What Children Say When Asked "What?": A Study of the Use of Syntactic Knowledge

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The present study explores two questions: What is the nature of older children's syntactic knowledge; how is that knowledge used in an everyday speech situation? Six-, eight-, and ten-year-olds repeated grammatical sentences as read by the first experimenter. Half the sentences were syntactically clear, half slightly distorted. Clear versions displayed basic grammatical relations and constituent structure perspicuously. The second experimenter, who sat at the other end of the room, asked "What?" after each sentence. The syntactic changes children might make to accommodate the listener were examined. Although the children made a variety of changes, at all ages they tended to change distorted versions to clear ones, and to repeat clear versions. The results suggest that children's syntactic knowledge is deeper and more accessible than had been supposed.

INTRODUCTION

The present study explores two questions: What is the nature of older children's (6- to 10-year-olds') syntactic knowledge; how is that knowledge used in an everyday example of communication failure? The everyday speech situation which formed the context for these questions was adapted from the Valian and Wales (1976) What? situation.

Valian and Wales define a What? situation as one in which the listener asks the speaker "What?" because s/he has had difficulty hearing and understanding what the speaker has said. The What? situation was formalized by having subjects read single sentences aloud and then respond to the experimenter's query. As one might expect, subjects typically raised their voice in replying. They also tended to change "distorted"

sentence versions like those presented in the second column of Table 1 to "clear" versions like those in the first column more frequently than they changed "clear" to "distorted" versions. The clear and distorted versions can be distinguished by how clearly they display (a) the basic grammatical relations of the sentence or (b) the constituent structure of the sentence or both. (See the Methods section for more extended definitions of "clear" and "distorted.")

Given either sentence version, adults have access to the corresponding one, and prefer the clearer version when asked What? Valian and Wales interpreted their results to suggest that adult speakers hypothesize that listeners process sentences with clearly displayed sentential relations more easily than those with less clearly displayed relations. That is, adults both have a body of syntactic knowledge concerning clarity of sentential relations and use that knowledge in a particular way in a What? situation.

The present study explores children's syntactic knowledge, and children's abilities to handle the What? query. With respect to syntax, there is not clear agreement about children's knowledge. Although older children seem quite sophisticated, some investigators have indicated both that some specific syntactic information is not acquired until quite late (Chomsky, 1969; though see Fabian, Note 1), and that even 5- and 6-year-olds are unable to discriminate between strings with normal and scrambled word order (Bohannon, 1976; Vasta & Liebert, 1973).

Here we examine primarily one kind of syntactic variation children can make to a What?, namely switches between syntactically clear and distorted versions of sentences; these are the changes the constructions listed in Table 1 were designed to test. Of additional interest were changes children made that the materials were not designed to test but would nevertheless be revealed in children's answers, such as changing a question to a declarative.

With respect to children's abilities to handle a What? on a communicative level, there have been several naturalistic studies. Garvey (in press), for example, observed the responses of children aged 3, 4, and 5 to a What? Even 3-year-olds respond appropriately, either by repeating the original utterance or by producing a paraphrase. However, the repetition category included verbatim and partial repetitions with or without elaborations, and thus was only grossly distinguished from the paraphrase category. Stokes (Note 2) has also shown that 2- and 3-year-olds can respond appropriately to a What?, as has pilot work in our laboratory. The responses of young children to a What? indicate that they know that a What? is a signal that communication has failed, and that some rectifying response is required. One question left open is whether, in the children's paraphrases, there are any consistent syntactic changes. "Paraphrase" alone is so broad and unspecific a term that it obscures the various syntactic ways paraphrase may be effected.

TABLE 1

EXAMPLES OF CLEAR AND DISTORTED SENTENCE VERSIONS FOR EACH LINGUISTIC CONSTRUCTION

Construction	Clear version	Distorted version
1 Relative ± marker	The games that he bought were fun.	The games he bought were fun.
2 Relative ± marker + aux	The children who were chewing gum made a lot of noise.	The children chewing gum made a lot of noise.
3 Object noun phrase complement	The doctor said that I had the measles.	The doctor said I had the measles.
4 Subject noun phrase complement—trans verb	It surprised them that Linda was late.	It surprised them Linda was late.
5 Subject noun phrase complement—intrans verb	It seemed that the dog was lost last night.	It seemed the dog was lost last night.
6 Yes–no (tag) questions	Mary's parents are mad at her, aren't they?	Aren't Mary's parents mad at her?
7 Manner adverbials	Superman quickly attacked the robbers.	Superman attacked the robbers quickly.
8 Deleted noun phrase aux questions	Why don't you finish your homework now?	Why not finish your homework now?
9 Permuted relatives	Everyone who went to the party had fun.	Everyone had fun who went to the party.
10 Verb + particle	Bobby put on his shirt.	Bobby put his shirt on.
11 To-dative	I gave a nickel to my friend.	I gave my friend a nickel.
12 Passive	Her brother called Carol a little brat.	Carol was called a little brat by her brother.

