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Some Preliminary Thoughts on the Acquisition of the Syntax and Semantics of *wh*-Constructions

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This note discusses the basic properties of *wh*-constructions, especially multiple *wh*-constructions in English, focusing on the *functional* nature of *wh*-phrases in natural language. With this as backgrounds, we will examine the findings of Roeper and deVilliers' (1991) study of the acquisition of *wh*-questions. It will be claimed that Roeper and deVilliers' findings can be taken as evidence that young children initially interpret *wh*-phrases as the universal quantifier, or some strong determiner in the sense of Milsark (1974). It will be further claimed that this strategy makes the acquisition of *wh*-constructions, especially multiple *wh*-constructions, easier.

1. Introduction

The purpose of the present article is to consider, in a rather preliminary way, syntactic and semantic properties of constructions involving *wh*-phrases and their implication to the theory of language acquisition. In particular, our focus will be on sentences involving (i) quantifier–*wh* interactions, and (ii) multiple occurrences of *wh*-phrases. Each of these is exemplified by the following.

(1) a. Who did everyone pull?

    b. Who pulled everyone?

(2) Who pulled who(m)?

The observation that has been made about these sentences is the following:

1. Sentences (1a) and (2) can be interpreted as having the pair-list interpretation, so that both can be answered by supplying pairs of individuals related by the predicate:

    (3) John pulled Max, Mary pulled Brandy, ...

2. Sentence (1b) does not have a pair-list interpretation, and it can only be answered by mentioning an individual:

    (4) John did.

3. Sentence (1a) allows a functional interpretation such as the following.

    (5) (Everyone pulled) their favorite dog.

    This is supposed to be true of (2) as well. We will turn to this issue below.

On the functional interpretation of a *wh*-question, the value of the *wh*-phrase is filled in by supplying a function that defines the relation involving the individuals. For detailed discussion, cf. Engdahl (1986), Chierchia (1992–3), Hornstein (1995), etc.

In this article, we will consider the issues raised by these phenomena in connection with language acquisition. In particular, we will reconsider the findings of Roeper and de Villiers (1991) on the children's interpretation of sentences involving *wh*-phrases and quantifiers from the perspective of the current theory exploring the interface between syntactic structure and semantic interpretation.

One specific issue that we would like to raise in the present article has to do with the insight expressed in several works in the current literature that *wh*-phrases occurring in multiple *wh*-constructions have distinct properties. Discussion in the following section will make this point specific.

2.   Nature of Multiple *wh* Questions

Comorovski (1996) points out two important properties of the first *wh* phrase in a multiple *wh* question, or the 'referentially independent' *wh* phrase in her terminology. The idea underlying this term is that, given two *wh*-phrases in a single sentence, one *wh*-phrase is referentially dependent on the other — in most cases it is the second *wh*-phrase that is dependent, and the dependence is on the first *wh*-phrase, hence the first one is referentially independent.

Now the properties that Comorovski ascribes to the referentially independent *wh* phrase are the following:[1]

    i. it has universal force

    ii. it must be d(iscourse)-linked

The first point is supported by at least two pieces of evidence. One is that a multiple *wh* question naturally awaits a pair-list answer. Recall our discussion above that a *wh* question involving a universal quantifier allowed both a functional answer and a pair-list answer. In contrast, a *wh* question with a non-universal quantifier allows only a functional answer.

(6) a. Who did most children feed?

     b. They fed their favorite dogs.

     c. *John fed Max, Mary fed Brandy, . . .

Answer (6c), a pair-list answer, is inappropriate to (6a) involving a non-universal quantifier *most*, while the functional answer (6b) is a possible answer to it. Thus, a multiple *wh* question shares this property of a *wh* question with a universal quantifier — this much constitutes one piece of evidence. Further, Comorovski (p.46 and elsewhere) observes that a multiple *wh* question allows, not only pair-list answers, but also functional answers:

(7) Q: Which student got back which paper?

     A: Every student got back his syntax paper.

Although Comorovski does not confirm this point herself, it must be a universal quantifier that matches the first *wh* phrase in the answer — no other quantifier belongs here:

(8) Q: Which student got back which paper?

     A: *Most students got back their syntax papers.

Thus, the claim that the first *wh* in a multiple *wh* question *is* a universal quantifier receives empirical support.

The second property that Comorovski ascribes to the first *wh* in a multiple *wh* question is d-linking. Comorovski cites the following examples from Bolinger (1978) to illustrate the point.

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[1]Hornstein (1995) makes the same claim to account for the fact that multiple *wh* questions anticipate pair-list answers.

(9) a. It's nice to have all those times scheduled, but when are you doing what?
        (#But what are you doing when?)

     b. It's nice to have all those activities ahead of you, but what are you doing
        when? (#But when are you doing what?)

