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Pragmatic factors in children's phrasal coordination*

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ABSTRACT

This study of children's conjunction reduction contrasted the syntactic view of forward and backward deletion of base structure elements with the idea that pragmatic factors of situational redundancy and perceptual grouping account for conjunction reduction. Ninety-four children described an action sequence (putting differently coloured beads into a cup) so that a listener positioned behind a screen could repeat them. Half the children communicated as the action was being carried out (SIMULTANEOUS condition), mitigating against perceptual grouping of beads in the cup. Half communicated after the action was completed (POST condition), permitting perceptual grouping. Backward deletion was more frequent in the post than in the simultaneous condition. Also, the overall high frequency of forward deletion reflected encoding of novelty and omission of repetitive elements. These results suggest syntax is pragmatically motivated.

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INTRODUCTION

Coordinate conjunction is the connection of sentences or phrases by a connective morpheme such as *and*. Some sentential conjunctions contain redundant elements. When this is true, there is a corresponding phrasal conjunction where redundant elements do not appear in the spoken sentence. This is illustrated by the following pair:

(1) The dog ran away and the cat ran away.

(2) The dog and the cat ran away.

A psychological question that is of interest to the present study is whether actual production of a phrasally coordinated structure necessarily involves derivation from the corresponding sentential. This is currently a controversial question in the acquisition literature. Ontogenetically, Lust and her colleagues (Lust 1977, Lust & Mervis 1980) have advanced the position that children first learn sentential coordinates and later derive phrasals from the corresponding sentential structure. Their position also implies that phrasal coordinates are derived from a sentential deep structure in the production process. For a variety of empirical reasons, de Villiers and colleagues (de Villiers, Flusberg & Hakuta 1976, 1977), Bloom and colleagues (Bloom, Lahey, Hood, Lifter & Fiess 1980), and Ardery (1980) have disputed this position. Our study deals with a period of time after initial acquisition, but is relevant to the issue of whether the actual production of phrasal coordinates by young children must always be derived from an underlying sentential form.

Whatever the psycholinguistic or linguistic theory of phrasal conjunction, there are gaps (or null anaphors) in a phrasally coordinated sentence which can be filled in by movement in one of two directions. Consider example (3):

(3) John —— and Joe swam the river.

In principle, a listener cannot fill in the missing predicate until he or she reaches a later point in the sentence; the person must therefore go BACK to fill in the missing element. Hence the term BACKWARD DELETION is used to describe the case where deletion operates on the first occurrence of a redundant linguistic element. Example (4) presents a case where such backward movement is not required to fill in the gap:

(4) The geologist explored the canyon and —— drew a map.

Here a listener already has the information necessary to fill in the gap when he or she arrives at it. One pass through the sentence in a forward direction is all that is required to fill in the gap. Hence the term FORWARD DELETION.

Lust and her colleagues have extensively studied the role of backward and forward deletion in the acquisition of coordinate structure beginning at age two (Lust 1977, Lust & Mervis 1980). Lust (1977) found, using an elicited imitation technique with 2- and 3-year-olds, that phrasal conjunctions with forward deletion patterns were easier than those with backward. In addition, forward sentential forms were frequently reduced, whereas backward forms

were not. Lust takes this reduction process to indicate more facility with forward forms and infers that the children understand the derivational relations between sentential and phrasal coordinations earlier for forward than backward forms. Lust & Mervis (1980) report on children's use of coordination in natural conversation. As in their imitation data, most of the phrasal coordination in children's natural speech reflected a forward reduction pattern. There were a few backward constructions but only at the highest MLU level. In addition, there tended to be a forward redundancy pattern in the sentential coordinations.

Ardery (1979, 1980) carried out comprehension and elicited production studies, using a wide variety of syntactic structures with children from 2;6 to 6;0. In the production task she provided enactments, using toy animals, which were appropriate to different sorts of phrasal conjunction; the child was then asked to describe the action sequence. For example, two different animals engaging in the same transitive action provided a referential structure appropriate to conjoined subjects and a backward direction of deletion (e.g. *The tiger and the turtle pushed the dog*). The results confirmed the generally greater difficulty of coordinate structures involving backward deletion; but Ardery also found an exception. One of the most difficult structures involved forward deletion: a subject–verb–object structure involving deletion of a redundant verb (verb gapping). Ardery's results support those of Lust (1977), while indicating at least one other syntactic factor which interacts with directionality of deletion.[1] On the other hand, de Villiers and her colleagues (de Villiers, Flusberg & Hakuta 1976, 1977) failed to find any significant differences between forward and backward constructions in children's imitation and comprehension. This was true at all ages studied, i.e. 3, 4 and 5 years. An analysis of reductions and elaborations in the imitation responses showed an age effect (4-year-olds produced the most reductions and elaborations, but it was not specific to sentence type).

