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How Children “Copy” Long-Distance Structures: The Production of Complex Wh-questions in German

Lydia Grohe, Petra Schulz, and Anja Müller

1. Introduction

Complex wh-questions such as *When did the boy say that he hurt himself or Was denkst du, wo die Kinder heute essen* (‘What do you think where the children are eating today’) pose a number of challenges for the language learner. In recent years much research has been devoted to the question of how children master the comprehension of different types of complex wh-questions (for an overview cf. de Villiers & Roeper, in prep). Children’s production of complex wh-questions has received less attention and has been mainly studied using elicited production. For English (Thornton, 1990) and French (Oiry & Demirdache, 2006) it has been found that children often produce wh-structures that are ungrammatical in the adult system, but licensed by UG. This is because they are grammatical options for complex wh-question formation in other languages like German. Research on the acquisition of complex wh-questions in German has to date been restricted to comprehension (Weissenborn, Roeper & de Villiers, 1991).

The present study is the first to examine the acquisition of different types of complex wh-questions in German, using an elicited imitation task. In comparison with elicited production, elicited imitation provides a more tightly controlled setting that helps to reveal children’s underlying syntactic representations (Lust, Flynn & Foley, 1998). Our findings provide first evidence that structures representing ungrammatical precursors in English and French are acquired early in German. Furthermore, building on these experimental data we propose an acquisition path for complex wh-questions in German that also takes into account differences in syntactic complexity of various types of complex wh-questions.

The paper is organized as follows: Section 2 discusses the types of complex wh-questions that were used in this study in terms of both the syntactic processes involved and the varying degrees of syntactic complexity. Previous research on children’s production of complex wh-questions in French and

*Lydia Grohe, Philipps-University Marburg; Petra Schulz and Anja Müller, Goethe-University Frankfurt. Contact: P.Schulz@em.uni-frankfurt.de. We thank the participants in the experiment and the teachers at the kindergartens. We are grateful to the audience at BUCLD 35 and the members of the ‘Forschungskolloquium Spracherwerb’ at Goethe-University Frankfurt for their helpful comments.

English is summarized in Section 3. Section 4 presents our elicited imitation study with 17 four-year-old German-speaking children, and Section 5 summarizes and discusses the results.

2. Theoretical background

Unlike short wh-questions such as *What did the boy say*, which form a single clause, complex wh-questions consist of two clauses, which can be combined either by subordinating or by adjoining the second clause to the first. Generally, wh-questions can be distinguished i.a. with respect to type of movement (long vs. short, overt vs. covert) and type of wh-phrase (scope marker vs. true wh-phrase), as well as integration of matrix and embedded clause (see Lutz, Müller & von Stechow, 2000; Reis, 2000).

2.1. Types of complex wh-questions in German

In German, Long-Distance (LD) wh-questions (1), Partial wh-questions (2), Parenthetical *was* (3), and Copy wh-questions (4) are among the types of complex wh-questions that have been studied most extensively (e.g., Reis, 2000). Importantly, while all four types are grammatical in German, only LD wh (1) and Parenthetical *was* (3) are allowed in English and French.

In the following, these four types of complex wh-questions are briefly discussed in turn. Note that Copy wh-questions were not used as experimental stimuli, but are relevant for the analysis of children's responses. LD wh-questions such as (1) consist of a matrix-clause headed by a wh-phrase (*wo denkst du*) and a complement clause (*dass die Kinder heute essen*).

- (1) LONG-DISTANCE WH-QUESTION¹
 Wo_i denkst du, t_i dass die Kinder heute t_i essen?
 Where_i think you t_i that the children today t_i eat
 'Where do you think that the children are eating today?'

The wh-phrase *wo* 'where' has moved from the complement clause to the matrix clause. This movement is traditionally referred to as successive-cyclic, because in a first step the wh-phrase moves into CP-Spec of the complement clause and in a second step into CP-Spec of the matrix clause. This type of long-distance movement is also called overt LD movement, because the wh-phrase has to be realized overtly (e.g., Grewendorf, 2002).

Let us now turn to Partial wh-questions, illustrated in (2), for which two different analyses have been proposed.

¹Note that LD wh-questions with the overt complementizer *dass* 'that' as in (1) are not attested in all varieties of spoken German, but are common in all southern German dialects.

- (2) PARTIAL WH-QUESTION
 Was_(i) denkst du, wo_i die Kinder heute t_i essen?
 What_(i) think you where_i the children today t_i eat
 *'What do you think where the children are eating today?'