In both of these examples, the first conjunct introduces the range of value for the first
wh in the well-formed multiple *wh* question that follows. If the pattern is broken as
in the examples in the parentheses, the resulting multiple *wh* question turns out to be
bizarre.

    The situation will be more complex if we take into account such inherently d-linked
wh phrases as *which* and *dore, dono* 'which' in Japanese, but the point is firm that the
first *wh* phrase in a multiple *wh* question must be d-linked.[2]

3. LF Mechanism

A way of incorporating the ideas and observations expressed by Comorovski (1995)
lies in the theory of LF-representation presented and developed by Chierchia (1991,
1992–3) and Hornstein (1995). These authors propose that a multiple *wh* question and
a *wh*-question involving a quantifier should be analyzed in LF schematically in the
following way:

(10) Wh_1 ... $[e_1 \text{ N}]$ ...
      'Generator'   'functional element'

The first *wh*-phrase serves as the 'generator', a quantifier that defines the domain of
quantification relevant to the binding relation. More specifically, Chierchia and Horn-
stein claim that the generator, in the case of multiple *wh*-constructions, has to be a
universal quantifier.

    The second *wh*-phrase serves as a 'functional element', which contains an empty
category that is bound by the generator. Nishigauchi (1997) discusses the nature of this
empty category and concludes that it should be identified as a bound pronominal.

    Along this line, the LF-representation of (2) is (11).

(2) Who pulled who(m)?

(11) Who_1 pulled $[e_1 \text{ person}]$

This is well-formed as an LF that represents a functional interpretation (and a pair-list
interpretation) of the sentence in question, since the empty category contained in the
functional element is bound by the generator.

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[2]Comorovski (1995, 114) presents an example of English where word-order is overridden by the inher-
ently d-linked character of *which*.

4.   The Implication for Language Acquisition

The theoretical framework described in the previous section suggests that *wh*-phrases are heterogeneous in character: they have distinct functions in terms of the relative positions within the sentence. This poses an intriguing question in the theory of language acquisition: does this heterogeneous nature of *wh*-phrases cause additional difficulty for language acquisition?

To be more specific, the task for language acquisition in the relevant area can be spelled out in such a way that the child must have attained the knowledge about multiple *wh* questions at least with respect to the following in order for his/her grammar to be identified with the adult grammar.

(12)   1. The first *wh* (wh_1) serves as the generator, which has the quantificational force of the universal quantifier.

2. The second *wh* (wh_2) serves as a functional expression, with an empty category within it.

3. The empty category within wh_2 must be bound by the generator (wh_1, a strong quantifier, or its trace). If the c-command requirement fails, the violation is taken to be a case of Weak Crossover (WCO). Much of the Superiority effects, for which there have been attempts to subsume the relevant violations under a variety of syntactic principles such as ECP, follows from WCO in this approach. Cf. Hornstein (1995), Comorovski (1996).

4. The binding of the empty category within the functional expression is highly local. This takes place, most preferably within a single clause (the 'clausemate' condition). Cf. Nishigauchi (1997, section 4.1).

Our concern here is whether all of these ingredients are present at early stages of language acquisition. If it is unlikely that all are present at the very beginning, how does the child grammar differ from the adult grammar with respect to the relevant linguistic phenomena? The experimental research conducted by Roeper and de Villiers (1991) (RdV hereafter) provides relevant data in this line of consideration. In the next section, we will review RdV's findings and consider how those findings can be interpreted in the light of the approach to *wh* constructions outlined above.

5.   Roeper and de Villiers (1991)

RdV conducted a series of experimental studies on the acquisition of *wh* constructions. In the first set of studies, they explored children's answers to double *wh*-questions such as:

(13) Who ate which fruit?

and they tried contrasting this with the following questions.

(14) a. Who ate fruit?

      b. The family ate what?

Of these, (13) is distinguished from the sentences in (14) in that it requires the exhaustive pair-list answers. Sentence (14a) can be answered by providing a list, but it is not required. Sentence (14b) calls for a literal repeat of the questioned word.

RdV's result was that by age 4, the paired exhaustive interpretation is well-established. In their experiment, 78.1% of the children of age 4–6 gave this type of interpretation to the double *wh* question (13). RdV's conclusion about this type of sentence is that by age 4, the children have made a clear syntactic connection: the double-question structure must have a bound-variable reading.

