

Relative clauses are barriers to *wh*-movement for young children*

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ABSTRACT

Two studies are described which investigate preschool children's sensitivity to relative clauses as barriers to the movement of *wh*-questions. The children were presented with short stories followed by questions in which the *wh*-word had two possible sites of interpretation, the ungrammatical option being inside a relative clause. A cross-sectional study with 23 children aged 3;1 to 6;1, and a longitudinal study over the course of one year with 12 children aged 3;1 to 4;1 at the start, found young children refused to extract *wh*-questions from the ungrammatical site inside a relative clause. This confirms other findings that children's early grammars are sensitive to universal constraints on movement. In addition, the children differentiated between *wh*-complements and relative clauses in their tendency to mistakenly answer the medial *wh*-complementizer but not the *wh*-relative pronoun. Explanations for the latter are framed in terms of children's initial assumptions about the attachment of complements.

INTRODUCTION

Questions about the poverty of the stimulus for language acquisition are frequently raised in connection with the domain of constraints on movement rules (e.g. Lightfoot, 1982). Adult languages that have *wh*-question movement in the syntax have been shown to have constraints on that movement. It is not possible to form certain sentences in which the *wh*-word has moved from a position inside a complex noun phrase, for instance. For example,

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although there is nothing semantically peculiar about asking a question about one member of a conjoined pair of noun phrases:

- (1) You saw William and who?

it is nevertheless not grammatical to move a question word from that position to its normal site at the front of an English sentence:

- (2) *Who_i did you see William and t_i?



(In this example a standard convention is used to portray the origin of the *wh*-word with a co-indexed 'empty category', its TRACE, t_i.) The learnability problem arises because young children are not exposed to examples of violations of these constraints labelled as errors. Adults simply neither say, nor correct themselves saying, such sentences as:

- (3) *What_i did you see the man that wore t_i?



equivalent to:

- (4) You saw the man that wore WHAT?

in which the question word is moved from inside a relative clause (another complex noun phrase). These constraints on movement first highlighted by Ross (1967) have been given many increasingly refined theoretical accounts in linguistics, and are sometimes conceptualized as 'barriers' to movement or 'islands' out of which movement is disallowed (Chomsky, 1986; Rizzi, 1990; Cinque, 1991; Szabolsci & Zwarts, 1992). For example, one claim is that languages universally obey a principle called SUBJACENCY:

SUBJACENCY PRINCIPLE:

Movement may not cross more than one bounding node.

Bounding nodes are IP (S), CP (S'), and NP.

Languages differ over whether S or S' is a bounding node.

(from Cook, 1988).

Subjacency rules out extraction from a relative clause, because the *wh*-question must move across the embedded IP, the embedded CP, and then out of the maximal projection NP that holds the head noun. These constraints are argued to be an integral part of Universal Grammar, that is, part of the innate endowment that the child brings to the task of language learning, rather than aspects of the grammar that are learned from exposure to critical data.

Several researchers have investigated constraints on *wh*-movement in young children (e.g. Otsu, 1981; Phinney, 1981; de Villiers, Roeper &

Vainikka, 1990; Crain, 1991) and found evidence of obedience to some constraints from at least age four years. Otsu (1981) was among the first to test directly whether children obey constraints on *wh*-extraction from relative clauses and prepositional phrases in a comprehension task. He presented his preschool subjects with short pictured stories such as:

Jane is drawing a monkey with a crayon. The monkey is drinking milk with a straw.

followed by a *wh*-question that was potentially ambiguous, but only if the child lacked the constraint on extraction from a relative clause:

- (5) What is Jane drawing a monkey that is drinking milk with?

Ambiguous between:

- (a) What_i is Jane drawing [a monkey that is drinking milk] with t_i?
 (b) What_i is Jane drawing [a monkey that is drinking milk with t_i]?

For adult speakers of English, there was only one possible meaning to the question, namely one that links the question to the main clause and construes the preposition as being associated with that clause. If the child showed no constraints on extraction, both sites might be possible and the child's answer of 'a straw' would reveal the availability of the embedded site. The sentences were of two types: simple sentences with prepositional phrase, and relative clause sentences such as (5). The simple sentences followed simple pictured stories:

Story: James is painting a picture of a boy with a book. James is painting a picture of the boy with a brush.

