3) post-conjunction (MLU 4.0 and beyond, Brown's level V and beyond). Moreover, a distinction was made between post conjunction Ss with MLU about 4 (3.76-4.75) and those with MLU about 5 (4.76 and beyond). Finally, since Ss with MLU about 5 can range in age from within the two-year age to late within the three-year age, two age groups of this ceiling language level were inspected (young, i.e., below 3 years, 5 months; and old, i.e., above 3 years, 5 months and below 3 years, 11 months).

Sentence length (control #4). Morpheme and syllable length of items was controlled in order to assess effects of structural variation on children's imitations. Sentence lengths were determined to tax the basic processing constraints of subjects at each age and developmental language level without widely surpassing them. Such lengths have been deduced from review of the psycholinguistic imitation literature and from pilot testing.

Conjoined sentence and derived sentence conjunction structures were equated in word length where possible (in some cases this is possible by the addition of determiners to the derived form and their omission in the conjoined sentence form) and equated in syllable length always.

Other constraints on stimulus sentences. Sentences were simple, with simplicity defined as follows. Vocabulary was familiar to the 2- or 3-year-old child. The parent was asked to verify vocabulary familiarity and substitutions were made where necessary. All verbs were in present

or simple past tense, with no auxiliaries. No prepositional phrases or other grammatical modifiers were used, except for determiners (a and the).

Regarding the conjunction of sentences, as specified above, all conjoined sentences were symmetric (e.g., SV&SV, but not SV&SVO). Conjunction reduction was designed to produce a semantically appropriate conjunction, avoiding either semantic anomaly (e.g., *The girl is tall and sick) or an idiomatic phrasal conjunction (e.g., spaghetti and meatballs). Conjunction was a-temporal rather than temporal (e.g., the sentence "she took medicine and got better" would not be used here, as the conjunction has an 'and-then' meaning).

Regarding the relations between conjoined sentences and derived sentences, agreement markings were kept constant between these two (e.g., the forms S∀+SV → (S+S)V, where the verb might have to be marked differently in the derived form to agree with a conjoined subject). This can be achieved, for example, by making the noun subjects plural, or by using the past tense in the original conjoined sentence form.

Testing Design. Test batteries were created of either simple sentence forms (Table 1, i-iv), or complex sentence forms (Table 1, v-viii). In addition a battery was created of constituent control forms (Table 2, i-ii) and the complex forms to which they were relevant (v and viii) on Table 1) (cf. comparisons c' and d' above). Each battery thus consisted of four deletion patterns, two forward and two backward. Each deletion pattern was represented in both conjoined sentence and derived sentence (phrasal conjunction) form. Each condition was replicated once. In addition, deep-surface order controls were tested by the addition of a ∀S+VS or a VaS+∀aS form to each of the groups above. The VS+∀S form (in both

conjoined and derived conjunction forms) was included in the simple battery, the VaS+VaS form in both the complex and constituent control batteries. This produced batteries of 20 sentences each.

Batteries were divided into two parts (of ten sentences each) to correspond to administration in two sessions. The second part consisted of replication items (thus making each part a complete set of conditions). Sentences were randomized, each part separately, with the constraint that sentential or derived conjunction forms not appear more than twice in succession.[31] Approximately half of each group received part 1 first, half part 2.

For simple sentence types, mean word length of sentences was 5.4 (range 5-7); syllable length was 7. For complex sentence types, mean word length of sentences was 8.5 (range 7-9); syllable length was 11. For constituent control sentences, mean word length was 7.9 (range 6-9); syllable length was 11.

The design of this study consisted of ten groups defined by the intersection of developmental level with sentence type (simple, complex or constituent controls), where the designed variations of each sentence type were tested at a series of developmental levels.

Simple sentence types were tested on four groups of Ss, developmentally differentiated as specified above: pre-conjunction, conjunction-onset and two levels of post-conjunction (MLU about 4 and MLU about 5). Complex sentence types were tested on three groups of post-conjunction level Ss (MLU about 4, MLU about 5, with two age specifications of the MLU 5 level,

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[31] Randomization was adopted in order to counteract possible syntactic set effects. (See Mehler & Carey, 1967.)

i.e., young and old).

Constituent structure controls (i.e., the constituent structure control forms and the complex forms to which they were relevant) were also tested on three groups of post-conjunction Ss (same distribution as for the complex forms).

Subjects. Sixty subjects, ranging in age from 1,11,19 to 3,10,24 (age in years, months and days) were tested. Twenty-eight were male; 32 were female.[32] All Ss were native-English speakers who had evidenced the onset of syntax in language (i.e.,who were beyond the one-word stage) and who had no ostensible language handicap. Ss were selected for willingness to complete the imitation task.[33]

Thirty-eight of the subjects were tested in their homes, where their mothers (or fathers, i.e., whoever was the principal caretaker of the child) participated in the testing (home Ss). Twenty-two subjects were tested by E alone in nursery schools (school Ss). Home Ss consisted mainly of the two-year-olds; school Ss mainly of the three-year-olds. There were 37 two-year-olds and 23 three-year-olds.

Families were contacted through pediatrician referral on both the East and West sides of Manhattan; they were also contacted through informal means, e.g., by E's location of communities of families with young

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[32]Six additional Ss were interviewed as pilot subjects.

[33]Eleven Ss interviewed proved not amenable to initiating and/or continuing the imitation task. Two additional Ss were interviewed but not used in this study since they were using a large degree of jargon, which neither their parent nor E understood, in their speech. This large degree of jargon would have made accurate analyses impossible. One S was eliminated since the speech sample revealed that she was still at a one-word stage. The speech sample was retained for the supplementary Ss for the purpose of future study; but these data are not reported in this study.

children. Parents of the home Ss were college-educated. Twenty of the home Ss had siblings; 18 were only children.

Nursery schools where school Ss were tested were the City University Graduate Center Day Care Center (consisting of children of Graduate Center students), two upper-middle-class nurseries in Manhattan and a play group in neighboring New Jersey.

Ss were thus generally children of academics or children of upper-middle-class families.

Materials. A Sony Cassette-Corder TC-110 and microphone were used to record both the speech samples and the imitation task.

Procedures. Home Ss were tested in one or two visits by E to a child's home. Visits, which were approximately one hour each, consisted of a collection of a speech sample (first visit) and an elicited imitation task (first and second visits). Usually one-half the imitation task was administered on E's first visit, and the remaining one-half on the second visit. If a child was particularly involved in the imitation task, however, the task was completed on the first visit.

School Ss were tested by E in the child's school according to the same format.

1. Speech samples. Speech samples consisted of a minimum of 100 utterances for each child. (This number of utterances has been specified by Brown as the minimum sufficient to calculation of basic speech sample parameters, e.g., MLU [1973; see also Slobin, 1967].) Usually about one-half hour was sufficient to provide this basic corpus.

For the home Ss, E's first visit to the child's home was initiated by collection of a speech sample. For the sample, the speech of the child

with his parent in a natural play situation was recorded. E brought toys (family of bear dolls) and a book (by Richard Scarry) to initiate talking. E was present, but minimally involved in this parent-child dialogue. The purpose of this period was to elicit as much child speech as possible in this time in a natural situation. This purpose was explained to the parent. The parent was also asked to gloss child speech in cases of phonological ambiguity, in order to aid later tape transcription. (That is, they were asked to interpret orally their child's unclear speech, so that this interpretation would register on the tape.)

These periods also served to acquaint the child with E before the imitation task.

For the school Ss the procedure was identical except for the setting. E brought a similar set of toys and recorded a similar natural play situation with the child as initiation of the first session. This again provided a collection of the speech sample and acquaintance of the child with E.

2. Elicited imitation task. An elicited imitation task was recorded after the collection of the speech sample. In general, the elicited imitation task was conducted according to the methodology defined in the Slobin, Field Manual (1967; see especially pages 11 and 25). In addition, however, a series of particular constraints were adopted for this study.

For the home Ss, mothers (or fathers) administered the model sentences. The child was asked by the parent to "say what I say" or "say the same story I say" or some variant thereof. The parent was given a series of instructions on the administration of this task (see appendix A).

A set of shorter training items was first administered to ensure

that the child understood the imitation task; and if necessary a shaping technique was used (Slobin, A Field Manual, 1967, pp. 11-12). If further training to the task was necessary, Ss were allowed to listen to a tape playback of model sentences by the parent and then by both parent and child. This process often served to interest children in the task.

The parent was then asked to administer a set of sentences according to the general constraings summarized in Appendix A. Principally, these constraints were the following. 1) Items were checked by the parent to ensure that vocabulary was familiar to the child. Substitution of familiar lexical items was made where necessary. 2) Reinforcement was given after every response, or as often as necessary, regardless of quality of imitation. 3) If a child echoed just the last word or last half of the sentence, the whole sentence was repeated once again. If an extended response was not then given by S, the parent was instructed to go on to the next item.[34] 4) If an item was refused, it was repeated again at the end of the series. If still refused, E provided another item with revised lexical items. An attempt was thus made to elicit an attempted imitation to every designed grammatical form; and to ensure that a child's refusal to imitate an item was a response to the linguistic form of an item and not to its lexical content. 5) Sentences were repeated (once) at the child's request. 6) Sentences were repeated at a later time after temporary task suspension if the parent judged a child's refusal to imitate to be due to distraction. In general, administration of the

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[34] An echo response, as defined here, is given by a child particularly in cases of fatigue or distraction (cf. Slobin & Welsh, 1968). Such a response is not informative of processing, however, and thus Ss were encouraged, by repetition, to process further.

imitation task followed individual children's attention patterns and was periodically discontinued and resumed according to these patterns (cf. Slobin, 1967, pp. 25,12). 7) Sentences were administered slowly but with normal intonation. Stress was thus not placed on the conjunction connective although it was articulated. 8) The parent was cautioned to leave adequate time for a child's response before going on to the next item.

A set of ten sentences was administered in the first session. A second set of ten sentences was similarly administered in a second session during a second visit to the home by E during the following two weeks. If on the first visit, however, the child was highly involved in the task after the first ten sentences had been elicited, the parent was asked to proceed to the second set of ten sentences at that time.

For school Ss, the elicited imitation task was administered according to identical constraints (see Appendix A, points 3-8 in particular) except that sentences were modelled by E rather than by the parent.

Data Transcription

All speech samples were transcribed by E. Transcription was morphological, according to the methodology described by the Slobin, Field Manual (1967, p. 212).

Basic descriptive measures calculated were: MLU (mean length of utterance), UB (upper bound), proportion of conjunction connective "and" usage (as proportion of utterances).[35] MLU was calculated according to

[35]Connective 'and' usage was calculated as proportion of utterances rather than as proportion of words since it had been found in a previous study that proportion of utterances appeared to be a stronger developmental index. In that study there was little difference between speech samples at two years and three years of age on connectives as proportion of words. (cf. Beilin & Lust, in press.)

the Slobin specifications (1967, p. 19; after Brown; cf. also Brown, 1973).

All imitation data were also transcribed by E. A reliability test was applied to a partial set of the data. A random selection of seven imitation protocols (i.e., seven Ss given twenty sentences each), one from each developmental level for simple sentence types and one from each level for complex sentence types, was independently transcribed and scored by a second judge. Thus 140 imitated sentences were independently transcribed and scored for this analysis. This sample represented thirteen percent of the simple sentence imitations, thirteen percent of the complex sentence imitations. Item scorings (correct, incorrect by elaboration or reduction error, incorrect by other error or unclear) by E and the second were correlated. Scoring agreed on 91% of these sentences. ($\chi^2(1)=102.74$, $p < .001$ for this association on correct and incorrect scores; and $\chi^2(1)=41.01$, $p < .001$ for this association on type of agreed errors as elaboration/reduction or other.)

The evaluation of imitation data according to the categories reported in this study may thus be considered reliable. (Cases of disagreement between E and the second judge were resolved by acceptance of E scoring.)

Imitation scoring. Parametric errors, such as change in tense or number inflections, omission of determiners, etc., were not considered in the analyses to be reported. That is, a sentence was considered correct or incorrect regardless of such errors. Meaning-preserving omissions of parts of complex words (e.g., 'bear' for 'teddy-bear') were also disregarded.

Moreover, a sentence was considered correct or incorrect regardless

of utterance of the conjunction morpheme, 'and'; although these imitation phenomena might be analyzed separately. That is, for example, given the model sentence, "The teddy-bear walks and sleeps," a child's utterance, "The teddy-bear sleeps, walks" would be considered correct as would "Lions run. Tigers run," for "Tigers run and lions run."

Reduction and elaboration errors considered in this study were only those of a syntactically and semantically appropriate type, i.e., only those which maintained the sense of the original conjunction and deleted the redundant element grammatically. Thus, given the sentential conjunction, "Kitties run and kitties hop," a reduction error would include "Kitties run and hop". A syntactic reduction which semantically erred, e.g., "Kitties sleep and run," would not be included. Similarly, given the phrasal conjunction, "Drink the milk and the soda," elaboration would include, "Drink the milk and drink the soda." It would not include a syntactic elaboration such as "Drink the milk and drink the juice" which misrepresented the sense of the original conjunction.

Single-nominal pronominalizations were considered correct, e.g., "Daddy played the guitar and he sang a song" for "Daddy played the guitar and Daddy sang a song."

RESULTS

Results are reported according to the following order: A. Organization of the data. Language level and linguistic form. B. Report of general characteristics of the data. C. Imitation of simple sentence type conjunction (SV+SV; VO+VO). D. Imitation of complex sentence type conjunction (SVO+SVO). E. Imitation of constituent-control sentences (aSV+aSV). F. Imitation of sentences with surface structure order reversals. G. Summary of results. Analyses of imitation of each sentence type are thus reported separately.

Regarding imitation data, reported analyses considered both i) successful imitations as differentiated by the design factors; and ii) errors characterized as elaboration (of phrasal conjunctions) or reduction (of sentential conjunctions) as differentiated by the directionality factor.

A. Organization of the Data. Language level and linguistic form. By analysis of speech samples, Ss were categorized into developmental language levels distinguished by MLU as follows: 1, Pre-conjunction (MLU≤2.90); 2, Conjunction-onset (MLU 3.0-3.75); 3, Post-conjunction (MLU 3.76-4.75); 4, Post-conjunction (MLU 4.76 and above). In addition, two levels of the last post-conjunction level (≥4.76) were differentiated by age: 4a, young (age below three years, five months); 4b, old (age three years, six months to three years, eleven months).

The 60 subjects were assigned to the ten groups specified by the

design (created by the intersection of developmental level with sentence type) to create 78 design units with seven or eight units per group.[36] Table 3 shows the number and mean age of Ss across each of these developmental levels tested for imitation of simple, complex and constituent control sentence types.

Insert Table 3

about here.

Tables 4 and 5 report means and standard deviations for basic descriptive data on the sample: MLU, UB, and percent of conjunction usage in speech samples for each group. In all, 1380 sentences were analyzed.

Insert Tables 4

and 5 about here.

B. General characteristics of the data

Basic descriptive data (MLU and UB) within age ranges (Tables 3 and 4) generally accord with that reported in psycholinguistic literature (cf. Brown, 1973). Upper bound lengths for the post-conjunction level 3 (MLU about 4, i.e., 3.76-4.75), however, were generally longer than those

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[36]The 60 Ss were each assigned to one of the ten groups specified by the design. In addition, 14 of these Ss who were particularly involved in the imitation task were reassigned to another sentence type group (i.e., they were asked to imitate an additional set of sentence types; and two Ss were assigned to all three sentence type groups. This reassignment of a subset of the Ss created the 78 design units for analysis. This cross-sentence-type group assignment of Ss was valid since the design of this study calls for analyses within sentence type only, and not across sentence type.

reported by Brown.[37]

In the total sample of 60 Ss, age generally correlated with MLU (.76, $p < .01$) and with developmental level (.83, $p < .01$). However, imitation performance (a total score) correlated significantly more highly with MLU (.77, $p < .01$) than with age (.36, $p < .05$) for the 32 Ss tested on simple sentences ($t[31] = 4.55$, $p < .001$); and more highly with MLU (.63, $p < .01$) than with age (.49, $p < .05$) for the 23 Ss tested on complex sentences (although this latter difference was not significant). Imitation data then are more clearly a function of developmental language level than of age per se.

