

**Empty categories and complex sentences:  
the case of wh-questions.**

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## Introduction

The present paper has as its topic the acquisition of complex syntax and the special problems it presents to the language learning child. The phenomena are at the forefront of modern linguistic theory, and the subtle predictions they make deserve notice by theorists of child language. In what follows I will point to some of the phenomena that fall under the notion of "empty categories" in syntax, then describe in more detail the types of empty categories that have been proposed in modern work. Following that description, I will raise questions about the acquisition of the forms: how do children's grammars accommodate empty categories, and how do we know when they do? The bulk of the chapter will be concerned with the evidence of acquisition of one major type of empty category, namely the one left behind when a wh-question is moved to the front of a sentence: wh-trace.

Why do linguists talk about "empty categories"? The well-grounded theoretical decision to permit movement rules in syntax had as a consequence the necessity of postulating empty categories in the original sites of the moved elements. Many complex sentences in English are argued to involve movement rules and/or empty categories, both of which present special challenges to acquisition theories. But are they theoretical entities that will disappear with the next theoretical shift? Consider some of the constructions in which empty categories have been proposed, with the small (e) indicating the empty category:

- 1) Mary seems (e) to be a success
- 2) Bella decided (e) to buy a car
- 3) What are you wearing (e)?
- 4) What are you looking for (e)?

In each case, some crucial component (argument) of the sentence has been omitted, for example an object of a verb that is obligatorily transitive (3), or a subject (1 & 2), and some mechanism must be proposed to reconstruct its role. It cannot be the case that we simply fill in any empty slot by inference, because there are sharp grammaticality contrasts when the empty element appears in some other positions:

- 5) \*Jane agrees that (e) should go.
- 6) \*Who did you say that (e) went?
- 7) \*I'm looking for my hat, will you look for (e) too?

If the phenomenon of empty categories is a discourse or pragmatic phenomenon, in which certain redundant things need not be said, then why are cases 5) through 7) different? The contrast 6) provides with 1) and 2) demonstrates that an empty subject cannot appear in a finite, or tensed, complement. Clearly, at least some of these phenomena are not explainable on pragmatic or inferential grounds, but on the basis of grammatical principles.

Consider more closely the case in 3) involving the *wh*-question. The verb *wear* is obligatorily transitive, as shown by the ungrammaticality of sentence such as:

8) My brother wears.

So *wear* has a requirement that the thematic role of object be filled. That lexical requirement is satisfied in the theory that the question word *what* began adjacent to the verb in the object position of the D-structure, and then moved to the front of the sentence in the S-structure. The movement leaves behind an empty element coindexed with the *wh*-word, and called a **wh-trace**.

Consider the contrast between 8) and 4), for an illustration of the principled nature of empty categories. 8) demonstrates that one cannot, apparently, have an empty object after a preposition. The object after prepositions must be filled: it is not a grammatical position for an empty category. Then why was 4) permissible? 4) involves a *wh*-question, and the assumption is that the object position is in fact occupied by the trace the *wh*-movement left behind, as in 3), fulfilling the requirement that prepositions need objects. But 7) shows that *wh*-words cannot leave traces in every possible position : in particular, not in the subject position of a clause beginning with "that".

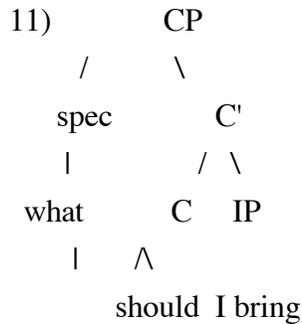
Where does the *wh*-question move to? In current syntax, the topmost node in sentence structure is typically the functional category CP, whose head is the functional category C, or complementizer. In an embedded sentence, that C position would be occupied by such forms as *that*, *if* or *for*. In main clauses, the C constituent is held to be obligatorily empty in English except in the case of questions. In yes/no questions, the C serves as the landing site for auxiliary movement (now called "I-to-C movement"):

9) Can he come early?

and as the landing site for *wh*-question movement:

10) What should I bring?

The fact that both auxiliaries and wh-questions move to the CP suggests it has further internal structure, in other words that the wh-word actually moves to the specifier position of CP and the Aux into the head of CP:



Furthermore, the movement of wh-questions is argued to be cyclic, in other words, the wh-word moves one clause at a time if it originates in an embedded position:

- 12) How did you say you wanted me to move the trunk?  
With the trolley.

The how has originated as an adverb attached to "move" in the lowest clause, and has "cycled" through the intermediate CP's in order to meet the requirement that movement be clause-bound. In each spec of CP, then, there is a trace left by the movement, and the whole chain of traces is coindexed with the moved "how":

- 13)  $\text{CP}[\text{How}_i \text{ did you say}_{\text{CP}}[\text{t}_i \text{ you wanted me}_{\text{CP}}[\text{t}_i \text{ to move the trunk } \text{t}_i]]]]?$

There are significant constraints on such long distance movement, which will be discussed in more detail below as we discuss their acquisition.

How are wh-traces different from other empty categories? In the next section, I will describe briefly where wh-traces fall in the larger scheme of empty categories that has been developed.

### **The Inventory of Empty Categories**

In contemporary work in the GB framework, there exists an inventory of empty categories that parallel the inventory of possible overt Noun Phrase (NP) categories in language. Just as there are three types of nominals: lexical NP's, pronouns, and anaphors, there are corresponding empty

categories governed by the same Binding principles (Chomsky, 1981), principles that define whether the nominals are free or get reference by being coindexed with (bound to) another nominal:

- a) pronouns must be free in their governing category<sup>1</sup>.
- b) anaphors must be bound in their governing category.
- c) referring expressions must be free everywhere.

These principles dictate the grammatical conditions for each of the types of noun phrase in the syntax. So, for instance, the binding principle for pronouns in a) states that pronouns cannot occur in positions where they are coindexed with an NP in the same clause. One cannot say:

14) Bill<sub>i</sub> shaved him<sub>i</sub>.

and mean that Bill shaved himself. On the other hand, one cannot have reflexive pronouns (an example of anaphors) too distant from their co-indexed NP, so one cannot say:

15) Bill<sub>i</sub> asked her to shave himself<sub>i</sub>.

Finally, it is ungrammatical to have full NP's bound at all:

16) The child<sub>i</sub> washed the child<sub>i</sub>.

These same binding principles are extended to define the conditions on the appearance of different types of empty nominals. Chomsky captured the variation among the empty categories by arguing for a four fold categorization based on two features: +/- pronominal, and +/- anaphoric. These are shown in Table 1.

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<sup>1</sup> By "governing category" is meant roughly, a clause. The following is an approximation: The governing category for  $\theta$  is the smallest category containing  $\theta$ , a governor for  $\theta$  and a subject. A governor is a lexical head: N,V,A,P. For a more complete description, see e.g. Cook (1988).

Table 1

	+p	-p
+a	PRO	Np-trace
-a	pro	Wh-trace

The equivalent of the **overt** lexical NP (neither pronominal nor anaphoric) is the trace left by Wh-movement, usually written as *t*. As discussed, it would occur in a wh-questions such as the following:

- 17) What<sub>i</sub> did he buy *t*<sub>i</sub>?

in which the "what" has moved in the syntax to the front of the sentence. Technically, it occupies the specifier position in the CP, which is the top-most maximal projection in the current syntax (see Figure 1)<sup>2</sup>. The trace is bound semantically to the wh-Operator, and is a **variable**, that is, it refers to the members of a set, rather than being a name.