De Villiers *et al.* (1977) also looked at transcriptions of naturalistic speech from three children. They found that almost all the early coordinations were forward and that backward forms were consistently rare. The scarcity of backward forms in naturalistic speech might be due to a lack of opportunity rather than ability. So de Villiers *et al.* (1977), like Ardery (1980), used an elicited production technique to study forward and backward coordination. In their technique, children (aged 3–4 years) described slides that portrayed either multiple agents appropriate to backward-deleted phrasal coordination or multiple objects appropriate to forward-deleted phrasal coordination. They found backward phrasals to be less frequent than forward at all ages,

[1] Ardery (1980) does not feel her results support Lust (1977), whereas Lust & Mervis (1980) do. The view presented here is our own; essentially, it agrees with Lust, Flynn, Chien & Clifford (1981) on this particular point.

but they showed a more rapid increase with age. At the older age, backward phrasals and forward phrasals were similar in frequency. Both de Villiers' and Ardery's results using controlled production situations would seem to indicate that backward phrasal coordinations are more difficult to produce even when the referential structure is appropriate to the grammatical form.

Thus, in summary, results concerning the role of backward and forward deletion in the development of coordination are not totally consistent. Lust *et al.* (1977, 1980) found some evidence for the primacy of forward over backward forms in imitation and spontaneous speech; Ardery found the same primacy of forward deleted forms in imitation and elicited production. De Villiers *et al.* (1976, 1977) found some evidence for this primacy in spontaneous speech and elicited productions, but not in comprehension or imitation. One reason for the differences in the findings on the imitation tasks may be that the syntax of the sentences used by Lust is not the same as that of the sentences used by de Villiers.

Despite the inconsistencies, however, all differences between forward and backward deletion in young children's performance with coordinate sentences favour forward deletion. At this point, then, the weight of the evidence indicates that, for English-speaking children, backward-deleted phrasal coordination is more difficult to master than forward. Our study also treats backward *vs.* forward deletion in children's phrasal coordination. However, rather than seeking to explain the acquisition of coordination through a comparison of different syntactic forms, our study used the structure of the referential situation to explain the production of one form or another. Thus, instead of emphasizing the impact of syntactic structure, our study emphasizes the impact of situational structure on the use of forward *vs.* backward forms of phrasal coordination.

Bowerman (1979) calls for more work on how and when children PRODUCE complex sentences. The present study attempts to do this using a carefully controlled communication situation. Delis & Slater (1977), among others, have found experimental control of communication situations useful in investigating complex sentence use by adults. We are using an experimental approach with a focus on pragmatics, the context of use, to explore children's production of complex coordinate sentences.

Since Bloom (1970), it has been generally accepted that the structure of the referential situation influences deep structure, where basic meaning relations have been traditionally represented. Our interest is in going beyond this point to demonstrate that the structure of the referential situation, an aspect of pragmatic context, also influences the subtle details of surface form, even with the propositional content of the intended message held constant. In addition, we will use the results of our study to question whether actual production of complex coordinate syntax always requires a distinct linguistic level of deep structure.

A key fact about coordinate sentences is that redundant linguistic elements represent redundant elements in the real world. Our earlier research (Greenfield & Smith 1976, Greenfield 1978, Greenfield & Zukow 1978, Greenfield & Dent 1979) has shown that constant or repetitive elements of a real-world referential situation tend to go unspoken, while uncertain or changing elements are linguistically realized, yielding utterances that are informative in the general sense of semantic information theory: that is, they resolve uncertainty, select from among referential alternatives, mark points of change. Thus the perception of redundancy and change in a real-world sequence of events could lead to the production of phrasal coordinate sentences.

Perceptual grouping relates to the gestalt properties of items in a stimulus array that are present in visual perception at the time of linguistic description. Such perceptual grouping could motivate the linguistic grouping that occurs in phrasal coordination. Referential redundancy and perceptual grouping constitute pragmatic motivations for the syntax of phrasal conjunction. These pragmatic factors were the focus of our analysis.

METHOD

Subjects

A total of 118 children participated in the experiment. They were of varied race and socioeconomic status, but all were native English speakers. They were attending an elementary school in a middle-income neighbourhood in Los Angeles. There were 57 six-year-olds (mean age = 6;7) and 61 ten-year-olds (mean age = 10;5).[2] All children described a specific series of complex actions to an adult who, the child was told, could not see the action. There were three construction tasks described by each child. The present analysis is based on the descriptions of only one of these tasks. (See Greenfield & Dent (1979) for a report of an analysis that encompasses all three tasks.)