Question:

- (6) What is James painting a picture of a boy with?

Otsu's results showed that three- and four-year-olds did rather poorly on this task, answering the questions in a manner that violated the barrierhood of the relative clause or the prepositional phrase some 25–35% of the time. However, he also included a test of comprehension of the relative clause, and found that the children who showed mastery of the structure in comprehension were more likely to respect the barrierhood of the relative clause. Nevertheless, the results were not perfect, and some errors were still observed.

In the years since Otsu's work there has been a great deal of attention paid to the difference between argument and adjunct *wh*-phrases. Some questions (*who*, *what* and sometimes *where*) are arguments of the verb, that is, they fulfil

obligatory grammatical roles such as subject or object and thus complete its subcategorization frame. Other questions (*when, how, why, usually where*) do not occupy argument positions with respect to the verb and are considered adjuncts, substituting for adverbs or prepositional phrases. Chomsky (1986), Rizzi (1990) and Cinque (1991) elaborate this difference in various ways, but here we will choose a simplified account that captures the essential contrast. We refer to a family of theories about barrier effects because though they make interesting and different empirical predictions, the details do not affect the arguments in this paper. In general there are two mechanisms that license the trace of a *wh*-question: LEXICAL GOVERNMENT and ANTECEDENT GOVERNMENT. The object argument *wh*-trace is licensed by LEXICAL GOVERNMENT from the verb, as in the following example where the transitive verb *help* licenses the object trace of the question word *who*:

(7) Who_i did he help t_i?

In contrast the adjunct *wh*-trace must be licensed by a different mechanism, because the adjunct is never required by the verb and so lexical government will not work. With ANTECEDENT GOVERNMENT, the trace is linked to the *wh*-word through what is called a well-formed chain. A well-formed chain involves a connection between some element (even a trace) that is higher in the tree and precedes the empty category. Fig. 1 shows a schematic diagram

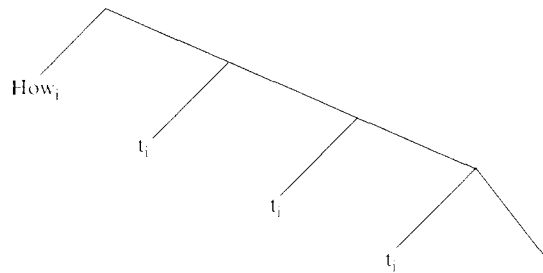


Fig. 1. Schematic diagram of a well-formed chain.

of a well-formed chain. So in the case of adjunct *wh*-movement, if the movement is across several clauses the *wh*-chain must leave a trace at each clause boundary in the position known in contemporary Government and Binding theory (Chomsky, 1981) as the specifier of the CP (or Complement Phrase). In other words, the movement is cyclic, or one CP clause at a time:

(8) How_i did Sam say [_{CP} t_i he would get Alice [_{CP} t_i to help him t_i]]?
 answer e.g.: 'by paying his bills while he was gone'.

This difference in licensing possibilities causes contrasts in movement of adjuncts and arguments over several clauses. Antecedent government can be blocked by an intervening *wh*-word such as the medial complementizer *how*:

(9) *When_i did you ask [how to help t_i?]
 *I asked how to help next holiday season.

The medial complementizer is argued to disrupt the chain of traces necessary to license the lower trace, because the *wh*-question *when* in (9) must move cyclically through the very location (the medial spec of CP) that is occupied by the medial complementizer *how* (for details see Chomsky, 1986; Rizzi, 1990). The question in (9) is thus grammatical only under the reading where the *when* originated in the first clause, as an adjunct to *ask*:

(10) *When_i did you ask t_i [how to help ?]
 answer: I asked last night.

However, the additional possibility of having lexical government with an argument *wh*-question means it can be co-indexed with the moved *wh*-word at a distance even across the barrier of an adjunct *wh*-medial:

(11) Who_i did you ask how to help t_i?
 I asked how to help my cousin.