Partial wh-questions consist of two clauses, with the second subordinated by the first. Unlike in LD movement, the wh-phrase *wo* 'where' overtly moves into CP-Spec of the subordinate clause, but is not overtly realized in CP-Spec of the matrix clause. Instead, *was* in CP-Spec of the matrix clause functions as a scope-marker, marking the position where the true wh-phrase is interpreted at LF (cf. also the discussion in Grewendorf, 2002). The underlying type of movement is referred to as 'partial', because the first step of the movement of *wo* resembles the successive-cyclic movement in LD wh-questions such as (1).

According to the Direct Dependency approach (e.g., McDaniel, 1989), Partial wh-questions involve LD movement, but in contrast to LD wh-questions (1) the second movement of the wh-phrase into CP-Spec of the matrix clause step is covert. Alternatively, it has been suggested that Partial wh-questions do not involve LD movement but short distance (SD) overt wh-movement of the wh-element into CP-Spec of the embedded clause and insertion of the scope-marker in CP-Spec of the matrix clause (Oiry & Demirdache, 2006; Jakubowicz & Strik, 2008). At this point we leave open the question of which account can best explain the data.

The third type of complex wh-question are Parenthetical *was*-questions, exemplified in (3):

- (3) PARENTHETICAL WAS-QUESTION
 Was_i denkst du t_i, wo_j essen die Kinder heute t_j?
 What_i think you t_i, where_j eat the children today t_j
 'What do you think, where do the children eat today?'

Parenthetical *was*-questions are characterized by the fronted wh-phrase *was* 'what' and verb-second word order in the second clause. It is assumed that the second clause is adjoined rather than subordinated to the first clause and thus the two clauses form two independent short wh-questions (cf. the Indirect Dependency approach by Dayal, 2000). Both wh-phrases are base-generated in their own clause and are overtly moved to CP-Spec in each clause. Thus, Parenthetical *was*-questions involve two overt SD movements.

Finally, let us consider Copy wh-questions (4), which because of time constraints were not included in the experimental design, but which were provided frequently as a response by the children (see Section 4.5.).

- (4) COPY WH-QUESTION
 Wo_i denkst du, wo_i die Kinder heute t_i essen?
 Where_i think you where_i the children today t_i eat
 *'Where do you think, where the children are eating today?'

Copy wh-questions have been analyzed as a variant of LD wh-questions such as (1) (e.g. Fanselow & Mahajan, 2000). In the Copy Theory of movement (cf. Chomsky, 1995), a movement operation is regarded as copying into a higher position and deleting the lower copy. Thus, in (4) the wh-phrase in matrix CP-Spec is assumed to be a copy from CP-Spec in the subordinate clause, with the lower copy being undeleted. Under this analysis, Copy wh-questions involve overt LD movement and the preservation of the copied wh-phrase in the subordinate clause. Moreover, (1) and (4) differ in that besides the deleted copy (1) contains the overt complementizer *dass* 'that' in C⁰.

2.2. Complexity of complex wh-questions: A preliminary proposal

The four types of complex wh-questions differ in number and length of movement as well as in the overtness of the movement operations. Following Chomsky (1995), we assume that LD movement is more costly than SD movement, and that overt movement is more costly than covert movement. Based on these assumptions the following analyses and degrees of complexity are suggested for the question types (1) to (4), illustrated below in (1') to (4').²

(1') LONG-DISTANCE WH-QUESTION
 Wo_i denkst du, t_i dass die Kinder heute t_i essen?
 ↑ ↑
 Where_i think you t_i that the children today t_i eat

LD wh-questions (1') involve overt and LD movement, which are both costly operations.

(2') PARTIAL WH-QUESTION
 Was_(i) denkst du, wo_i die Kinder heute t_i essen?
 ↑ ↑
 What_(i) think you where_i the children today t_i eat

Partial wh-questions (2') are suggested to be less complex than (1'). On one analysis, the wh-movement is long and covert (McDaniel, 1989); on the other it is short and overt (Oiry & Demirdache, 2006; Jakobowicz & Strik, 2008). For the purposes of this study, we assume that both analyses do not differ in complexity. On both analyses, insertion of the scope-marker *was* adds to the complexity, even though it has to be left open at this point in what way exactly.