Finally, there is the question of what developmental differences may be expected. Garvey (in press) and Stokes (Note 2) both found that nonverbatim repetitions increased with age. Those findings make sense, because one would expect children's syntactic repertoire to get larger with age and, correspondingly, for it to be reflected in an increased diversity of responses to a What? In the present experiment, then, we may expect greater variety and extent of changes to be made as the children get older.

The present study used modifications of the Valian and Wales (1976) constructions as stimuli to determine whether the children had knowledge of, and could manipulate, clarity of sentential relations. We also examined other syntactic changes, and developmental differences.

METHODS

Subjects

Ninety-six children, equally divided between females and males at each of three grade levels (Grade 1, mean age 6,9.5; Grade 3, 8,8.5; Grade 5, 10,7.5) served as subjects. Children were randomly selected from their classrooms; the schools were private grammar schools in the Bronx. Each child was tested individually by two experimenters. (A 97th child was eliminated from the analysis because his responses to the What? query were too far removed from the original sentences.)

Procedure and Apparatus

When the child entered the testing room, located in the school, the two experimenters put the child at ease and showed the child the tape recorder; the experiment then began. The child sat in one corner of the room with one of the experimenters. The other experimenter sat in the diagonal corner of the room, a distance which varied, depending on the available room, from 10 to 15 ft. The two experimenters alternated roles; E_1 designates the experimenter who sat with the child.

E_1 began reading the following instructions:

> We want to play a game with you called the What? game. I'll explain it to you. You know, it happens sometimes that you'll say something to your mother or father and they'll say What? because they didn't hear and understand you. Then you have to say what you said all over again. Sometimes you say it the same way and sometimes you say it a different way. In the What? game we pretend that somebody doesn't hear and understand what we say. E_2 and I will show you how we play the game. E_2 is going to put on those earphones so it really will be harder for her to hear what you say.

E_2 then put on disconnected Sennhauser earphones that look like foam rubber ear muffs.

Then E_1 stopped reading and said to E_2, who was in her position in the diagonal corner, "The brown horse won the race." E_2 said "What?" in a

natural, questioning intonation. E_1 said, "The horse that was brown won the race," in a louder voice. Since pilot work had shown that children were reluctant to change their utterances, the experimenters modeled changing the utterance to insure that the child realized change was allowed; none of the constructions used as practice sentences were used in the experiment itself.[1] E_1 then said, "See, you can say it a different way the second time. I said the same thing, only a different way. I wanted to make sure that E_2 heard and understood me. Let's try another one." E_1 and E_2 then repeated the What? sequence with another sentence, again changing it the second time.

The instructions continued:

> Now you can play the game, too. I'll say something to you and then you say it. E_2 will say "What?" just the way she did with me. Then you say it again so that she can hear and understand you better. Let's try a few. Remember that you can say it a different way the second time if you want to.

The child was then given five practice sentences. The following procedures were used to insure that the child was playing the game properly. If the child failed to repeat the sentence after E_1, s/he was asked to remember to repeat it first; if s/he failed to repeat it verbatim, s/he was reminded that s/he had to say it exactly the same way the first time. This was to insure that the child could both encode and remember the sentence as originally presented. If the child made no response to E_2, E_1 suggested a response to the child, which was the second sentence of each of the practice pairs. If the child repeated the sentence verbatim after E_2's query, E_1 suggested a way in which the child could have said it differently, namely, the second sentence in the pair. At the same time, E_1 emphasized that it was all right for the child to "say it the same way," although s/he may sometimes want to "say it a different way."

After testing with the experimental sentences began, the following procedures were used: If the child failed to repeat the sentence verbatim, E_1 reminded the child to say it exactly the same way, and then tried the sentence again. If the child again failed to repeat the sentence verbatim, the failure was ignored by the experimenters and normal procedure continued. Such data were not included in the analysis; a double failure happened infrequently. At random intervals, E_1 or E_2 said the child was doing well.

Halfway through the testing, the child was asked if s/he would like to take a break and have a cookie. If the child said yes, the break lasted a couple of minutes. If the child said no, testing was continued. Testing

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[1] The six practice pairs exemplified a variety of changes: expansion of an adjective to a relative clause, substitution of a verb for verb+particle, conjunction reduction, reduction of question+or not to a question, prepositional phrase permutation, alteration of construction from conjunction to prepositional phrase, and from POSS-ing to an infinitive.

lasted approximately 50 min. The children seemed to enjoy the experiment. The child's responses were transcribed after the experiment.

Materials

Four sentence pairs were created for each of 12 linguistic constructions; the sentences were simplifications of those used by Valian and Wales (1976). Within each construction the clear and distorted versions differed in how clearly they displayed the sentential relations of that construction. The two versions were identical except for one contrasting portion.

Sentential relations is used here as a cover term for two interdependent grammatical properties: (a) the basic grammatical relations of a sentence, which include *subject of, object of, indirect object of, modifier-head;* (b) the composition of constituent structure, i.e., what elements make up a sentence, a noun phrase, a verb, a prepositional phrase, and so on for each grammatical category. Recovery of the meaning of a sentence is thought to require computation of (a) and (b) (Katz, 1972; Fodor, Bever, & Garrett, 1974). In each of constructions 1–12, the clear and distorted versions differ in how clearly they display (a) or (b) or both.