(Chomsky, 1986; Rizzi, 1990). Although (11) might be considered marginal in acceptability to adult speakers, especially without a leading context, (9) is clearly worse. Recent research with four- to six-year-olds (de Villiers, Roeper & Vainikka, 1990; Maxfield & Plunkett, 1991) has revealed that they are extraordinarily sensitive to the argument/adjunct distinction and to the differential possibilities of movement of each type of question. In general they are more liberal in the movement of arguments than adjuncts, in keeping with the licensing differences.

In the light of these newer findings, it is worth re-examining the work by Otsu on extraction from relative clauses, since he used exclusively argument questions (actually arguments of prepositions) in his research. Since the traces do receive lexical government from their prepositions, the violation in the relative clause case is one of subjacency, not of licensing *per se*. Subjacency has been argued to be a weaker constraint even for adults than other kinds of barriers, for instance, the long distance interpretation of the

question in (11) represents a subjacency violation (*who* crosses both S (IP) and S'(CP)), yet many adults find it acceptable. If children are even more lenient than adults in licensing the movement of argument questions – for instance, if the full properties of the NP barrier are not established – then Otsu's results are less surprising. The argument/adjunct distinction found in previous research suggests that it is likely that children in the same age range would show greater obedience to the relative clause boundary if adjunct questions were used instead. Adjunct questions cannot be extracted from within a relative clause (remember that the trace indicates the reading: the claim is that *how* cannot be interpreted with respect to the lower verb *worked*):

- (12) *How_i did you meet the man who worked t_i?

Since there is no possibility of lexically licensing an adjunct trace via the verb, that interpretation should be completely ungrammatical for children as well as adults. Hence by testing children's sensitivity to adjunct extraction from relative clauses we can clarify their behaviour in Otsu's task.

The work described below had a second justification. Previous work (de Villiers, *et al.* 1990) found a robust stage of grammatical development in which children answered the medial *wh*-question instead of the fronted *wh*-question in a form such as:

- (13) How did he ask who he should help?

In other words, they answered the *who* instead of the *how*. If this is a strategy that is extragrammatical, such as 'answer the last question word you hear', such children might also be prone to answer a *who* complementizer, that is the relative pronoun, in a relative clause sentence:

- (14) How did the dog bark who climbed the tree?

The following account therefore details two studies of adjunct *wh*-movement involving constraints on extraction from relative clauses, to see if four-year-old children are obedient to the constraints and to see if they answer the relative pronoun.

STUDY 1

Adjunct extraction from different varieties of relative clause

METHOD

Subjects

Subjects were 23 children in a private day care centre affiliated with a College. The children consisted of 13 girls and 10 boys, with an age range of 3;1 to 6;1 and an average age of 4;7. All of the children spoke English as a first language and were without any handicapping conditions.

Stimuli

The stimuli consisted of short pictured stories that set up the appropriate conditions for the use of the relative clause, and allowed for all possible construals of the question being asked at the end. For an example, see Fig. 2.