Figure 1 here

The small *pro* (+p,-a) is distributed as a **pronoun** in languages that permit it, namely free in its minimal governing category. For instance, in Italian, it would occur in a sentence such as:

- 18) (**pro**) more  
(he went)

Small *pro* does not occur in adult English, and it is hypothesized to occur only in languages that have a rich inflectional system, so that the case and number of the subject (agreement) are actually marked on the verb inflection. It is only licensed, in other words, by a feature of the agreement (AGR) category.

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<sup>2</sup> See Radford, Meisel (this volume) for further descriptions of functional categories such as the CP, and descriptions of X-bar syntax.

The trace left by NP movement (from e.g. passivization) is an **anaphor** (+a,-p), which must be bound in its governing category. For instance, there is an empty category hypothesized in the passive sentence:

- 19) The cat<sub>i</sub> was chased e<sub>i</sub> by the dog.

and also in the "raising verb" sentence above:

- 1) Mary<sub>i</sub> seems e<sub>i</sub> to be a success.

However these three empty category types do not exhaust the possible types in English, as the form PRO must still be accounted for. PRO is hypothesized as the empty subject of infinitives in 2) from above:

- 2) Bella decided PRO to buy a car.

PRO behaves sometimes as a pronoun and sometimes as an anaphor (hence +p,+a), leading to a variety of proposals about its distribution. The theory of Control was developed to account for the distribution of PRO (Chomsky 1981). Essentially, some verbs allow subject control of the PRO in the infinitival clause as in 2), where Bella is the subject of both clauses, while others like *persuade* allow object control:

- 20) Bill persuaded Jim<sub>i</sub> PRO<sub>i</sub> to buy a car.

In other cases, PRO behaves as a pronoun with arbitrary reference:

- 21) Bill liked the decision PRO<sub>arb</sub> to buy a car.

The adequacy of the above scheme has been debated in recent work, and several changes have been proposed. Rizzi (in press) expands on the notation used by Chomsky for empty categories by adding the feature +/- variable to the class of possibilities, following work by Lasnik and Saito (1992). The +/- variable feature is designed to capture other differences in the way empty categories behave, in particular, whether they behave as variables or as constants. As mentioned above, a wh-trace has the characteristics of a variable: the answer to a genuine question such as:

## 22) Who came to the party?

must be a set of individuals, not a constant. Rizzi adds new categories to the scheme in Table 1, but the full ramifications of those additions remain to be established so they are only mentioned here.

An important principle governing the distribution of the non-pronominal empty categories and formulated variously over the past several years is known as the **Empty Category Principle** (here from Rizzi, 1990):

A non-pronominal empty category must be properly governed. Proper government can be satisfied either by lexical or antecedent government.

Lexical government is satisfied by e.g. a transitive verb or a preposition requiring an object; antecedent government by a coindexed governor in the same clause. The principle has application especially in explanation of the distribution of **wh-traces**, for example in the different behavior of adjunct and argument traces discussed below.

Notice that the empty category set is **parameterized** because:

- i) small pro appears only in certain languages, namely pro-drop languages with a rich inflectional system,
- and
- ii) wh-trace does not occur in languages with no overt wh movement in the syntax (e.g. Chinese, Japanese, Turkish).

In addition, the properties of the empty categories interact with the syntax of the language (e.g. in the definition of governing category) and with the lexicon (e.g. in the class of verbs that control PRO). Having situated the nature of wh-traces within the larger scheme of empty categories, let us turn to the special problems that are presented in accounting for the acquisition of these forms.

### **The acquisition problem**

Here are some of the general problems that arise in considering the acquisition problems for the child in learning about empty categories.

- a) How does the child determine what is the inventory of empty categories for her language?

For example, could the child begin with a generic empty category as a "default", then differentiate them? A very natural proposal might be for the child to begin with the category **pro**,

because pro simply fulfills the requirements of lexical theta-projection, without involving any chains. But how do other empty categories then emerge? Could pro stand in place of e.g. wh-trace at the beginning ( see e.g. Roeper, Rooth, Mallis and Akiyama, 1984, and de Villiers, Roeper and Vainikka, 1990)? Alternatively, maybe the child has an undifferentiated empty category, and successively adds the features (+p,+v,+a)( See Perez, 1993)?

b) How does the child determine the syntactic conditions under which empty categories are allowed?

For instance, how does the child learn that English lacks the rich agreement features that would license pro in subject position? How does the child recognize the passive sentence as a case involving movement?

c) How does the child acquire constraints on empty categories such as the ECP?

Does the child automatically know the difference between adjuncts and arguments? Does the child make mistakes in this system and receive corrective feedback?

These basic questions of inventory, distribution, and constraints are general ones that will be addressed with respect to the specific case of wh-trace. First, however, consider the general difficulties faced by a researcher who wants to determine children's knowledge of empty categories. In the case of adult grammars, linguists have access to judgments and intuitions to bolster the data from production and comprehension. In the case of child language, we have limited access to intuition, so our procedures for asking about the child's grammars must be "devious", to use an expression of Chomsky's (1965). Furthermore, if the child's grammar is non adult, can one determine which part of the network of phenomena is awry? That is, can one tell which of the following is/are true:

- i) the child's phrase structure syntax is different, for example, clauses may be adjoined rather than embedded.
- ii) the inventory of empty categories is either impoverished or deviant from the adult language target, for example, may lack a feature such as "+variable".
- iii) the formulation of the empty category principle is different or incomplete, for example, antecedent government may not be possible.

These questions will be addressed with respect to a particular variety of empty category, namely wh-trace, as an illustration of these challenges to analysis. Much literature has already been devoted to

the "empty subject" phenomenon in child language, so that it would be impossible to include discussion of the competing proposals in that domain as well in this chapter. The debate revolves around whether the missing subjects are a performance or a competence phenomenon, and if competence, whether they are best described by discourse or grammatical rules. The interested reader is referred to Hyams (1986), Bloom (1990), Valian (1990), Rizzi (in press), Perez-Leroux (1993), Lillo-Martin (in press). The issue of control and PRO is addressed in two recent reviews with differing perspectives on the issue of whether the structures or the principles are discontinuous in acquisition (see McDaniel and Cairns, 1990; Sherman Cohen & Lust, in press).

How do we know that young children's wh-questions involve the category wh-trace? There are several kinds of questions that can be asked: and these will be addressed in the following sections.

### **Are the wh-questions a result of movement?**

When young children produce a wh-question such as:

23) What can I eat?

has the wh-word actually undergone "movement"? The world's languages fall into several types, some that require wh- movement, and some that do not. Asian languages such as Chinese and Japanese do not have grammatical wh-movement, but leave the wh-word "in situ" in the sentence, occupying the place where it "belongs" in the phrase structure:

24) Chinese: Ni xihuan shei?  
You like who?

Young English-speaking children virtually never produce such sentences- their wh-words are in the front from the beginning. Yet when one considers the learnability problem, their lack of confusion is somewhat mysterious. The input they receive from adults is ambiguous for figuring out which kind of language they are learning because the study of "motherese" reveals that it often contains questions in which the wh-word is left in place:

25) You want what?

These questions occur with surprising frequency: 1 in 57 utterances in 7,000 parental utterance samples from Adam's transcripts, 1 in 80 in Eve's and 1 in 146 in Sarah's (Brown, Cazden Bellugi, 1969).