Each construction is discussed separately in the *Scoring* section, but a general formulation of clarity of sentential relations can be given here. First, the closer the proximity of two or more elements in surface structure, the better they display their joint membership in a grammatical category (construction 10), or the better they display the modifier-head relation (constructions 7 and 9). Second, the more explicitly the basic grammatical relations are marked in surface structure, the better they are displayed; explicit marking can be achieved either by morphological elements (constructions 1, 2, 8, and 9) or by morphological elements plus position in the sentence (constructions 11 and 12). Third, the more explicitly constituents are marked, either morphologically (constructions 1–6) or positionally (construction 9), the better the constituent structure is displayed. The sentences were constructed so that just one structural aspect would be contrasted at a time.

There is another way of describing the differences between clear and distorted versions: In constructions 1–6, 9–11, and, arguably, 7 and 8, the clear form meets the structural description of a transformation and the distorted form meets the structural change. The most common effects of applying transformations are to distort grammatical relations and constituent structure. So it is not surprising that there is more than one way to characterize clear-distorted differences. The present experiment is neutral with respect to the two characterizations offered here.

Table 1 lists each construction and gives an example of a clear and distorted version. Sentences were not controlled for length. The clear versions ranged between 3 and 11 words, with a mean of 7.31 and standard deviation of 1.56. Seventy-five percent of all clear sentences

were between 7 and 9 words long. The distorted versions ranged between
1 (''Tired?'') and 9 words, with a mean of 6.58 and standard deviation of
1.78. Seventy-five percent of all distorted sentences were between 5 and 8
words long.

Data are not reported for an additional six constructions. For five
constructions, the sentence pairs differ along different sets of dimensions
than the clear-distorted dimension, such as nouns vs gerunds. The sixth
construction consisted of four nonsentences which represented putative
deep structure strings. A total of 72 test sentences was constructed.

Design

Subjects were divided into two subgroups of 16 each (8 female, 8 male)
at each of the three age groups. One subgroup read two clear and two
distorted sentences from each construction and the other group read the
four complementary versions. Each subject received a different random
order of sentences.

The design allowed computation of a two-within, one-between repeated
measures analysis of variance with subjects repeated across construction,
of which there were 12 types, and across syntactic form, which was either
clear or distorted and nested within age group. The design also allowed for
computation of a different two-within, one-between analysis, with sen-
tences repeated across syntactic form and subjects and nested within
construction. These two analyses in turn allowed computation of *min F's*.

Scoring

Forty-five percent of all the children's responses were *verbatim* repeti-
tions of the original sentence (48% of clear versions were verbatim; 42%
of distorted versions). The remaining responses explored a great variety
of changes. Some changes were *relevant* to the hypothesis: They altered
the construction being tested. The *relevant* changes and *verbatim* re-
sponses determined basic response categorization. Other changes were
nonrelevant: They altered other portions of the sentence than those we
made predictions about.[2] Yet other changes produced a sentence that was
unscorable. We discuss *nonrelevant* changes first.

Since the nonrelevant changes varied from minor ones like substitution
of *the* for *that* to major ones like passivization, it seemed advisable to
reflect the difference in the scoring procedure. Nonrelevant changes were
accordingly divided into minor and major ones. Minor changes involve
only low-level structural changes, primarily substitutions of one word for
another, deletions, and insertions of nonsentential constituents. Re-
sponses that were the same as the original sentence except for minor

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[2] It will be remembered that, within each construction, each sentence was identical to
its alternate version except for one contrasting portion. Predictions and comparisons were
therefore logically limited to children's treatment of the contrasting portion.

changes were called partial repetitions, and thus distinguished from verbatim repetitions.

Nonrelevant major changes involve high-level structural changes. Of the sentences containing major changes, 24% were insertions of sentential constituents (e.g., a verb, a relative clause), 50% were distortions of nonrelevant sentential relations (e.g., dative movement, passivization), and 22% were changes of one construction into a related construction (e.g., object relative into subject relative). (An itemization of all major changes that occurred five or more times may be obtained from the senior author.)

As mentioned above, relevant changes and verbatim responses determined basic response categorization; nonrelevant changes determined subcategorization. There were three basic response categories, two of which were used in the statistical computations.

Category 1a contains *stay* responses; stay responses include verbatim repetitions and partial repetitions, 67% of all responses. Category 1b contains *semi-stay* responses, responses in which the sentential relations *vis-à-vis* the construction being tested are not altered (thereby resembling *stay* responses), but in which nonrelevant major changes are also made, 4% of all responses.

Category 2a contained *switch* responses, responses which are changes to the matching version: production of the distorted version if the original version had been clear; production of the clear version if the original version had been distorted. *Switch* responses included both verbatim renditions of the matching version and partial renditions (renditions with nonrelevant minor changes), 13% of all responses. Category 2b contained *semi-switch* responses, responses in which the sentential relations *vis-à-vis* the construction being tested matched those of the alternate version (thereby resembling *switch* responses), but in which nonrelevant major changes were also made, 3% of all responses.

Stay and *semi-stay* responses received a score of 1, *switch* and *semi-switch* received a score of 0. The appropriate means were computed for each subject's and each item's score for each construction.