Thus, it appears as though children by age four have the generator-functional structure as an LF for multiple *wh* constructions, just as in the adult grammar. However, they observe a somewhat curious fact in the result obtained: the list interpretation (their 'BV (=bound variable) response) occurred as one of the most frequent responses to a single *wh*-question, where adults would usually answer just the subject or object. To the sentence type (14a), 57.1% of the children aged 2–3.11 years gave a list-interpretation, and 32% of the older children aged 4–6 years showed the same response. From these observations, RdV conclude that 'when the BV reading is present, it is overgeneralized to contexts where it is, at least, pragmatically **unnecessary** for adults.' (p.233) The puzzle, of course, is 'why do they extend the BV reading to cases where it is not obligatory (even if they are not ungrammatical)?' (*ibid.*)

RdV proceed to examining whether the child grammar distinguishes the sentences which allow the list interpretation from those which do not. For this purpose, they chose to see if children appreciate the contrast between (1a–b), which we repeat below.

(15) a. Who did everyone pull?

      b. Who pulled everyone?

If the child grammar were like the adult grammar, children would get the list interpretation for (15a) but not for (15b). RdV explored this contrast with several groups of children at the 3–4 year old range, varying the stimuli and the preamble (stories) in certain ways.

Their discovery was that the BV interpretation was overgeneralized here again. Of the 16 children aged 3.2 to 5.4, 72.9% got the BV interpretation for (15a) and 69.1% got the same interpretation for (15b).

Faced with these results, RdV consider various ways to account for the peculiar behavior of the child grammar with respect to *wh* constructions. In what follows, we will discuss the properties of the child grammar in the relevant area, as exhibited by the experimental studies of RdV, in the light of the current theory of logical representation, some aspects of which we described in the previous section.

6.   The Hypothesis

In section 4., we pointed out the following ingredients that must be part of the linguistic knowledge relevant to multiple *wh* constructions and *wh* constructions involving quantifiers. We repeat the statement here.

(16)   1. The first *wh* (wh_1) serves as the generator, which has the quantificational force of the universal quantifier.
2. The second *wh* (wh_2) serves as a functional expression, with an empty category within it.
3. The empty category within wh_2 must be bound by the generator (wh_1, a strong quantifier, or its trace). If the c-command requirement fails, the violation is taken to be a case of Weak Crossover (WCO). Much of the Superiority effects, for which there have been attempts to subsume the relevant violations under a variety of syntactic principles such as ECP, follows from WCO in this approach.
4. The binding of the empty category within the functional expression is highly local. This takes place, most preferably within a single clause (the 'clausemate' condition).

We have little to say about (16–4) in the present discussion. The point (16–3) is relevant to RdV's observation, which we saw in the previous section, that there was no contrast between (15a–b) in child grammar. This point, in and of itself, is actually a complex consisting of a number of theoretical ingredients. The following is a list, by no means intended to be exhaustive, of such ingredients.

1. Sensitivity to c-command.

2. Sensitivity to WCO, which is itself a complex of a number of factors.

3. The roles that *wh* and quantifiers play with respect to the generator–functional structure in LF.

Each of these is a research topic which requires careful scrutiny, and it is beyond the scope of this paper to consider all of them, even in a cursory way.

In the present discussion, we focus on the point 3 of this list, which is (16–1) and (16–2). The hypothesis that I would like to suggest here is that the child grammar is insensitive to the heterogeneous character of *wh*-phrases. More specifically, I suggest the following hypothesis:

- All *wh*-phrases are generators in child grammar.

where, by child grammar I mean the stage of linguistic development described by RdV's work. While I do not intend to provide any comprehensive theory of the phenomena under consideration, I am going to show that this supposition is at least not incompatible with the following facts observed by RdV.

1. Overgeneralization of the list interpretation.

2. The absence of the quantifier-*wh* asymmetry.

In what follows, we will consider each of these in turn.

6.1 Overgeneralization of the list interpretation

First, I would like to suggest that our hypothesis is compatible with RdV's observation that the child grammar that they examined had a curious tendency to overgeneralize the list-interpretation to cases of *wh*-constructions where it is not required.

Suppose that the meaning of *wh*-phrases is essentially a universal quantifier. Then the meaning of sentences like *Who ate fruit?* would be something close to the following in the child grammar.

(17) Everybody ate fruit — who are they?

Then, as long as the concept of listing is associated with the semantics of *every* in the child grammar, it comes as no surprise that children would answer the question sentence under consideration by providing a list.

Furthermore, this is also compatible with RdV's observation that what they call 'generic response' by age four was established for the single questions — by 'generic responses' they mean answers like *The family ate fruit* to the same *wh* question.

In RdV's study, 35% of children aged 4–6 gave this type of answer to *Who ate fruit?* and 33.3% of these children gave the same type of answer to *The family ate what?* Curiously, none of the children of the younger age group (2–3.11) showed this response.