But maybe if children hear any fronted wh-questions, that is enough information for them to figure out that the language involves syntactic wh-movement? Unfortunately, then the case is not so clear cut for a child in the reverse situation, namely learning an Asian language. Chinese speakers produce wh-words at the front of questions when they want to use emphasis, or topicalize what is being questioned, the equivalent of:

26)            What you want?

So both the English and the Chinese learner would have an impossible task with simple induction. Instead, both learners must figure out whether the speakers use wh-fronting ( or wh-in situ) as a grammatical or a discourse device: is it the special case, dependent on certain kinds of discourse (see e.g. Pesetsky, 1987; Authier, 1993), or is it the syntactic norm?

As mentioned, the English child does not produce wh-in situ, at least at first. However, it is still possible that a wh-trace is not involved in these early productions. A separate mechanism exists in grammar for linking other kinds of "empty categories" to the NPs with which they are coreferent, as described above. It has been argued by Roeper (et al 1984,1988) that children's first questions might involve an empty category such as "pro" (possibly with features +p,-a) rather than a trace, though the evidence is controversial (Crain, 1991; McDaniel & McKee,1989). In more recent syntheses, Roeper and de Villiers (1992) and Perez-Leroux (1993) speculate that the initial wh-word might also lack the variable [+v] feature. In fact, if the feature [+v] arises from having an appropriate operator in the specifier of CP, the child might lack that feature precisely until a proper movement analysis of wh-questions is achieved. So perhaps the child's grammar does not include trace until syntactic wh-movement is clearly justified for the language. As described above, the evidence about the language is murky until the child can distinguish the discourse conditions that distinguish the various types of question, and surely that rests on experience.

**Do children treat the empty category in wh-questions as a variable?**

The idea that the wh-trace behaves as a variable has several facets. As mentioned, the wh-operator in spec-CP is considered to be a quantificational operator, and the trace it binds is not taken to refer to a fixed individual but to a set. Takahashi (1991) and Maxfield (1991) both provide evidence of a sensitivity at age 3 or so to the differences between the discourse requirements of a real and an 'echo' question (see also Authier, 1993). In an experimental game, Takahashi showed that 3-4 year olds would answer a real question with a fully quantified (variable) answer, but would answer an echo question with a single name, or just the information supplied by the preceding discourse. For instance, in the context of a story children were told that:

The children had fruit for dessert

and were shown a picture of children eating various fruits. When asked:

27) What did the children eat?

they answered e.g.

28) "Strawberry, and a banana, and a cherry"

but when asked:

29) The children ate what?

they replied:

30) "Fruit".

In short, the moved wh-question, but not the in situ question, was treated as requiring a variable answer by the child. Evidence such as this is suggestive, though not conclusive, that by age 3, wh-questions are derived by movement and involve a trace bound to an Operator which behaves like a quantifier. Further evidence in support of that claim is provided by an extensive comparison of wh-questions and quantifiers in Roeper and de Villiers (1991). In general, the experimental evidence reveals that children also provide exhaustive paired readings of "double" wh-questions such as:

31) Who brought what?

from about age 3 years, answering e.g.:

32) The daddy brought the chips and the baby brought the apples.

rather than e.g.:

33) The daddy.

Supportive evidence that the older child's wh-questions are created by movement comes from a consideration of auxiliary movement. The wh-word moves into a position in the phrase structure tree known as the Specifier of the CP position (see Figure 1). However, in questions, the auxiliary moves from its normal position as the head of IP, into this empty head of CP. Several theorists have proposed that children's grammars may be incomplete in this regard, for example, only having one position in the CP node (Roeper,1988; Radford,1991) or having some restriction on filling both positions at once (Weinberg,1991). If so, that would provide an explanation for the observed delay in some children between Aux movement in yes/no questions and in wh-questions. That is, these children go through a stage in which they invert auxiliaries in yes/no questions but not in wh-questions (see Weinberg, 1991 for review). They produce sentences such as:

34) Can I go?

35) Will you do it?

at the same time as wh-questions like:

36) Where I can go?

37) What you will do?

If the child only has one grammatical site at the front of the sentence, in the wh-question there would be no "place" in the structure for the aux to move.

A more radical alternative depends on the assumption that the CP node might not be present at the beginning of children's grammar (see Meisel, this volume). Then the first wh-questions that children produce may in fact be formed by adjunction to the S, or to an IP, before a CP is built (see de Villiers, 1991; Vainikka, 1992). Only when the CP node is formed would true movement, trace, and auxiliary inversion appear. This claim is not without its opponents (Valian, 1992), who argue that the CP is fully available from the beginning, and find the evidence for a stage

as clear as that described above less convincing in children they have studied ( For discussion see also Meisel, this volume, and Radford, this volume).

**Does the empty category in children's wh-questions have any phonological consequences?**

Experimental work from a different angle reinforces the idea that wh-questions in young children leave behind an empty category with the properties of wh-trace. In an important study, Crain and Thornton (1991) demonstrated that young children know that English does not permit contraction of lexical material over the site of a wh-trace. For instance, although it is common in American English to contract "want to" to "wanna", there are syntactic constraints on where that can occur:

- 38) Who do you want to help t?
- 39) Who do you wanna help t?
  
- 40) Who do you want t to help you?
- 41) \*Who do you wanna help you?

Because a trace intervenes in ( 40), the contraction in (41) is disallowed (Chomsky, 1976). Crain and Thornton used a clever elicited production protocol for encouraging children to ask the relevant questions, such as the following involving a rat puppet who was too timid to talk to grown-ups:

Experimenter: The rat looks hungry. I bet he wants to eat something. Ask ratty what he wants.

- 42) Child: What do you wanna eat?

To elicit the subject extraction case in (41), they made the situation more complex:

Experimenter: There are three guys in this story: Cookie Monster, a dog and this baby. One of them gets to take a walk, one gets to take a nap, and one gets to eat a cookie. The rat gets to choose who does each thing. So one gets to take a walk, right? Ask ratty who he wants.

- 43) Child: Who do you want to take a walk?

The results with 21 children aged 2;10 to 5;5 years were clear-cut: the object extraction forms permitted contraction 59% of the time, but the subject extraction forms only produced 4% contraction. At minimum, the results support the view that children's wh-questions are co-indexed with an empty category, and that category has the same phonological consequences as wh-trace in the adult language.

Crain and Thornton (1991) also studied rightward contraction, such as the phenomenon of is-contraction, which cannot occur in front of a trace (Bresnan, 1978):

- 44) Do you know what that is doing t up there?
- 45) Do you know what that's doing t up there?
  
- 46) Do you know what that is t up there?
- 47) \*Do you know what that's t up there?

Twelve children in the age range 2;11 to 4;5 showed striking obedience to this constraint in a similar elicited production task. Thus these constraints on contraction induced by the presence of trace add strong support to the notion that the empty categories associated with wh-questions have psychological reality in the child's grammar: their consequences are phonological as well.

### **Are children's wh-traces subject to the constraints of the ECP?**

The ECP governs the possibilities for non-pronominal empty categories in general. To look at this issue in detail requires consideration of the phenomena of long distance movement, or the movement of questions across clauses. As described earlier, the wh-word moves to a position in front of the sentence, in the specifier position of CP and it does so for each clause that it crosses. So each of the following questions has a trace left behind:

- 48) Who did she see t at the party?
- 49) Where did he think he was going t?
- 50) How did Ann say that Joan wanted to bake t the bread?

An important constraint on this cyclic movement occurs if another element fills the spec-CP slot in an intervening position, for instance, a wh-complementizer is theoretically in the spec-CP of an embedded clause:

- 51) He asked where to fix the car with the wrench.