²In the following, 'complexity' refers to the costs of the syntactic derivation in contrast to the term 'complex wh-questions', which refers to the compositional character of the wh-questions discussed here. Note that we are ignoring semantic issues of complexity here in interpreting these wh-questions.

(3') PARENTHETICAL WAS-QUESTION
 Was_i denkst du t_i, wo_j essen die Kinder heute t_j?
 ↑ ↑
 What_i think you t_i, where_j eat the children today t_j

Paranetical *was*-questions (3') involve two overt and SD movements, which should make them less costly than (1'). Note, however, that unlike LD wh-questions Paranetical *was* involves additional movement of the verb in V2. We leave open at this point whether (3') is less costly or as costly as (2'), because the status of the scope marker *was* in (2') in terms of complexity is unclear.

(4') COPY WH-QUESTION
 Wo_i denkst du, wo_i die Kinder heute t_i essen?
 ↑ ↑
 Where_i think you where_i the children today t_i eat

Copy wh-questions (4') involve overt LD movement, without deletion of the lower copy. In comparison with LD wh-questions (1'), it may be that they are as costly as (1') or they may be less costly than (1'), because the additional step, deletion of the lower copy, has not taken place. Table 1 summarizes the types of movement operations and additional properties of the structures (1) to (4):

Table 1: Complexity of different types of complex wh-questions

N ^o	Question type	Type of wh-movement	Other relevant properties
(3)	Paranetical <i>was</i>	Two overt SD	V2 movement
(2)	Partial wh	Covert LD OR Overt SD	Scope marker <i>was</i> Scope marker <i>was</i>
(4)	Copy wh	Overt LD	Undeleted copy
(1)	LD wh	Overt LD	Complementizer <i>dass</i>

Based on these analyses, for the structures (1) to (4) we suggest as a starting point the following differences in complexity (with ">" meaning 'more complex'):

- (5) Complex wh-questions in German: Degrees of Complexity
 - a. Long-Distance wh > Partial wh
 - b. Long-Distance wh > Paranetical *was*
 - c. Long-Distance wh ≥ Copy wh
 - d. Partial wh ?= Paranetical *was*

Due to reasons of space the above discussion skips over many details and points to a number of unresolved questions, including the costs of undeleted copies or insertion of a scope marking element. In the present study we provide first evidence that acquisition data may help answer some of the questions related to the underlying structure and complexity of complex wh-questions in German (for acquisition stages in French proposed by Oiry & Demirdache, 2006 see Table 2).

3. Previous acquisition research

Given the degrees of complexity (cf. Table 1), initially children should have difficulty producing complex wh-questions. Several studies using elicited production provide support for this assumption for children acquiring English and French. In a study of complex wh-questions in English, Thornton (1990) found that of the 21 children between the ages of two and five tested, 20 were able to produce LD wh-questions, but half of them also produced Copy wh-questions such as (4), which are ungrammatical in English. Furthermore, two of the children also produced Partial wh-questions, which are ungrammatical in English as well. Likewise, Oiry and Demirdache (2006) found that of 20 French-speaking children between the ages of three and six, 19 were able to produce LD wh-questions, and 8 also produced questions with an overt or covert scope marker in the matrix clause, which resemble German Partial wh-questions (2) and are ungrammatical in French. Based on their results and on theoretical considerations, Oiry and Demirdache postulated three acquisition stages for French, summarized in Table 2.

Table 2: Acquisition stages for complex wh-questions in French (Oiry & Demirdache, 2006)

Stage	Movement / Scope marker
Indirect Dependency	SD movement / Argument wh-phrase
Direct Dependency	SD movement / Overt or covert scope marker
Adultlike	Overt LD movement / no scope marker

In the Indirect Dependency stage children should produce only structures with SD movement. The second stage of Direct Dependency is characterized by the production of wh-structures with overt or covert scope markers and SD movement. Only in the third adultlike stage are French-speaking children expected to exhibit overt LD movement. According to Oiry and Demirdache (2006), these stages are licensed by UG and may represent possible structures from languages other than French. More specifically, German Parenthetical *was*-questions, Partial wh-questions, and LD wh-questions are argued to correspond to the three acquisition stages listed in Table 2. Note that this acquisition path is consistent with the complexity rankings that we suggested for these three structures in Table 1 and (5).

