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Children's Comprehension of Pronominal Subjects and Missing Subjects in Complicated Sentences

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In an adult grammar, the choice of a referent for a missing subject and the choice of an antecedent for a pronominal subject are restricted by different conditions. For example sentence (1)

1) To learn Chinese in ten lessons would amaze John.

means, minimally, that it is John who is learning Chinese. But in a sentence such as (2), which has a pronominal complement subject,

2) For him to learn Chinese in ten lessons would amaze John.

reference of the pronoun is unrestricted, and the antecedent of the pronoun may or may not be "John". For an adult the choice of a referent for the missing subject of sentences such as (1) is restricted to a sentence-internal noun phrase which satisfies certain configurational requirements. The pronominal subject in the structurally identical sentence (2) is not so restricted. The antecedent of the pronoun may occur within the sentence, but the pronoun may also have a referent which is not mentioned in the sentence and is determined from the context of the utterance.

We find quite a different picture with children's responses to structures containing missing subjects or pronominal subjects. Children use the same rules to determine the antecedent of a pronominal subject as they use to determine the referent of a missing subject. In both cases the pattern of responses indicates that children use a rule of noncoreference which is based solely on linear relationships between the proform and a possible antecedent and which ignores command relationships between them.

Two experiments were conducted with children aged 3 to 5 years. Each experiment tested children's comprehension of four sentence types: conjoined sentences, sentences with sentential subjects, sentences with verbal complements and simple active declarative sentences. In Experiment I each sentence contained a missing subject in one clause and in Experiment II the same clause contained a pronominal subject. Examples (3) through (6) show the types of sentences used in each experiment:

	Experiment I.	Experiment II.
	A. Conjoined Sentences:	
3) a. b.	The duck jumps over the horse and stands on the rabbit.	The duck jumps over the horse and he stands on the rabbit.
	B. Sentences with Sentential Subjects:	
4) a. b.	To kiss the lion would make the duck happy.	For him to kiss the lion would make the duck happy.
	C. Sentences with Verbal Complements:	
5) a. b.	The sheep tells the duck to jump over the horse.	The sheep tells the duck for him to jump over the horse.

D. Simple Active Declarative Sentences:

6) a. The duck bumps into the horse.
b. The duck bumps into the horse.

Each experiment had 24 subjects -- 8 three year olds, 8 four year olds and 8 five year olds. Each child, individually, acted out 3 tokens of the above sentence types with toy animals. For each sentence three animals were placed in front of the child, and he manipulated them to act out the sentence. When the child finished acting out the sentence, the animals were returned to their places, and three new ones were put out for the next sentence.

The conjoined sentences of Experiment I, such as sentence (3a), have the subject of the second conjunct missing in surface structure. The child must determine a referent for the implicit subject in order to be able to act out the second clause. In an adult grammar, the implicit subject of the second clause is coreferential with the subject of the first conjunct. These sentences were very easy for children to correctly interpret: 96% of the sentences were correctly acted out.

Consider now the conjoined sentences of Experiment II. These sentences contained a pronominal subject in the second conjunct. For an adult, the choice of an antecedent for the pronoun is unrestricted. The pronoun may be anaphorically related to either of the noun phrases preceding it in the sentence, or it may refer to something not mentioned in the sentence. Three and four year olds have a highly preferred reading for the pronoun: 90% of the responses interpreted the pronominal subject as coreferential with the subject of the first conjunct. The fact that choice of an antecedent is unrestricted and yet that 3 and 4 year olds overwhelmingly favor an interpretation which is identical to the interpretation given missing subjects in conjoined clauses provides evidence that the same rules are operating in the determination of antecedents in both cases.

Responses of 5 year olds, unlike those of 3 and 4 year olds, show a statistically significant difference between the interpretation given conjoined sentences containing a missing subject in the second conjunct and the interpretation of conjoined sentences with a pronoun in the second conjunct. All the 5 year olds correctly interpreted the conjoined sentences of Experiment I: that is, they selected the subject of the first conjunct as the referent of the missing subject of the second conjunct. But half of the 5 year olds gave at least one response to the conjoined sentences of Experiment II which selected the object of the first clause, rather than the subject of the first clause, as the antecedent of the pronominal subject. They acted out (3b) by having the duck jump over the horse and the horse stand on the rabbit. Five year olds appear to realize that the choice of a referent for a pronoun is less restricted than the choice of a referent for a missing subject, whereas 3 and 4 year olds treat them in an identical manner and choose the subject of the first clause as the antecedent of both proforms.