Development of conjunction 'and' usage in natural speech (Table 5) was found to be gradual. There was no clear stage-like progression from no use to use of conjunction, although conjunction is only very infrequently used below level 2 (Brown's level IV). By level 3 (MLU about 4) Ss demonstrate the essential recursive aspect of conjunction 'and'; using on the average about one 'and' per every ten sentences. At the next developmental level, 'and' usage increased to about .15 (one and one-half uses of 'and' to every ten sentences or three uses of 'and' to every 20 sentences) and appeared to remain at that level throughout the third year of age. The increase in percent of conjunction use with each developmental language level is statistically significant although that between

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[37]This may be due to several factors. One factor may be this study's particular concern for conjunction 'and' usage. Length of UB correlated significantly with conjunction 'and' usage ($r = .67$, $p < .01$). This study considered as a single utterance, utterances using the conjunction 'and', unless there was a notable pause between the two connected conjuncts, and/or unless there was a clear semantic deviance between the two conjuncts. Also, it is well known that such descriptive parameters as MLU and UB are less reliable at upper levels.

the two ages of the final language level (MLU about 5) is not. Percent of conjunction 'and' usage correlated more highly with children's success on imitation of conjoined sentences ($r=.70$, $p < .01$) than with age ($.47$, $p < .01$) (although the difference was not significant) for subjects tested on simple sentences (N=32); and with age ($.49$, $p = .05$) but not for imitation for Ss tested on complex sentences (N=23). In general, percent of conjunction 'and' usage correlated highly with MLU ($r=.75$, $p < .01$) as would be expected.

Children's imitation, to be reported in following sections, showed an internal consistency in that there was a significant degree of correlation between Ss' performance on the first item of a linguistic form and on the second or replication item, which occurred later in the test battery. For simple sentences, 64% of these data concurred (as either [1] correct, [2] incorrect by an elaboration or reduction error, or [3] incorrect by other error). This is a significant proportion of the population, given the hypothesis that such concordance would occur by chance ($z=5.14$, $p < .001$). For complex and constituent control sentences, 60% of these data pairs concurred ($z=3.95$, $p < .001$). This suggests that to a significant degree, children's responses to imitation items were responses to the grammatical structure of the sentences, which remained constant from item to item, and not to individual lexical content.

Finally, possible differences between performance of male and female children were investigated by ANOVA within both simple sentence types and complex sentence types. Both analyses revealed the effect of sex on children's imitation performance to be insignificant. The data for male and female subjects have therefore been pooled.

C. Simple sentence conjunction (SV+SV, VO+VO)

Thirty-two subjects in the first four developmental language levels were tested for imitation of simple conjunction forms (SV+SV and VO+VO). This produced 512 sentences for analysis. There were eighteen boys and fourteen girls ranging in age from 1,11,19 to 3,1,3 (age in years, months, days at date of testing initiation). Mean age of the sample was 30 months. Table 6 summarizes the basic description of Ss in each language level by: age, sex, number of utterances in speech sample, MLU, UB, spontaneous conjunction usage (as percent of utterances).

Insert Table 6

about here.

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i. Degree of successful imitation. A four factor analysis of variance was performed on the imitation data for simple sentences to evaluate the factors considered above: Developmental level (as specified above) x Conjunction form (sentential or phrasal) x Directionality of deletion pattern (forward or backward) x Constituent structure (SV or VO). The ANOVA was thus a 4x2x2x2 design with repeated measures on the last three factors. The relevant data consisted of success on an imitation item and its replication (score range 0-2, cf. Hsu & Feldt, 1969). Table 7 shows the means for each condition.

Insert Table 7

about here.

The ANOVA showed that three of the four factors were significant as main effects. Developmental language level was significant (F [3,28]= 15.98, $p < .001$). Testing of means (by the Newman-Keuls method) showed that success in conjunction imitation for simple sentences increases significantly between level 1 and 3 and between 3 and 4 ($p < .01$ in each case) although not step-wise between levels 1 and 2 or 2 and 3. Means for each of the developmental levels were: .484, .850, 1.031, 1.625. Conjunction form was significant (F [1,28]=11.36, $p < .01$). Children found imitation of sentential conjunctions significantly easier than imitation of phrasal conjunctions. The mean number of sentential conjunctions correct was 1.102, of phrasal conjunctions was .855. Constituent structure was also a significant factor in conjunction imitation (F [1,28]=7.06, $p = .01$). Children found VO+VO forms easier than SV+SV forms. Means were 1.078 and .867 respectively.

Directionality (whether the conjunction deletion pattern was forward or backward) was not significant as a main effect. Directionality, however, interacted significantly with each of the other factors in a series of significant two-way interactions (Directionality x Conjunction form, F (1,280)=23.62, $p < .001$; Directionality x Developmental Level, F (3,28)=3.20, $p < .05$; Directionality x Constituent structure, F (1,28)= 5.94, $p < .05$. Directionality also interacted in a significant three-way interaction, Developmental level x Conjunction form x Directionality, F (3,28)=4.80, $p < .01$. The Conjunction form x Directionality interaction (shown in Figure 1) revealed that the difference between sentential and phrasal conjunction forms in terms of success of Ss' imitations occurred only on conjunction structures with a backward deletion pattern (S$\emptyset$+SV, V$\emptyset$+VO) (t[56]=5.58, $p < .001$). Sentential and phrasal conjunction

forms were in fact equivalent for conjunction structures with forward deletion patterns (SV+$\not$V and VO+$\not$O). In addition, significantly more phrasal conjunctions were correct with forward deletions than with backward deletions (t[56]=2.06, p. $<$.05); and significantly more sentential conjunctions were correct with backward redundancy patterns than with forward (t[56]=3.94, p $<$.001).

Insert Figure 1

about here.

The Developmental level x Conjunction form x Directionality interaction (shown in Figure 2) revealed that at level 3 (MLU 3.76-4.75) successful imitation of sentential conjunction structures with forward deletion patterns deviated from the general developmental pattern of superiority of sentential over phrasal conjunction forms, and the developmental curve of this conjunction structure deviates from linearity.

Insert Figure 2

about here.

The directionality x Level interaction is subsumed in this three-way Developmental level x Conjunction form x Directionality interaction and is explained by it. (The two-way interaction, in general, was caused by the fact that forward deletion pattern sentences [both sentential and phrasal] are easier at the first developmental level, pre-conjunction, while at later levels backward forms are equivalent to forward forms (at

levels 2 and 4) or in advance (at level 3) (see Figure 3).)

Insert Figure 3

about here.

Finally, the significant interaction of Directionality with Constituent structure revealed that VO+VO forms were easier than SV+SV forms only with forward deletion patterns. Backward deletion patterns of SV+SV and VO+VO forms were equivalent in difficulty (S∅+SV≡V∅+VO) while forward deletion patterns on VO+VO forms were significantly easier than forward deletion patterns on SV+SV forms (VO+∅O>S∅+SV) ($t[56]=3.58$, $p < .001$).

According to the hypotheses outlined above, individual comparisons within constituent structure of backward and forward deletion patterns were tested. The hypotheses of precedence of forward deletion patterns are shown below, followed by the observed means and the results of *a priori* comparisons (by *t*-test) of their differences:[38]

Sentential conjunction	t value	p
a. SV+∅V > S∅+SV .781 1.313	3.57	<.01
b. VO+∅O > V∅+VO 1.063 1.250	-	ns
Phrasal conjunction		
a. SV+∅V > S∅+SV .688 .688	-	ns
b. VO+∅O > V∅+VO 1.188 .813	2.82	<.01

[38]All *t*-tests reported in this study involve two-tailed hypotheses unless specified otherwise.

In accord with the non-significance of directionality as a main effect, the testing of individual means suggested that a hypothesis of precedence of correct imitation of forward deletion patterns for simple sentence types was confirmed only for phrasal conjunctions, and only for the VO+VO structures.[39]

In summary, the ANOVA on children's imitations of simple sentence conjunctions confirmed the superiority of sentential conjunction over phrasal conjunction in early language, and confirmed the developmental status of level 3 (MLU 3.76-4.75) as the first level of significant conjunction production. Directionality, although not significant as a main effect, interacted significantly with all other factors. The significant superiority of sentential over phrasal conjunction structures held only for backward deletion patterns. Phrasal conjunctions with forward deletion patterns were significantly easier than those with backward patterns.

Moreover, sentential conjunctions with backward redundancy patterns were significantly easier than those with forward; and sentential conjunctions with forward redundancy patterns appear not to develop linearly (Figure 2). As will be seen in the following section (error analysis), the superiority of sentential conjunction structures with backward reduction patterns over those with forward was a consequence of the fact that the reduction error was particularly common on sentential conjunctions with forward deletion patterns and largely absent from those with

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[39]Here, and throughout this report of results, developmental "precedence" of one form over another will be assumed to be indicated by greater success on the particular form at low developmental levels. Comparisons between specific developmental levels will be made where appropriate, in which case this general notion of precedence will be made more specific.

backward patterns. In particular, the developmental drop in accuracy of imitation of sentential conjunction structures with forward deletion patterns at level 3 (Figure 2) was due to the fact that this error was particularly common at this developmental level.

ii. Elaboration and reduction errors on simple sentences with conjunction. There were significantly more reduction errors on sentential conjunctions (13.7% of items) than elaboration errors on phrasal conjunctions (4.7%) ($t[31]=3.07$, $p < .01$). Table 8 shows the distribution of reduction errors on the various forward and backward conjunction forms, at each language level. Table 9 shows this distribution for elaboration errors.

Insert Tables 8 and

9 about here.

As Table 8 suggests, reduction errors for sentential conjunction forms occur almost entirely on forward deletion patterns, accounting for 50% of all errors on these forms and occurring on 27% of these items. Reduction errors are virtually non-existent on backward deletion patterns (2% of errors and only 1% of items) ($t[31]=5.66$, $p < .001$). This holds for both constituent forms, SV and VO (see Table 10). The small amount of elaboration error on phrasal conjunctions made comparison of forward and backward deletion patterns tenuous for this error. The data suggest, however, (Table 9), that the elaboration error occurs on both forward and backward patterns (primarily on VO+∅O and S∅+SV, and less so on V∅+VO and SV+$V). When differences between individual forward and backward patterns were inspected, it was found that for the SV+SV pair, more

elaboration occurred on the backward, S∅+SV, than on the forward, SV+S∅, form ($t[31]=1.97$, $p=.05$, one-tailed). There was no significant difference between elaboration on the V∅+VO and VO+∅O pair.

Insert Table 10

about here.

Developmentally, Tables 8 and 9 suggest that percentage of reduction error increased to its highest at level 3, the first post-conjunction level (MLU about 4) and then decreased as Ss began to reach ceiling performance at the last (MLU about 5) level (both as proportion of items and as proportion of errors). Elaboration errors increased through the last level as proportion of errors but remained at a constant low level as proportion of items across development. (See Figure 4. Additional data on this figure will be discussed subsequently.)

Insert Figure 4

about here.

In summary, then, directionality of deletion pattern was found to be a significant factor in determining the nature of children's errors to a conjunction form, although it did not likewise determine differences in correct responses. Specifically, reduction errors on sentential conjunctions occur principally where a forward deletion pattern exists, and rarely with a backward deletion pattern. In general, a corresponding difference for backward and forward phrasal conjunctions was not found. That

is, Ss did not elaborate backward deletions while maintaining forward deletions; although there was some suggestion that this may hold for the SV+SV>S~~V~~+SV comparison. In general, however, elaboration, when it occurred, characterized responses to both forward and backward phrasal conjunctions.

D. Complex sentence conjunction (SVO+SVO)

Twenty-three Ss were tested on complex sentence conjunction (SVO+SVO). This provided 368 sentences for analysis. Fifteen Ss in two post-conjunction developmental language levels (post-conjunction with MLU about 4 and post-conjunction with MLU about 5) were tested. These Ss ranged in age from 2,4,17 to 3,3,24. Mean age of the sample was 34 months. In addition, eight Ss in an older age range in the last language level (MLU about 5) were tested on these sentences. These older Ss ranged in age from 3 years, 6 months to 3 years, 11 months. Their mean age was 43 months.

Table 11 summarizes the basic description of Ss in each level by: sex, age, number of utterances in speech sample, MLU, UB, spontaneous conjunction usage as percent of utterances. There were seven boys and sixteen girls.

Insert Table 11

about here.

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i. Degree of successful imitation. One four-factor unweighted means analysis of variance was performed on these imitation data for the first two groups (post conjunction developmental levels 3 and 4, i.e.,

MLU about 4, and about 5 respectively) to evaluate the following factors: Developmental level x Conjunction form (sentential or phrasal) x Directionality of deletion pattern (forward or backward) x Scope of deletion (single unit or double unit). The last factor referred to the variation in amount of redundancy (in sentential conjunctions) or amount of deletion (in phrasal conjunctions) where either single unit (SVO+VO, SV+SVO) or double unit (SVO+VO, SV$+SVO) deletion was possible. The ANOVA was thus a 2x2x2x2 design with repeated measures on the last three factors. A second ANOVA, analogous in form, and intersecting with the first, was then applied to the two age groups (young and old: mean ages 36 months and 43 months respectively) within the final post-conjunction (MLU about 5, i.e., $\geq$ 4.76) level to assess the effects of Age within this level (i.e., Age x Conjunction form x Direction x Scope). Table 12 shows the means for each condition within both ANOVA.

Insert Table 12

about here.

The first ANOVA on Ss' imitation in two developmental language levels defined by MLU (MLU about 4 and MLU about 5, levels 3 and 4 respectively) revealed 3 of the 4 factors to be significant as main effects. As with simple sentences, Developmental level ($F[1,13]=7.519$, $p < .02$) and Conjunction form ($F[1,13]=17.648$, $p < .01$) were significant factors in children's imitations of complex sentence conjunction. Again, development from language level 3 (MLU about 4) to level 4 (MLU about 5) was significant in Ss' imitation success. Mean number of items correct are .821 and 1.219. Again, also

sentential conjunction forms were significantly easier for children than phrasal forms. Means are 1.270 and .770 respectively.

Also similarly to the analysis of simple sentence conjunction, Directionality was not significant as a main effect. However, with complex sentences, neither did Directionality interact with any of the other factors. In fact, no interactions were significant in this analysis.

The absence of significant interactions in the data suggests that for complex sentences, the Conjunction form effect is a stronger effect than for simple sentences. It holds for both forward and backward deletion patterns, and it holds equivalently at both developmental language levels considered here. Figure 5 demonstrates the constancy of this effect.

Insert Figure 5

about here.

With complex sentences, in addition, deletion pattern Scope was found to be a significant factor in conjunction imitation ($F[1,13]=16.68$, $p < .01$). Sentences with double unit deletion patterns (SVO+$\not$V$\not$O, S$\not$V$\not\emptyset$+SVO) were significantly easier than those containing single unit deletion patterns (SVO+$\not$VO, SV$\not\emptyset$+SVO). Means were 1.237 and .804 respectively. The absence of a significant interaction of Scope with Conjunction form signified that this relation held for both redundancy scope (in sentential conjunctions) and deletion scope (in phrasal conjunctions) equivalently.

In the second and overlapping factorial ANOVA which was applied to two age groups of the final language level (MLU about 5), the young

group which had appeared in the previous analysis, and an older group, Age was found to be not significant. The overall-mean for the older age group was 1.375 (compared to the 1.219 of the younger group at this level). For this level 5 sample, Conjunction form was again a significant factor ($F[1,14]=45.95$, $p < .001$) as was Scope of deletion pattern ($F[1,14]=28.64$), $p < .001$). Here again, no other factor, and no interaction, was significant.

It was found then that while success in conjunction imitation increased significantly with the development of language (measured generally by MLU), it did not further increase with age throughout the third year of age. Throughout this time, phrasal conjunctions remained significantly more difficult than sentential conjunctions; and deletion patterns of greater scope remained significantly easier.

Although Directionality was not significant as a main effect for complex sentences as for simple sentences, individual a priori comparisons of forward and backward deletion patterns are made below as specified by the design. Since no significant difference was found between the age groups of language level 4, the data have been combined for these analyses over all 23 Ss tested on complex sentences. Again, the hypothesis of precedence of forward over backward deletion patterns is stated, followed by the observed means and the results of a priori comparisons (by t-test of correlated means) of their differences.

Sentential conjunction	t value	p
c. SVO+$\not{S}$VO > SV$\not{O}$+SVO 1.17 1.44	-	ns
d. SVO+$\not{S}\not{V}$O > S$\not{V}\not{O}$+SVO 1.39 1.74	2.15	<.05

Phrasal conjunction			t value	p
c.	SVO+SVO .70	SVØ+SVO .39	-	ns
d.	SVO+SVO 1.13	SVØ+SVO 1.26	-	ns

In conclusion, then, a thesis of developmental precedence of conjunctions with forward deletion patterns over those with backward is not supported in terms of number of correct imitation responses to complex sentences (SVO+SVO) with conjunction. This confirms a similar negative finding with simple sentence conjunctions (SV+SV, VO+VO) reported above.

ii. Elaboration and reduction errors on complex sentences with conjunction. For complex sentence conjunction, in contrast to simple sentence conjunction, elaboration and reduction errors occurred to an equivalent extent in children's imitation. Reduction responses occurred on 7.6% of sentential conjunction items (26.9% of errors) and elaboration responses occurred on 12% of phrasal conjunction items (21% of errors). Table 13 shows the distribution of reduction errors on the various forward and backward conjunction forms at each language level. Table 14 shows this distribution for elaboration errors.