The acquisition of complex wh-questions in German has to date not been investigated for production. Herrmann (2010) examined children's ability to produce short wh-questions in an elicited imitation design. Typically developing three- and five-year-olds were presented with grammatical and ungrammatical short wh-questions. Both groups performed at ceiling on the imitation of grammatical questions, and corrected up to 45% of the ungrammatical questions into grammatical structures. These results show that in elicited imitation tasks children are sensitive to the structure of short wh-questions and that their responses reflect their syntactic competence.

In sum, previous research on the production of complex wh-questions in English and French has found that Partial wh-questions and Copy wh-questions, which are both ungrammatical in the adult system, are allowed by children's intermediate grammars. These findings have been argued to suggest that these structures function as precursors to LD wh-questions, i.e. they may be acquired earlier and are later replaced by exclusive production of the target structure. Given that children's intermediate grammars are licensed by UG, a similar acquisition path can be assumed for German, in which Parenthetical *was*-questions, Partial wh-questions, and Copy wh-questions are expected to be mastered earlier than LD wh-questions. This assumption was tested in our experimental study. As a method we used elicited imitation, because the elicited imitation study with short wh-questions showed that by analysing the attempted imitations we may gain insight into children's underlying syntactic representations.

4. Experimental study

An elicited imitation study was designed comparing three types of complex wh-questions: LD wh, Partial wh, and Parenthetical *was*. Further types, such as Copy wh, were not included due to time constraints. Children's age range was determined based on Herrmann's (2010) results of an elicited imitation study on short wh-questions, since there are no studies exploring the production of complex wh-questions using elicited imitation. Herrmann found that children aged three and five were able to imitate short wh-questions consisting of four or five words. Therefore, the research hypotheses stated below were tested in children aged four.

- (H1) Monolingual German-speaking children produce Long-distance wh-questions significantly less often correctly than Parenthetical *was*-questions.
- (H2) Monolingual German-speaking children produce Long-distance wh-questions significantly less often correctly than Partial wh-questions.
- (H3) Incorrect reproductions are structures that are less complex in the adult language.

4.1. Participants

Seventeen monolingual German-speaking children participated in the experiment (8 girls and 9 boys). Their mean age was 4;6 years (range: 4;0 to 4;10). In order to ensure that children's language abilities were typically developed, three pretests were administered: A plural formation task and an elicited imitation task (SETK 3-5, Grimm, 2001), and a wh-question-after-story task (LiSe-DaZ, Schulz & Tracy, to appear). Seventeen adults were tested as a control. Their age ranged from 21 to 59 years, the mean age being 28 years. All participants lived in the area of Frankfurt am Main, where LD wh-questions containing the overt complementizer *dass* 'that' are grammatical.

4.2. Method and Material

The aim of the present study was to explore children's syntactic representations of complex wh-questions. Elicited imitation was chosen as a method, because complex wh-questions are long enough to prevent reproduction via short term memory only.

24 test items were presented, eight in each of the three conditions: Parenthetical *was*, Partial wh, and LD wh. The sentences contained between seven and nine words and between seven and eleven syllables.³ Four different wh-words were used: *wen* 'whom_Acc', *wem* 'whom_Dat', *wo* 'where' and *wohin* 'where-to', each of them six times. The matrix verbs used were *denken* 'think', *glauben* 'believe', and *meinen* 'mean'.

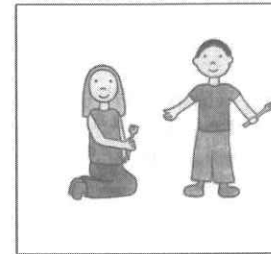
To ensure that differences between the test conditions were due only to their syntactic difference (cf. Lust et al., 1998), eight triples were created. These differed as little as possible across the three conditions, by keeping the number of words and syllables, the wh-phrase, the matrix verb, and the adverb constant.

4.3. Procedure

A short introductory story was read by the experimenter before each test sentence. This story served to introduce the characters and event given in the test sentence to ensure that the proposition of the embedded wh-clause in the test sentence could be accepted as true.⁴ Then, the participant was presented with the pre-recorded test sentence on a portable computer. Each test item was accompanied by a picture to help the participants focus on the task (cf. Figure 1). The task was to exactly reproduce the question for a puppet, which had been introduced as suffering from hearing problems. The puppet in turn answered the question.

³According to Grimm (2001), four-year-old-children are able to reproduce as many as eight words and more if they are part of a sentence.

⁴See Demirdache & Oiry (2008) for evidence that the falsification of the second clause may affect the production of complex wh-questions.