Children's responses to sentences with sentential subjects, sentences (4a) and (4b) above, are interesting in a number of respects. They provide evidence for children's use of a rule of noncoreference similar to that proposed by Lasnik (1976) for adult grammars. They also provide additional evidence for children's uniform treatment of missing subjects

and pronominal subjects.

In the sentences with sentential subjects only two noun phrases are mentioned, but, as with the other sentences, three animals were put out for the child to manipulate. The two mentioned in the sentence plus an extra one not mentioned. These sentences were very difficult for children, and the initial reaction of most children to a sentence such as "To kiss the lion would make the duck happy," was "Who does the kissing ?"

Two-thirds of the children chose a noun phrase external to the sentence as the subject of the embedded clause. Given a sentence such as (4a), where the three animals placed before the child were the lion, the duck and a horse, two-thirds of the children acted out the sentence by having the horse kiss the lion while the duck did nothing. One-third of the children correctly interpreted sentences such as (4a) by having the duck kiss the lion.

Choice of the animal not mentioned in the sentence as the subject of the embedded clause indicates that children do not have a requirement that the noun phrase which is coreferential with a missing embedded subject be internal to the sentence. These responses also indicate that children are considering only the linear relationships between a missing subject and a potential antecedent in determining the antecedent of an implicit subject and are ignoring the command relationships between them. In (4a) the matrix noun phrase, "the duck," follows the missing subject in the linear order of elements in the string, but it commands the missing subject and so is in the proper structural relationship to serve as the antecedent of the missing form. Despite this, 67% of the children incorrectly selected the animal not mentioned in the sentence as the subject of the embedded sentence.

In structurally identical sentences, such as (4b), which have a pronominal embedded subject rather than a missing embedded subject, the reference of the pronoun is unrestricted. A correct interpretation of the sentence allows for the choice of either a sentence-internal noun phrase or a sentence-external noun phrase as the referent of the pronominal subject.

We find the same distribution of responses for these sentences as we found with sentences with missing embedded subjects. One-third of the children selected the sentence-internal noun phrase as the antecedent of the pronominal subject. As with the sentences with missing complement subjects, the remaining 2/3 of the children selected the animal not mentioned in the sentence as the referent of the pronominal subject. For sentence (4b), where the three animals put out were the lion, the duck and the horse, these children had the horse kiss the lion.

The tendency for most children to choose a sentence-external noun phrase as the referent of the missing embedded subject and of the pronominal embedded subject is not due to the fact that there were 3 animals placed in front of the child and that only two were mentioned in these sentences. Children did not perceive the experiment as requiring that they use all the animals placed before them in acting out the sentences. We can determine this by examining their responses to simple active declarative sentences such as (6a) and (6b). Out of a total for both experiments of 144 simple active declarative sentences only one sentence received a response which involved the animal not mentioned in the sen-

tence. So there was clearly no tendency for children to feel obligated to use all the animals because of the experimental design. The fact that 2/3 of the children did choose a sentence-external referent for missing embedded subjects and for pronominal embedded subjects indicates the existence of a productive linguistic strategy.

This strategy can be formulated as a rule of noncoreference which differs in an important respect from the adult rule for establishing anaphoric relationships between noun phrases. Lasnik has formulated the following rule of noncoreference for adult grammars (p. 6):

7) If NP_1 precedes and commands NP_2, and NP_2 is not a pronoun, then NP_1 and NP_2 are noncoreferential.

His rule was not intended to include missing subjects, and there are differences in the restrictions for determining the antecedent of a pronoun and for selecting the referent of a missing subject, as mentioned earlier. But children treat both of these forms the same, and so we will analyze their responses to both missing subjects and pronominal subjects in terms of rule (7).

In sentence (4a), NP_1 is the missing embedded subject, and NP_2 is the matrix noun phrase, "the duck." In (4b) NP_1 is the pronominal embedded subject, and NP_2 is again the matrix noun phrase, "the duck." In both cases, NP_1 precedes NP_2 but does not command it, and so Lasnik's rule of noncoreference will not mark them as noncoreferential.

Children's responses can be accounted for by eliminating the command relationship from the rule. Children ignore command relationships in establishing anaphoric relationships and utilize only linear relationships. Their rule can be formulated as follows:

8) If a proform B precedes a possible antecedent A, then A and B are noncoreferential.

In (4a) the proform is the missing embedded subject, and in (4b) it is the pronominal subject. In both (4a) and (4b) the proform precedes the possible antecedent, "the duck," and so rule (8) will mark the proform and the matrix NP as noncoreferential noun phrases. The fact that an anaphoric relationship cannot be established between the proform and its possible antecedent requires that a referent for the proform be found outside the sentence: so the child chooses the animal not mentioned in the sentence as the referent.