Insert Tables 13 and

14 about here.

Similarly to the simple sentence conjunction data, these data reveal that children produce reduction errors only on conjoined sentences with forward deletion patterns, and not on those with backward deletion

patterns (Table 13). In these data not a single example of a backward reduction error was found, while the forward reduction error accounts for nearly 50% of the errors on sentences with forward reduction patterns as with the simple sentences. The reduction error is most common on the SVO+$V0 form where the scope of redundancy is extended to both subject and verb (64% of errors).

Moreover, in these data, correlation of forward deletion pattern of sentential conjunctions with reduction was also supported by the fact that for the forward SVO+$VO conjunction form, 15% of imitations pronominalized the redundant S in a forward reduction, e.g., given the sentence, "Daddy played the guitar and Daddy sang a song," Ss produced, "Daddy played the guitar and he sang a song." For the forward deletion pattern, SVO+$V0, 4% of imitations pronominalized the redundant S. On backward reduction patterns only one imitation (2% of items) included a pronominalization and in this case the pronominalization was also forward: "Mommy fixed the lunch and baby ate it." These pronominalized utterances have been included among correct responses in the analyses reported above (and not among the reduction errors). However, if pronominalization is considered a "partial deletion" (cf. Delisle, Harries) then these data lend further support to deletion processes in imitation errors as essentially forward. When pronominalization occurs, it is mainly on forward reduction patterns and/or it operates in a forward fashion, i.e., the pronoun occurs in the right conjunct.

Regarding elaboration errors on complex sentence type conjunctions, it was found, surprisingly, that Ss also elaborated the forward deletion patterns to a greater extent than they elaborated the backward deletions.

Ss elaborated 20% of the forward deletion patterns (36% of errors) while they elaborated only 4% of the backward deletion patterns (7% of errors). Thus, as with simple sentence conjunctions, elaboration was found to occur on both forward and backward conjunction deletion patterns, while reduction occurred only on forward patterns.

Developmentally, Tables 13 and 14 suggest that both the reduction and the elaboration responses increased to their highest (as percentage of errors) at level 4 (MLU about 5). Older 3-year-olds at this language level showed a decrease in these behaviors (see Figure 4).

Directionality then is shown to affect error types although it does not affect correct responses in imitation of sentences with conjunction. Reduction errors occur only for forward reduction patterns, while elaboration errors occur for both forward and backward deletion patterns. Again, this finding for complex sentence conjunctions is similar to that for simple sentence conjunctions.

E. Imitation of constituent control sentences

As stated in the introduction and methodology, tests for effects of directionality, such as those reported above, have been confounded with differences in constituent structure of deleted elements (and of remaining regrouped elements) between forward and backward reduction patterns. It is thus possible that the finding of no significant effect of directionality on children's correct imitations of conjunctions was due to constituent structure differences between forward and backward structures rather than to the directionality factor.

To assess this possibility, a group of Ss (analogous to the group tested on complex SVO+SVO sentences) was tested on a set of conjunction

structures which would allow the following comparisons;

c.' SVO+$VO > aS∅+aSV
d.' aSV+a$V > S∅+SVO

The terms of these comparisons have been equated in constituent structure (according to surface structure considerations; see footnote 29) and should allow a test of a directionality effect without the confounding of constituent structure differences.

Twenty-three Ss were tested on the constituent control sentences in the same three developmental groups as the Ss tested on complex sentences. Table 15 summarizes the basic description of Ss in each level. Fifteen of these Ss had also been tested on the full set of complex sentences. Eight were tested only on the constituent control comparison sentences. Eight were boys, Fifteen were girls.

Insert Table 15

about here.

All of these Ss were tested on a set of sentences with adjective-nominal structures in subject position (aS∅+aSV; aSV+a$V) as well as on two of the complex sentence structures (SVO+$VO; S∅+SVO) to permit comparisons c' and d'. All sentences were given in both sentential and phrasal conjunction forms.

Before comparisons c' and d' are evaluated, a basic description of this additional constituent control data will be reviewed. Two ANOVA (one between developmental language levels 3 and 4 and one between two age groups of level 4) were performed on the children's imitations of the set of extra adjective-nominal structures (aSV+aSV). These analyses were

analogous to the analyses of complex sentences. They were 3-factor ANOVA (Developmental level [or Age] x Conjunction form x Direction) (2x2x2). Table 16 shows the means for each condition within both ANOVA.

Insert Table 16

about here.

As can be seen from an inspection of the means, these adjective structures were extremely difficult for the children. Mean number correct over all aSV+aSV forms was .576 as opposed to a mean over all complex (SVO+SVO) forms of 1.152 (for 23 Ss). While there was a significant increase in their successful imitation from Developmental language level 3 to 4 (MLU about 4 to about 5) ($F[1,13]=6.89$, $p=.02$) there was no difference within level 5 between the younger and the older age group. This finding for constituent control adjective-nominal structures was thus similar to that found for complex sentences.

Also similarly to results on complex sentences, Conjunction form had a significant effect on these adjective sentences. For the younger sample varying developmental language level $F(1,13)=8.509$, $p=.01$. Mean number of sentential conjunctions correct was .674, of phrasal conjunctions was .353. For the older sample varying age within level 4, $F(1,14)=7.875$, $p=.02$. Here mean number of sentential conjunctions correct was .938, of phrasals was .563.

For these analyses, Directionality was also a significant effect ($F[1,13]=20.17$), $p=.001$ for the first sample; $F(1,14)=38.16$, $p<.001$ for the second sample.) That is, aSV+aSV forms were significantly easier than

aSV+aSV forms over other conditions. Here, however, the Directionality effect was confounded with a deletion Scope effect. Since Scope had been found to be a significant factor in previous analyses (of complex sentence types) where it was not confounded with directionality, this greater success on the aSV+aSV form may as well be due to the Scope factor as to the Directionality factor.

In general then, imitation of the adjective-nominal conjunction forms (aSV+aSV) to be used on constituent control comparisons of directionality, was found to follow the same constraints as complex sentence, SVO+SVO, conjunction imitation. That is, they developed significantly from language levels 3 to 4, but not between two age groups within the 3-year-old age; sentential conjunction forms were significantly easier than phrasal conjunction forms and double unit deletion scope was significantly easier than single unit deletion scope. Markedly, however, adjective-nominal (aSV+aSV) conjunction structures were more difficult than many complex sentence conjunction structures (SVO+SVO).

When the specific comparisons between adjective-nominal and complex sentence conjunction structures are considered, according to the design, the results are the following (for 23 Ss). Again, mean numbers of items correct are presented, followed by results of t-test of differences.

Sentential conjunction		t value	p
c.'	SVO+SVO > aSV+aSV 1.13 .304	4.03	<.001
d.'	aSV+aSV > SVO+SVO 1.174 1.609	2.65	<.02

Phrasal conjunction	t value	p
c.' SVO+$VO > aS∅+aSV .783 .174	3.48	<.01
d.' aSV+a$V > S∅∅+SVO .696 1.26	2.61	<.02

The hypothesis of a precedence of forward deletion patterns is thus confirmed for single unit deletions (where a forward S deletion is being compared to a backward V deletion) in both sentential and phrasal conjunction forms. However, it is disconfirmed in the case of double unit deletions (where a forward aS or noun phrase deletion was compared to a backward verb phrase deletion). Here the backward (verb phrase) deletion was significantly easier than the forward (aS) adjective-nominal deletion. However, both of these findings can be explained by the simple precedence of SVO+SVO conjunction structures over aSV+aSV structures, since in all cases it was the SVO+SVO structure which was significantly easier.

When the same comparisons are investigated in terms of error patterns the results are also ambiguous. In general, there was very little reduction (only 4.3% of forward items, 10.5% of errors; or 2.2% of all items) on the aSV+aSV forms; and no elaboration. (Although it should be noted for the aSV+a$V form that in 3 cases (6.5% of items, 10% of errors) Ss partially elaborated this form with a pronoun, e.g., "The chocolate ice-cream-cone melted and it broke.") Mean numbers of error types are shown below according to the designed comparisons.

Reduction error (sentential conjunction)

c.' SVO+$VO > aS∅+aSV	
.22	0
d.' aSV+a$V > S∅∅+SVO	
.09	.04

Elaboration error (phrasal conjunction)

c.' SVO+$VO > aSV+aSV
.48 0

d.' aSV+a$V > SVO+SVO
0 .13

Again, as in previous analyses, little or no reduction occurs on backward deletion patterns, but there was similarly, only little reduction on the forward aSV+a$V form. For phrasal conjunctions of aSV forms, elaboration occurred on neither the forward nor the backward variant.

In summary, although the surface structure of aSV+aSV conjunctions was equivalent in complexity to that of SVO+SVO conjunction forms, the aSV+aSV conjunctions were more difficult for children. This is probably due to the greater complexity of the deep structure and/or derivational history of these forms. As a result, a forward directionality hypothesis is only tenuously confirmed for single unit deletions in these comparisons and disconfirmed for double unit deletions. Similarly, probably due to the greater difficulty of these forms, there was very little processing by elaboration or reduction on these forms, making error type comparisons also tenuous.

F. Imitation of sentences with surface structure order reversal

As discussed in the introduction and methodology, effects due to directionality of deletion pattern in conjunction structures could be due to surface structure order of elements or to their deep structure order. To evaluate this issue, Ss were tested on a sentence form which permuted in surface structure the underlying order of elements. This sentence form was created by the there-insertion transformation which permutes the order

of subject and verb in surface structure. Ss were thus additionally given either a VS+∀S or a VaS+∀aS sentence form (in both sentential and phrasal conjunction form) to allow for the following comparisons:

e. VS+∀S > S∀+SV

f. VaS+∀aS > aS∀+aSV

(Examples of the S∀+SV and aS∀+aSV forms are shown in Tables 1 and 2. The VS+∀S form is exemplified, in sentential conjunction form, by: There is milk and there is soup. The VaS+∀aS form is similarly exemplified by: There are red crayons and there are green pencils.)

As stated above, a directionality effect due to surface order would predict the VS+∀S there-insertion form to show a similar precedence to the S∀+SV form, as a forward deletion pattern does to a backward pattern; although a directionality effect due to underlying order would predict these to be equivalent.

Given the results of this study to this point, these questions can be made more specific. A directionality effect has been unambiguously found only for error types. Reduction errors on sentential conjunctions occur principally on forward deletion patterns. One can then ask at this point, does this same error type phenomenon occur with the there-insertion form (VS+∀S). If so, this correlation of reduction with directionality of sentence form is specifically a correlation with surface structure order.

The 32 Ss tested on simple sentence types were given the simple VS+∀S there-insertion form; all other Ss, tested on complex and constituent control sentences were given the nominal-adjective there-insertion form, VaS+∀aS. Success on these forms is shown in Table 17. Error types are shown in Table 18.

Insert Tables 17 and

18 about here.

As can be seen from Table 17, the there-insertion sentences were difficult for the children, developing at a slower rate than the other simple (Table 7) or complex (Table 12) sentence types. A considerable degree of reduction error did characterize the VS+V̸S sentential conjunctions, however, as it did for forward deletion patterns in general and as it did not for backward deletion patterns. Nineteen percent of the simple VS+V̸S sentences (24% of errors) showed a reduction error. Twenty-six percent of the complex VaS+V̸aS sentences showed the reduction error (33% of errors). With this sentence type, moreover, the corresponding error phenomenon held--there was very little elaboration of this form. There was in fact no elaboration for the simple sentence type and only 5% elaboration (6% of errors) for the complex type.

For the simple sentence type, VS+V̸S, degree of reduction followed the general developmental pattern of reduction errors on forward forms in general, increasing to its highest at level 3 (MLU about 4). For complex sentences, reduction errors increase to the highest level inspected here, increasing in fact with age during the third year.

Tests of the relevant comparisons of means for the reduction error type are as follows (on 32 Ss for simple sentences, on 23 Ss for constituent structure controls).

Reduction (sentential conjunction)	t value	p
e. VS+V̸S > SV̸+SV .375 .031	3.23	<.01
f. VaS+V̸aS > aSV̸+aSV .39 0	not testable	

Thus, there are significantly more reduction errors on the VS+V̸S (and VaS+V̸aS) conjunction forms than on the corresponding backward forms as there were for forward deletion patterns in general. Since the forward deletion pattern of the VS+V̸S (or VaS+V̸aS) type conjunction is specifically a surface structure directionality and not an underlying directionality, the correlation of directionality with the reduction error type appears to be a surface structure effect.

Summary of results

Conjunction form (whether sentential or phrasal) was a significant factor in children's conjunction imitation. Consistently, sentential conjunctions were significantly easier than phrasal conjunctions, whether for simple or for complex sentence types (although this difference disappeared when Ss began to reach ceiling performance, e.g., at level 4 for simple sentences; see Figure 2). Constituent structure was also significant in children's conjunction imitation with VO+VO conjunctions being significantly easier than SV+SV conjunctions for simple sentences.

Directionality of deletion pattern was not significant as a main effect in children's correct responses to conjunction, whether of simple or of complex sentence type. That is, Ss correctly imitated forward and backward deletion patterns (over both phrasal and sentential conjunction forms) equivalently. However, with simple sentence types, measured on a lower developmental range, (levels 1-4), directionality significantly

interacted with both conjunction form and developmental level. In imitation of these sentences, the difference between sentential and phrasal conjunction forms in fact occurred only with backward deletion patterns. For forward deletion patterns, there was no significant difference between success on sentential and phrasal forms; and phrasal conjunctions with forward deletions were significantly easier than phrasal conjunctions with backward deletions. Moreover, this interaction with directionality was affected by development in that a general precedence of forward deletion patterns (both sentential and phrasal forms) appeared to characterize the earliest developmental language stage (see Figure 3).

For complex sentence conjunctions, SVO+SVO, however, measured on a higher developmental range (levels 3-4, and one older age group within 4), directionality did not interact withother factors in Ss' conjunction imitation. In summary, individual directionality comparisons, a-d, were considered for both simple and complex sentence types, (i.e., a. SV+$V > S$+SV; b. VO+$O > V$+VO; c. SVO+$VO > SV$+SVO; d. SVO+$$O > S$$+SVO. Stated in terms of a hypothesized precedence of forward deletion directionality, these were disconfirmed except for 'b' in phrasal conjunction form (VO+$O > V$+VO).

An attempt to control for constituent structure differences between backward and forward deletion pairs in order to more clearly assess effects of directionality produced ambiguous results. Although by design constituent structure between deletion pairs was equated at the surface structure level by the use of adjective-nominal structures in subject position (to correspond to VP structure), it was not equated at the deep structure level. The adjective-nominal structures, which have greater

underlying complexity than the SVO structures, were considerably more difficult for children, making comparisons between these structural types ambiguous.

Directionality of deletion pattern, however, was found to be a significant factor in determining the nature of children's errors to sentential conjunctions. The reduction error, where Ss delete redundant elements to produce a phrasal conjunction form which is systematically related to the sentential conjunction of the stimulus sentence, occurs principally on sentential conjunctions with forward deletion patterns and rarely on backward deletion patterns. This correlation of error type and deletion pattern direction was found to hold for both simple sentence and complex sentence conjunctions. It held for all comparisons, a-d. Directionality appeared not to be significantly related to the elaboration error type, however, which occurred equivalently on backward and forward phrasal conjunctions in all cases except for comparison a, where more elaboration occurred to the backward deletion within the SV+SV structure. In general, there were significantly more reduction errors than elaboration errors on simple sentence types and both errors occurred equivalently on complex sentence types.

A test of surface-underlying order differences in order to determine the source of the directionality effect on the reduction error revealed that the surface order reversal (by there-insertion, i.e., VS+ƯS or VaS+ƯaS) conjunction type was the source of reduction errors, as forward deletion patterns were in general, and as backward deletion patterns were not. The correlation of the reduction error type with deletion direction thus appears to be a surface structure order effect.

Table 19 summarizes the above results of tests of specific directionality comparisons in terms of correct responses and in terms of errors.

Insert Table 19

about here.