If the position is already filled, a *wh*-question cannot cycle through that *spec-CP* and leave a trace, so the resulting sentence is ungrammatical:

- 52) How did he ask where to fix the car *t*?

The question in 52) sounds grammatical, but only under the interpretation of *how did he ask*, not *how would he fix the car*. What precisely is it that blocks the long distance interpretation in such a question as (52)? The crucial point is that the medial *wh*-word in (52) is in the specifier position of the medial *CP*, through which the lower question would have to move to obey successive cyclic movement. Hence the "landing site" in the medial *CP* is blocked, and the "long distance" reading is therefore excluded.

More precise accounts of the phenomena need to be provided, however, because there is a striking difference between **adjunct** questions and **argument** questions in this regard. Argument questions refer to arguments of the verb: subjects and objects (and possibly indirect objects for verbs such as *give*). On the other hand, adjunct questions occupy oblique roles with respect to the verb: where, how, why, when. They are not required to fulfill the verb's thematic roles. Hence adjunct traces can only be ANTECEDENTLY governed, not LEXICALLY governed. This distinction turns out to be significant in comparing the long distance movement possibilities of different questions. Consider the question:

- 53) What did he ask how to fix *t*?

Notice that such a question is perfectly understandable even though the trace of *what* is in the lower clause. Compare the adjunct question in (54) with the argument question in (55):

- 54) How did the man ask who to draw?  
55) Who did the man ask how to draw?

Whereas (54) is like (52) in allowing only the short distance interpretation, (55) allows the possibility of a long distance reading despite the occupied medial *spec* of *CP*. Rizzi (1990) offers a full account of this difference in his formulation of the empty category principle, which allows lexical licensing of arguments, but requires antecedent licensing for adjuncts. Object *wh*-traces (arguments) are always properly governed because they are lexically governed by the verb, hence

can be found in the lower clause even with an intervening adjunct trace in the medial COMP position:

56) Who<sub>i</sub> did she ask how to help t<sub>i</sub>?

Adjunct wh-traces (e.g. those of how or when), however, are not lexically governed so require antecedent government. However, if another wh-word intervenes in the medial COMP, it acts as the nearest potential antecedent governor and the chain is disrupted:

57) \*When<sub>i</sub> did she ask how to help t<sub>i</sub>?

Hence the traces of arguments and adjuncts have quite different distributional possibilities captured by the ECP. Do children know these possibilities?

de Villiers, Roeper and Vainikka (1990) looked at whether young children know these constraints on interpretation (Chomsky, 1986). They presented children with stories followed by ambiguous questions that permitted the children a choice between a grammatical and an ungrammatical interpretation, to see if the children would systematically resist the latter.

For example, take the following short story (See Figure 2 for pictorial support like the children received):

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 Figure 2 here  
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This little girl went shopping one afternoon, but she was late getting home, She decided to take a short way home across a wire fence, but she ripped her dress. That night when she was in bed, she told her mom, "I ripped my dress this afternoon".

58) When did she say she ripped her dress?

Now given the story, there are two possible interpretations of (58), depending on where the listener interprets the trace to be for the wh-question "when": is it connected as an adjunct to "say", or to "rip"?:

59) When<sub>i</sub> did she say t<sub>i</sub> she ripped her dress?

60) When<sub>i</sub> did she say she ripped t<sub>i</sub> her dress?

That is you might answer: "at night" (if (59), or "that afternoon" (if 60), depending on your interpretation. The answer corresponding to (59) is referred to as a "short distance" movement, because the *wh*-word moves within the first clause. The answer to (60) on the other hand, involves a long distance movement because the *wh*-word moves from the lower, or embedded, clause.

de Villiers et al showed that 3 to 6 year olds are quite happy to provide either answer, suggesting that they do readily permit "long distance movement". But perhaps they are just guessing what is needed for an answer? If so, they should be just as likely to guess the long distance answer in the case of a subtle variant of the question following the same story:

61) When did she say how she ripped her dress?

The long distance interpretation "in the afternoon" should strike you as a peculiar answer now. Of course, 61) represents the case discussed above in which the medial spec of CP is occupied by the *wh*-complementizer *how*, so the trace of *when* in the lower clause is not properly governed according to the ECP. In fact, only rarely do 3 year old children give a long distance answer to questions such as (61), which contains a medial *wh*-word. Hence they know the subtle constraint on interpretation by about age 3 years.

Most importantly, de Villiers et al (1990) tested the adjunct/argument asymmetry in children aged 3 to 6, and found evidence that the children behaved in accordance with the ECP. That is, not only do children allow long distance movement for (58), not only do they appropriately block it for (61), but they also show the very contrast between arguments and adjuncts that the adult language respects. That is, they allowed long distance movement of an argument over an adjunct in the medial CP (55), but not the long distance movement of an adjunct (61) over the same barrier. Table 2 shows the basic results from de Villiers et al (1990), since replicated several times for English, and in a longitudinal study (de Villiers and Roeper, in preparation). Notice that the percentages of ungrammatical long distance readings, namely ones that violate the ECP, are very low (maximum 8%).<sup>3</sup> Recent studies (see papers in Maxfield and Plunkett, 1991) have explored children's knowledge of this constraint in German, French, Caribbean Spanish, and Greek (Leftheri, 1991), and have found strikingly similar results from young children exposed to the translations of these sentences.

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<sup>3</sup> The reason that the percentages sum to less than 100% is due to a fascinating departure from adult grammar, to be explained in more detail in the next section.

Table 2 here

Consider what a learning theory might offer as an account of how children acquire this knowledge of the conditions under which "long distance movement" is blocked. Such a theory would have to claim that children hear questions all the time. As they do so, they observe people answering them and notice that half the time, some questions are answered one way, and half the other. Other questions (like (61)) are only answered one way, so they do likewise. But what exactly is "like (61)"? Each situation will be unique, and the child must ignore the variations in context, words and meanings to attend only to the grammatical principles involved. For the learning theory to work, the two-year-old would have to be equipped with the ability to sift through evidence of this subtlety to arrive at the appropriate generalization. In other words, the unconscious mind of the 2 year old child would be performing an inductive analysis of the same subtlety as the conscious, trained linguist.

It is not beyond one's imagination to conceive of such a process. However, the data would have to be rich enough to distinguish the alternatives, i.e. ample evidence would be needed to successfully partition the types (52) through (61) above, and their allowable answers. The problem that immediately arises is the rarity of such sentences in the input. In hundreds of hours of recorded conversations between several young children and their caregivers, we have found a couple of dozen examples, and of course never closely contrasting pairs like those described above. The likelihood that the principles could be derived from experience alone seems rather low.

Instead, it is argued, the principles governing e.g. the movement of wh-words, or the conditions on empty categories must be part of universal grammar, part of the innate equipment that the child brings to the task of language learning. On this familiar view, children don't construct "wild" grammars, that is, grammars that lie outside the family of known or possible languages.

Nevertheless, there is no guarantee that the grammar that a child constructs will be the same as that of the target language, because input data will be necessary to refine which grammar it is from the family of possibilities. Hence the child's intermediate grammars may be interesting variants that are strikingly different from that of their parents. Such an example is provided in our work on wh-movement, and the explanation for why this particular variant is selected may provide a deep insight into children's early grammars and their inventory of empty categories.