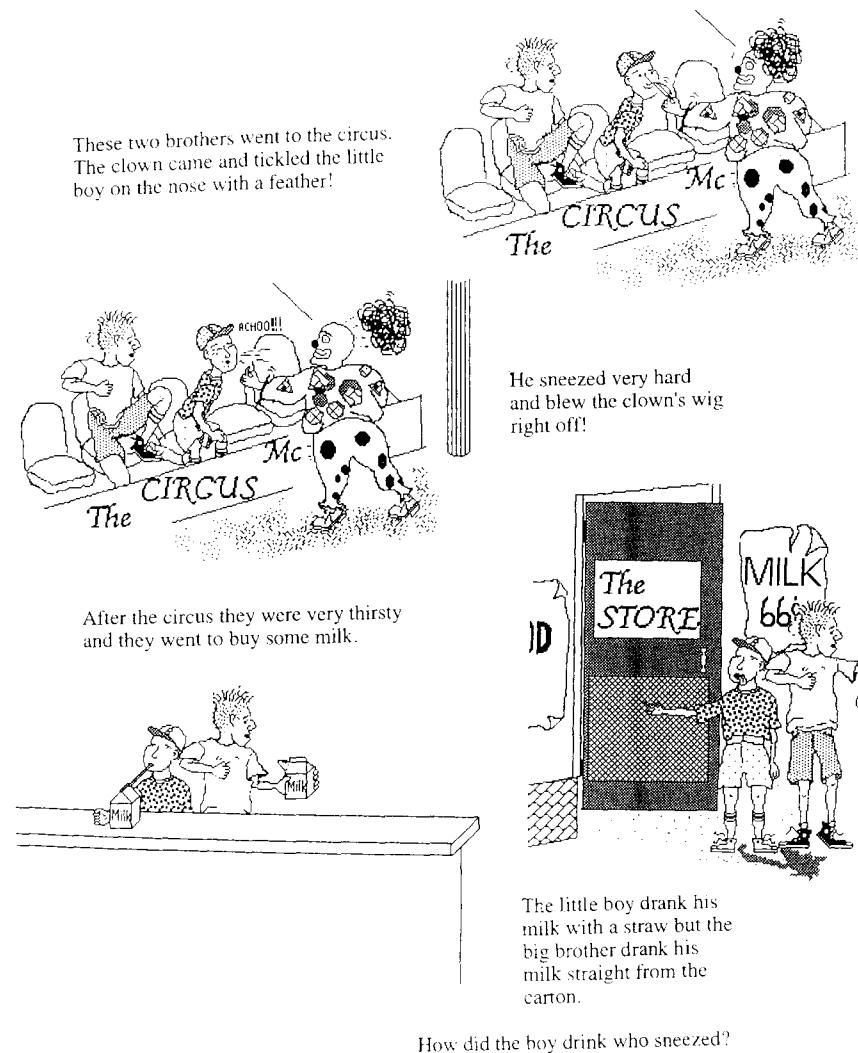


Fig. 2. Example stimulus.

The stimuli took three different forms, depending on where the relative clause was located in the sentence. For SUBJECT RELATIVES, the relative clause followed the subject and hence the *wh*-word was connected to an adverbial adjunct of the second verb phrase *get home* for the legitimate adult reading:

(15) How_i did the man who hurt his leg get home t_i?

A mistaken reading that violated the relative clause boundary would be to answer as if the question were linked to an adverbial adjunct of the first verb in the linear sequence, namely *hurt*:

(16) *How_i did the man who hurt his leg t_i get home?

The second type were OBJECT RELATIVES, in which the legitimate reading links the *wh*-word to an adverbial adjunct of the first verb:

(17) How_i did the man rescue the cat t_i who broke her leg?

and a mistaken reading would allow it to connect to the verb inside the relative clause:

(18) *How_i did the man rescue the cat who broke her leg t_i?

The third type consisted of EXTRAPOSED SUBJECT RELATIVES, in which the relative clause on the subject was extraposed to the end of the sentence, and for which the legitimate reading would be:

(19) When_i did the man go home t_i who hurt his leg?

and an illegitimate reading:

(20) *When_i did the man go home who hurt his leg t_i?

Consider some possible outcomes. If a child answers by linking the adjunct *wh*-question to the first verb without concern for structure, the child will fail on type 1 (15) and succeed on types 2 (17) and 3 (19). If a child is insensitive to the relative clause boundary, any site for the question could be chosen on any type of sentence, for approximately 50% correct. If the child respects the relative clause boundary, the child should answer with a second verb interpretation for 1 and a first verb interpretation for 2 and 3. Finally, if the child perceives the relative pronoun/complementizer as a question word, they might answer the *who* instead of the *how*.

Procedure

The six relative clause stories and questions were presented in randomized order to the children as part of a larger battery of 20 questions, none of which had relative clauses as part of their structure. The children were tested individually in a quiet space by two experimenters, and their responses were videotaped to check against the on-site transcription at a later time. The child

was read each story and then asked the question using natural intonation. Pointing responses were recorded but clarification was requested by saying 'tell me?'. None of the children seemed at all uneasy about the difficulty of the task, and often begged to return the next day.