Procedure

We asked each child to communicate an action sequence (see Fig. 1) involving certain redundant elements, so that a listener who could not see the action would be able to carry out the same sequence. Half of the children in each age group described during the action (SIMULTANEOUS CONDITIONS), the other

[2] Lust and colleagues (Lust, Flynn, Chien & Clifford 1981, Lust & Wayakama 1979) have imitation data indicating that, because of the syntactic structure of Japanese, Japanese children find backward deletion easier than forward. In a similar view, Rappe du Cher (no date) has data indicating that backward-deleted structures do not cause greater difficulty than forward for Turkish-speaking children. This finding has implications for identifying exactly what syntactic factors produce a directionality constraint. Because this issue is only tangentially related to our principal concerns, we have limited ourselves to discussing results obtained with English-speaking children.

TABLE 1. *Conditions and cell sizes*

Time of description related to action	Activity dimension			
	Active (*S* acts)		Passive (*E* acts)	
	Age 6	Age 10	Age 6	Age 10
Simultaneous	13	12	12	12
Post	12	12	8	13

No action	
Age 6	Age 10
12	12

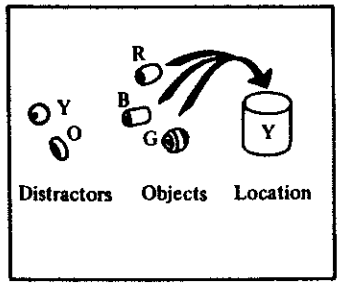

Fig. 1. Combinatorial action task. Beads in a cup: pot method with equivalent objects.

half after it had been completed (POST CONDITIONS). In addition, half of the children in each of these conditions described their own actions (ACTIVE CONDITIONS). The other half described the experimenter's (*E*'s) actions (PASSIVE CONDITIONS). For the present purposes, the relevant action sequence involved placing a series of three differently coloured beads into a cup one at a time (see Fig. 1). In addition to the above four conditions, we asked another group of 6- and 10-year-olds to communicate to a listener how to build the completed structure (three of five beads already in the cup) without having seen or performed any action (NO ACTION CONDITION). Table 1 gives the layout of these conditions and the number of subjects per cell.

For each child the physical setting was the same. That is, one adult experimenter (E_1) and the child sat on one side of a table with a second experimenter (E_2) sitting across the table. Between E_2 and the child there was a white wooden screen with an opening at the level of E_2's face (see Fig. 2).

The children in each age group were randomly assigned to one of the five conditions with the restriction that sex of the participants was balanced across

TABLE 2. *Five conditions of description and the instructions given in each condition*

Time	Activity	
	Active (child performs action)	Passive (child watches E_1 perform action)
Simultaneous (description simultaneous with action)	*Simultaneous active* E_1: Here are your toys, and I'll give (name E_2) the same toys. This is what I want you to copy (E_1 points to model – model always present) E_2 can't see this, and she can't see what you're doing, so tell E_2 what you're doing while you copy it so that she can build the same thing. She can't see this, and she can't see what you're doing. So remember to tell her what you're doing. OK? Now watch me. (Demonstrate action.)	*Simultaneous passive* E_1: These are my toys, and I'll give E_2 the same toys. I'm going to copy this (point to model – model always present). E_2 can't see this, and she can't see what I'm doing. You tell her what I'm doing so she can build the same thing. She can't see this and she can't see what I'm doing, so you have to tell her what I'm doing. OK? E_1 performs action.)
Post (description after action)	*Post active* E_1: Here are your toys, and I'll give E_2 the same toys. This is what I want you to copy (point to model – model always present). E_2 can't see this, and she can't see what you're doing. So when you're all done, tell her what you did so she can build the same thing. She can't see this, and she can't see what you're doing, so when you're all done, tell her what you did. OK? Now watch me. (Demonstrate action.)	*Post passive* E_1: These are my toys, and I'll give E_2 the same toys. I'm going to copy this (point to model – model always present). E_2 can't see this, and she can't see what I'm doing. When I'm all done, you tell her what I did so she can build the same thing. She can't see this, and she can't see what I'm doing, so when I'm all done, tell her what I did. OK? (E_1 performs action.)
No action	These are yours (E_1 places cup with three beads in it and two extra beads on the table in front of the child) and I'll give (name E_2) the same toys (gives E_2 the cup and all beads unassembled). E_2 can't see this. You tell her how to build one so she can make one like this. The exact place of these (E_1 gestures to the beads in the cup) doesn't matter. OK?	