The final sentences tested in these experiments were sentences with verbal complements such as (5a) and (5b). An adult response to (5a),

5) a. The sheep tells the duck to jump over the horse.

requires the missing complement subject to be coreferential with the indirect object of the matrix clause, "the duck," and 58% of the sentences were correctly interpreted in this way by the children. However 38% of the sentences were incorrectly comprehended by the children as having the

missing complement subject coreferential with the subject of the matrix clause. The children would act out (5a) by making the sheep jump over the horse. One child accompanied this action by saying, "The sheep says, 'I'm going to jump over the horse,'" thus verbally expressing his misinterpretation of the sentence.

The distribution of children's responses to the corresponding sentences of Experiment II are nearly identical. These sentences were structurally identical to the sentences of Experiment I but contained a pronominal complement subject rather than a missing complement subject. Sixty one percent of the sentences were interpreted as having the pronominal subject coreferential with the matrix indirect object, compared with 58% for the corresponding sentences of Experiment I. Thirty six per cent of the sentences had the matrix subject identified as the antecedent of the pronominal complement subject, compared with 38% for the corresponding responses of Experiment I.

The distribution by response type of individual children is nearly identical for the sentences with verbal complements in the two experiments. Chart (9) shows the number of children who chose only the matrix indirect object as the antecedent of the proform, those who chose only the matrix subject and those who gave mixed responses.

9) Sentences with Verbal Complements.

Children's Choice of Antecedent	Experiment I Missing Complement Subject	Experiment II Pronominal Complement Subject
Group I: Chose only indirect object	9	9
Group II: Chose only matrix subject	3	4
Group III: Gave mixed responses	12	11

There were 9 children in Experiment I and 9 in Experiment II who always chose the matrix indirect object as the referent of the complement subject; these are the children in Group I. These children appear to have an adult grammar for sentences with verbal complements.

There were 3 children in Experiment I and 4 in Experiment II who consistently selected the subject of the matrix clause as the antecedent of the complement subject; this is Group II. These children's responses result from a parsing strategy, the conjoined-clause analysis, discussed in Tavakolian (1977). Children analyze the two clauses of these sentences as being conjoined simplex sentences, rather than as being a matrix clause and a verbal complement clause. Children interpret the missing complement subject as being coreferential with the subject of the first clause by using the same rule which selects the subject of the first

conjunct as the coreferential noun phrase of the missing subject of the second conjunct. They use the same rule to determine the referent of the complement subject in sentences (5a) and (5b) as they used to determine the noun phrase coreferential with the missing subject in conjoined sentences such as (3a).

Half the children in each experiment are in Group III. They gave a mixture of responses, sometimes choosing the matrix indirect object as the referent of the complement subject and sometimes choosing the matrix subject. Both the potential antecedents of the proform, the matrix subject and the matrix indirect object, precede the proform, and so the rule of noncoreference, presented in (8), does not apply to mark either possible antecedent as being noncoreferential with the proform. In terms of the rule of noncoreference the choice of either the matrix subject or the indirect object as the antecedent of the complement subject is a correct response, and this fact is exemplified by the children in Group III who chose both in their responses.

In summary, the results of these two experiments indicate that children are using the same rules to determine the referent of both missing subjects and pronominal subjects when they occur in structurally identical sentences. Children analyze missing subjects as anaphoric elements, and they apply the rules used to establish anaphoric relations between a pronoun and a possible antecedent to determine a referent for missing subjects. In sentences with verbal complements most children give a combination of responses -- sometimes choosing the matrix subject and sometimes the matrix indirect object as the referent of the proform. In conjoined sentences the rule which assigns the subject of the first clause as the antecedent of a missing subject is also used to determine the antecedent of a pronominal subject in the second clause. In sentences with sentential subjects, a rule of noncoreference operates to eliminate the sentence-internal NP as a possible antecedent for the proform.

The use of only linear relationships to determine the antecedent of a proform represents an important way in which children's comprehension of these sentences differs from an adult's. It also provides an indication of the types of structural relationships, linear rather than command relationships, which are easiest for children to comprehend.

In an adult grammar there is an overlap of restrictions for the two types of proforms considered in this paper, but the conditions on them are not identical. Children's early formulation of restrictions on the determination of anaphoric relationships are less differentiated than adult formulations. Children apply identical restrictions to both types of proforms and only later begin to differentiate them.

The fact that children have a uniform treatment of missing subjects and pronominal subjects provides support for an analysis of adult grammars such as Wasow's (1972), which treats the relationship between a missing subject and its referent as an anaphoric relationship which should be accounted for by the same rules used to account for other anaphoric relations.

Footnotes.

1. This paper was presented at the Annual L.S.A. Meeting, Philadelphia, in December, 1976.