### Is the child's wh-movement entirely adult-like?

Given the data just described, why not argue that by age 4 or so, children have the entire grammar of wh-movement and traces established? There are several intriguing phenomena that qualify that argument and suggest that there may still be more to be mastered. Children in all the above languages show a characteristic error at 3 and 4 years of age that is similar to an option for interpretation that appears in some dialects of German (McDaniel, 1989). In German, it is possible to have a questions such as:

- 62) Was hat er gesagt wie er das Kuchen machen kann?  
 What did he say how he the cake make can?  
 [ How did he say he could make the cake]

Notice that the first question word "was" [=what in English] is not answered; it just serves to mark the sentence as a question. It is only the medial question "wie" [=how] that needs an answer. This is thus an option in Universal Grammar, and it is an option that young children readily allow around the age of 3-4 years. That is, asked a question such as :

- 63) When did she say she how she ripped her dress ?

young children are very prone to answer the medial "how" in English ( de Villiers et al, 1990), German, French, and Spanish (see papers in Maxfield and Plunkett, 1991) in Greek (Leftheri, 1991), Black English (Seymour et al 1992) and Mauritian Creole (Adone and Vainikka, 1990). They are especially likely to do so when the medial question is an argument such as "who" or "what" ( de Villiers et al, 1990).

Simpler explanations spring to mind for this phenomenon: perhaps the children just answer the last question word they hear? Several control experiments rule out the simpler explanations (see Roeper & de Villiers, 1992) . For instance, children do not answer the medial question in a yes/no question:

- 64) Did Micky tell Minnie what he bought?

nor do they answer the final "who" if it is the complementizer of a relative clause:

- 65) How did the dog climb up who barked?

(de Villiers & Roeper, 1991, and in preparation). They thus restrict their answers to the medial embedded question of a sentence marked initially as a wh-question. Children's interpretations therefore appear to fall within the options provided by Universal Grammar, but why is partial movement such a likely "default" (Lebeaux, 1988, 1990)? Thornton (1991) discovered that children's productions also allow a "copy" of the initial wh-word when they are put in an elicited production situation and encouraged to produce complex sentences. For example, they produce questions such as:

66) What do you think what's in her hat?

and less frequently, cases in which the medial question is not a direct copy:

67) What do you think where the marble is?

Thornton's analysis also connects the phenomenon to the partial movement possibility in German, but she argues that the phenomenon is due to the child's rules for specifier-head agreement. That is, for a case of long distance movement when there is a trace in the intermediate specifier of CP, the children's grammar insists upon an explicit complementizer to carry agreement features, and that complementizer is realized as a wh-form. In support of this claim, Thornton demonstrates that children do not produce these intermediate forms in the case of infinitival complements, only tensed complements, because only the latter trigger spec-head agreement. In their later development, children must observe that spec-head agreement is only necessary for subject extraction questions, and that the agreeing complementizer must in fact be null (Rizzi, 1990). The difficulty in reconciling this plausible account with the comprehension data lies in the fact that children answer the medial questions, and they do so for both infinitival and tensed questions. This fact makes it necessary to propose that the medial questions are part of a semantic chain, rather than just a morphological reflex.

Consider an alternative perspective. It is established that in some languages the initial wh-word serves as a scope-marker, linked to the medial wh-word, but only one trace and one movement are involved:

68) What<sub>i</sub> did you say [<sub>CP</sub> what<sub>i</sub> [ you want t<sub>i</sub>]]<sup>4</sup>

---

<sup>4</sup> German typically has the expression was, while Slavic languages allow how as the scope marker (Browne ; pc).

German is the language where the phenomenon has been analyzed in the greatest depth and an important feature emerges: partial movement occurs only where there is no subcategorization. That is, first, partial movement occurs with verbs that do not subcategorize for a wh-word, like denken (think), but not fragen (ask), which takes indirect questions (that is one can say "ask when.." but not "\*think when..").

Second, the structure appears at the right in German, but the righthand complement must have been extraposed, as German is an SOV language with government to the left. In other words, the verb complement must have begun to the left of the verb, then been extraposed. How could the extraction be from this clause once it is moved to the right? After extraposition, the clause is no longer embedded, but adjoined, yet German speakers can interpret wh-questions as arising there. Clearly whatever explains this fact in German must be connected to the facts in English child acquisition. German permits both partial movement and long distance movement from such clauses; so does the young child. The extraction from an "extraposed" clause has been addressed in a variety of ways, for instance Koster (1987) and Bayer (1990) introduce a notion of "domain extension" to account for the fact that this clause is accessible to movement.

Roeper and de Villiers (1992) propose that the child's complement clause is attached at a higher level than for the adult: it is not **syntactically** subcategorized by the verb though it is **thematically** governed by it. They propose that it is attached at a higher level than V, perhaps at the level of VP. As such, it is analogous to the German complement, namely not subcategorized to the right by the verb, but attached at a higher level. Thus for the child's grammar, the empty category in the lower clause is licensed by "thematic government", a weaker version of the ECP. Roeper and de Villiers offer the suggestion that only when this complement is syntactically subcategorized does the possibility arise for the empty category to become a trace under proper licensing by the ECP, consequently permitting the formation of successive cyclic chains. Hence the appearance of strict syntactic subcategorization should coincide with the disappearance of partial movement as an option for the child.

On behalf of this claim, Roeper and de Villiers put forward evidence from the child's spontaneous productions that suggests that all the features of syntactic subcategorization are not worked out immediately. Particular verbs set particular requirements on the form of their complements which are not necessarily respected by young children, for example (Roeper and de Villiers, 1992):

- 69) "did I seem that I was under the covers" (2 times)  
 "it's clear to hear" (2 times)  
 "..listening what you think"  
 "..listening what I whistled"  
 "I'm thinking why it's broken"

If these arguments are correct, and it must be admitted that they are controversial, then the Empty Category Principle may be formulated along different lines at the start, to accommodate the possibility of long distance movement in the presence of incompletely specified complement structures. Thus the presence of medial answers leads to a radical proposal about the nature of children's initial grammars, but they remain inside the domain of possibilities of Universal Grammar. Future work on German and other languages with this option may offer new understanding of child grammars in this regard.

### **Is there evidence for a Null Operator in child grammar?**

A subtle variant on the constraint on long distance interpretation comes from a consideration of the possibilities of another class of sentences discussed in the adult literature on *wh*-movement. A Null Operator occurs in adult language in certain sentences in which the CP position is c-commanded by an NP, and it in turn binds an empty category (not a trace), which forms a coindexed chain with that NP (Chomsky, 1977;1982):

- 70) Sam is hard to find a job for  
 71) Sam is hard [OP<sub>i</sub> PRO to find a job for e<sub>i</sub> ]

Given that children show sensitivity to the presence of a medial question as a barrier to adjunct long distance movement, questions then arise about other kinds of elements that could serve as barriers. The proposed existence of **null operators** raises the question: do children's grammars show sensitivity to null operators as barriers? Vainikka and Roeper (1992) tested the hypothesis that children would have access at this same age to an empty version of the *wh*-operator, an abstract (Null) Operator. How could one test whether children have a null operator in their grammars? The consequence of such a null operator filling the spec CP position is that it blocks *wh*-movement through that CP, just as an overt operator would:

Overt operator in medial CP:

72) \*How<sub>i</sub> did Sam say WHERE to fix the car t<sub>i</sub>?

Abstract/null operator in medial CP:

73) \*Where<sub>i</sub> did the boy buy it OP to splash on his face t<sub>i</sub>?