conditions. Table 2 presents the instructions given in each condition. In the four conditions that involved action (SIMULTANEOUS ACTIVE, SIMULTANEOUS PASSIVE, POST ACTIVE and POST PASSIVE) the basic procedure was to present the child with a model of the finished construction and the toys necessary to copy the model (plus distractors). As discussed above, the task was to place a certain three of five beads into a cup one at a time. In the ACTIVE conditions, where the child performed the action, the method of combining the materials was modelled to ensure that the particular series of actions that were of interest were performed. This modelling also served to clarify the instructions – for example, that the particular place of the beads in the cup was not significant (the *E* casually tossed the beads into the cup and they were not exactly like

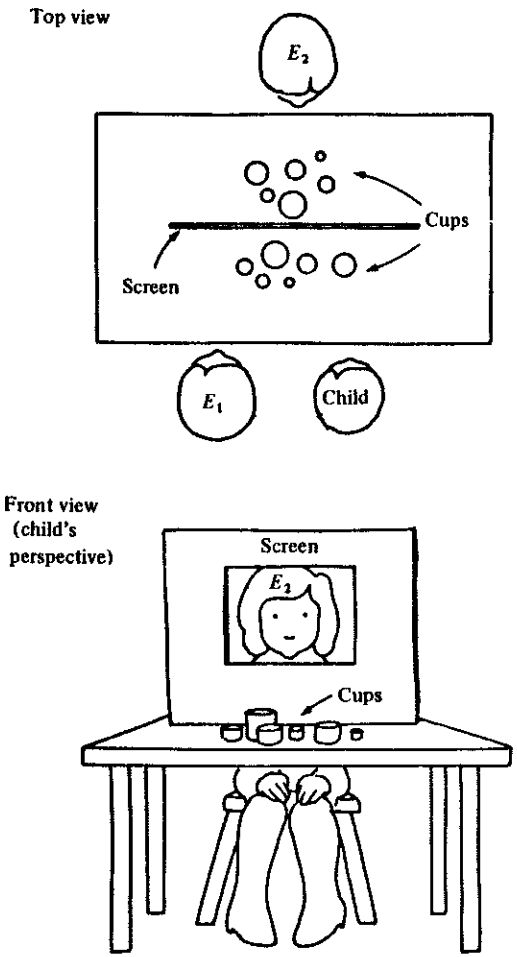

Fig. 2. Schematic drawing of the experimental situation.

the model in position). In the PASSIVE conditions, the action was not modelled before the child described what the experimenter was doing. In the NO ACTION condition, of course, no action was performed either by the experimenter or the child. Since there was no opportunity to communicate nonverbally (by the modelling) to the child that position did not matter, this was explicitly stated in the instructions (see Table 2).

As Fig. 2 shows, all persons could see each other's faces and the child could see only the face of E_2, not her hands or toys (E_2 always had the same toys as the child). Each child was told that E_2 could see the child's face but not his/her hands or what (s)he was doing. In actuality, E_2 could see what the child did and so always produced exactly what the child made (i.e. in ACTIVE conditions). Since, from the child's point of view, the problem was to tell E_2 what (s)he was doing so that E_2 could build the same thing, the child never failed. There were distractor beads so that the child could not simply use *I put them together* or *I put the beads in the cup* as a description and be sufficiently informative.

RESULTS AND DISCUSSION

In a previous analysis (Greenfield & Dent 1979) we demonstrated that the probability of linguistic encoding increased with uncertainty of the elements, where uncertainty is a function of the absence of repetition or redundancy across actions and, in addition, the presence of alternatives within an action. This analysis showed which elements are likely to be linguistically realized. But this does not speak to the question of syntactic organization. The present analysis explores the syntactic organizations used by the children. All descriptions were audiotaped. These tapes were then transcribed for content.

A complex action sequence in which certain elements are repeated as the sequence proceeds should produce coordinate structures involving conjunction reduction. Such syntactic structures can be defined as sentences or phrases joined by a connective morpheme in which some linguistic redundancy has been eliminated or avoided. Because of the structure of the action sequence – a linear sequence of very similar actions – *and* was the most frequent connective morpheme generated by this task. A few subjects used *then* or *and then*.

We found many such structures in our description data and they were more frequent in the older group of children (two-tailed chi-square test, $\chi^2 = 3{\cdot}69$, $P < 0{\cdot}05$). An example from a ten-year-old child illustrates this phenomenon.

(5) She put blue red and green into the yellow one.

Given that the structure of an action sequence involving repetitive, redundant elements stimulates coordinate structures in verbal descriptions, it is necessary to specify further what this can tell us about the precise nature of coordinate structure.