Introduction:

Toby and Anna spot two children. The children are holding some forks in their hands and they are hungry already.

Test sentence:

Wo denkst du, dass die Kinder heute essen?

'Where do you think that the children eat today?'

Figure 1: Example of an introductory story, test sentence, and picture

4.4. Quantitative results

Reproduction of a test sentence was coded as correct if all words were imitated in the correct order. Minor phonetic deviations such as /p/ instead of /b/ in the word *Blume* 'flower' were ignored. While adults correctly imitated 406 out of 408 test sentences (99.5 %), the children imitated only 178 test sentences correctly (43.6 %). Figure 2 shows the results for both groups according to condition. The adult group performed at ceiling across all conditions. The children reached 48 % correct in the Parenthetical *was*-condition, 59 % correct in the Partial wh-condition, and 24 % correct in the Long-distance wh-condition.

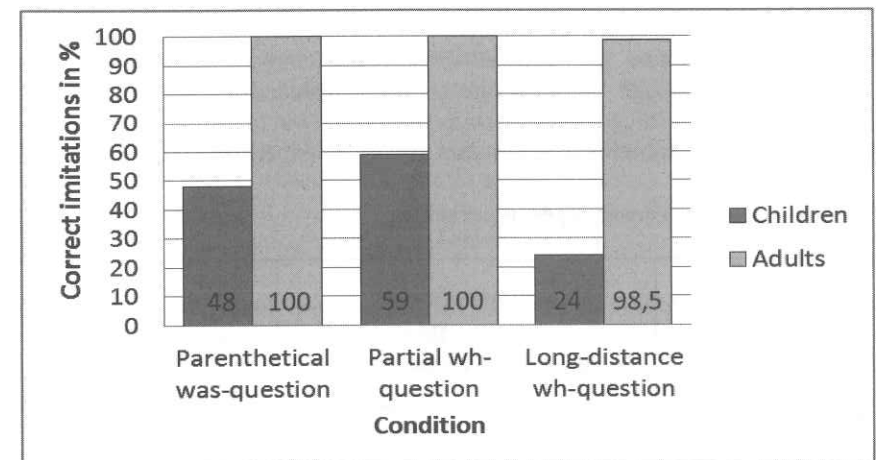


Figure 2: Percentage of correct imitations for children and adults by condition

Focusing on the child data, a one-way ANOVA revealed a significant main effect for wh-question type ($F=4.72$, $p=.013$). A paired sample t-test showed that

the difference between Parenthetical *was* and LD wh was significant ($t=3.52$, $p=.003$), confirming H1, according to which LD wh-questions are more difficult to produce than Parenthetical *was*-questions. The difference between Partial wh and LD wh was significant as well ($t=5.49$, $p<.001$), confirming H2, which states that Partial wh-questions are produced significantly more often correctly than LD wh-questions. Moreover, the difference between Partial wh and Parenthetical *was* was not significant ($t=-1.91$, $p=.074$).

4.5. Error analysis

As adult's performance was at ceiling,⁵ only children's responses were considered further. For the present study, we focused on conversions of the target sentence into other complex wh-structures. In order to be counted as a conversion, the meaning of the sentence had to be preserved. Slight lexical and morphological deviations were accepted (e.g., case error, different matrix verb, missing adverb). Importantly, there were no conversions into LD wh-questions. Therefore, children's errors were divided into the following categories: conversion into Parenthetical *was* (I), conversion into Partial wh (II), conversion into Copy wh (III). The remaining non-conversion errors were coded as category IV; it contained short wh-questions, ungrammatical structures, slips of the tongue, syntactically correct questions with major lexical or morphological deviations, imitations with major deviations causing a change of meaning, etc.

Only one conversion into Parenthetical *was* (category I) was found, which made up 0.4 % of all errors. Conversions into Partial wh (category II) accounted for 23 % of all errors. 20 % of all errors were conversions into Copy wh (category III), although this structure was not included in the experimental stimuli. Errors of category IV accounted for 57 % of all errors. Table 3 summarizes the distribution of error types across the experimental conditions:

Table 3: Children's error types in percentage

Error types	Conversion into:			IV Others	Total of errors per condition
	I Parenthetical <i>was</i>	II Partial wh	III Copy wh		
Test condition					
Parenthetical <i>was</i>	--	12	2	17	31
Partial wh	0.4	--	4	20	24
LD wh	--	11	13	20	44
Errors per error type	0.4	23	20	57	100

⁵The two errors in the adult group were caused by one participant, who converted two Long-distance wh-questions into Copy wh-questions.