Notice that in both questions, the short-distance reading is available but the long distance reading is not. Vainikka and Roeper argued that if children project a null operator in such purpose clauses, they should restrict their interpretations of questions to the short distance readings. Remarkably, in a tightly controlled experiment, 3-6 year olds did so 98% of the time. The authors argue that before age 3, the evidence for abstract operators in children's spontaneous speech is more slim, and they tie the appearance of the operators to the full development of the CP (see Vainikka, 1992). After age 3, abundant use of purpose clauses begins, in which there is an empty category in the object position, coindexed with a moved NP. The assumption is that they also involve an empty operator to license the chain. Examples of these constructions are as follows:

(examples from Nina in CHILDES):

74) And the spaghetti for the dogs to eat (e)<sub>i</sub>.

This<sub>i</sub> is for the dog to eat (e)<sub>i</sub>.

He doesn't like nothing<sub>i</sub> to eat (e)<sub>i</sub>.

We don't have any more blocks<sub>i</sub> to make (e)<sub>i</sub>.

We could play with these and make a little horsie<sub>i</sub> to ride on (e)<sub>i</sub>.

### **Are there other restrictions on where wh-trace can appear in children's grammars?**

Other research on young children has uncovered obedience to a variety of constraints described for the adult language. However, it is not the case that constraints are automatically present from the earliest age. In some case, they depend on lexical acquisitions, or the establishment of some other grammatical feature, before they can be fixed. The picture is thus a more complex one than the claim that children know constraints from the beginning: the course of their appearance sheds light on other significant aspects of acquisition such as case, control, and the semantics of complementation. In this section, the interaction of restrictions on wh-trace and these other aspects of syntax will be discussed, but much work in this area is ongoing and the theories may not be fully resolved.

### a) Cases of obedience to constraints on wh-movement

In addition to the studies of wh-islands described above, children's grammars are sensitive to NP barriers, both nominalizations and relative clauses. Roeper and de Villiers (1991) showed that 3-5 year olds do not allow adjunct wh-questions to extract from nominalizations e.g.:

75) \*How<sub>i</sub> did the mother see his riding t<sub>i</sub>?

Interestingly, they readily allowed argument extraction:

76) Who<sub>i</sub> did the mother show his copying t<sub>i</sub>?

showing the same asymmetry in this regard as adult subjects tested in the same way. Following work by Otsu (1981), de Villiers and Roeper tested wh-extraction from relative clause environments, and showed that 3- 5 year old children very consistently block adjunct extraction from inside a relative clause:

77) \*How<sub>i</sub> did the woman who knitted t<sub>i</sub> swim?

Goodluck, Foley and Sedivy (1991) tested whether preschool children would extract from temporal adjunct clauses, another barrier for wh-questions in adult English. The children did block movement from true adjunct clauses such as temporal adjuncts

78) \*Who did the elephant ask before helping t<sub>i</sub>?

de Villiers and Plunkett (1992) explored children's obedience to a constraint known as "Superiority" (Chomsky,1981) and given various accounts theoretically (see Cheng & Demirdash,1990). It is designed to account for why certain orders of wh-questions are disallowed in sentences with more than one question, that is, certain questions seem to take priority over others in claiming the initial spec-CP slot:

79) Who slept where?  
\*Where did who sleep?

80) How will she make what?  
\*What will she make how?

In general, however, the phenomenon is incorporated into the theory as a consequence of the Empty Category Principle. Given children's general obedience to the ECP, do they obey Superiority? de Villiers and Plunkett set up an elicited production task in which the child had to confront a situation containing multiple unknowns, and after a couple of neutral models, persuaded children to ask what they needed to know to complete a scene being acted out with toys. On half of the trials, children were "led" by starting the sentence with the "wrong" wh-word, namely one that would result in a superiority violation. For instance, if the target were something like:

81) Who slept where?

The children might be prompted with:

82) "Where....?"

In this way they elicited 45 instances of "double" questions from seventeen 3-5 year olds, and in only one (dubious) case was superiority violated. The children strongly resisted being misled and instead turned the misprompted sentences around, or rephrased them:

83) "Where....?"  
"Where did this one and that one sleep?"

One child even stopped the experimenter in mid-prompt and said "It's better if I start"!

Other work has explored sensitivity to constraints using production methodology. In English, a constraint on subject extraction known as the "that-trace" filter disallows extraction from the subject position of a clause introduced by the complementizer "that":

84) \*Who<sub>i</sub> did the woman say that t<sub>i</sub> came?

However Thornton (1991) using elicited production tests found that preschool children did produce such forms. The children who did so were also prone to "copy" the wh-form:

85) What do you think that's in the box?  
What do you think what's in the box?

so she argued that the production is a byproduct of the requirement for explicit spec-head agreement, as described earlier. Thornton thus argues that the children are in fact producing these forms to preserve the ECP, not in violation of it.

However, earlier work by Phinney (1981) using a comprehension task did not discover many violations of "that-trace" in her subjects. Her task involved comprehension of a sentence such as:

86) Who did the pig see that swam?

If 92) is construed as having a trace following "that":

87) Who<sub>i</sub> did the pig see that t<sub>i</sub> swam

the sentence is a violation of the that-trace filter, but the child has an alternative of choosing a relative clause reading for the sentence:

88) Who<sub>i</sub> did the pig see t<sub>i</sub> [that swam]

The pictured story defined different referents for the two readings, but the children only rarely chose the reading (87) that would result from a violation. The younger children were most prone to treat it as the simple sentence "Who did the pig see?" So Phinney's evidence is in keeping with the notion that English children obey the "that-trace" filter. How this could be so is still somewhat mysterious. The "that-trace" effect is not universal- Greek, for example, lacks it - so it is not plausibly part of the child's default set of constraints. It must be triggered by some particular development elsewhere in the child's grammar. Leftheri (1991) in her study of wh-movement in Greek, and Perez -Leroux(1991) in her study of Spanish, found children of 3 to 5 years readily extract the subject from sentences with an explicit complementizer, just as adults allow in those languages.

But what gives the child the clue about her language? Surprisingly, children do not seem particularly attentive to meaning contrasts conveyed by the complementizer 'that' , and they are rather late in using it as a complementizer for sentences (de Villiers & Roeper, 1992; see also Bloom, Rispoli, Gartner & Hafitz, 1989). The trigger for "that-trace" must lie deeper than knowledge of the complementizer itself.

## **b) Apparent violations of constraints on wh-movement**

There are other striking cases of disobedience to constraints that are more troubling because the adult languages all agree that the questions are violations, so the solution does not rest on non-universality. For instance, take the phenomenon of extraction from quotations, or direct speech. The analysis of these forms is not completely certain syntactically: are they adjuncts, or do they involve some additional NP node? Nevertheless, the judgment that there is a barrier is very clear not just for English but for all the other languages tested:

89) \*How<sub>i</sub> did the boy say "can I come t<sub>i</sub>?"

Weissenborn, Roeper and de Villiers (1991) report experiments in three languages: English, French and German, in which young children aged 3-6 years were given short stories and then asked a question that tested whether they would allow extraction from inside a quotation environment. In each language the clues to the presence of the quotation were slightly different: in English, it was the presence of an inverted auxiliary:

90) \*How<sub>i</sub> did the boy say "Can the girl beat t<sub>i</sub> the drum?"

Compare:

91) How<sub>i</sub> did the boy say the girl can beat t<sub>i</sub> the drum?