Category 3 contained unscorable responses, which were not used in the statistical computations. Of the sentences that were unscorable, 39% eliminated the construction being tested (e.g., by deleting a relative clause or matrix clause), 44% changed to an unrelated construction (e.g., changed a relative or complement to a coordinate structure). A conservative approach was adopted in the scoring, so that some changes that fit our criteria as clarifying sentential relations were scored as unscorable because the changes could also be interpreted as due to sensitivity to processing limitations. They could not uniquely be attributed to sentential relations. For example, center-embedded constructions were often

changed to coordinate constructions, a change which made sentential relations more explicit, but which could have just reflected children's knowledge that center-embedded constructions are hard to process, independent of specific syntactic considerations. When changes were obviously ambiguous as to their source, they were scored as unscorable, rather than as favorable to the hypothesis. Thirteen percent of all responses were unscorable; 5% of the subject cells were missing and required data replacement. (An itemization of all unscorable responses that occurred five or more times may be obtained from the senior author.)

A summary of the scoring procedure used for each construction is presented below. The procedure for the distorted versions was the inverse of that used for the clear versions, so only the procedure for clear versions is described.

The discussion of each construction gives the rationale for terming one version clear and the other distorted. It also summarizes the nonrelevant major changes and unscorable responses that occurred five or more times. In summarizing the types of nonrelevant major changes the numbers in parentheses represent, in sequence, the number of times the change occurred in the clear version and was scored *semi-stay,* the number of times the change occurred in the clear version and was scored *semi-switch,* the number of times the change occurred in the distorted version and was scored *semi-stay,* the number of times the change occurred in the distorted version and was scored *semi-switch.* In summarizing the types of unscorable responses, the numbers in parentheses represent, in sequence, the number of times the response occurred to a clear version and the number of times it occurred to a distorted version. Within each construction, there was a total of 384 possible responses (two clear sentences per child, two distorted sentences per child, 32 children per grade, three grades).

(1) Object relative. For clear versions a *stay* or *semi-stay* response required presence of the relative marker *that, who* or *which.* A *switch* or *semi-switch* response required absence of a marker. The relative marker signals a constituent boundary explicitly and hence contributes to clarity of constituent structure. The marker also provides explicit evidence of a direct object of the relative clause verb and hence contributes to clarity of basic grammatical relations.

    30 nonrelevant major changes (8% of all responses)
      13 (7–3–0–3) changes from object relative to subject relative
       7 (2–1–2–2) insertions of a sentential constituent, or *there,* or creation of a cleft
          sentence
       7 (3–0–3–1) permutations of the relative clause or a prepositional phrase
    70 unscorable responses (18% of all responses)
      52 (25–27) reductions of the two-clause sentence to a one-clause sentence: 20

(9–11) responses accomplished this by deleting the relative clause; 32
(16–16) accomplished it by compressing the material in the two clauses to
one clause[3]
   7 (4–3) separations of the sentence into two clauses joined by a coordinate or
        subordinate connective[4]

(2) Subject relative and BE-aux. For clear versions *stay* or *semi-stay*
required both presence of a relative marker and full relative clause verb.
Switch or *semi-switch* required absence of a marker or partial or complete
absence of the relative clause verb or both. The marker signals a con-
stituent boundary and the subject of the relative clause.

24 nonrelevant major changes (6% of all responses)
   9 (5–1–0–3) permutations of the relative clause, or interchange of relative clause
        and matrix clause content, or changes to a similar relative clause
   8 (2–4–1–1) insertions of a sentential constituent
   6 (3–0–0–3) passivizations
46 unscorable responses (12% of all responses)
   25 (13–12) separations of the sentence into two clauses joined by a coordinate or
        subordinate connective[4]
   13 (7–6) deletions of the relative clause

(3) Object noun phrase complement. For clear versions, *stay* and *semi-
stay* required presence of the complementizer *that* (or an equivalent like
like), *switch* or *semi-switch* required absence of a complementizer. The

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[3] Singly center-embedded sentences (constructions 1–5, 9) received two main unscorable
treatments from the children. The first was to compress the sentences into a one-clause
sentence, either by deleting one of the clauses or by compressing all or part of one clause's
verb phrase into a prenominal adjective and using the remaining clause's verb phrase as the
only verb phrase. The latter response usually does clarify basic grammatical relations
because the modifier and its head are now adjacent. The classification of these responses as
unscorable may thus be overly conservative, but it was done because the presence or
absence of an explicit constituent boundary in these constructions could only be judged if
two clauses were present.
   The second typical unscorable response to embedded sentences is discussed in Footnote
4.
   [4] Scoring separation into two clauses as unscorable for (1), (2), (4), (5), (9) is perhaps overly
conservative. In (1), (2), and (9) the effect of the separation is usually to supply an explicit
subject (and, where relevant, object) for each clause, thereby clarifying the basic grammati-
cal relations within each clause. In many of the cases in (4) and (5) the separation not only
clarifies intraclausal basic grammatical relations, but interclausal ones as well by giving first
the complement clause and then using an anaphoric pronoun to refer to it as subject of the
matrix clause. What offsets these considerations is that a well-known performance limitation
may be causing the responses. Children and adults find right-branching or coordinate
structures much easier to process than left-branching or center-embedded structures. Sep-
aration into two clauses reduces left-branching and center-embeddedness. Thus, the motiva-
tion behind separation into two clauses may not be due to the operation of internalized
grammatical principles. Since the change could not uniquely be assigned to clarity of
sentential relations, it was not scored as supporting our hypothesis.

complementizer here provided an explicit constituent boundary, marking the onset of a new clause.