RESULTS

The children's responses were coded as follows:

- (a) main clause, constituting a correct response;
- (b) relative clause, representing a violation of the relative clause boundary;
- (c) medial, referring to an answer to the complementizer *who*, i.e. the relative pronoun;
- (d) *how/why* confusion, in which the child answers a *how* question as if it were a *why* question – a prevalent error encountered before in such work (de Villiers, 1991);
- (e) other, referring to answers that applied to none of the interpretations we could imagine, e.g. to *when* instead of *how*;
- (f) *don't know*, being literally the child's answer.

The most revealing way to discuss the results is to show the percentages of children choosing each option next to the site in the sentence of the question they answered. These results are shown in Table 1. The children were

TABLE 1. *Adjunct extraction from relative clauses*

| | | | |
|---|-----|-------|------------------|
| <i>Subject relatives</i> | | | |
| (1) How did the boy who sneezed _____ drink the milk _____? | | | |
| 4-5 yr olds | 0% | 0% | 94% ^a |
| 3-4 yr olds | 0% | 0% | 58% |
| <i>Object relative</i> | | | |
| (2) How did the woman help the man _____ who won the race _____? | | | |
| 4-5 yr olds | | 91.5% | 0% |
| 3-4 yr olds | | 61% | 0% |
| <i>Subject relative extraposed</i> | | | |
| (3) When did the woman sleep _____ who painted the picture _____? | | | |
| 4-5 yr olds | 92% | 0% | 2% |
| 3-4 yr olds | 47% | 0% | 10.5% |

^a Percentages beneath the relative pronoun represent answers as if that were a question.

divided into two groups, 8 subjects with an average age of 3;7 yrs and 15 subjects with an average age of 5;4 yrs. The percentage remaining constitutes the remainder of responses (d), (e), (f).

No child in either the younger or the older group answered the relative pronoun *who*. Furthermore, there were vanishingly few violations of the barrierhood of the relative clause, and almost all of these were from the

youngest children and the least familiar structure, namely the extraposed subject relative. The position of the relative clause made no difference to the children's choice of site for the *wh*-question, that is, they did not attach the *wh*-adjunct blindly to the first verb encountered. The percentage of responses to *how* as if it were the question *why* occurred among the three-year-olds and was observed also in some four- and five-year-olds, but only represented 4.6% of the responses overall.

In the second study, the opportunity arose to test a group of three-year-olds over the course of one year to study the changes in their grammars. Among the battery of questions we designed to follow these changes we included two relative clause sentences of the subject-extraposed variety.

STUDY 2

A longitudinal study of adjunct extraction from relative clauses

METHOD

Subjects

Twelve children took part in all the rounds of testing: five boys and seven girls. Their mean age and age range in the three testing periods is shown in Table 2. All children were enrolled for two successive years in a College nursery school.

Stimuli

The two sentence types chosen for study were subject extraposed sentences. The children received three tests: one in October, one in January and one the following October. Because of the proximity of the first two tests, two new stories were used in the January testing. The following sentences were used:

October (tests 1 and 3)

- (21) How did the boy drink who sneezed?
- (22) How did the dog climb up who barked?

January (test 2)

- (23) How did the woman swim who knitted?
- (24) How did the man talk who changed the baby?

In addition, the children were tested with a full array of questions involving embedded questions such as:

- (25) How did the boy ask who to help?
- (26) How did the boy say what he caught?

All of these have an adjunct at the beginning (*how*) followed by an embedded question headed by either *what* or *who*. Half of these were tensed, the other

TABLE 2. *Ages at three testing periods*

| | Mean age | Age range |
|---------|----------|-----------|
| October | 3;7 | 3;4-4;1 |
| January | 3;10 | 3;7-4;4 |
| October | 4;7 | 4;4-5;1 |

half were infinitivals. The stories were designed to allow either answer for the *how*, or an answer to the medial question word. The inclusion of these sentences allowed us to compare their responses to the two superficially similar structures. Do children who answer the medial question in embedded questions also answer the relative pronoun in the relative clause?

Procedure

Each child was tested individually using the same methodology as in Study 1. There were two brief sessions at each time period for each child. The two relative clause sentences were not adjacent to each other in the otherwise randomized presentation of the testing materials.