In French, the clue was the absence of the complementizer 'que' (that), which is obligatory for indirect speech:

92) \*Comment<sub>i</sub> est-ce que le garçon a dit "La jeune fille va jouer t<sub>i</sub> du tambour"  
[how did the boy say \_\_ "The young girl will beat the drum \_\_"]

Compare:

93) Comment est-ce que le garçon a dit que la jeune fille va jouer t<sub>i</sub> du tambour?

In German, the clue was given by difference in "verb-second" in the lower clause, an interesting contrast with the English case. In German, the auxiliary verb kann must be in second position with respect to some other element, in this case the NP das madchen, hence a trace is not possible from within the quotation:

- 94) \*Wie<sub>i</sub> sagt der Junge "Das Mädchen kann trommeln t<sub>i</sub>?  
 [how does the boy say \_\_ "The girl can beat the drum \_\_\_\_"]

In a non-quotation environment, kann is in second position relative to the trace of the long distance movement. Compare:

- 95) Wie<sub>i</sub> sagt der Junge [t<sub>i</sub> kann das Mädchen trommeln t<sub>i</sub>?]

Children showed the same phenomenon in all three languages: they allowed extraction of the adjunct question freely from the quotation environments, in clear contradiction of the adult grammars. Once again, it may be necessary to invoke the difficulty that young children have in properly identifying the level of attachment of these clauses, which admittedly rests on rather fragile clues. No research has yet explored the age at which this is mastered, however there is suggestive evidence that 4 year olds may not have full command of quotation. For example, a study by de Villiers and Roeper (1991) on pronoun interpretation with children in the same age range found a significant group of children who allowed coreference in acting out the sentence:

- 96) \*"He<sub>i</sub> can sit here" said Micky<sub>i</sub>

The inverted verb in such a sentence requires that the complement be a quotation for an adult, but some 4-5 year old children did not regard that as a restriction on their interpretations of the pronoun reference.

Roeper and de Villiers (1992) argue that children's command of the right level at which to attach complements is not completed by age 4 or so, and furthermore, primarily because of the idiosyncratic nature of complements both within and across languages. In English, it is necessary to learn for each verb what kind of complementizer it takes, and for each verb class, what complements are allowed. Hence there is considerable lexical learning that must proceed before some of these syntactic decisions can be made.

Furthermore, some semantic/conceptual acquisition is required to understand the meaning of complements, which usually involve verbs of mental activity or communication. For instance, de Villiers, Sherrard and Fretwell (1992) tested three and four year olds on questions involving structures such as (103). Consider a typical story from their task:

This mom sneaked out late one night and bought a birthday cake for her little girl. When the little girl saw the bag from the store, she asked "What did you buy?" The mom wanted the cake to be a surprise, so she said, "Oh, just some paper towels!"

97) What did the mother say she bought?

The three year olds were strikingly prone to answer "cake", apparently ignoring the matrix clause. By four, more children answered "paper towels", sometimes adding "but she lied"! de Villiers et al (1992) demonstrated experimentally that this changeover to consideration of the meaning added by the matrix clause occurs at exactly the point in time where the same children master traditional "false belief" tasks (Leslie, 1987; Wellman, 1990; Wimmer & Perner, 1983). That is, the 3-year old children but not the four year olds also failed on a task that involved taking into account another person's perspective and knowledge, suggesting that cognitive development may be interacting with the acquisition of the complement's meaning. The latter task was relatively independent of linguistic complement meaning. For example, the child were told the following story, which was also acted out in front of them:

"This bunny rabbit bought a nice carrot, and he decided to put it in this RED basket to eat later. Then he went out to play. While he was out, the mother bunny rabbit took the carrot out of the red basket and grated some of it into a cake. Then she put it back, but she put it in the BLUE basket, see? Then she went to borrow a cake pan. While she was gone, the little bunny rabbit comes back inside and he's hungry, so he decides to have some carrot to eat. "

98) Where does the little bunny look for the carrot?

The same three year olds who answered "cake" to question (97) above, answered "the blue basket" given the above scenario and (98), neglecting the difference between reality and the content of the protagonist's speech or knowledge. Of course, there is a classic chicken-and-egg problem here: does linguistic development drive cognitive development, or vice-versa? That is, the child could know the meaning of the complement, but must master the way that it changes dependent on particular matrix verbs. Presumably this is dependent upon developing the concept of how other minds could be different from one's own. Yet is it not possible that exposure to such linguistic differences could spur the child to that discovery?

In another set of studies, extensive exploration of children's understanding of the inferences possible with factive verbs by Philip and de Villiers (1992a,b) has revealed that 4 year

olds make different inferences than do adults. For instance, upon being told in the context of a story that:

Jim forgot that his aunt was arriving by train, so he went to the bus station to pick her up.

when asked:

99) Did Jim forget that his aunt was coming?

four year olds answer confidently "yes!" The particular feature that such a sentence manifests is the feature of being non-monotonic increasing, that is, with most ordinary sentences the inference from one statement to the other works out fine. Compare:

100) Jim said that his aunt was coming by train.

101) Did Jim say his aunt was coming?- the answer is yes.

The sentence (100) has the property of being monotonic increasing, that is, one can make an inference from the subset of events described by (100) to the larger set described by (101). However, certain elements create environments in which the inference is not allowed:

Negation:

102) Jim didn't say his aunt was coming by train

103) Did Jim say his aunt was coming?- unclear.

Factives:

104) Jim forgot his aunt was coming by train

105) Did Jim forget his aunt was coming?- unclear.

Quantificational adverbs:

106) Jim often eats grapes with a fork.

107) Does Jim often eat grapes?- unclear.

Philip and deVilliers reported that children succeed at these inferences at different points in acquisition, and it is only once they succeed at these inferences that their grammars change in other ways. Szabolsci and Zwarts (1990,1992) suggested that it was precisely this feature of "not being monotone increasing" that creates so-called "weak islands" for wh-movement in adult grammars.

So, notice that negation, factive verbs, and adverbs all block long distance interpretation of the wh-question:

108) \*Why<sub>i</sub> did Jim forget his aunt was coming t<sub>i</sub>?

[Note: the reading: "because he lost his diary" is fine, but "to go to the Bar Mitzvah" is disallowed]

109) \* Why<sub>i</sub> did Jim not say his aunt was coming t<sub>i</sub>?

110) \* Why<sub>i</sub> did Jim often say he liked jazz t<sub>i</sub>?

Philip and de Villiers (1992a,b) tested the hypothesis that children would fail to perceive the barrierhood of these elements as long as they also failed on the inference tasks, and the evidence was generally in support. They included the standard case of wh-islands (de Villiers et al, 1990) in their design, and proved that the same children who ignored the weak islands created by this semantic factor, were still strikingly obedient to the wh-island, that is, they never allowed long distance readings for a sentence such as:

111) Why did the mother ask what he made t?

Thus, they argue that child language data provides evidence for two factors in the barriers to wh-islands, one semantic and one syntactic, because they disassociate in acquisition.