> 9 nonrelevant major changes (2% of all responses)
>   7 (2–1–2–2) insertions of a sentential constituent
> 40 unscorable responses (10% of all responses)
>   15 (10–5) deletions of the complement verb phrase
>   6 (3–3) deletions of the matrix verb
>   10 (6–4) permutations of the matrix and complement clauses
>   7 (2–5) substitutions of a new sentence without a complement clause

(4) Subject noun phrase complement with transitive verb. For clear versions *stay* or *semi-stay* required presence of a complementizer, *switch* or *semi-switch* required absence of a complementizer. The complementizer here provides an explicit constituent boundary; it neither contributes to clarity of basic grammatical relations nor distorts them.

> 59 nonrelevant major changes (15% of all responses)
>   51 (25–3–7–16) changes of complement: in the new complement the past participle of the verb is used as a predicate adjective, or a psychological adjective is used
>   7 (3–1–2–1) insertions of a sentential constituent
> 103 unscorable responses (27% of all responses)
>   79 (31–48) separations of the sentence into two clauses joined by a coordinate or subordinate connective[4]
>   9 (3–6) deletions of the derived matrix clause
>   8 (5–3) shifts to a *for-to* or *POSS-ing* complement
>   5 (3–2) condensations of the matrix and complement into a single-clause sentence[3]

(5) Subject noun phrase complement with intransitive verb. For clear versions a *stay* or *semi-stay* response required presence of a complementizer, *switch* or *semi-switch* required absence of a complementizer. The complementizer marks a constituent boundary.

> 16 nonrelevant major changes (4% of all responses)
>   9 (6–0–1–2) insertions of a sentential constituent
>   6 (1–3–2–0) changes to a related *that* complement
> 97 unscorable responses (25% of all responses)
>   49 (26–23) deletions of the derived matrix clause
>   29 (17–12) separations of the sentence into two clauses separated by a coordinate or subordinate connective[4]
>   5 (1–4) changes to a *for-to* or *POSS-ing* complement
>   7 (5–2) substitutions of a new sentence without a complement clause

(6) Yes–no (tag) questions. For clear versions, *stay* and *semi-stay* required presence of the tag, *switch* and *semi-switch* required absence of the tag. The choice of this contrast was based on the Katz–Postal (1964) analysis of yes–no questions, in which the deep structure form was disjunctive; the tag form displays more of the disjunctive structure than

does the non–tag form. A declarative form of either sentence would also fail to display disjunctive structure.

> 51 nonrelevant major changes (13% of all responses)
> 40 (0–25–15–0) changes from interrogative to declarative
> 10 (1–1–8–0) insertions of a sentential constituent

(7) Manner adverbials. For clear versions a *stay* or *semi-stay* response required placement of the adverb directly adjacent to the main verb. *Switch* or *semi-switch* required placement at sentence-initial or sentence-final positions. We assumed here that the adverb modified the verb, rather than the entire verb phrase; the modifier–head relation is more perspicuous if the modifier and head are adjacent.

> 16 nonrelevant major changes (4% of all responses)
> 15 (8–0–2–5) passivizations
> 53 unscorable responses (14% of all responses)
> 46 (28–18) deletions of the adverb
> 5 (2–3) conversions of the adverb to an adjective

(8) Deleted noun phrase [aux/V]. For clear versions a *stay* or *semi-stay* response required the subject noun phrase and full verb (including auxiliary). *Switch* or *semi-switch* required absence of either noun phrase or verb or auxiliary. In the clear version the subject of the sentence is explicitly marked.

> 18 nonrelevant major changes (5% of all responses)
> 15 (10–0–0–5) insertions of a sentential constituent
> 14 unscorable responses (4% of all responses)
> 10 (5–5) changes from interrogative to imperative or declarative

(9) Permuted relatives. For clear versions a *stay* or *semi-stay* required placement of the content of the relative clause alongside the subject noun phrase. *Switch* or *semi-switch* required the content of the relative to be sentence-final. The clear, or unpermuted, version does not interrupt the subject noun phrase (e.g., *everyone who went to the party*) and hence contributes to clarity of constituent structure and the basic grammatical relation *subject of.*

> 29 nonrelevant major changes (7% of all responses)
> 17 (9–2–4–2) reductions of the relative clause to a prepositional phrase by deleting the relative pronoun and verb
> 5 (1–0–4–0) interchanges of the matrix verb phrase and the relative clause verb phrase
> 76 unscorable responses (20% of all responses)
> 49 (10–39) separations of the sentence into two clauses joined by a coordinate or subordinate connective[4]
> 16 (9–7) condensations of the two-clause sentence into a one-clause sentence, accomplished by either directly deleting the relative clause or by convert-

ing the relative clause into the main verb phrase and deleting the main verb phrase

(10) Verb plus particle. For clear versions, a *stay* or *semi-stay* response required presence of the particle right-adjacent to the verb. A *switch* or *semi-switch* required presence of an object noun phrase between the verb and particle. When the verb and particle are not interrupted, the fact that they jointly make up the constituent *verb* is clearly displayed.