In general, imitation of conjunction by children from 1,11,19 to 3,10,24 in an elicited imitation task situation showed that the ability to produce model sentences with conjunction developed gradually during this period in correlation with the development of the language system (where development was grossly measured by MLU). Occurrence of conjunction in natural speech and length of upper bound also correlated with developmental language levels ($r=.62$ and $.70$ respectively, $p < .01$ in both cases, $df=59$). Development was not stage-wise during this period, however. Some ostensibly adequate processing of conjunction structures was noted in the earliest developmental stages measured here, termed a pre-conjunction stage, before Ss were productively using the conjunction morpheme 'and' in natural speech. (Mean number of simple sentence conjunctions correct at this level was .484; success was mainly on sentential conjunction forms (.688 vs. .281 for phrasal conjunction forms). However, significant improvement in accuracy of performance occurred only at the third level measured here (MLU about 4); and Ss did not approach ceiling performance for simple sentence conjunctions (SV+SV, VO+VO) until the final developmental stage measured here (MLU about 5). Moreover, several complex sentence conjunction types (SVO+SVO) and certain adjective-

nominal conjunction types (aSV+aSV) continue to develop beyond the third year of age. The linguistic factors of conjunction form, directionality and constituent structure appear to constrain this development structurally according to the results reviewed above.

DISCUSSION

This study investigated structural constraints on the development of conjunction in child language, where these structural constraints were defined by linguistic theory. In particular, the study investigated the possibility that a conjunction reduction structure (i.e., a systematized association between sentential and phrasal conjunction forms) characterizes early child language. Finally, it investigated the further possibility that this conjunction reduction structure might be modified in child language by a directionality constraint on its deletion component. To the degree that these possibilities could be confirmed, evidence of the structural quality of the child language system was said to exist. Specifically, if the conjunction reduction structure is confirmed in child language, then it is necessary to characterize this language as consisting of at least two representational levels (a surface level and a deeper level) interrelated by the deletion transformation. The structural or abstract quality involved in this interrelation of levels is the primary component of a "grammar" (see footnote 1 above). Thus, determining such structural aspects would make it necessary to characterize child language as in some way "grammatical."

If, in addition, a directionality constraint is found to restrict the activity of the conjunction reduction deletion transformation in the grammar, and thus to modify the conjunction reduction structure, then some definition of qualitative characteristics of the conjunction reduction structure in child language would be provided. It was seen above

that certain grammatical theories (e.g., Langendoen, Harries) predict such a constraint (for adult grammar).

Moreover, to the degree that these possibilities were confirmed, contradictions in data on imitation of conjunction by young children (Slobin & Welsh vs. Beilin & Lust) would be explained; and some information would be gained as to the accuracy of a specific language acquisition universal based on such data (Slobin, 1971). Finally, to the degree that these possibilities were confirmed, there would be some specification of an intersection of language acquisition universals with grammatical structure; i.e., there would be some resolution of the issue of if and how such language acquisition universals must be modified by reference to the grammar.

Review of hypotheses of this study

To investigate these issues, two major hypotheses were tested in this study. 1) The possible developmental precedence of sentential conjunctions in child language was investigated. Given a conjunction reduction structure in grammar, phrasal conjunctions systematically relate to sentential conjunction forms. It might be expected therefore that in the acquisition and development of a grammar characterized by the conjunction reduction structure, sentential conjunctions would be primary. (That is, sentential conjunction would be developmentally precedent to phrasal conjunction ; where developmental precedence is measured as greater success on one form than on another at low developmental levels.) Although several researchers have suggested that this is the case (e.g.,Menyuk, Limber) no previous systematic empirical investigation of the issue exists.

Moreover, previous experimentation has suggested that young children, when asked to imitate phrasal conjunctions, often elaborate these conjunctions to their full corresponding sentential forms, where redundant elements which had been deleted by the conjunction reduction transformation are reiterated in surface structure (Slobin & Welsh, 1971). This would suggest, at least, that sentential conjunction forms are relevant to children's processing of phrasal conjunction forms. At the same time, other ostensibly contradictory research has suggested that young children, when given full sentential conjunction forms, often reduce these, by deleting redundant elements, to corresponding phrasal conjunction forms. This would suggest that the inverse of the above relation between sentential and phrasal conjunction forms is relevant to child language. The existence of this bipartite set of research suggested that the conjunction reduction transformation might be relevant to child language, i.e., it suggested that children might systematically relate phrasal and sentential conjunction forms. Confirmation that both error types occur in children's conjunction imitation, then, would provide further empirical support for the conjunction reduction structure as characteristic of child grammar. Thus as a correlary to the first hypothesis of primacy of sentential conjunction in child language, the occurrence of these two error types (elaboration and reduction) in children's conjunction imitation, was assessed.

2) A second hypothesis of this study concerned the description of the deletion component of the conjunction reduction transformation. Linguistic theory has argued several versions of the proper description of this component in the adult grammar. In particular, linguists have

considered the issue of whether this deletion component is best described as a) a mirror-image phenomenon (with deletion occurring equivalently in right or left conjuncts depending on the original branching structure of the deleted components) (Langacker), or b) as a directionally constrained process with deletion operating principally on the right conjunct, the antecedent of the deleted element remaining constant in the left conjunct (a forward reduction hypothesis; Harries, Langendoen). If the conjunction reduction structure characterizes child language, then the further question arises as to which model most adequately describes its deletion component. Analysis of previous imitation of conjunction data suggested that the forward deletion model might be most adequate to child language. The Beilin & Lust sentences, which children had consistently reduced to phrasal conjunction forms, were characterized by forward deletion patterns (i.e., grammatical exercise of the conjunction reduction transformation deleted an element in the right conjunct) while many of the sentences which Slobin & Welsh reported, where a child did <u>not</u> reduce sentential conjunctions or <u>did</u> elaborate the phrasal conjunction form to a sentential conjunction, were backward deletion patterns (i.e., conjunction reductions would have produced a deletion in the left conjunct). It was hypothesized then that reduction errors (such as Beilin & Lust <u>Ss</u> had demonstrated) might be correlates of forward deletion patterns. This raised the more general question as to whether the earliest phrasal conjunction structures in the productive child grammar were in fact those with forward deletion patterns. This would have suggested that the forward directional description of the conjunction reduction deletion component would have model-theoretic significance for child grammar. On the other hand, if forward

and backward directional deletions occurred equivalently in child language, some support would exist for the mirror-image model as most adequate to the description of conjunction in child language. There are then essentially two aspects to the second hypothesis of this study concerning the directionality of the conjunction reduction deletion component. One investigates the possible correlation of a reductive error type to a forward deletion pattern. The other more generally investigates the existence of directionally varied deletion patterns in conjunction structures in child language.

Primacy of sentential conjunction. The results of this study, based on the elicited imitation of systematically varied conjunction structures by young children, appear to confirm the first hypothesis. Children consistently found imitation of sentential conjunction forms significantly easier than imitation of corresponding phrasal conjunction forms. This effect held for sentential and phrasal conjunctions which were exact structural counterparts and which were equated in syllable length, with variation in morpheme length minimized. Moreover, this effect was found to hold for widely varying conjunction structures (simple sentence, SV+SV, VO+VO; complex sentence, SVO+SVO; sentences with adjective-nominal structures in subject position, aSV+aSV). Results also appeared to confirm the supplement to this hypothesis. Both elaboration and reduction errors occurred in children's imitations of conjunction structures.

In general then, the data appear to confirm a structural aspect

to the child grammar, where structure is defined as a systematic relation between levels of linguistic representation (here, sentential and phrasal conjunction forms). As previously stated, the Chomsky grammar proposes that the final state of the language system (i.e., the adult grammar) includes the sentential conjunction form as structurally basic. That is, underlying language contains a sentential conjunction rule, $S \rightarrow S\ S^*$; other conjunction forms are transformational derivatives. This is, in fact, the essential definition of the conjunction reduction relation. The developmental data appear to support this formal model in that the observed developmental primacy of sentential conjunctions signifies the basic availability of the sentential conjunction form to the developing language system. That is, in the temporally extended acquisition process, phrasal conjunctions will have corresponding sentential conjunction forms available as structural referents in the language system. This is evidenced by the observed developmental ordering of the two conjunction forms. It would not be evident if phrasal conjunction forms were developmentally ordered prior to sentential conjunctions. Moreover, if phrasal and sentential conjunctions were synchronously achieved developmentally, support for the Chomsky model would be essentially ambiguous, since a grammatical model postulating both phrasal and sentential conjunctions as equivalently available in underlying structure (e.g., Dougherty) would appear to fit the data as well.

The data then support a structural description of child language through: (a) primary sentential conjunction and (b) elaborative and reductive error patterns suggesting systematic relations between sentential and phrasal conjunction forms. The finding that these structural

aspects characterize child language, provides the foundation for further more precise analyses of these structural components. The second hypothesis of this study, regarding possible directional constraints on the deletion operation of the conjunction reduction transformation directed these analyses.[40]

The directionality of deletions. In general, analysis of the directionality issue was necessary in order to further support the thesis of structural components in child grammar. The directionality issue concerns the quality of reduction, via deletion, within the conjunction reduction structure. This further information was necessary, because data in support of sentential conjunction primacy in child language are also predicted by the putatively a-grammatical "operating principle" (#3 above) proposed by Slobin. That is, principle #3 predicts that children prefer underlying relations to be overtly marked in surface structure. Sentential conjunctions provide this effect, as phrasal conjunctions do not. In particular, it was necessary to consider the deletion directionality issue in order to resolve the data differences noted in previous conjunction imitation research (Slobin & Welsh vs. Beilin & Lust studies). As hypothesized, the results showed that reduction errors (to sentential conjunctions) were constrained by the directionality of the deletion process involved. The reduction error in fact occurred on backward reduction patterns only very rarely

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[40]Notably, the existence of the deletion operation as a component of the conjunction structure of child language is indirectly suggested by the presence of both sentential and phrasal conjunction forms in the child language system and directly suggested by the existence of the reduction error, since here Ss appear to actually delete redundant elements of a conjunction structure.

(see Table 19), and occurred on forward reduction patterns quite frequently. That is, when redundant elements in a sentential conjunction were left-branched and grammatical application of conjunction reduction would delete an element in the right conjunct, leaving the initial left conjunct complete, young children frequently applied this structural reduction, deleting from the right conjunct. When, however, the redundant elements were right-branched and grammatical exercise of a conjunction reduction transformation would produce a deletion in the left conjunct (either by deleting left-ward or by deleting forward and then regrouping remaining elements) Ss almost always left the redundancy of the sentential conjunction in the surface structure rather than applying the reduction. This phenomenon appears to explain then, why Beilin & Lust found a large degree of reduction behavior in imitation of conjunction whereas Slobin & Welsh did not. Beilin & Lust sentences all had forward reduction patterns, while many Slobin & Welsh sentences had backward reduction patterns. (The two cases where Slobin & Welsh do report reduction behavior are forward reductions, e.g., E: "Daddy is going to get some cookies and Daddy is going to get some juice" → S: "He gonna get some cooky and juice".) In general then, young children seem to preferentially apply reductions to sentential conjunctions where the deletions are forward (i.e., occur in the right conjunct) and not to apply them when they are backward (i.e., occur in the left conjunct).

The more general issue follows here: are phrasal conjunctions with forward deletion patterns developmentally primitive, i.e., do they occur earliest in the developing grammar, since children seem to be producing them in their earliest language via this reduction error. Moreover,

is there perhaps a general developmental constraint against the production of phrasal conjunctions involving backward reductions in early grammar, as there is, apparently, a constraint against applying the reduction process to them in the imitation errors. Investigation of this issue required analysis of children's relative success in imitating conjunctions with backward and forward deletion patterns. This question principally refers to the structure of phrasal conjunctions. However, it may also be asked of sentential conjunctions. In this case, the question regards the location and structure of redundancy: are sentential conjunctions with right-branched redundancy (which are thus structurally eligible for backward deletions) significantly more difficult (succeeded significantly later developmentally) than those with left-branching redundancy (which are structurally eligible for forward deletions). Given the systematic relation between sentential and phrasal conjunction structures predicted by the grammar it is not unreasonable to ask the deletion directionality question in terms of both sentential and phrasal conjunction forms. Moreover, investigation of a general developmental constraint against phrasal conjunction production, justified examining the possibility that elaboration errors might occur to a greater degree for backward deletion patterns.

When young children's correct imitations of conjunctions with directionally varied deletion patterns (forward and backward) in both sentential and phrasal form were inspected in this study, it was found that directionality was not significant as a main effect for either simple (SV+SV, VO+VO) or complex (SVO+SVO) type sentences. Phrasal conjunctions with backward and forward deletions, matched for basic

constituent structure in specific comparisons, were in most cases equivalent in difficulty (see Table 19). Sentential conjunctions with directionally varied redundancy patterns, in the same comparisons, for the most part were also either equivalent in difficulty or the backward reduction pattern was superior. (This latter phenomenon was seen to be a reciprocal effect of the fact that many forward sentences were reduced in imitation while backward sentences were not.) Moreover, children appeared to elaborate backward and forward deletions equivalently.

However, further analyses revealed effects of directionality. In the imitation of simple sentence type conjunction (SV+SV, VO+VO) by the youngest sample (age 1,11,19 to 3,1,3; mean age two-and-a-half years; mean MLU 3.84) it was found that directionality of conjunction deletion pattern interacted significantly with conjunction form (as sentential or phrasal) in affecting Ss' successful imitation of conjunction. Sentential conjunction forms were easier than phrasal conjunction forms for backward deletion patterns, but not for forward. Imitation of sentential and phrasal conjunction forms was equivalent for forward forms. Moreover, these young Ss were able to correctly imitate phrasal conjunctions with forward deletion patterns significantly better than those with backward deletions. In addition to correlating with error type, then, deletion pattern directionality significantly affected success in conjunction imitation. It did not do so, however, as an independent main effect, but by interacting with structural aspects of conjunction form.[41] Thus, although the finding of correlation

[41]Although statistical interactions are, in general, less reliable than main effects, those in the present analyses are conceptually significant by a priori theory, and therefore worth considering. Most clearly, they provide incentive and direction for further research.

of the reduction error type with directional (forward) deletion patterns was not complemented by the finding that backward deleted phrasal conjunctions were consistently elaborated at any developmental level, it was complemented by the finding that backward deleted phrasal conjunctions were more difficult at initial language levels.[42]

Choice of a grammatical model as explanation of the data

The finding that directionality was not statistically significant as a main effect in children's conjunction imitation would appear to support the hypothesis of a mirror-image conjunction reduction model--which predicts that forward and backward conjunction deletions would be equivalently available to the language system. Langacker's claim that "the existence of pairs of similar rules (differing only in directionality) . . . is not fortuitous, but . . . the human child is . . . equipped to expect this kind of regularity" (1969, p. 576) would seem to be generally justified by these data.

However, other findings contradict this conclusion: 1) the nature of reduction errors was principally forward and 2) directionality interacted with development (and with conjunction form) so that phrasal conjunctions with forward deletion patterns were easier than those with backward deletion patterns at lowest developmental language levels. These data, appear to support a forward deletion model of conjunction reduction in the language of the youngest child. Because of the non-significance

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[42]Error types to these backward deleted forms are more serious than the elaboration error type; i.e., they do not convert the backward deletion structure to another equivalent structure, e.g., sentential conjunction with right-branched redundancy. Instead they convert it to a non-equivalent structure which offends the sense of the conjunction, e.g., Ss utter one SV component alone.

of directionality as a main effect, however, they must be viewed as supportive, rather than confirmatory, of the forward deletion model.

Moreover, further questions must be considered regarding the nature of the observed directionality effect.

Further evidence regarding the nature of a directionality effect in this study

The nature of the directionality effect observed in this study was further assessed by investigation of the source of the effect in the grammar. Since the strongest directionality effect consisted of the constraint on errors, this investigation was performed principally on error data.

In particular, the question was asked--is the directionality involved principally surface structure or deep structure determined? To the extent that it is deep structure determined there is evidence that the syntactic nature of conjunction reduction (i.e., the transformational relation between sentential and phrasal conjunction forms) is itself constrained by directionality considerations.[43]

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[43]Moreover, finding an effect of directionality on conjunction reduction in early child grammar, where this effect was deep-structure determined, might be considered significant not only because it might empirically distinguish two theories of the grammatical structure of the conjunction reduction transformation (as discussed above) but also because it might have implications for the issue of the order of constituents in deep structure. Although most transformational linguistic theory since Chomsky assumes an ordered language base (where in English, for example, the underlying order would be S+V+O), some current theory (in particular Sanders, 1970) suggests that deep structure in all language is essentially unordered (e.g., S,V,O). Constituent order is thus considered a surface structure effect created by language-specific ordering rules late in a derivational sequence of rules. According to Sanders' proposal of this thesis, such ordering rules apply after the conjunction reduction transformation. An effect of directionality on conjunction reduction in early child grammar would be difficult to explain in terms of such a thesis.

On the other hand, to the effect that the directionality effect is surface structure determined, there is evidence that the effect may be principally located peripherally to the syntactic component of the grammar (i.e., on the periphery of the syntactic structure of the grammar where syntactic structure is represented as $\Sigma = (P_i, \ldots P_2, \ldots P_n)$, where P_i is the deep, and P_n the surface structure set of phrase-markers [see Chomsky, 1971].)