In order to analyse the coordinate structures in more detail, the phrasal

coordinations were scored for whether they were forward or backward conjunctions (Ross 1970) and whether the Agent and/or Action was conjoined or the Object and/or Location (see Table 3). This scoring system requires some explanation. We scored only those phrasal conjunctions that included an overt connector (usually *and*). A pause of at least one second or falling intonation in combination with a pause of at least one second were used to make utterance boundaries (falling intonation is indicated by a period in the examples – commas indicate pauses one second or longer without falling intonation), and we scored only those coordinations within utterances, which in our data were all phrasal coordinations.[3] In the description of the task, forward deletion of Agent and Action leads to standard forms, while forward deletion of Object or Location leads to a non-standard form. The reverse is true for backward deletion. See Table 3 for sample constructions.

TABLE 3. *Types of forward and backward deletion with examples of each*

	Forward	Backward
Agent and/or Action	(Standard form) I put in the red bead, blue bead, and green bead.	(Non-standard form) Red bead, blue bead, green bead I put in the cup.
Object and/or Location	(Non-standard form) Red bead in, blue in, green in.	(Standard form) Red, blue, and green bead in the cup.

If the perception of redundancy or repetition in the referential situation motivates the reduction aspect of phrasal conjunction, then we would expect only one type, forward deletion. Forward deletion yields a coordinate structure in which all elements are linguistically realized in the first proposition, then repeated or constant elements are omitted from the second proposition. In backward deletion, a redundant element is omitted from the first proposition. Thus backward deletion is inconsistent with an explanation of phrasal coordination in terms of redundancy deletion, because, in backward deletion, an element is omitted on its first potential appearance (while it is still relatively uncertain or new) then encoded in the second sentence when it would have become redundant or old.

In our experimental situation there are four repetitive elements: agent, action, object and location. Example (5) eliminates the repetitive agent and action (*she put*) through the production of a forward-deleted structure in

[3] Some participants used the construction *take and put* instead of just *put* in describing the action. We scored this as one encoding of action because we did not want to inflate artificially the frequency of action relative to the other categories that had only one possibility per move of being encoded. We were not interested in whether the actions were analysed into components; this occurred in a minority of the descriptions.

which *she put* appears in the first clause, but is omitted in later clauses. Forward deletion of agent and/or action was the most common form of conjunction reduction under all conditions (see Table 4).

TABLE 4. *Percentage of children producing conjoined structures in involving different types of forward or backward deletion*

	Effect of grouping factor with planning factor held constant			
	Forward		Backward	
Condition	Subject and/or verb deletion (more standard forms)	Object and/or prepositional phrase deletion (less standard forms)	Object and/or prepositional phrase deletion (more standard forms)	Subject and/or verb deletion (less standard forms)
Simultaneous:				
Perceive action	43 (21/49)	33 (16/49)	2 (1/49)	0 (0/49)
Post:				
Perceive end state	27 (12/45)	18 (8/45)	11 (5/45)	0 (0/45)

	Effect of planning factor with grouping factor held constant			
	Forward		Backward	
Condition	Subject and/or verb deletion (more standard forms)	Object and/or prepositional phrase deletion (less standard forms)	Object and/or prepositional phrase deletion (more standard forms)	Subject and/or verb deletion (less standard forms)
Passive: no action sequence demonstrated in advance	42 (17/45)	27 (12/45)	6 (2/45)	2 (1/45)
Active: action sequence demonstrated in advance	31 (15/49)	27 (13/49)	10 (5/49)	0 (0/49)

However, the elimination of all four repetitive elements – agent, action, object and location – in a coordinate structure involves both forward and backward deletion, if one is to come out with a syntactically standard or preferred construction. Here is a hypothetical example:

(6) I'm putting the blue the green and the red bead in the yellow.

Whereas *I'm putting* (agent and action) appears in the first clause (forward deletion), *bead in the yellow* (object and location) is omitted in the first (backward deletion). Thus the syntactically more standard form for eliminating redundancy in the locative phrase (backward deletion) is at odds with

the syntactic form generated by applying the pragmatic rule to eliminate objects and locations as they are repeated (forward deletion). But backward deletion can also be pragmatically motivated – by the grouping factor. Backward deletion of the prepositional phrase yields a description that linguistically groups the three beads together just as they are physically grouped in the yellow cup at the end of the action sequence. Here is a hypothetical example of this sort of backward-deleted structure.

(7) You put the red the green and the blue into the yellow.

Note that the grouping causes mention of location to be deferred to the end of the sentence, the position which would also result from a backward-deletion process.

For those children who are describing action in progress (simultaneous conditions), repetitive action should be a salient factor in their verbalizations. If the pragmatically motivated tendency to omit repeated action elements is dominant, then we should not find any structures which could have been created by backward deletion. Indeed, the elimination of mention of a repeated location should lead to less standard syntactic forms, i.e. syntactic structures which could have been created by forward deletion, where the preferred form is a backward-deleted one. Here is a hypothetical example:

(8) Put the red in the yellow, the blue in, the green.