50 nonrelevant major changes (13% of all responses)
  18 (8–1–0–9) expansions of an adjective to a relative clause or sentence
  16 (7–0–0–9) passivizations
  12 (5–1–6–0) insertions of a sentential constituent
19 unscorable responses (5% of all responses)
  7 (5–2) deletions of the particle or substitutions of a new verb
  7 (3–4) substitutions of a new sentence

(11) To-dative. For clear versions a *stay* or *semi-stay* response required presence of the indirect object and the indirect object marker *to*. *Switch* or *semi-switch* required absence of the indirect object or the marker. The marker makes clear the presence of the indirect object.

10 nonrelevant major changes (3% of all responses)
  6 (3–0–2–1) insertions of a sentential constituent or *there*
54 unscorable responses (14% of all responses)
  46 (20–26) substitutions of a converse or near-converse verb for the original
    verb, with the result that the indirect object properly becomes the subject
    of the sentence
  6 (3–3) substitutions of a new sentence

(12) Passive. For clear versions a *stay* or *semi-stay* response required the active voice; *switch* or *semi-switch* required the passive voice. In the clear version the surface "subject" and "object" match the deep structure subject and object; in the distorted version they do not. Hence, the active contributes to clarity of basic grammatical relations.

49 nonrelevant major changes (13% of all responses)
  36 (8–0–0–28) dative movements
  10 (3–1–4–2) insertions of a sentential constituent
28 unscorable responses (7% of all responses)
  13 (8–5) uses of a middle verb such as *get* or a converse verb
  11 (6–5) reversals of subject and object or indirect object

RESULTS

An overview of the results is presented in Table 2. First, clear versions are preferred to distorted versions. At every age the number of repetitions (verbatim and partial) is greater for clear versions than distorted versions, as is the number of semi-stay responses. At every age the number of

TABLE 2
Proportion Response Type, as a Function of Age, to Clear and Distorted Sentence Versions Collapsed across Construction Type[a]

	Stay (verbatim)	Stay (partial)	Semi-stay	All stay	Switch	Semi-switch	All switch	Unscorable
Grade 1								
Clear	.61	.26	.02	.89	.04	.01	.05	.05
Distorted	.57	.20	.01	.78	.13	.01	.15	.08
Grade 3								
Clear	.43	.28	.05	.77	.09	.03	.12	.12
Distorted	.37	.20	.03	.61	.21	.05	.26	.13
Grade 5								
Clear	.38	.21	.09	.68	.10	.03	.13	.19
Distorted	.32	.16	.06	.54	.18	.07	.25	.21
All grades								
Clear	.48	.25	.06	.78	.08	.02	.10	.12
Distorted	.42	.19	.03	.64	.17	.04	.22	.14

[a] Total responses per version type per grade = 768.

switches to the corresponding version is greater for distorted versions than clear versions, as is the number of semi-switches.

Second, the ratio of distorted switch responses to clear switch responses decreases with age. Six-year-olds change distorted versions to clear versions 3.19 times as much as they change clear versions to distorted versions, 8-year-olds 2.45 times as much, and 10-year-olds 1.74 times as much. The decrease with age may suggest that younger children have a response bias favoring the clear version.

Third, children make more major structural variations as a function of age. Structural variation is operationally defined here as occurring if a semi-stay, switch, semi-switch, or an unscorable response occurs. (Verbatim repetitions and partial repetitions are thus excluded.) At age 6, children make structural variations in 18% of queried sentences; by age 10 the figure is 46%. In contrast, the number of partial repetitions (repetitions with one or more nonrelevant minor changes) does not increase with age. Thus, as age increases, major structural variation is increasingly manipulated as a way to meet the demands of the What? situation. As expected, children also raised their voice in responding.

Table 3 gives the mean response scores to clear and distorted versions for each construction type, presented separately by age group. *Stay* and *semi-stay* responses were scored 1, *switch* and *semi-switch* were scored 0. The higher the score, the greater the proportion of *stay* and *semi-stay* responses. According to prediction, the syntactically clear forms should receive higher scores, as is the case in 8 of the 12 constructions. (The presented scores have been averaged across sentences; subject means were highly similar.)

A strong effect of syntactic form is present at each grade level. With subjects as the measure repeated across syntactic form and construction, the effect of syntactic form is significant beyond the .001 level. Grade 1 $F_1(1,31) = 68.7$, Grade 3 $F_1(1,31) = 38.24$, Grade 5 $F_1(1,31) = 42.54$.[5] With sentence items as the measure repeated across syntactic form and nested within construction, syntactic form was also highly significant. Grade 1 $F_2(1,36) = 33.21$, Grade 3 $F_2(1,36) = 49.58$, Grade 5 $F_2(1,36) = 53.69$. These Fs were used to compute *min F'*s at each grade. (See Clark, 1973, for the formulae.) For Grade 1, for syntactic form, *min F'*(1,62) = 31.34, $p < .001$; Grade 3 *min F'*(1,64) = 21.59, $p < .001$; Grade 5 *min F'*(1,65) = 23.73, $p < .001$. Thus, children at each age level change distorted versions to clear versions more often than they change clear versions to distorted versions.