When this issue was tested in this study by observing whether imitation of a surface order reversal (VS+$\not$S) of an underlying (S$\not$+SV) form would reveal the directionality phenomenon (i.e., reduction of redundant elements) predicted by its surface order deletion pattern (forward) or the absence of the directionality phenomenon predicted by its underlying order (backward) deletion pattern, it was found that surface structure order correlated with the error-type behavior. That is, the VS+$\not$S sentence elicited significantly more reductive processing than the S$\not$+SV form, a correlation which held for forward reductions in general. It thus appeared that it was surface structure order and not underlying order which was responsible for the directionality effect. It would appear to follow, therefore, that the constraint on directionality noted for young children's imitation of conjunction, whereby reductions occur on forward deletion patterns, and not (or rarely) on backward deletion patterns, would be based peripherally to the syntactic component) of the grammar. Furthermore, no direct implications follow from these data regarding the ordering of the language base (cf. footnote #43).

Explanation of the directionality effects: Grammatical or a-grammatical

The finding that surface structure order, rather than underlying order, determines the directionality effect found in this study, might suggest the alternative thesis that the effect is in fact not based in the grammar at all, but is based in a perceptual or cognitive system, or in some other behavioral, a-grammatical source.

The additional findings that the directionality effect principally characterized errors, and only complementally (by delimited interaction) characterized correct responses, might be interpreted as supporting this alternative thesis. Errors can be interpreted as adumbrating psychological processing; while correct imitations can be interpreted as reflecting the structural description of the competence dimension of language. Under the assumptions of the imitation task, if a S correctly imitates a grammatical form, then it is assumed that his language competence structure (as well as his language production system) allow the structural aspects of this utterance.

Under this alternative thesis, the directionality effect would be descriptive of behavioral processing; it would not be descriptive of the structure of conjunction reduction in the grammar.[44] Rather, the non-significance of directionality as a main effect for correct imitations

[44]This difference between errors and correct responses, under the above interpretation, would also suggest the interesting point that the form of processing constraints (in this case directionally constrained as operating forward, as shown by errors) does not necessarily fully match the form of a competence model (allowing bidirectional deletions, as shown by correct imitations), even in young children. However, see below for modification of this point.

would suggest that a directionally neutral (e.g., a mirror-image) deletion model would best characterize this conjunction reduction structure.

More specifically, it might be speculated that the directionality effect would be explained not only by a grammatical description of conjunction reduction deletion as essentially forward (e.g., Harries, Langendoen) but by a production requirement for an initial sentence kernel (SV or SVO) in early child language. In the case of the SV+SV form, for example, a left-fronted phrasal conjunction in surface structure would offend this constraint (e.g., [S+S]V), while a right-ended conjunction would not (e.g., S[V+V]).

It has been proposed that such "cognitive" or "perceptual" phenomena underlie language universals. Language universals thus become "linguistic manifestations of some broader cognitive principles" (Kuno, 1972, p. 9). For example, according to Kuno, the "natural phenomenon" of the language user's need for non-interruption of an initial skeleton sentence explains the existence of a number of language universals or metarules which appear to preserve this skeleton. (Cf. also Bever [1970] who suggests that such a sentence skeleton relates to segmentation strategies in young children.) Kuno suggests that this "functional" principle explains the facts that SVO languages such as English allow only a rightward extraposition rule, and there are no rightward extraposition rules in any language that move constituents not to sentence final position, but to the middle of a skeleton sentence pattern.

In general, with regard to the directionality of conjunction reduction, the Harries, and Langendoen forward reduction proposals and the Kuno "natural explanation for syntactic universals" would seem to be

indistinguishable in terms of descriptive adequacy, since they both predict the same natural language phenomenon, i.e., conjunction deletion in the right rather than the left conjunct.

It might appear, then, that empirical findings of this study (deletion directionality correlative with error type; general non-correlation of deletion directionality with differences in correct imitation; and the implication of surface structure order as the source of the directionality effect) as well as the existence of an applicable performance theory (Kuno, 1972) would encourage an interpretation of these data in terms of the relegation of the directionality phenomenon to a psychological performance model rather than to the grammar per se.

This conclusion must be qualified on several grounds, however. 1) In general, the fact that surface order detemines directionality effects on conjunction reduction does not have straightforward implications for the nature of the grammar; at the same time that it locates the source of the behavioral effect. To the degree that surface order does not interact with syntax (i.e., with the structural relation between underlying and surface sets of phrase markers), this finding (of surface structure order determination of directionality effects) may be interpreted as begging the question of the syntactic structure of the grammar. More specifically, the surface order finding would not in this case deny that directionality may constrain the grammar as well as surface structure processing.

On the other hand, to the degree that surface structure order integrates with syntactic structure (as for example, might be implied by recent revisions in standard transformational theory; see Chomsky, 1971),

the finding that surface structure order constrains deletion bidirectionality, provides supportive data for constraining the syntactic structure (i.e., the conjunction reduction structure) in this way.

2) This general issue is particularly relevant to adequate description of the conjunction reduction structure because of ambiguity in linguistic theory regarding the proper grammatical location of the conjunction reduction rule. The location of the conjunction reduction transformation in a rule ordered transformational sequence is known to be relatively late, e.g., it is ordered after passive transformation, (although it is considered by some an "anywhere rule"). It thus applies close to surface structure, to strings which are putatively ordered much as the surface string itself (cf. Harries). It would appear possible then that the order effects due to the VS and ∅S (there-insertion) transformation in this study were in fact due to such a shallow level rather than to surface structure per se; the effect thus would not be a-syntactic. For this reason, the resolution of the question as to whether deep structure or surface structure order determined the directionality effect in this study does not clearly resolve the question of the source of a conjunction reduction deletion directionality constraint as syntactic or a-syntactic.

3) These specific questions regarding grammatical conjunction reduction raise the more general issue of the nature of interrelations of the structure of the grammar with extra-grammatical systems, e.g., cognitive systems such as perception. These interrelations may be viewed as alternation or as interaction (cf. Bever & Langendoen, 1972). In general, however, at the same time that grammatical structure is constrained

by principles of language use, such structure maintains its independence of usage systems (cf. Langendoen [1974], in particular fn. 18, p. 32). The perceptual and grammatical explanations of the directionality effect in this study, thus, may be viewed not as alternatives, but as homologues.

4) Moreover, it is not clear exactly how a perceptual model alone would explain the directionality effect as it occurred in this study (i.e., correlation of reductive processing with forward deletion patterns). Consideration of this issue would require consideration of formal models of surface structure parsing procedures (e.g., Langendoen, 1974; Kimball, 1973). More generally, it is not clear how the Kuno "functional" principle (of an initial sentence skeleton) operates. Kuno explains its effect only in the general terms of the statement that "sentences are understood from left to right" and it is not totally clear why an initial sentence skeleton should aid comprehension of the remaining portions of the sentence.

5) Empirically, the data of this study themselves confirm that, with regard to the directionality effect on conjunction reduction, grammatical and processing systems are not merely homologous, but precisely integrative. a) The reduction errors observed in this study were "grammatical"; i.e., they deleted redundant elements, leaving ostensibly correct derived structures of phrasal conjunction form. The reductions, for example, do not delete right-conjunct final elements (whether redundant or not) as a simple a-structural serial position effect would predict.

Notably these reductions are "grammatical" according to either a "mirror-image" or a "forward reduction "conjunction model. However, since backward reductions did not occur (in the error patterns) these data are

exhaustively explained by the forward reduction model; whereas they are inexhaustively, and therefore more weakly explained by the mirror-image model.

b) Further, the directional constraint on reduction was not limited to the errors in this study. The additional empirical findings that directionality interacted with conjunction form, modulating the relation between sentential and phrasal conjunction forms, and that phrasal conjunctions with forward deletion patterns may in general be easier than those with backward at early developmental levels suggests that directionality deletion effects are not independent of the grammar. (The additional interaction with development will be discussed further below.)

In summary, then, it would appear that both theoretical and empirical considerations regarding the directionality effect observed in this study, support (although they do not confirm) a description of the conjunction reduction deletion component in the grammar of child language as constrained directionally (i.e., in a forward direction).

Two areas remain to be considered here. Both were treated in this study in terms of design controls in the analysis of the above issues. One involves the constituent structure of deleted (and regrouped) elements in the conjunction reduction transformation; the other involves the developmental nature of the empirical data upon which this study was based.

Interaction of constituent structure in conjunction reduction. Conjunction reduction is in fact essentially constrained by constituent structure, such structure entering precisely into its definition. Chomsky, (1957) had specified, for example, that "the rule for conjunction must make explicit reference to constituent structure" (p. 36). Since Chomsky's

statement, however, there has been little advance in theoretical definition of these constraints (e.g., Schachter, no date).

The effects of constituent structure on the issues considered above were revealed in ways manipulated by the design of the study and in other ways which were more untoward. On the one hand, VO+VO conjunction structures were found to be significantly easier than SV+SV conjunction structures. This finding was interesting from the point of view that V and O components are sub-constituents of a single (VP) constituent node; while S and V might be interpreted as two constituents with distinct nodes in grammatical structure. (The difference here is a structural hierarchy difference.) Why this constituent structure difference should interact with directionality so that the VO conjunction was easier than SV conjunction only for forward deletion patterns is not clear.

With complex (SVO) sentence types, constituent structure issues are more complex. The designed attempt to control for constituent structure of deleted (and regrouped) elements within specific comparisons (e.g., to correct these constituency differences within the SVO+$VO > SVØ+SVO comparison by inspecting the SVO+$VO > aSV+aSV comparison) failed. Consideration of the aSV structures rather interestingly suggested the relevance of underlying structure rather than (or as well as) surface structure to conjunction processing. The data revealed aSV+aSV conjunction structures to be extremely difficult for the children within the total age range studied. As noted in footnote #29, the adjective structures result from an embedded S in the underlying subject NP node and from a series of transformations. However, this finding invalidated the proposed

additional comparisons (between SVO and aSV types) as critical evaluations of the directionality effect. In other words, evaluation of directionality effects on complex sentence type (SVO) conjunction structures remain essentially confounded with constituent structure variations.

That such constituent structure differences did in fact interact with the proposed directionality factor is revealed by informal observations. For example, the sentential conjunction form, S∀∅+SVO was the easiest complex form achieved (it was developmentally achieved first); and the corresponding phrasal conjunction was the first phrasal conjunction achieved. Not only does this form have a wider deletion (or redundancy) scope (2 morphemes) but the deleted VP node is one of the highest nodes dominated by the conjunct sentence. Such a finding might best be interpreted in terms of the linguistic theory which describes the universality of this particular constituency deletion as opposed to others in terms of its hierarchical depth (cf. Sanders & Tai, 1972; see fn.[22]).

In a similar vein, the deletion pattern, SV∅+SVO, in phrasal conjunction form, was the last to be achieved. In fact, in the full developmental range studied here, it is failed by most Ss in most cases. As Langendoen has pointed out, this form is considered by some to be ungrammatical or at least semi-grammatical (e.g., Chomsky, 1957) in which case an interpretive rule is required for its description; alternatively, if considered grammatical, an additional syntactic rule, "node raising" is required (Langendoen, 1974, personal communication)(see fn.16).[45]

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[45]This raises a more general issue considered only tentatively above. That is, in this study it has been considered that the conjunction reduction rule which describes the full set of deletion patterns considered here: SV+$V, VO+∀O, S∀+SV, V∅+VO; SVO+$VO, SV∅+SVO; SVO+$∀O; S∀∅+SVO, is bipartite, i.e., involves both deletion and regrouping components, although this study has addressed itself in particular to the deletion

Further study of conjunction reduction must confront such constituent structure issues directly.

Language development and conjunction

Finally, the issue of development, and the validity of the proposed language acquisition universal (#3 above) must be considered with regard to the results of this study. Principally, in this study, the grammar was used as a formal instrument of analysis for child language; and development was used reciprocally as an instrument of analysis of the adult grammar.[46] Clearly, this position is tenable only if some assumption of continuity between initial state and end state grammars is made, an assumption by no means necessary. If the adult generative grammar has psychological reality, however, a developmental theory may assume such continuity via the continuity of the developing organism. The initial part of this study attempted to test this assumption in order to validate it to some degree. Thus the study sought evidence that the grammatical structure of conjunction reduction was applicable to child

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component. Recent work on conjunction (Langendoen, Hankamer) has suggested that this may not be the case equivalently for all deletions; specifically the regrouping component may be optional (see fn.[10]). Although this distinction may be less critical for analyses of the deletion characteristics considered in this study, it would be important to further work on conjunction, in particular to that considering constituent structure issues more carefully.

[46] In a sense, this position is analogous to the Piagetian position on developmental data as epistemologically relevant to cognition. That is, analysis of development is assumed to reveal, through simplification and separation, components later involved in complex interactions within cognitive systems. Development per se then becomes an instrument of analysis.

language. The data evidenced interrelations between sentential and phrasal conjunction forms, where a) developmental priority of sentential conjunction and b) the existence of elaboration and reduction in children's processing of conjunction structures were interpreted as respecting this structure. These data appeared to validate further invstigation of language acquisition in terms of the structural models of conjunction provided by grammatical theory.

Notably, this conclusion does not necessitate the stronger conclusion that very early child grammar is described by the full definition of a conjunction reduction model. Rather, it argues only that structural parameters of the conjunction reduction model appear to be relevant to this developing grammar. The fact that at earliest language stages very few phrasal conjunction structures and only some sentential conjunction structures were available suggests in fact constraints on the grammatical model. It suggests, in other words, that the range of application of the conjunction reduction structure may be limited at earliest stages of development.

Moreover, elaboration and reduction errors were at their highest at those developmental levels where Ss were beginning to achieve some significant success on the conjunction structures (i.e., overall mean of about 1 in a range of 0-2)(see Figure 4). This occurred about level 3 for simple sentence conjunctions; about level 4 for complex sentence conjunctions and persisted to the older age group for adjective-nominal sentence conjunctions. This might suggest that the elaboration and reduction errors were themselves constructive processes in a developing language system. At the same time, however, the fact that even at the earliest

syntactic level (level 1, MLU below 3) there was some evidence of reduction and of elaboration (albeit minimal) holds open the intriguing possibility that the structural parameters of conjunction reduction may be in some abstract way relevant to the grammar even at this earliest stage.

The remaining analyses of this study attempted to further determine the nature of early constraints on this putatively structurally defined language system. Significantly, it was found that the directionality phenomenon (in terms of analysis of correct responses) interacted with developmental language level. Youngest (and least developed linguistically) subjects, (age 1,11,19-3,1,3; mean age 30 months; mean MLU 3.84), who were not yet using conjunction productively in their natural speech, showed a preferential success on forward deletion patterns (when both sentential and phrasal conjunction forms of simple sentences are conflated)(see Figure 3) which was not obvious at later developmental levels. Moreover, when the directionality effect was investigated for an older age range (for complex sentences), with a higher language development range (age 2,4,17-3,10,24; mean age 38 months; mean MLU>5) no effect of directionality was found and directionality did not interact with any other specified factors. An effect of directionality of conjunction deletion pattern on the correct production of conjunction, as measured here, appears then to be developmentally bound.

What this suggests about the general nature of language development is an intriguing question. In particular, if the directionality phenomenon were the simple result of a processing constraint, then it might be suggested that at earliest stages, processing constraints and grammatical structures are inherently bound (or interdependent); while at

later stages this is less the case. Development then would be characterized by a gradual disengagement or growing independence of such systems. This thesis has been proposed by Slobin and is in fact a correlate of his proposed acquisition universal (#3 above)(1971). Slobin suggests, ". . . at the beginning levels it could be that there is little difference between short-term processing strategies and linguistic rules. That is to say, the child's knowledge of language--beyond the definitional knowledge proposed at the outset--is represented chiefly by the techniques he uses to interpret and produce sentences" (p. 346).

However, if the directionality phenomenon is more accurately described as grammar-based as suggested above, then the earliest child language system simply reveals this structural aspect of the grammar more clearly. That is, the development of other language components, (e.g., the regrouping component of the grammar) later acts to complement an initial forward deletion component. Development then is structurally definable. It is characterized by gradual qualitative conversion of original structures to more complex structures. This general issue of alternative developmental theories can be considered more specifically in terms of a consideration of the adequacy of the specific language acquisition universal stated above (#3).

Before considering this last point, however, it should be noted that conclusions about specific developmental language levels must be resisted here due to the small sample size (N=8) within each developmental level. Likewise, conclusions regarding developmental trends must be viewed as basically suggestive. It is interesting to note, however, that the first ostensibly recursive use of the conjunction'and' (i.e., one in

ten utterances) in natural apeech appeared at level 3 (MLU about 4). This is the age at which first substantial success on simple sentence conjunction (SV+SV, VO+VO) and initial success on complex sentence conjunction (SVO+SVO) occurs. This level corresponds to Brown's level V, the level at which he predicted evidence of conjunction in child language (1973). However, it is also interesting to note that there is no clear stage-wise progression between levels; and, as suggested above, some adequate processing of some conjunction structures appears to occur even at earliest levels.