On the other hand, for those children who are describing completed action (post conditions), the action component should be less salient, the current state of affairs – three beads in a cup – relatively more salient. For these children, the grouping of the beads will be a perceptual factor favouring structures which could have arisen from backward deletion as in (7) above.

Our results are exactly in line with these hypothesized pragmatic processes. Virtually no structure which could reflect backward deletion occurs in the simultaneous conditions. Of those children who conjoin object properties (usually colours) or objects (beads), 33 out of 35 (94%) use the forward-deleted form, even when it is less standard, rather than the backward-deleted form ($P < 0{\cdot}001$, one-tailed binomial test). Because Lust's (1977) findings indicate that backward-deleted forms are within even the younger children's competence, the less standard forward forms appear to stem from combining the linguistic realization of new action elements with the omission of repetitive ones. Here is an example from a 10-year-old girl who described the action sequence while watching the experimenter carry it out:

(9) She putting a red bead in the yellow and a green one a blue one.

The important fact about this example is that the object and locative phrase *bead in the yellow* is realized the first time a bead is put in the yellow cup, then subsequently omitted. The syntactically preferred form, in contrast, would omit *bead in the yellow* when the first bead was placed in the cup, and then realize it upon the last repetition of this action element, yielding a sentence like this hypothetical one:

(10) She putting a red a green and a blue bead in the yellow.

A second example from a ten-year-old boy who gave a description while carrying out the action himself presents a slightly different situation.

(11) Put in a blue one and a red and the green.

Here, the forward deletion of *in* results in a standard syntactic form: however, backward deletion (placing *in* at the end) was also a possibility. In terms of our theme, we interpret such examples as, again, choosing to emphasize novelty rather than repetition in the referential situation. The following examples present parallel examples from the 6-year-old group.

(12) First I putted in the red. Then I putted in the blue then the green. (POST ACTIVE)

(13) I'm putting the red one in the yellow one and the green one in the yellow one and the blue one. (SIMULTANEOUS ACTIVE)

When, however, the action sequence is described after the fact (POST CONDITIONS), we do find that a number of children using conjunction reduction form structures which could have arisen from backward deletion. Here is an example from a 10-year-old who has just watched the experimenter carry out the action sequence:

(14) She put blue red and green into the yellow one.

The second example comes from a 10-year-old girl in the other POST condition – where the subject describes after carrying out the action herself:

(15) I put the red the blue the red and the green in the yellow.

Note in both of these examples that linguistic grouping of the bead description reflects their physical grouping in the yellow cup at the time of description. A parallel example from a 6-year-old in the POST PASSIVE condition follows:

(16) She put a green and red and blue in the yellow can.

While forward-deleted forms for omitting redundant mention of object (bead) or location (yellow cup) still predominate in the POST conditions (62%), backward-deleted forms become much more prevalent than under the conditions of simultaneous description (38% in the POST condition vs. 6% in the SIMULTANEOUS conditions). A Fisher Exact Probability Test indicates that the difference between the number of children manifesting backward deletion of object and/or locative phrase in the POST vs. SIMULTANEOUS conditions is statistically significant ($P = 0{\cdot}02$, two-tailed test).[4]

The fifth condition, the NO ACTION (NA) condition in which the child describes a cup with three beads in it and has not seen any action, was included to see if more backward deletion would be used in the descriptions. We reasoned that if no action was seen, the serial nature of the components of the construction would be de-emphasized. This should make it even more likely that representation of grouping rather than elimination of repetition

[4] One child who showed both backward and forward deletion of a locative was eliminated from the sample for this statistical test.

would be emphasized, yielding an even higher frequency of backward deletion. The data bore out this hypothesis to some extent. The occurrence of backward forms was more frequent in the NO ACTION than in any other condition except POST ACTIVE (see Table 5). A Fisher Exact Probability Test shows that the difference between frequency of backward and forward forms in the NO ACTION condition was significantly different from that difference in the SIMULTANEOUS conditions ($P = 0{\cdot}02$, two-tailed test). There was no significant difference when the NO ACTION condition was compared to the POST conditions. The proportion of children using backward constructions to those using forward constructions is as follows: SIMULTANEOUS conditions – 2·9% (1/34); POST conditions 31·6 (4/11); NO ACTION condition 36·4% (4/11) (see Table 6).