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[5] For Grade 5 F_1, there were 9/32 missing cells for the distorted version of construction (4) and 12/32 missing cells for the distorted version of construction (5). All missing cells were filled by randomly selecting other fifth-graders' scores for the same version of the same construction. Fifth-graders' F_1 for syntactic form was 18.85, $p < .001$ when constructions (4) and (5) were excluded.

TABLE 3
MEAN SCORES FOR CLEAR AND DISTORTED SENTENCE VERSIONS PRESENTED BY CONSTRUCTION FOR EACH GRADE LEVEL

	Construction[a]												$\bar{X}$
	1	2	3	4	5	6	7	8	9	10	11	12	
Grade 1													
Clear	.93	.95	.83	.98	.95	.80	1.00	1.00	1.00	.97	.92	1.00	.94
Distorted	.79	.86	.82	.48	.76	1.00	1.00	.63	.84	.92	.97	.91	.83
C–D	+	+	+	+	+	–	0	+	+	+	–	+	+
Grade 3													
Clear	.87	.87	.61	.95	.91	.60	.95	1.00	.95	.94	.84	.98	.87
Distorted	.67	.57	.78	.51	.62	.98	.95	.33	.41	.84	.85	.74	.69
C–D	+	+	–	+	+	–	0	+	+	+	–	+	+
Grade 5													
Clear	.73	.83	.75	.93	.89	.43	.81	1.00	.96	.98	.86	.88	.84
Distorted	.75	.52	.77	.38	.47	.94	.95	.41	.50	.81	.98	.52	.67
C–D	–	+	–	+	+	–	–	+	+	+	–	+	+

[a] Names and examples of each construction are presented in Table 1.

At each age level there was also a significant effect of construction type; the absolute score obtained by ignoring syntactic form and averaging the clear and distorted versions varied by construction. That is, some constructions were changed more often than others, independent of syntactic form, Grade 1 $min\ F'(11,82) = 2.68, p < .01$; Grade 3 $min\ F'(11,119) = 2.64$, $p < .005$; Grade 5 $min\ F(11,118) = 2.41$, $p < .01$. Some constructions showed the effect of syntactic form more strongly than others, as shown by the significant interaction between construction type and syntactic form, Grade 1 $min\ F'(11,99) = 4.42, p < .001$; Grade 3 $min\ F'(11,102) = 6.20$, $p < .001$; Grade 5 $min\ F(11,149) = 7.63, p < .001$.

Eight of the twelve constructions showed an overall positive difference score. The effect was in the opposite direction for (3) object noun phrase complement, (6) yes–no (tag) questions, (7) manner adverbials, and (11) to-datives. $Min\ F'$s were computed for the eight constructions which had significant F_1s and F_2s. (The analyses of variance using subjects as the random effect for individual constructions were computed omitting all subjects who had a missing cell for either clear or distorted version.) Five constructions showed an effect of syntactic form in the predicted direction at or beyond the 0.01 level, two at the 0.1 level, and one in the reverse direction at the .005 level.[6] For (2), relative ± marker + aux, $min\ F'(1,5) = 5.05, p < .1$; for (4) subject noun phrase complement with transitive verb, $min\ F'(1,20) = 52.35, p < .001$; for (5) subject noun phrase complement with intransitive verb, $min\ F'(1,6) = 14.96, p < .01$; for (8) deleted noun phrase-verb, $min\ F'(1,12) = 83.19, p < .001$; for (9) permuted relatives, $min\ F'(1,6) = 21.96, p < .005$; for (10) verb + particle, $min\ F'(1,10) = 4.24$, $p < .1$; for (12) passive, $min\ F'(1,63) = 21.58, p < .001$. Of the constructions for which the distorted version was preferred, only (6) yes–no (tag) questions was significant, $min\ F'(1,7) = 28.01, p < .005$. The results by construction are similar to those of Valian and Wales (1976).

Age differences were tested both with subjects repeated across syntactic form and construction type and nested within grade level, and with sentence items repeated across syntactic form and grade level and nested within construction. The main effect of age was significant, $min\ F'(2,139) = 12,36, p < .001$, showing that, independent of syntactic form, amount of change increased with age. No interactions involving age were significant with $min\ F'$.

To summarize, children at all grade levels show a significant effect of syntactic form. They prefer the clear version of a sentence to the distorted

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[6] Choice of an acceptable α level was difficult. $Min\ F'$ may be overly conservative when language items are chosen as being representative, rather than being chosen randomly (Cohen, 1976). To require a smaller α level because of multiple analyses may compound the problem when using $min\ F$. In addition, the small number of items (4) per construction made a significant F_2 difficult to achieve.

version after being queried. The extent to which sentences are changed also varies as a function of construction and age.[7]

DISCUSSION

Several features of the results deserve special discussion. First, of the children's changes that affected the construction being examined, half were changes within the clear-distorted dimension we had characterized. Thus, even though a large variety of changes in those constructions was possible, the particular changes that were relevant to the hypothesis under test were frequent. On the other hand, half the changes represented other structural dimensions, so that if sentential clarity is operative, other factors obviously are also.