Language acquisition universal: Grammatical or a-grammatical

The language acquisition universal (#3) which predicts young children's preferences for surface structure exemplification of underlying elements which are grammatically optional in surface structure has been supported in a general sense by the results of this study. Children's preferences for sentential conjunction forms rather than phrasal conjunction forms supports the general meaning of this universal, when interpreted in terms of conjunction. This study has, however, provided a grammatical explanation for this universal in this case and thus theoretically questioned its nature as "revealed by the general psychology of perceptual development" (Slobin, 1971, p. 345). A review of the description of conjunction in linguistic theory revealed that, in this case, a specific grammatical structure describes the inter-relation between a full and a reduced language structure. The full structure in fact describes the underlying structure. In this case the acquisition principle #3 is equivalent to the general acquisition principle that

sentences closest to underlying structure are primitive developmentally.[47]

Moreover, the results of this study also provided evidence that, for English, the language acquisition universal (#3) cannot in fact be stated independently of this grammatical structure. It was found 1) that the acquisition universal does not hold over all variations in grammatical form as a cognitive or perceptual theory would predict. The universal was constrained in cases where a grammatical model would predict that it would be constrained. That is, as predicted by a forward deletion model of conjunction reduction (e.g., Langendoen, Harries ; reduced (phrasal) conjunctions were equivalent in difficulty to full (sentential) conjunctions for young children when the conjunction deletion patterns were forward for simple sentence forms; see Figure 1). 2) Moreover, young children frequently reduced full sentence forms, as a grammatical model of conjunction reduction would predict, but as a cognitive-perceptual model would not. In fact, for young children, with simple sentence forms, full sentences were reduced significantly more often than they were elaborated; while with complex sentence forms full sentences were reduced as often as reduced sentences were elaborated. 3) Moreover, there were significantly more reductions on forward deletion patterns than on backward patterns. This further structural constraint is not predicted by language acquisition universal #3 while it is predicted by a grammatical model of conjunction reduction constrained by forward deletion.

4) In addition, ancillary data of this study more indirectly supported the relevance of the conjunction reduction structure of child

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[47]Notably, it is not necessary that this be the case. Developmentally, Ss could originally use sentences closest to surface form, modelled directly from the environment.

language, and contradicted predictions made by an a-grammatical version of language acquisition universal #3. The adjective-nominal conjunction structures tested in this study were extremely difficult for children and their reduced forms were not elaborated by them, (just as their sentential forms were for the most part not reduced). This phenomenon is not predicted by language acquisition universal #3 which does not take account of grammatical structure. It is, however, predicted by a grammatical model wherein elaboration (or deletion) must take account of the constituent structure (derived or underlying) to which it applies.

It must be concluded then that statement of a language acquisition universal such as #3 cannot be formulated by reference to psychological principles of cognition or perception alone. It must take account of the grammatical description of the language structures to which it applies. Both theoretical and empirical considerations have argued this point.

Table 1. Deletion Patterns of Conjoined Structures and Examples in both Conjoined Sentence and Derived Sentence Form[a]

Simple Forms				
Forward deletion			**Backward deletion**	
i.	SV + $\not$V	(V+V)	iii.	S$\not$ + SV	(S+S)
ii.	VO + $\not$O	(O+O)	iv.	V$\not$ + VO	(V+V)
Complex Forms				
v.	SVO + $\not$VO	(VO+VO)	vii.	SV$\not$ + SVO	(SV+SV)
vi.	SVO + $\not\not$O	(O+O)	viii.	S$\not\not$ + SVO	(S+S)

Examples[b]

Simple Forms			
Conjoined sentence	**Derived sentence**	**Conjoined sentence**	**Derived sentence**
i.a. The girl jumps and the girl runs.	b. The girl jumps and runs.	iii.a. The girls jump and the boys jump.	b. The girls and the boys jump.
ii.a. Hit the ball and hit the drum.	b. Hit the ball and the drum.	iv.a. Push the ball and kick the ball.	b. Push and kick the ball
Complex Forms			
v.a. Mommy drinks the milk and Mommy eats the cake.	b. Mommy drinks the milk and eats the cake.	vii.a. Mommy bakes the cake and Daddy ices the cake.	b. Mommy bakes and Daddy ices the cake.
vi.a. Mommy hides the ball and Mommy hides the bat.	b. Mommy kides the ball and the bat.	viii.a. The girls like ice-cream and the boys like ice-cream.	b. The girls and the boys like ice-cream.

[a]Groupings complementary to deletion patterns are shown in parentheses.

[b]These examples are not actual test items. See appendix B.

Table 2. Deletion Patterns of Constituent Control Sentences and Examples in Both Conjoined Sentence and Derived Sentence Form[a]

Forward deletion		Backward deletion	
i. aSV + ∅SV (V+V)		ii. aS∅ + aSV (aS+aS)	
Examples[b]			
Conjoined sentence	Derived sentence	Conjoined sentence	Derived sentence
i.a. The little girl sang and the little girl danced.	b. The little girl sang and danced.	ii.a. The big boys jumped and the little dogs jumped.	b. The big boys and the little dogs jumped.

[a]Groupings complementary to deletion patterns are shown in parentheses.

[b]These examples are not actual test items. See appendix B.

Table 3. Number of Subjects in each Condition at each Language Level and Mean and Standard Deviation of Age (in months) within Group

Language Level	1 Pre-Conjunction (MLU ≤ 2.9)	2 Conjunction Onset (MLU 3.0-3.75)	3 Post-Conjunction (MLU 3.76-4.75)	4 Post-Conjunction (MLU ≥ 4.76) young (≤ 40 months)	4 Post-Conjunction (MLU ≥ 4.76) old (42-47 months)
Simple Sentences[a] (SV+SV, VO+VO)	8 26 (1.1)	8 30 (3.5)	8 32 (2.9)	8 33 (3.1)	
Complex Sentences[b] (SVO+SVO)			7 32 (2.8)	8 36 (4.0)	8 43 (1.7)
Constituent Controls[c] (aSV+aSV, SVO+SVO)			7 32 (2.7)	8 36 (4.0)	8 45 (1.6)

[a]See Table 1, i-iv for examples of simple sentences. See appendix B1 for sentences used.

[b]See Table 1, v-viii for examples of complex sentences. See appendix B2 for sentences used.

[c]See Table 2, i-ii for examples of constituent control forms and appendix B3 for sentences used.

Table 4. Mean and Standard Deviation (in parentheses) of MLU and UB for each Group

Language Level	1 Pre-Conjunction (MLU ≤ 2.9)	2 Conjunction Onset (3.0-3.75)	3 Post-Conjunction (3.76-4.75)	4 Post-Conjunction (≥ 4.76) young	4 Post-Conjunction (≥ 4.76) old
Simple Sentences					
MLU	2.36 (.39)	3.39 (.22)	4.15 (.41)	5.48 (.58)	
UB	6.5 (.76)	8.5 (1.20)	14.9 (4.2)	18.8 (6.6)	
Complex Sentences					
MLU			4.11 (.35)	5.91 (.74)	5.91 (.98)
UB			12.7 (3.1)	22.5 (6.1)	20.5 (6.1)
Constituent Controls					
MLU			4.17 (.32)	5.71 (.79)	6.12 (.79)
UB			14.7 (5.0)	20.1 (6.8)	20.3 (5.3)

Table 5. Mean Proportion of Conjunction 'and' Usage (as proportion of utterances) in Spontaneous Speech for each Group

Language Level	1 Pre-Conjunction (MLU≤2.9)	2 Conjunction Onset (3.0-3.75)	3 Post-Conjunction (3.76-4.75)	4 Post-Conjunction (≥4.76) young	4 Post-Conjunction (≥4.76) old
Simple Sentences	.006	.04	.10	.20	
Complex Sentences			.09	.15	.15
Constituent Controls			.08	.13	.23

Table 6. Description of Subjects Tested for Imitation of Simple Sentences with Conjunction at Each of Four Developmental Language Levels

Language Level	age (in months)	sex	number of utterances in speech sample	MLU	UB	conjunction "and" usage as proportion of utterances
Pre-Conjunction	24	M	198	2.04	7	.005
	26	M	272	1.97	6	0
	26	M	307	2.22	6	0
	26	M	238	2.76	7	.02
	26	F	209	2.03	6	.01
	26	M	321	2.91	8	.009
	27	M	223	2.79	6	0
	28	F	136	2.15	6	0
Conjunction-Onset	24	F	258	3.24	10	0
	28	M	248	3.54	7	.04
	29	F	216	3.53	8	.02
	31	M	281	3.0	10	.08
	31	F	147	3.44	7	.02
	31	F	220	3.23	8	.04
	32	F	240	3.45	9	.11
	36	M	275	3.69	9	.02
Post-Conjunction(4)	27	M	262	3.85	16	.04
	28	F	198	3.77	9	.17
	32	F	175	4.70	18	.11
	32	M	171	3.85	18	.13
	32	F	226	3.79	11	.03
	34	M	106	4.46	10	.09
	34	F	155	4.72	17	.15
	35	M	245	4.02	20	.07
Post-Conjunction(5)	28	M	120	4.98	10	.21
	29	M	175	4.78	15	.14
	32	M	182	5.49	27	.24
	33	F	167	5.89	17	.29
	34	M	147	5.99	19	.31
	35	M	202	4.84	22	.20
	35	F	182	5.50	12	.10
	37	F	142	6.38	28	.14

Table 7. Mean Number of Simple Sentence Items Correct at each Language Level by Conjunction Form, Directionality and Constituent Structure

	Sentential		Phrasal	
	forward	backward	forward	backward
Pre-conjunction (MLU ≤ 2.90)				
SV+SV	.375	.750	.250	.0
VO+VO	1.125	.500	.750	.125
	.688		.281	
Conjunction-onset (MLU 3.0-3.75)				
SV+SV	.750	1.375	.500	.375
VO+VO	.875	1.000	.625	.500
	1.000		.500	
Post-conjunction (MLU 3.76-4.75)				
SV+SV	.625	1.500	.625	.625
VO+VO	.625	1.625	1.625	1.000
	1.094		.969	
Post-conjunction (MLU ≥ 4.76)				
SV+SV	1.375	1.625	1.375	1.750
VO+VO	1.625	1.875	1.750	1.625
	1.625		1.625	

Table 8. Reduction Error on Simple Conjoined Sentences (as percentage of sentences)(Percentage of error in parentheses)[a,b]

Developmental Language Level / Deletion Direction Constituent Structure	Forward			Backward			Forward & Backward
	SV+∅V	VO+∅O	total	S∅+SV	V∅+VO	total	total
Pre-conjunction	25 (31)	0 (0)	13 (20)	0 (0)	0 (0)	0 (0)	6 (10)
Conjunction-onset	25 (40)	38 (67)	31 (53)	6 (20)	0 (0)	3 (11)	17 (39)
Post-conjunction(4)	31 (46)	63 (91)	47 (68)	0 (0)	0 (0)	0 (0)	23 (52)
Post-conjunction(5)	13 (40)	19 (100)	16 (63)	0 (0)	0 (0)	0 (0)	8 (42)
Total	23 (39)	30 (63)	27 (50)	2 (5)	0 (0)	1 (2)	14 (31)

[a]See conjoined sentence examples on Table 1, i-iva.

[b]N=8 subjects in each language level group; N=16 sentences for each language form at each language level.

Table 9. Elaboration Error on Simple Sentences with Phrasal Conjunction (as percentage of sentences). (Percentage of error in parentheses)[a,b]

Developmental Language Level / Deletion Direction Constituent Structure	Forward SV+$\not$SV	Forward VO+$\not$VO	Forward total	Backward S$\not$V+SV	Backward V$\not\emptyset$+VO	Backward total	Forward & Backward total
Pre-conjunction	0 (0)	0 (0)	0 (0)	6 (6)	0 (0)	3 (3)	2 (2)
Conjuncton-onset	0 (0)	13 (18)	6 (6)	13 (15)	0 (0)	6 (8)	6 (8)
Post-conjunction(4)	0 (0)	0 (0)	0 (0)	19 (27)	6 (13)	13 (21)	6 (12)
Post-conjunction(5)	6 (20)	13 (100)	9 (43)	0 (0)	0 (0)	0 (0)	5 (25)
Total	2 (2)	6 (15)	4 (7)	9 (14)	2 (3)	6 (9)	5 (8)

[a]See phrasal conjunction sentences (derived sentences) examples on Table 1, i-ivb.

[b]N=8 subjects in each language level group; N=16 sentences for each language form at each language level.

Table 10. *t* tests on Amount of Reduction Error on Simple Conjoined Sentences with Forward and Backward Deletion Patterns on Combined Language Levels (N=32) [a]

Analysis		Mean	*t*
Forward	(SV+$V, VO+¥O)	1.06	5.66***
Backward	(S¥+SV, VØ+VO)	.03	
SV+SV		.47	3.70***
S¥+SV		.03	
VO+¥O		.59	--[b]
VØ+VO		0	

[a] See Table 1, iiia-iva for examples of backward deletion patterns on conjoined sentences.

See Table 1, ia-iia for examples of forward deletion patterns on conjoined sentences.

[b] *t* test not applicable due to zero variance

***$p > .001$.

Table 11. Description of Subjects Tested for Imitation of Complex Sentences with Conjunction at Each of Three Developmental Levels

Language Level	age (in months)	sex	number of utterances in speech sample	MLU	UB	conjunction "and" usage as proportion of utterances
Post-Conjunction(4)	29	F	153	3.75	12	.04
(MLU 3.76-4.75)	29	M	189	3.91	12	.07
	31	F	165	4.16	16	.07
	32	F	175	4.70	18	.11 *
	34	M	106	4.46	10	.09 *
	35	F	112	3.79	10	.17
	36	F	217	4.03	11	.06
Post-Conjunction(5)	28	F	124	6.02	15	.06
(MLU≧4.76)	33	M	217	4.92	19	.12
young	37	F	140	5.17	16	.06
	37	F	142	6.38	28	.14 *
	37	F	221	6.31	30	.14
	39	F	145	5.41	18	.12
	39	F	160	5.85	26	.18
	40	F	159	7.19	28	.36
Post-Conjunction(5)	42	F	170	5.94	17	.12
(MLU≧4.76)	42	F	103	5.02	12	.06
old	42	M	122	4.76	15	.09
	43	M	127	7.48	29	.23
	43	F	111	6.70	28	.19
	44	M	187	5.22	21	.11
	44	M	160	5.35	18	.08
	47	F	104	6.80	24	.34

*Child was also tested on Simple Sentences; reappears on Table 6.

Table 12. Mean Number of Complex Sentence Items Correct at Each Language Level by Conjunction Form, Directionality and Scope of Deletion

	Sentential		Phrasal	
	forward	backward	forward	backward
3. Post-conjunction (MLU 3.76-4.75)				
SVO+$VO; SVØ+SVO	.714	1.143	.429	.143
SVO+$V̸O; SV̸Ø+SVO	1.143	1.286	1.000	.714
	1.071		.571	
4. Post-conjunction (MLU ≥4.75) (young)				
SVO+$VO; SVØ+SVO	1.250	1.375	.750	.625
SVO+$V̸O; SV̸Ø+SVO	1.375	1.875	.875	1.625
	1.469		.969	
Post-conjunction (MLU ≥4.75) (old)				
SVO+$VO; SVØ+SVO	1.500	1.750	.875	.375
SVO+$V̸O; SV̸Ø+SVO	1.625	2.000	1.500	1.375
	1.719		1.031	

Table 13. Reduction Error on Complex (SVO+SVO) Conjoined Sentences (as Percentage of sentences) (Percentage of error in parentheses)[a,b]

Developmental Language Level	Deletion Direction / Constituent Structure and Deletion Scope	Forward			Backward			Forward & Backward
		SVO+$VO	SVO+$V/O	Total	SVØ+SVO	SV/Ø+SVO	Total	Total
	Post-conjunction(4) (MLU 3.76-4.75)	21 (33)	29 (67)	25 (47)	0	0	0	13 (27)
	Post-conjunction(5) (MLU ≥ 4.76)							
	young	6 (17)	31 (100)	19 (55)	0	0	0	9 (35)
	old	6 (25)	0	3 (14)	0	0	0	2 (11)
	Total	11 (26)	20 (64)	15 (42)	0	0	0	8 (27)

[a] See conjoined sentence examples on Table 1, v.a-viii.a.