RESULTS

The children's responses were coded as in study 1, and are displayed in Table 3. Notice that there is very little change over the three time periods, primarily because the children's responses respected the barrierhood of the relative clause from the first period. The percentages are also close to those obtained in the cross-sectional Study 1 for this sentence type. In the last testing session the children were nine months younger on average than the four-to-five-year-olds in Study 1, which may be reflected in their slightly poorer performance. However, to put the percentages in perspective, only two medial answers were received over the course of the study out of 70 opportunities, and a total of 5 violations of the relative clause boundary.

Table 4 shows the contrast in responses obtained for the adjunct questions with medial argument complementizers over the same age range from these children. Notice the very high prevalence of medial responses: they average 56% of the children's answers. Even the appropriate short-distance answers are completely overshadowed by the medial answers, and violations of the embedded question boundary are vanishingly few (4 total out of 142 opportunities). Note also that there is little evidence of consistent developmental change in the medial answers, though the incidence of correct answers to the questions does show an increase over the year.

TABLE 3. *Answers to adjunct question in Study 2 over the three time periods*

| | | | |
|--------------------------|-------------|------|------|
| October | | | |
| How did the dog climb up | who barked | ? | |
| | 54.5% | 4.5% | 4.5% |
| January | | | |
| How did the woman swim | who knitted | ? | |
| | 41.7% | 0% | 8.3% |
| October | | | |
| How did the dog climb up | who barked | ? | |
| | 70.8% | 4.5% | 8.3% |

TABLE 4. *Answers to adjunct questions with medial argument embedded questions*

| | | | |
|----------------------|----------------|--------|------|
| October | | | |
| tensed: | | | |
| How did the boy say | what he caught | _____? | |
| | 4.3% | 69.1% | 0% |
| infinitival: | | | |
| How did Rover learn | what to catch | _____? | |
| | 31.8% | 45.4% | 0% |
| January | | | |
| tensed: | | | |
| How did the boy say | what he ate | _____? | |
| | 1.2% | 60% | 8% |
| infinitival: | | | |
| How did Big Bird ask | who to help | _____? | |
| | 16.6% | 54.1% | 0% |
| October | | | |
| tensed: | | | |
| How did the boy say | what he caught | _____? | |
| | 29.2% | 50% | 0% |
| infinitival: | | | |
| How did Rover learn | what to catch | _____? | |
| | 29.2% | 58.3% | 8.3% |

GENERAL DISCUSSION

The results presented in these two studies are consistent in their findings that three- and four-year-old children recognize the relative clause boundary as a barrier to the movement of a *wh*-adjunct question. The subject relative clause control makes it clear that this is not a strategy of answering the question with respect to the superficially closest verb, but is a structure-dependent rule of grammar. The children in this study are clearly respecting the status of the relative clause as a barrier. In general our results show earlier and clearer evidence for the barrierhood of the relative clause with *wh*-adjunct extraction than Otsu obtained with *wh*-argument extraction, and this is in keeping with

other data that suggest children allow greater license to the movement of *wh*-arguments than to *wh*-adjuncts. The lexical licensing of the argument may in fact override subjacency, just as it does for adults in certain cases.

It is particularly interesting to obtain these results with children of this age range because other studies on comprehension of relative clause structures suggest late acquisition (Sheldon, 1974; Tavakolian, 1981). However, these studies typically demand that the child recreate the meaning from hearing the structure in isolation, and then act out the event. The present task provided clear contextual support in the pictured story, but allows the child the choice of interpretation of the question containing the relative clause.

In fact, at least some of the stories in Study 1 and all of the stories in Study 2 were designed to be pragmatically appropriate for the use of the relative clause in the question (Hamburger & Crain, 1982). For instance, for the question associated with Fig. 2, notice that the story contained two boys, and they both drank milk, so the question about 'How did the boy who sneezed drink the milk?' could be MISANSWERED by referring to the way that the boy who did NOT sneeze drank the milk (notice it was more salient in our story: at least it shocked some of our subjects!). There were only 5 answers of that sort out of the 184 opportunities presented in both studies, suggesting that the children were processing at least some of the meaning of the relative clauses and not just registering its presence as a barrier. This finding concurs with the conclusions of Crain and colleagues (Hamburger & Crain, 1982; Crain, McKee & Emiliani, 1990; Crain, 1991) that some of the perceived delay in relative clause comprehension is a consequence of the rigorous demands of act-out tasks, and may underestimate the child's grammatical knowledge as tapped by say, elicited production (see also Solan & Roeper, 1978). Nevertheless, the mature user of relative clauses must also be able to reconstruct events in the absence of context, and Otsu (1981) did find an association between being able to act out a relative clause and respecting its barrierhood.