Second, there was evidence of directionality within the clarity dimension: Clearly displayed sentential relations were preferred in responses to a What? in 8 out of 12 constructions, a result highly similar to adult performance. That there were 4 constructions where the clear version was not preferred may either show that clarity is not a highly important dimension in this task, or indicate that other considerations can override clarity, or show that we used faulty linguistic analyses.

Tag questions illustrate the latter two possibilities. As Valian and Wales (1976) point out, the tag question's status as a question is obscured in the tag form, since declarative intonation and sentence structure are maintained until the tag. Thus, the full display of the disjunctive structure of the question which is provided by the tag version competes with a clear display of the sentence mode provided by the distorted version. Also, the Katz–Postal analysis of tag questions could be incorrect; Akmajian and Heny (1975) provide an analysis in which the tag is transformationally copied (with appropriate modifications) from an initial declarative-like string. Thus, on their analysis, the tag version would be classified as distorted.

The variability of the effect of syntactic form or clarity as a function of construction means that there is only weak support for the prediction that talkers will prefer a clear version in response to a What? If further experimentation can determine that certain other factors systematically override clarity, or if further linguistic work justifies reversing the clear-

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[7] It should be remembered that the children were strongly encouraged in the instructions to change their utterances, although no suggestion was made as to the type of change. The amount of structural variation seen in the present experiment may thus be artificially high. On the other hand, it may be artificially low in the formalized situation because of the very large number of What?'s to which subjects were exposed. There is, in any event, no reason to think that the increased amount of variation with age is a result of peculiar features of the experiment, especially since Garvey (in press) also reports more paraphrasing with age, though for younger children.

distorted labels on some constructions, then our tentative conclusion will be more strongly supported.

Third, the developmental differences are quite consistent. Six-year-olds are the least versatile and flexible in their responses to a What? They give the largest proportion of verbatim responses, the highest ratio of distorted switch responses to clear switch responses, and the smallest number of unscorable responses. That is, the two main effects of development are an increase in the overall amount of change and a decrease in the extent to which the clear version is preferred. This pattern of results may indicate that 6-year-olds' syntactic knowledge is narrower than older children's, or that 6-year-olds are more rigid in assessing what will count as an appropriate response to a What?, or both.

That the 6-year-olds understand the sentences is indicated by their ability to repeat them correctly, by their ability to change distorted versions to clear ones, and by their ability to maintain a paraphrastic relation between their first and second utterance, whatever the change. We speculate that 6-year-olds change fewer sentences because the original sentence version, even when distorted, places less load on the production mechanism than does creation of a new sentence. That is, it is usually easier to repeat a previously uttered sentence than to produce a new one.

The higher ratio of distorted switch responses to clear switch responses might also place less load on the younger children's production mechanism: The changes are in the distorted-to-clear direction rather than the reverse because the sentential relations which must be recovered for comprehension to take place are more directly represented in the clear version than the distorted version. If the child begins with a distorted sentence, s/he will, in the process of understanding the sentence, determine the sentential relations which are directly displayed in the clear version. The clear version is then more accessible because it is less deformed. The 6-year-old's behavior, therefore, might be understood as a response bias in favor of the clear version.

Another indication of the 6-year-olds' lack of sophistication is their production of fewer unscorable responses. Even though they have the constructions in their repertoire, they apparently do not realize the appropriateness of such responses to a What? Older children have a deeper understanding of the What? situation.

Thus, the present study suggests that many kinds of structural properties are known to children and exploited in a What? situation, and that sentential clarity may represent one major type. The What? situation, by its nature, recruits responses that coordinate a host of different types of knowledge—knowledge about processing constraints, about pragmatics, semantics, syntax, and so on.

There are some avenues of future study that do not seem warranted by our results, namely those which rely exclusively on nonstructural factors.

For example, memory difficulties are an unlikely source of variance because the children could repeat the sentences verbatim and more sentences, rather than fewer, were changed with age. Memory difficulty would be expected to decrease with age and therefore fewer sentences should be incorrectly repeated after a query. Instead, more sentences are changed as age increases.

A tendency to prefer redundancy is unlikely because in most of the constructions the principle of maximizing redundancy does not apply, and in the five where it does apply, it fails on two. Preference for short sentences is also unlikely because in the nine cases where one version (generally the distorted version) was shorter than the other, 6-year-olds preferred the shorter version three times, 8- and 10-year-olds four times. Bever's (1970, 1974) strategies and Slobin's (1973) operating principles also do not account for the data.

In summary, children in a What? situation, like adults, do not view syntactic variation as mandatory, although the number of verbatim and virtually verbatim responses decreases with age. Syntactic changes are an increasingly used option as age increases, probably reflecting greater understanding of the communicative potential of syntactic variation and perhaps greater syntactic knowledge as well. One important type of syntactic change suggested by our results is a change toward more clearly displayed sentential relations.

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