[b] N=7 subjects in Post-conjunction(4) group and N=8 subjects in each of the Post-conjunction(5) groups; N=14 sentences for each language form at the first level; N=16 sentences for each language form at the latter language levels.

Table 14. Elaboration Error on Complex Sentences (SVO+SVO) with Phrasal Conjunction (as percentage of sentences) (Percentage of error in parentheses)[a,b]

Developmental Language Level	Deletion Direction / Constituent Structure and Deletion Scope	Forward			Backward			Forward & Backward
		SVO+$\not{S}$VO	SVO+$\not{S}\not{V}$O	Total	SV$\not{O}$+SVO	S$\not{V}\not{O}$+SVO	Total	Total
	Post-conjunction(4) (MLU 3.76-4.75)	7 (9)	14 (29)	11 (17)	7 (8)	7 (11)	7 (9)	9 (13)
	Post-conjunction(5) (MLU≥4.76)							
	young	31 (50)	31 (56)	31 (53)	0	0	0	16 (30)
	old	25 (44)	6 (25)	16 (39)	6 (8)	6 (20)	6 (11)	11 (23)
	Total	22 (33)	17 (40)	20 (36)	4 (5)	4 (12)	4 (7)	12 (21)

[a] See phrasal conjunction sentences (derived sentences) examples on Table 1, v.b-viii.b.

[b] N=7 subjects in post-conjunction(4) group and N=8 subjects in each of the post-conjunction(5) groups; N=14 sentences for each language form at the first level; N=16 sentences for each language form at the latter language levels.

Table 15. Description of Subjects Tested for Imitation of Constituent Control Sentences at Each of Three Developmental Levels

Language Level	age (in months)	sex	number of utterances in speech sample	MLU	UB	conjunction"and" usage as proportion of utterances
Post-Conjunction(4)						
	29	F	153	3.75	12	.04 *
	29	M	189	3.91	12	.07 *
	31	F	165	4.16	16	.07 *
	32	F	175	4.70	18	.11 **
	34	M	106	4.46	10	.09 **
	34	M	156	4.19	24	.12
	36	F	217	4.03	11	.06 *
Post-Conjunction(5)						
young	28	F	124	6.02	15	.06 *
	33	M	217	4.92	19	.12 *
	37	F	140	5.17	16	.06 *
	37	F	221	6.31	30	.14 *
	38	M	130	5.05	13	.06
	39	F	190	5.15	14	.04
	39	F	160	5.85	26	.18 *
	40	F	159	7.19	28	.36 *
Post-Conjunction(5)						
old	43	F	111	6.70	28	.19 *
	44	M	187	5.22	21	.11 *
	44	F	147	5.39	14	.09
	45	F	105	5.70	15	.06
	46	M	108	7.03	22	.48
	47	F	116	5.25	14	.25
	47	M	100	6.84	24	.31
	47	F	104	6.80	24	.34 *

*Child was also tested on Complex Sentences; reappears on Table 11.

**Child was also tested on Complex Sentences and on Simple Sentences; reappears on Tables 6 and 11.

Table 16. Mean Number of Constituent Control Adjective-Nominal Sentences Correct by Developmental Level, Conjunction Form and Directionality

	Sentential		Phrasal	
	forward	backward	forward	backward
	aSV+aSV	aSV+aSV	aSV+aSV	aSV+aSV
3. Post-conjunction (MLU 3.76-4.75)	.571	.0	.286	.0
4. Post-conjunction (MLU ≥ 4.75)(young)	1.625	.500	.875	.250
Post-conjunction (MLU ≥ 4.75)(old)	1.250	.375	.875	.250

Table 17. Mean Number of Correct Imitations for There-insertion Sentences Permuting Surface Structure Order of Subject and Verb

	VS+ŴS[a]		VaS+ŴaS[b]	
	Sentential	Phrasal	Sentential	Phrasal
1. Pre-conjunction (MLU ≤ 2.9)	0	.063		
2. Conjunction-onset (MLU 3.0-3.75)	.188	.188		
3. Post-conjunction(4) (MLU 3.76-4.75)	.313	.250	.125	.125
4. Post-conjunction(5) (MLU ≥ 4.76) (young)	.375	.500	.350	.250
(old)			.385	.462

[a] N=32.

[b] N=31.

Table 18. Reduction and Elaboration Errors on VS+∀S and VaS+∀aS (There-Insertion) Conjunctions (percentage of items; percentage of errors in parentheses)

	VS+∀S[a]		VaS+∀aS[b]	
	Reduction	Elaboration	Reduction	Elaboration
Pre-conjunction (MLU ≤ 2.9)	12.5 (12.5)	0		
Conjunction-onset (MLU 3.0-3.75)	18.8 (23.1)	0		
Post-conjunction(4) (MLU 3.76-4.75)	31.3 (45.5)	0	0	0
Post-conjunction(5) (MLU ≥ 4.76) young	12.5 (20.0)	0	20.0 (30.8)	10.0 (13.3)
old			46.2 (57.1)	3.8 (5.0)

[a] N=32

[b] N=31

Table 19. Summary of Deletion Directionality Comparisons for Conjunction Structures (in terms of correct response and of error type means)[a,b]

Directionality Comparisons	Correct Imitation						Error Type					
	Sentential Conjunction			Phrasal Conjunction			Reduction (of sentential conjunction			Elaboration (of phrasal conjunction)		
	means	t-value	p	means	t-value	p	means	t-value	p	means	t-value	p
a. SV+$V>SV+SV	.78>1.31	3.57	**x	.69> .69	-	ns	.47>.03	3.7	***	.03>.19	-	ns
b. VO+VO>VØ+VO	1.06>1.25	-	ns	1.19>.81	2.82	**	.59>0			.13>.03	-	ns
c. SVO+$VO>SVØ+SVO	1.17>1.44	-	ns	.70>.39	-	ns	.22>0			.43>.09	2.15	*
d. SVO+$VO>SVØ+SVO	1.39>1.74	2.15	*x	1.13>1.26	-	ns	.39>0			.35>.09	-	ns
c'. SVO+$VO>aSV+aSV	1.13> .30	4.03	***	.78> .17	3.48	**	.22>0			.48>0		
d'. aSV+a$V>SVØ+SVO	1.17>1.61	2.65	*x	.70>1.26	2.61	*x	.09>.04	-	ns	0 >.13		
e. VS+VS>SV+SV	.44>1.31	5.26	***x	.50> .69	-	ns	.38>.03	3.23	**	0 >.19		
f. VaS+VaS>aSV+aSV	.52> .30	-	ns	.43> .17	-	ns	.39> 0			.09> 0		

[a]Comparisons which are significant in the opposite direction, i.e., backward forms are easier, have probability values marked with an x.

[b]All tests are 2-tailed. *=$p<.05$, **$p<.01$, ***$p<.001$
Tests which are not statistically possible because of zero variance are left blank.

Figure 1. Interaction between Sentential and Phrasal Conjunction Structures and Forward and Backward Deletion Patterns

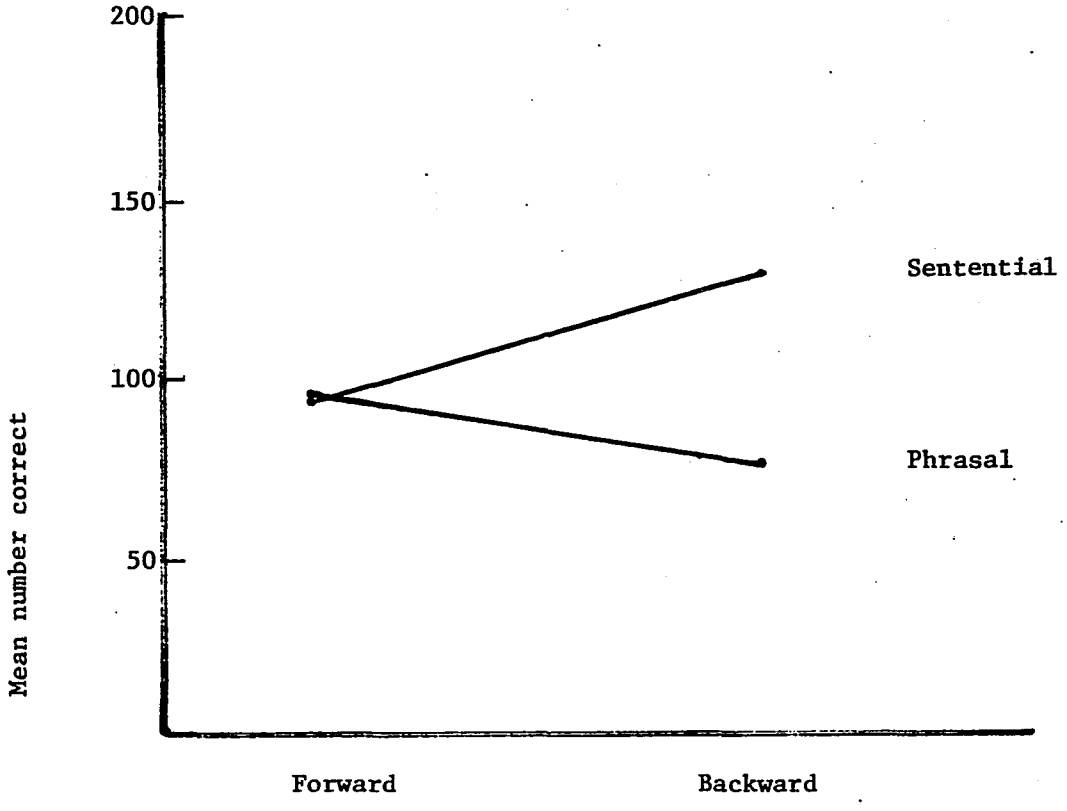


Figure 2. Imitation of Sentential and Phrasal Conjunction Structures with Forward and Backward Deletion Patterns at each of Four Developmental Language Levels

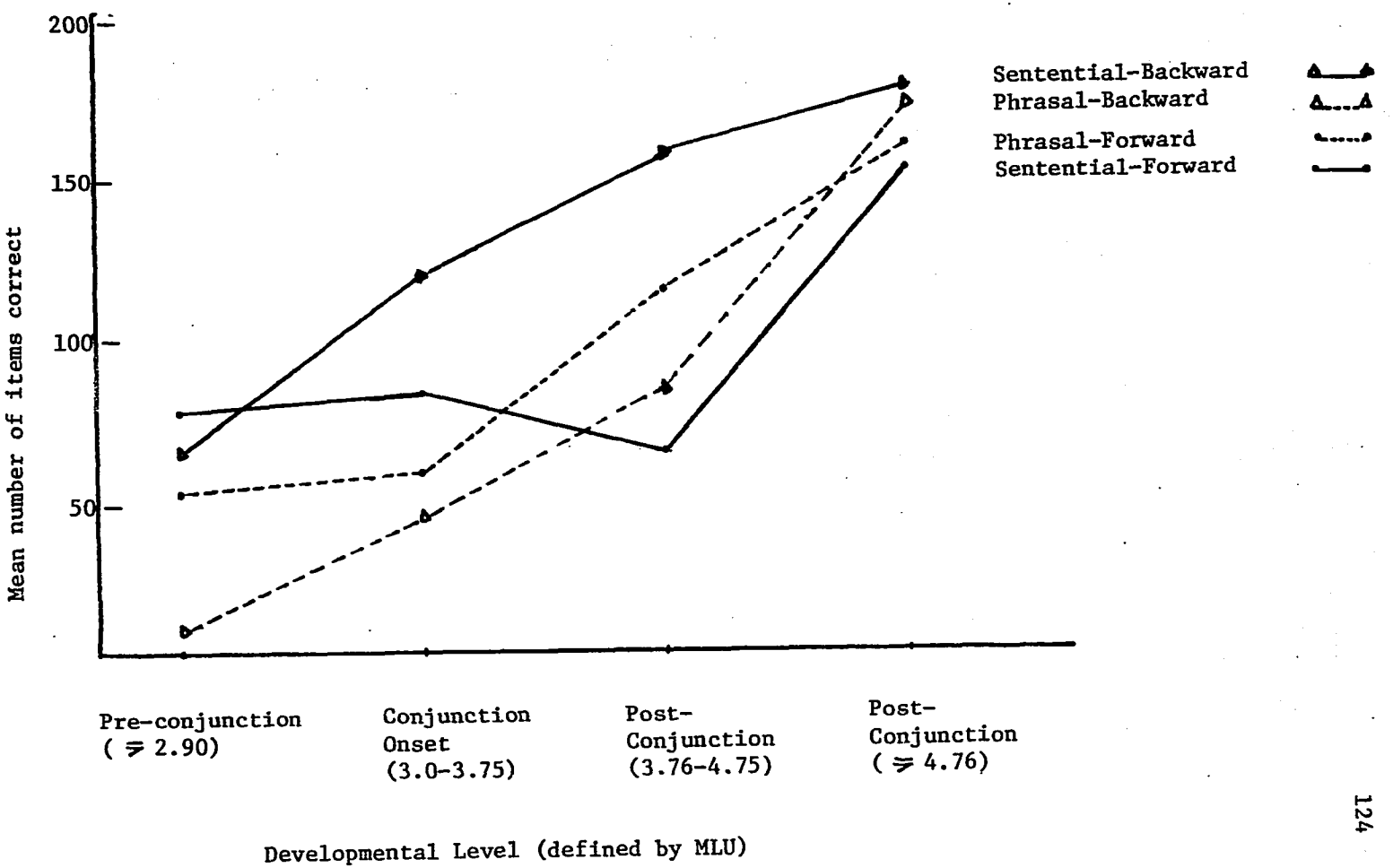


Figure 3. Interaction of Developmental Level with Directionality of Conjunction Structures

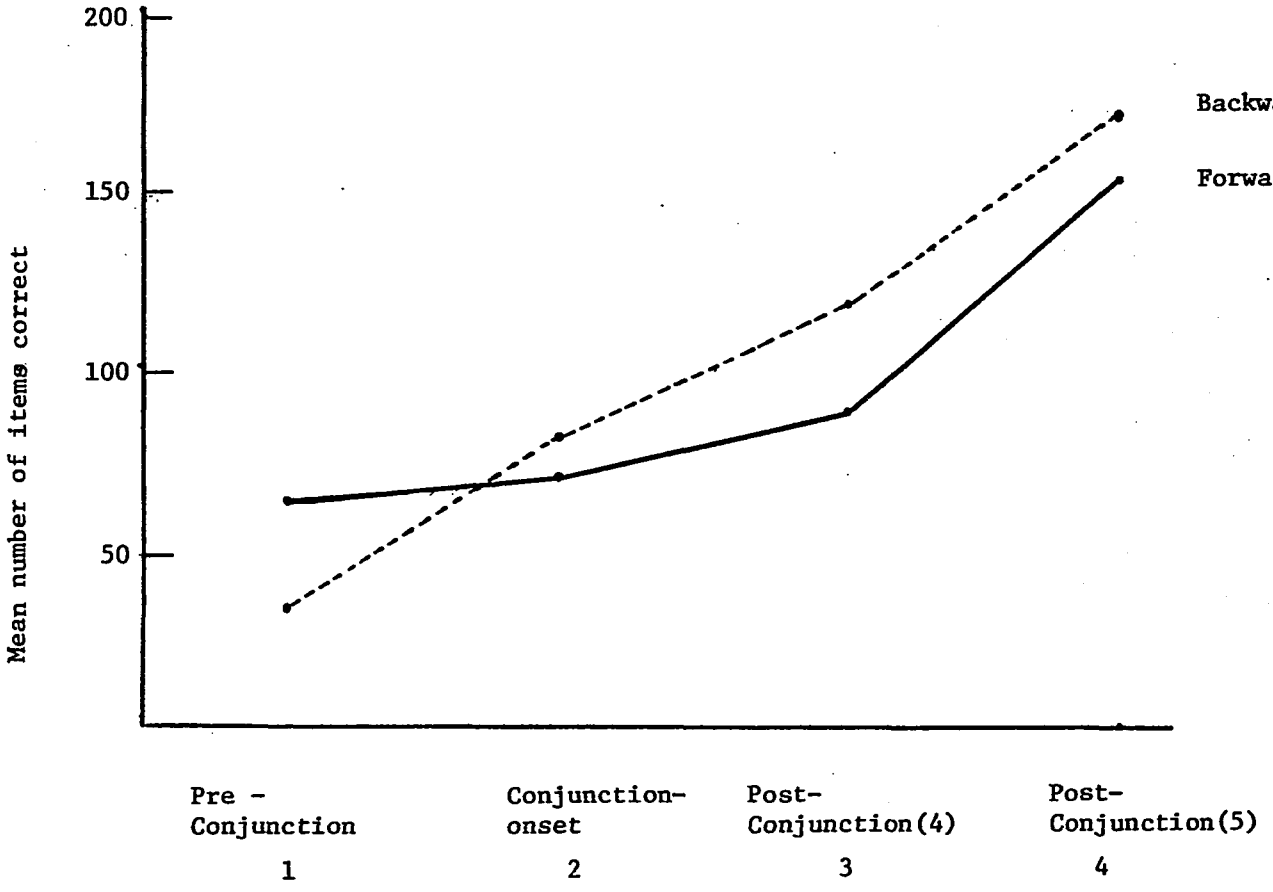


Figure 4. Developmental Change in Amount of Reduction and Elaboration Errors on Sentential and Phrasal Conjunction Forms as Percentage of Errors (Simple, Complex and Adjective-nominal Sentence Types)