TABLE 5. *Percentage of subjects using forward and backward forms in all conditions*

Condition	Ss using forward	(%)	Ss using backward	(%)
Simultaneous active	(17/25)	68	(0/25)	0
Simultaneous passive	(18/24)	75	(1/24)	4·1
Post active	(9/24)	37·5	(5/24)	20·8
Post passive	(10/24)	47·6	(1/21)	4·76
No action	(11/24)	45·8	(4/24)	16·6

TABLE 6. *Proportion of backward to forward deletion constructions in each experimental condition*

Condition	Backward forms/ Forward forms	%
Simultaneous active	0/17	0
Simultaneous passive	1/17	5·9
Simultaneous total	1/34	2·9
Post active	5/9	55·6
Post passive	1/10	10
Post total	6/19	31·6
No action	4/11	36·4

Thus, the NO ACTION condition looks most like the POST ACTIVE condition in frequency of backward forms and proportion of backward to forward forms. It seems that describing a construction that is complete and present in perception at the time of description is most influenced by the perceptual grouping factor and not by the serial aspects of action carried out on the child's side of the screen. However, the potency of the NO ACTION condition

may have been diminished by the fact that the subject may envisage the adult on the other side of the screen carrying out the action sequence simultaneously with the instructions. In that case, effective communication would require forward rather than backward deletion, so that the listener could carry out the first component act without waiting for the instructions to finish.

In our particular experiment, there is a pragmatic factor in addition to perceptual redundancy and grouping that could augment the use of backward deletion: the opportunity to plan one's utterance (cf. Keenan & Bennett 1977). That is, omission of the earlier of two identical elements must involve planning ahead to the end of the sentence, a factor de Villiers, Flusberg & Hakuta (1977) have identified as important. Consider this example:

(17) John [ate some cake] and Mary ate some cake.

In order to omit *ate some cake* after *John*, the speaker need realize at that point that Mary did too. In order to plan the end of an utterance while or before producing the beginning, the referential situation must not be in flux and must already be known. This would be the case when the description was produced after the action was complete. Thus, grouping cues are confounded with planning cues in the comparison of POST and SIMULTANEOUS conditions. In order to separate out planning cues from grouping cues, an analysis was done holding grouping cues constant. Because a demonstration was given in advance in the conditions where the child carried out the action sequence himself (ACTIVE conditions), but not where he watched the experimenter (PASSIVE conditions), the active conditions provided more planning cues than the passive conditions. Grouping cues were, however, equal in two types of conditions. Comparison of the two active conditions with the two passive conditions for proportion of forward and backward deletions of object and/or prepositional phrase revealed no significant differences between the two conditions. Hence planning cues do not seem to augment backward-deleted structures in the way that grouping cues do.

CONCLUSIONS

In conclusion, pragmatic factors appear to influence the syntax of coordinate sentences used to describe the complex action sequence examined in the present study. The overriding result, dominant in all conditions, is that repetition of elements in an action sequence stimulates forward-deleted structures, even where they would not be preferred from a purely syntactic point of view. In this type of coordinate sentence, an action element (e.g. location) is linguistically realized the first time it appears, but drops out on subsequent repetitions. This cognitive strategy for utilizing information about the action sequence being described leads either to a more standard or to a less standard syntactic form of forward deletion, depending on whether repetition occurs in agent–action or object-location. This is because forward

deletion of agent and/or action leads to a standard syntactic form (as in (5)), whereas forward deletion of object and/or locative phrase leads to a less standard form (as in (9)). The prevalence of these forward forms where backward would be preferred or more standard is all the more interesting when one considers that backward-deleted forms are within children's competence even before age six, the youngest age level in this study (Lust 1977). Thus, how standard the syntax of coordination will be is influenced more by the pattern of redundancy in the referential situation than by level of competence with some generalized syntactic process of backward deletion. Within our own study this point is illustrated even more dramatically, for, when visual grouping cues are stronger, backward-deleted structures are produced by children the same age as those who produce only the less standard forward-deleted structures when grouping cues are weaker. However, such backward-deleted forms were produced by a minority of subjects even in the POST conditions. It is difficult to know if this is because subjects envisioned the listener carrying out the action simultaneously with the instructions, thus needing the representation of novelty entailed by forward deletion, or because forward deletion is syntactically simpler, as in Lust's formulation (e.g. 1977). In the latter case, we would then have an interaction between syntactic and pragmatic factors.

Our results show that pragmatic factors relating to the perceptual structuring of the referential situation influence subtle aspects of syntactic form. One is led to wonder about the role of these pragmatic factors in the original acquisition of the syntax of coordination (cf. Ervin-Tripp 1977).

Our findings call into question whether a base structure level of linguistic representation is always necessary for sentence production. In this communication task, phrasal coordinates are merely one by-product of the general finding that elements of the referential situation do not receive linguistic expression if they can be assumed from the referential situation because they are CONSTANT, REPETITIVE or UNINFORMATIVE in the situation (Greenfield & Dent 1979). For example, in this task the word *bead* is rarely part of the children's descriptions; it is uninformative as the task requires the speaker to distinguish among alternative beads. However, no linguistic theory would want to say that the word *bead* had been deleted from a linguistic base structure. It makes more sense to see the beads as an unambiguous part of the non-verbal message structure, a part that can therefore be omitted from the linguistic level. In other words, *bead* is OMITTED from linguistic representation, not DELETED from a linguistic base structure. If, in this task, phrasal coordinates arise in similar fashion, as a means of eliminating repetitive referential elements, then there is equally no reason to see them as having been deleted from a linguistic base structure. Instead, it is logical to offer a parallel explanation: that repetitive elements have simply been omitted from linguistic representation and that phrasal coordinates are the direct product of this process.