One final result from our work also concerns a lexical difference for complement attachment, and reveals the fruitfulness of exploring interlinked phenomena in the area of complementation. The case is an intriguing one, and we do not pretend that the syntax is completely worked out. Boyd (1992) discusses the differences between the superficially similar sentences:

112) The boy made a decision to play

113) The boy liked the decision to play

The difference between the sentences with verbs like "make " and verbs like "like" are several-fold:

There are different referents for the "empty" subject ( PRO) in the infinitive, in the sense that *make the decision* allows the subject to be the same as in the matrix clause, but *like the decision* lets it be arbitrary in reference:

- 114) The boy<sub>i</sub> made the decision PRO<sub>i</sub> to play  
 115) The boy liked the decision PRO<sub>arb</sub> to play

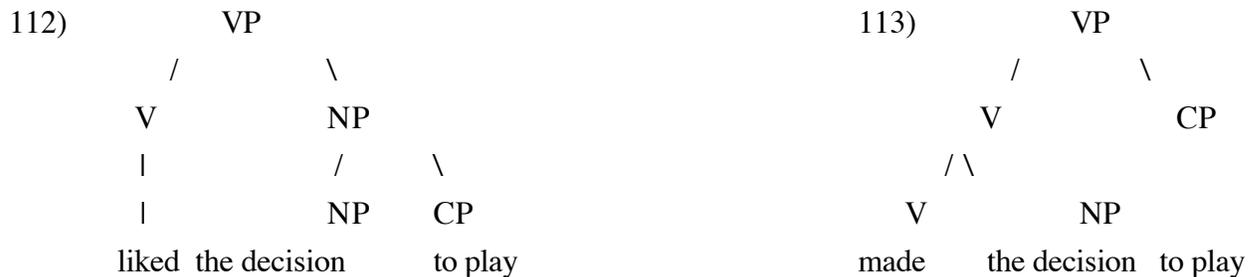
Long distance Wh-movement is different:

- 116) When<sub>i</sub> did the boy make the decision to play t<sub>i</sub>?  
 117) \*When<sub>i</sub> did the boy like the decision to play t<sub>i</sub>?

Binding is different for a pronoun in the scope of the infinitive:

- 118) \*The boy<sub>i</sub> made the decision to shave him<sub>i</sub>  
 119) The boy<sub>i</sub> made the decision to shave himself<sub>i</sub>  
 120) The boy<sub>i</sub> liked the decision to shave him<sub>i</sub>  
 121) \*The boy<sub>i</sub> liked the decision to shave himself<sub>i</sub>

A full linguistic account of these facts is still tentative, but several reasonable proposals can be advanced. One is that the noun incorporates into a complex verb in the case of "make the decision" but not in the case of "like the decision". Consider the difference roughly as follows:



As a consequence, the phrase "to play" is either a regular infinitival complement of the resulting complex verb, or not. When it is, then wh-movement is possible through the intermediate spec of CP. When it is not, then wh-movement is impossible because the CP is embedded in the complex NP, "decision to play". When PRO is controlled by the verb and coreferent with the subject, a pronoun in the lower clause cannot be coreferent with the subject without violating Principle B of the binding conditions. When PRO is arbitrary, the pronoun can corefer with the subject of the matrix verb.

Just what it means for something to become a "complex verb" is enormously complex, but the account is not completely necessary to the present purposes (see de Villiers and Roeper, forthcoming). For the present, assume that the structures are quite distinct for "like the decision" and "make the decision". If children take time to learn the subcategorization frames for particular verbs, they may at first make no distinction between verbs like "make" and verbs like "like". If the default is to allow long distance movement wherever there exists thematic government regardless of syntactic subcategorization (Roeper and de Villiers, 1992) and the verbs in question: make, like, choose- are complement taking verbs, the children should allow long distance movement to occur for both types of verbs.

In the binding domain, the default assumption of children in this age range seems to be to a failure of Principle B, i.e. to treat pronouns as if they can corefer in the same way as reflexives (Wexler & Chien, 1986; Jacobowicz, 1984). Hence for both types of verbs, the reflexive interpretation should be allowed, if not preferred. However, the following prediction relates these facts together. When children learn the difference between the structures for "make" and the structure for "like", then there should be two consequences:

i) They should disallow coreferential readings for the sentence:

122) \*Bert<sub>i</sub> made a decision to shave him<sub>i</sub>

but allow them still for:

123) Bert<sub>i</sub> liked the decision to shave him<sub>i</sub>.

ii) They should disallow long distance readings for the non-controlling verb case:

124) \*When<sub>i</sub> did the boy like the decision to play t<sub>i</sub>?

while allowing them still for the case:

125) When<sub>i</sub> did the boy make the decision to play t<sub>i</sub>?

To test this prediction, de Villiers, Roeper, Mitsui and Hallahan (1992) gave 4-5 year children two tests: one to explore their wh-movement across the different verb-control types, and one to test their binding of pronouns in the same structures. About half of the children allowed long distance movement with cases such as:

126) \*When<sub>i</sub> did the boy like the decision to play t<sub>i</sub>?

and about half of the children allowed coreference for the case:

127) \*Bert<sub>i</sub> made a decision to shave him<sub>i</sub>

Studying the two groups formed on the basis of their answers on the binding task, the evidence that emerged was in support of the predictions, namely, only children who passed the test of binding differentiated the structures in terms of their wh-movement possibilities. Thus the acquisition of the appropriate barrier to wh-movement rested again on acquisition involving other parts of the grammar, in this case, the acquisition of control into different types of complements.

A similar account involving the acquisition of exceptional case marking is detailed in Roeper and de Villiers (1991).

What, then, do these cases of barrier violations have in common? Children apparently respect the barriers of medial wh-questions, empty Operators, NP maximal projections and temporal adjuncts. However children in the same age range of 4 to 6 do not obey the barrierhood of quotation, factivity, and non-controlling verbs. In each of these cases, other evidence can be adduced that the children fail to control some significant semantic/syntactic phenomena associated with the complement type at issue. For instance, with quotation, they are not in full control of the pronoun coreference properties that distinguish direct and indirect speech. With factives, they differ from adults in their presuppositions and their inferences. With non-controlling verbs, they fail to respect the binding principles for pronouns. It is thus tempting to argue that these problems have a common source; the child at 4 years or even later has still a considerable number of subtle properties about complementation to fix. In many cases, the fixing may be delayed by idiosyncratic properties of the complement system involving lexical learning, learning that necessarily takes sufficient exposure to the language. In other cases it is possible that the development is delayed pending certain cognitive developments, say those included under the concept of "theory of mind", or the capacity to handle asymmetric inferences. The precise way in which these factors impact on the development of a mature wh-question is being actively researched.

## Discussion

It is difficult to see how the child could begin with a fully worked out inventory of empty categories, given that there is some parametric variation across languages. With respect to wh-

questions, the nature of the empty category in the beginning is still controversial, but it may not have precisely the features (-p,-a,+v) of wh-trace in the adult language. That determination might wait upon the right analysis of the wh-questions as involving movement, and the establishment of the landing site in spec-CP. Nevertheless, the empty category associated with wh-questions in 4 year olds' grammar does seem to have associated the quantificational properties of a true question, the requisite blocking effects on phonological phenomena such as contraction, and it appears to obey the empty category principle, a principle held to apply to non-pronominal empty categories.

However, acquiring the full grammar of questions in English and other language is seen to interact with many other features as well as the process of lexical learning during childhood. Complexity is necessarily introduced by the problem of assigning the right analysis to the complement, which is ambiguous in multiple ways. The child must determine its level of attachment, the control features that may be transferred by the verb, the possibility of exceptional case marking, its monotonicity properties and factivity. All of these aspects require time to learn, and it is only when these features are securely fixed that a final determination of barrierhood can be made. Until that time, a weaker version of the empty category principle may be in operation, one that does not depend on strict syntactic subcategorization. This "thematic government" may be all that the child requires to license the appearance of an empty category in the embedded clause linked to a wh-question. Whether the empty category is at this point entirely equivalent to the adult wh-trace is a research question of considerable current interest.