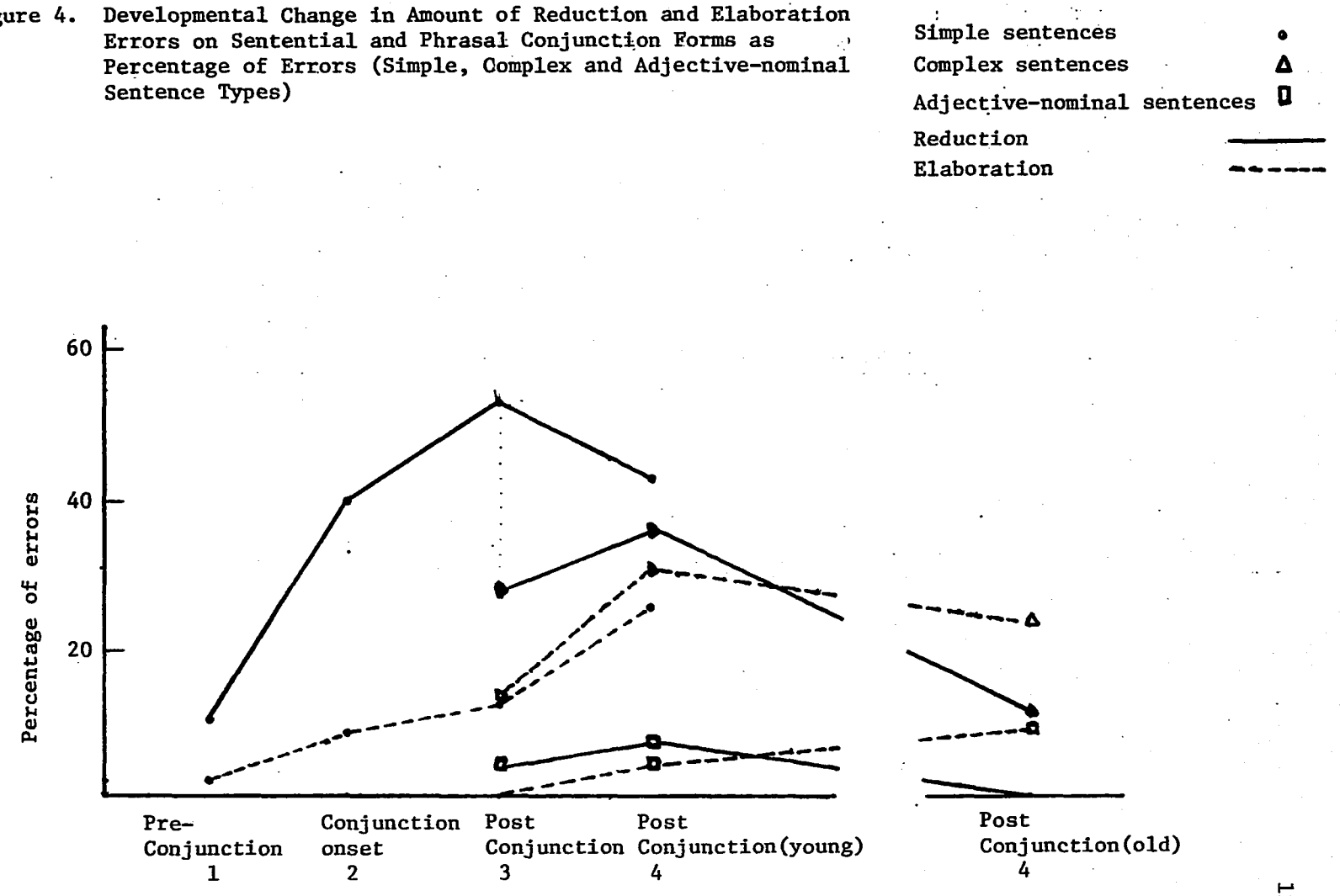
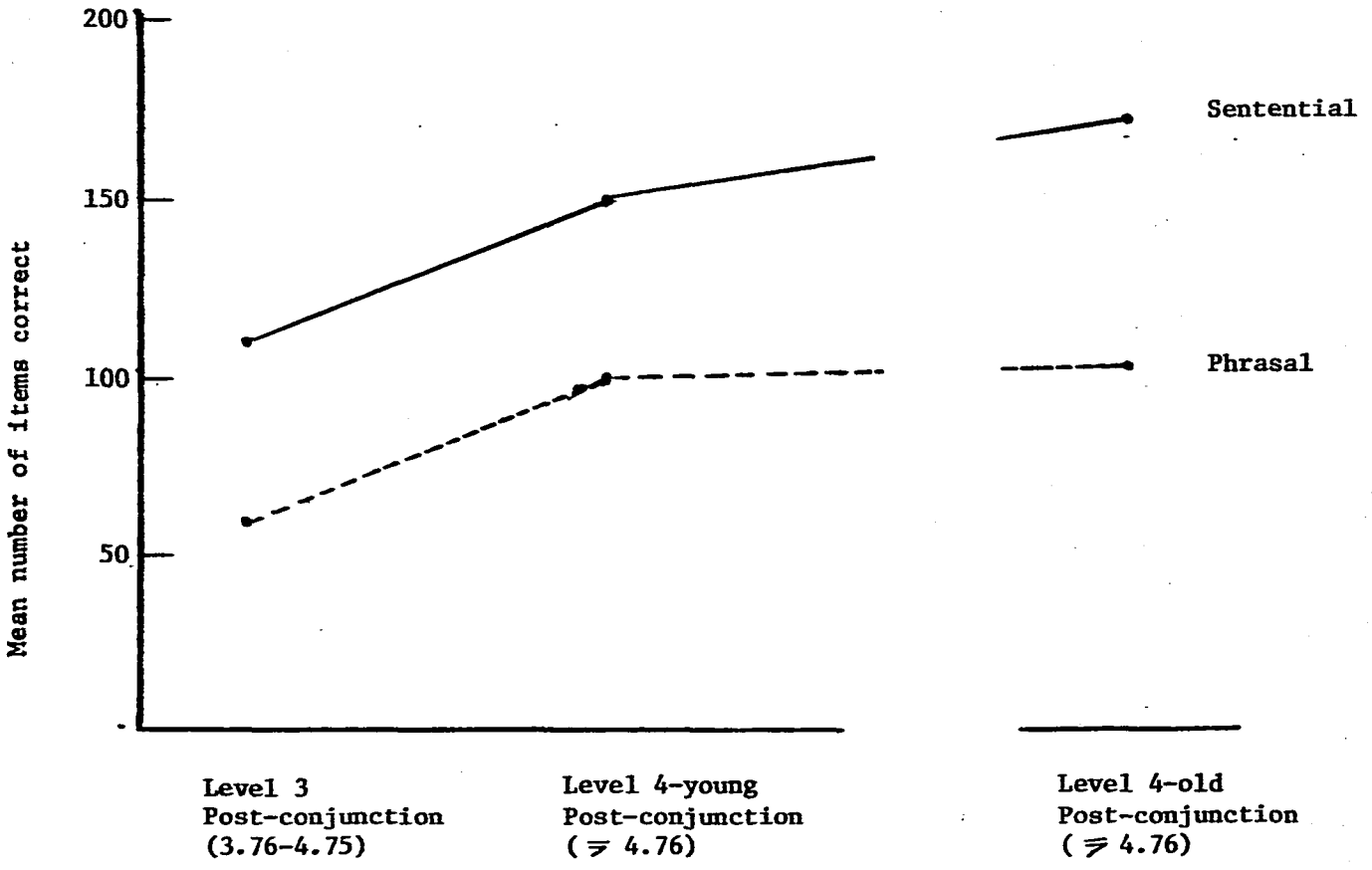


Figure 5. Development of Sentential and Phrasal Forms of Complex Sentence Conjunction (SVO+SVO)



Appendix A

Summary of instructions to parent on administration of the elicited imitation task

1. E explained that the purpose of the task was to inspect child-language versions of the sentences. (This was in order to allay parent's possible anxiety about a child's incorrect imitations.)

2. The parent was asked to inspect the vocabulary of the set of items to ascertain that all vocabulary was familiar to the child. In cases of unfamiliarity, other words, which the parent judged familiar to the child, were substituted (maintaining linguistic form and syllable length of items constant). Where appropriate, names of the child or of friends of the child could be substituted in the sentences.

3. Reinforcement is to be generally given (after every imitation if necessary) regardless of 'correctness' of imitation.

4. If the child simply echoes the last part of a sentence (e.g., the last conjunct) the sentence should be repeated. If the child's imitation is not then extended, the next item should be administered.

5. If a child does not repeat a sentence, a second attempt should be made by the parent. If an item is continuously refused, parent should proceed to the next item, returning to the refused item at the end of the series. If non-response is judged due to distraction, the same procedure is followed; in this case, however, it may be necessary to temporarily discontinue task administration until the child's interest in the task can be renewed. (This general procedure is in accord with the Slobin, Field Manual, 1967, see pages 12 and 25.)

6. Adequate time should be left for the child's response before going on to the next item.

7. Sentences should be administered slowly so that all words can be heard including the conjunction, 'and'; but normal intonational patterns should be used.

8. If a child requests repetition of a sentence, the sentence may be repeated (once), but the whole sentence must be repeated at once.

Appendix B1

Simple Forms (5-7 words)(7 syllables) - #1

Training items:

Hello
Charlie jumps
I like ice cream

1.	THE KITTIES AND THE DOGS HIDE	S∄ + SV	d
2.	EAT THE CRACKERS AND THE CAKE	VO + ∄O	d
3.	THERE IS MILK AND THERE IS SOUP	VS + ∄S	s
4.	WASH AND DRY THE PANDA-BEAR	V∅ + VO	d
5.	THE CHOO-CHOO-TRAIN STOPS AND TOOTS	SV + ∄V	d
6.	BABIES LAUGH AND BABIES CRY	SV + ∄V	s
7.	MOMMIES JUMP AND BABIES JUMP	S∄ + SV	s
8.	THERE ARE JELLY-BEANS AND NUTS	VS + ∄S	d
9.	EAT ICE-CREAM AND EAT COOKIES	VO + ∄O	s
10.	BLOW BUBBLES AND CATCH BUBBLES	V∅ + VO	s

Appendix B1 continued

Simple Forms (5-7 words)(7 syllables) - #2

Training items:

Hello
Jenny jumps
I like ice-cream

1.	TIGERS RUN AND LIONS RUN	S∅ + SV	s
2.	DRINK THE MILK AND THE SODA	VO + ∅O	d
3.	KITTIES HOP AND KITTIES RUN	SV + $V	s
4.	PUSH AND HUG THE KITTY-CAT	V∅ + VO	d
5.	LOVE MOMMY AND LOVE BABY	VO + ∅O	s
6.	THERE ARE COOKIES AND CRACKERS	VO + ∅S	d
7.	HUG MOMMY AND KISS MOMMY	V∅ + VO	s
8.	THE DOLLS AND THE BABIES JUMP	S∅ + SV	d
9.	THERE ARE BEARS AND THERE ARE DOGS	VS + ∅S	s
10.	THE TEDDY-BEAR WALKS AND SLEEPS	SV + $V	d

Appendix B2

Complex forms (7—9 words)(11 syllables) - #1

Training items:

Hello
Charlie jumps
I like ice-cream

1.	THE BUNNIES EAT GRASS AND THE SQUIRRELS EAT GRASS	S∀Ø + SVO	s
2.	MOMMY COOKED THE DINNER AND ATE THE CRACKERS	SVO + $VO	d
3.	THERE ARE BIG KITTY-CATS AND LITTLE BUNNIES	VaS + ∀aS	d
4.	DADDY PLAYED BASEBALL AND DADDY SANG A SONG	SVO + $VO	d
5.	THE BABY COOKED THE SOUP AND THE BIRTHDAY-CAKE	SVO + $∀O	d
6.	THE BOY CAUGHT AND THE GIRL THREW, THE BASKETBALL	SVØ + SVO	d
7.	BURT COLORED THE BOOKS AND SARAH READ THE BOOKS	SVØ + SVO	s
8.	THE MOMMY AND THE LADY ATE THE ICE-CREAM	S∀Ø + SVO	d
9.	MOMMY MADE THE LUNCH AND MOMMY MADE THE CAKE	SVO + $∀O	s
10.	THERE ARE RED CRAYONS AND THERE ARE GREEN PENCILS	VaS + ∀aS	s

Appendix B2 continued

Complex forms (7 - 9 words)(11 syllables) - #2

Training items:

Hello
Jenny jumps
I like ice-cream

1.	THE DADDY ATE THE CRACKERS AND THE ICE-CREAM	SVO + $V̸O	d
2.	MOMMY HOLDS JENNA AND MOMMY READS THE BOOKS	SVO + $VO	s
3.	SARAH LIKES THE CATS AND SARAH LIKES THE DOGS	SVO + $V̸O	s
4.	JENNA ATE THE COOKIES AND DRANK THE SODA	SVO + $VO	d
5.	MOMMY COOKED THE LUNCH AND BABY ATE THE LUNCH	SVØ + SVO	s
6.	THERE ARE BLUE BIRDS AND THERE ARE YELLOW FLOWERS	VaS + V̸aS	s
7.	THE GIRL AND THE MOMMY BAKED A BIRTHDAY-CAKE	SV̸Ø + SVO	d
8.	CHRIS LIKED THE CANDY AND BURT LIKED THE CANDY	SV̸Ø + SVO	s
9.	THE MOM FED AND THE DAD WASHED, THE KITTY-CATS	SVØ + SVO	d
10.	THERE ARE PINK ICE-CREAM-CONES AND GREEN CANDY-BARS	VaS + V̸aS	d

Appendix B3

Constituent Controls (6-9 words)(11 syllables) - #1

Training items:

Hello
Charlie jumps
I like ice-cream

1.	THE GIRL AND THE MOMMY BAKED A BIRTHDAY-CAKE	S∄∅ + SVO	d
2.	LITTLE BUNNIES RUN AND LITTLE BUNNIES HOP	aSV + ∡$V	s
3.	WENDY MADE COOKIES AND WENDY FIXED THE LUNCH	SVO + $VO	s
4.	THE BLACK SQUIRRELS AND THE TINY BUNNIES HIDE	aS∄ + aSV	d
5.	HUCKLE ATE THE COOKIES AND DRANK THE SODA	SVO + $VO	d
6.	THERE ARE RED BALLOONS AND THERE ARE YELLOW KITES	VaS + ∄aS	s
7.	THE HAPPY KITTY-CAT MEOWS AND DANCES	aSV + ∡$V	d
8.	JULIE LIKED THE PIE AND SARAH LIKED THE PIE	S∄∅ + SVO	s
9.	THERE IS STRAWBERRY ICE-CREAM AND GOOD CANDY	VaS + ∄aS	d
10.	THE SILLY CLOWNS LAUGH AND THE HAPPY GIRLS LAUGH	aS∄ + aSV	s

Appendix B3 continued

Constituent controls (6-9 words)(11 syllables) - #2

Training items:

Hello
Charlie jumps
I like ice-cream

1.	MOMMY HUGGED THE DOG AND JENNA HUGGED THE DOG	S∀Ø + SVO	s
2.	THE CHOCOLATE ICE-CREAM-CONE MELTED AND BROKE	aSV + Á$V	d
3.	THERE IS BROWN CAKE AND THERE IS ORANGE SODA	VaS + ∀aS	s
4.	DADDY PLAYED THE GUITAR AND DADDY SANG SONGS	SVO + $VO	s
5.	THE SOFT KITTIES AND THE BROWN TEDDY-BEARS SLEEP	aS∀ + aSV	d
6.	THE BIG HORSES RUN AND THE LITTLE DOGS RUN	aS∀ + aSV	s
7.	THE MONKEY ATE THE PIE AND DRANK THE WATER	SVO + $VO	d
8.	THE BOY AND THE DADDY MADE A CHOO-CHOO-TRAIN	S∀Ø + SVO	d
9.	SILLY ERNIE LAUGHS AND SILLY ERNIE CRIES	aSV + Á$V	s
10.	THERE ARE WHITE BUNNY-RABBITS AND BROWN MONKEYS	VaS + ∀aS	d

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