Looking at conversion errors by test condition, Parenthetical *was*-questions were converted mostly into Partial wh (12 % of all errors). Partial wh-questions were rarely incorrectly reproduced as conversions. Finally, LD wh-questions were equally converted into Partial wh (11 %) and Copy wh (13 %). Leaving aside the non-conversion errors (category IV), children's errors were never conversions into LD wh, which we argued to be the most complex of the structures tested, but into Partial wh (and Copy wh), which we argued to be less complex in the adult language, thus confirming (H3).

5. Summary and discussion

In an elicited imitation task, four-year-old German-speaking children and an adult control group were tested on their production of Long-distance wh-questions, Parenthetical *was*-questions, and Partial wh-questions. While adults' performance was at ceiling across conditions, a quantitative analysis of the child data revealed that the four-year-olds had more difficulty producing Long-distance wh-questions than Parenthetical *was*-questions and Partial wh-questions, confirming hypotheses (H1) and (H2). Together with the fact that children sometimes produced Copy wh-questions, which were not included in the test design, these findings provide first evidence that the method of elicited imitation is well-suited to tap into children's syntactic representation of complex wh-questions in German. Due to the length of the test stimuli, children were not able to simply reproduce the wh-questions via short term memory, but had to reconstruct the syntactic representation accordingly.

The qualitative error analysis confirmed that the most complex question type tested was Long-distance wh-questions, which requires long and overt movement of the wh-phrase to Spec-CP of the matrix clause. No conversions into LD wh-questions were found, and many of the LD wh-stimuli were converted into Partial wh-questions and Copy wh-questions, respectively.

Given these sets of results, let us now reconsider the degrees of complexity suggested in (5) in Section 2, repeated below:

- (5) Complex wh-questions in German: Degrees of Complexity
- a. Long-Distance wh > Partial wh
 - b. Long-Distance wh > Parenthetical *was*
 - c. Long-Distance wh ≥ Copy wh
 - d. Partial wh ?=? Parenthetical *was*

Both, (5a) and (5b) are supported by the quantitative child data. The statistical comparison of Partial wh and Parenthetical *was* (5d) suggests that these types do not differ. Under the assumption that children convert more complex structures into less complex ones, the qualitative error analysis provides additional evidence for (5a). For (5d), it suggests that Partial wh is less complex than Parenthetical *was*. LD wh-questions were also converted into

Copy wh, which suggests that the stronger reading of (5c) holds. Thus, based on the present study, we suggest the following revised degrees of complexity:

- (5*) Complex wh-questions in German: Degrees of Complexity revised
- Long-Distance wh > Partial wh
 - Long-Distance wh > Parenthetical *was*
 - Long-Distance wh > Copy wh
 - Parenthetical *was* > Partial wh

Summarizing these rankings, the following complexity hierarchy for complex wh-questions emerges:

Table 4: Complexity hierarchy for complex wh-questions

Question type	Type of wh-movement	Other relevant properties	Complexity
Partial wh	Covert LD OR Overt SD	Scope marker <i>was</i>	Low
Parenthetical <i>was</i>	Two overt SD	V2 movement	Middle
Copy wh	Overt LD	Undeleted copy	Middle
LD wh	Overt LD	Complementizer <i>dass</i>	High

Given that more complex structures are acquired later than simpler ones, we propose that the acquisition path for complex wh-questions in German is reflected in the complexity hierarchy presented in Table 4. Thus, Partial wh should be acquired first, followed by Parenthetical *was* and possibly Copy wh, while LD wh-questions are expected to be acquired last. Further studies are needed to examine whether these predictions are borne out across ages and methods.

Note that the acquisition path we suggest for German differs only slightly from the acquisition stages that have been suggested for French (Oiry & Demirdache, 2006, cf. Table 2). In German, Partial wh, which involves scope marking, is predicted to be acquired before Parenthetical *was*, while in French the scope marking strategy should be acquired later. This difference may be related to syntactic features other than wh-movement, such as presence of V2-movement in the embedded clause in German, or to semantic differences across structures and languages that we could not address in the present study. Cross-linguistic research could shed light on some of these issues, and elicited imitation seems a suitable way of tapping into children's underlying representations of complex wh-questions.

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