More specifically, production of phrasal coordinates in the SIMULTANEOUS conditions also calls into question whether, in this situation, phrasal coordinates are produced from sentential forms serving as a base structure. Since, in the simultaneous conditions, a description is produced as the action unfolds, the deletion process required to derive a phrasal coordinate from a sentential would have to begin before the whole sentential form could have been produced. Hence, a linguistic model would be needed which could allow meaning to be actualized syntactically as the referential event is in the process of being constructed. The only linguistic model to include the possibility of on-line processes in which semantics and syntax are intercalated in this way are Montague grammars (Fodor 1980). But Montague grammars exclude a base structure level from their linguistic analysis. Hence, rather than view phrasal coordinates as being derived from their corresponding sentential base structures in this situation, it seems much more reasonable to conceptualize the production process as involving a direct encoding of the referential situation into the surface of the sentence as it is produced.[5] Thus, in this task, grouping of linguistic elements (words) would not be the result of a syntactic transformation but a perception based on the gestalt qualities of the words' real-world referents.

Similarly, the effect of perceptual grouping of objects in stimulating backward-deleted phrasal structures also casts doubt as to whether phrasal coordinates are produced from sententials in this situation. It seems unnecessarily complex from a cognitive point of view (especially when one considers the speed with which sentences are produced) to suppose that perceptual grouping operates AFTER the formation of a sentential structure in which words representing the grouped objects are not contiguous. It seems more likely that the coordinated phrase (e.g. blue red and green) is, instead, a DIRECT coding of the perceived group in surface structure form. Here again, it is the nature of the child's perception of referents rather than a syntactic transformation which appears to account for the grouping of linguistic elements.

To summarize the hypothetical process, the child does not generate full sentences from which elements are subsequently deleted. Instead, the perception of a referential situation provides a nonlinguistic base structure from which the coordinate structure is generated. Linguistic elements do not come into being at all if they can be assumed from the structure of the referential situation; thus, linguistic elements are omitted, not deleted. But this is not to say that linguistic base structure and transformational processes have no role. Imitation studies show that children as young as two will produce a phrasal coordinate from a sentential (reduction) and vice versa (elaboration)

[5] In adult psycholinguistics, a model which seems to fit our data is that of Marslen-Wilson & Tyler (1980), in which all linguistic levels (e.g. semantic and syntactic) are processed simultaneously and interact with each other.

(Slobin & Welsh 1973, Beilin & Lust 1975). Hence there are times when production depends on deriving one linguistic structure from another. Note, however, that this evidence comes from imitation studies in which there is no situational structure from which a coordinate sentence could be derived. Thus, it is possible that in actual production, sentences are derived from situational structure where a concrete referential structure exists and that derivation of one linguistic structure from another takes place only when no concrete referential structure is available in the speech situation.[6] This conceptualization posits three levels; a semantic or referential level, a level of linguistic base structure and a level of linguistic surface structure. It hypothesizes, furthermore, that sufficient structuring on the semantic level, particularly when there is a concrete referent present, will cause the levels of linguistic base structure to be bypassed in the actual production of sentences.

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[6] The ease of imitating backward-deleted forms relative to forward in Japanese, reported by Lust and colleagues (Lust & Wayakama 1979, Lust, Flynn, Chien and Clifford 1981), may also be related to the fact that no concrete action context is available as a referent. Lust *et al.* (1980) see their Japanese findings as casting doubt upon our interpretation of phrasal coordination as eliminative of repetitive elements in an action sequence because backward structures delete new elements. However, in the absence of a concrete referential context, purely syntactic factors may play the decisive role. To know whether Japanese children confirm our hypothesis or not, it would be necessary to see what kind of coordinate structures they produce in our communication task. (This argument originates in a comment made by Elizabeth Bates in response to Lust's presentation at the 1980 Stanford Child Language Research Forum.) Pointing in the same direction, we have found that adults bypass surface syntactic cues comprehending verbal action instructions when instructions accord with the action structure assumed by the subject (Greenfield & Westerman 1978). Others have also found that processing of syntactic cues is reduced in adult comprehension as semantic cues to structural relations become stronger (e.g. Fravenfelder, Segui & Mehler, 1980).

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