Consider also the lack of answers to the medial complementizer or relative pronoun *who*. The evidence from Study 2 makes it clear that children who are three years old differentiate the two structures by their striking preference for medial answers to the embedded question. This is not an artefact of the question word being *what* rather than *who*, because the sentences with *who* (see the January stimuli) were treated in the same way. We have shown that children sharply distinguish between *wh*-words in an extraction chain and *wh*-relatives. What is the significance of this fact? First it demonstrates that simple performance accounts of why a medial question is answered are inadequate. The child makes a subtle distinction between similar structures whose informational impact is totally distinct.

In addition, it appears that the distinction is present before children have mastered the adult form of the long-distance rule. Although there are

differences of opinion about its theoretical basis in children (e.g. Thornton, 1991 who has parallel data on production; Roeper & de Villiers, 1992), the grammatical accounts of the medial question phenomenon all refer to the structure of partial movement permitted in German and some other languages (McDaniel, 1989). In these structures, the initial question word serves as a scope marker for the medial question word, which is answered as the true question, e.g.

- (27) Was hat er gesagt wie ein Kuchen machen kann?
 what did he say how a cake to make can?
 How_i did he say to bake a cake t_i?

Why does a child have an extra form of *wh*-movement found in a few adult languages, but not in English? This simple question leads to an important question that must be asked about the initial state of the child's grammar. For simple phenomena such as case marking, it has been proposed that a child might have a simple default case before it becomes differentiated. Vainikka (1989) suggests that children have a default genitive, leading to expressions like *my do it* (see also Lebeaux, 1988, 1990).

What is the initial state assumption about movement-chains? It is possible that there is an initial state in which the child assumes no transformations until there is evidence for them. But the child must be ready to recognize a long-distance chain when it appears. It is evident from all accounts of long-distance rules that this recognition involves more than the module responsible for movement rules. A child must also recognize the type of verb involved, for instance, in English the verb *say* allows long-distance questions, but *murmur* does not:

- (28) *Where_i did he murmur that she kept her purse t_i?

Similarly, the child must recognize the attachment differences among clauses to know that extraction from quotation environments is forbidden:

- (29) *Where_i did she say 'can I leave my computer t_i?'

These features of long-distance rules refer to other modules of grammar which are being acquired in their own fashion.

One answer to this problem is to have a system of default representations, ultimately replaceable, which allow the basic construction to be recognized and used. The default form of the long-distance rule allows the child to form a chain, and allows an intermediate *wh*-word, even while the case-system, the subcategorization system of the verb, the lexical differentiation of *wh*-words and the level of attachment may all be incomplete in the child's grammar (see Roeper & de Villiers, 1992 for details). The learnability of the grammar may depend upon the presence of such default structures and partial *wh*-movement appears to be such a default.

Roeper & de Villiers (1992) argue that the children's grammar permits partial movement structures primarily because they do not yet have the embedded question subcategorized under the main verb, though they recognize that it is thematically connected to it, that is, that the verb in question requires the satisfaction of a particular thematic role such as *THEME* or *GOAL* (e.g. that *ask* does not stand alone as an intransitive verb) but thematic roles are only projected onto arguments. Crucially, therefore, the default should be excluded for adjuncts such as relative clauses, and the results from these studies confirm that prediction. But that begs the further question, how does the child recognize the relative clauses as adjuncts? We argue that the lack of thematic connection between the verb and the relative clause leads the child to recognize its adjunct status, and thus its barrierhood to long distance movement AND the impossibility of analysing it as a case of partial movement.

In sum, the present study presents evidence for early knowledge of the barrier status of relative clauses for *wh*-movement; demonstrates that children between three and five distinguish structurally between relative clauses and *wh*-complements; and provides further evidence for an account of partial movement as a default structure in children's early grammar.

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