As long as the universal quantifier is associated with the notion of the group, the 'generic response' can be considered as a realization of the group expression. It is not easy to make sense of the fact that the 'generic responses' were limited to the relatively older children, but if we consider the group expression as an abbreviation

of the individual expressions, we could interpret the abbreviation as a mental activity requiring some level of maturation.

6.2 The absence of the quantifier-*wh* asymmetry

Our hypothesis that all *wh*-phrases are generators naturally expects that there will be no contrast between (15a–b), repeated here.

(18) a. Who did everyone pull?

b. Who pulled everyone?

Under our hypothesis, both of these are understood by the children as synonymous with the following.

(19) Everyone pulled everyone. (Who were they?)

The semantics of this sentence in adult grammar is in fact quite complex, and its interpretation in the child grammar would be different from that — to this, we will turn shortly. The point here is simply that this interpretation is compatible with the list-interpretation given to both (18a–b) in the child grammar. More specifically, the fact that the list-interpretation is given to (18a) does not warrant the generator-functional structure in the child grammar. Rather, it is more likely that the list-interpretation associated with this sentence is a result of a wrong structure which happens to be compatible with it.

7. The Implications

In the discussion so far, we have presented the hypothesis that *wh*-phrases in child grammar are generators, having the universal force, everywhere. This poses an interesting question. Given the heterogeneous nature of *wh*-phrases, why do children start out assuming that *wh*-phrases are universal quantifiers? In fact, it has been traditionally acknowledged, since the seminal work of Karttunen (1977) among others, that the quantificational force of the *wh*-phrase is existential.

One possible line of reasoning lies in the ease of learning: which is easier for children to learn, to learn that some *wh*'s are existential (with the initial knowledge that they are universal), or to learn that some *wh*'s are universal (with the initial knowledge that they are existential)? My conjecture is that it is much easier to learn that some (in fact, most) *wh*-phrases are existential, with the initial assumption that *wh*'s are universal. In the first place, the data suggesting that are abundant. If the child starts out assuming that *wh*'s are universal, a single conversation where a *wh*-question is answered by supplying just one individual as a value to it would be sufficient to

correct his/her assumption, provided, of course, that the child has developed sufficient pragmatics (not logical semantics) in such a way that the child knows that a felicitous conversation requires that a universal quantifier is associated with a list of individuals/objects. And such conversations are heard frequently in daily life.

In contrast, multiple *wh*-questions are not so commonly heard as questions with a single *wh*. Furthermore, if one is lucky to hear such sentences, it is not clear what would make the child realize that universal quantification is involved. The fact that the multiple *wh* question is answered list-wise does not directly lead to the realization of universal quantification.

The interpretation of (18) as (19) is consistent with the observations made in the literature on *quantifier-spreading* in child language (cf. Aurelio and Philip (1991), Philip and Takahashi (1991), etc., as well as RdV):

(20) **Quantifier-Spreading**:
     A quantifier attached to one NP applies to all NP's in a clause.

This phenomenon is illustrated by children's response to questions such as:

(21) Does every boy have a milkshake?

where every boy in the picture has a milkshake but there is one milkshake not taken by anybody. While the adult response to this sentence in the given context would be in the positive, what Philip and Aurelio (1991) discovered was that 74% of the time children between 2 to 5 years responded, "Not this one," while pointed at the extra milkshake. This phenomenon has been taken by the researchers to mean that the quantificational force of the indefinite NP is determined by that of *every boy*.

Our conjecture on multiple *wh* constructions is consistent with this phenomenon, although it is not clear at this point whether one of the *wh*'s has universal force because the other one has universal force or both of them are universal from the outset.

One other question which is left totally unanswered is what kind of trigger is available to let the children know that the second *wh* in multiple *wh* constructions is a functional element. It is not only existential in its quantificational force, but, if the theory outlined in section 3 is on the right track, it must contain an empty category, whose property is identified as bound pronominal. But this problem lies in the same direction as the one facing the quantifier-spreading phenomenon: how do children stop spreading the quantifier and come to have the adult grammar of quantification?

8.   *wh*-Constructions in Japanese

As has been discussed by Nishigauchi (1990, 1991, 1999), *wh*-phrases in Japanese function not just as interrogative pronominal elements but also as (part of) quantificational expressions, as can be seen in examples such as:

(22) a. Dāre-mo-ga ki-ta.
              -Nom came
          'Everyone came.

      b. Dare-mo ko   na-ka-ta.
                     come not-Past
          'Nobody came.'

The particle *mo* yields two outputs combining with *dare* 'who': *dāre-mo*, with accent on the first mora, is a universal quantifier, while *dare-mo* with no accent is a negative polarity indefinite.

Nishigauchi (1990, 1991, 1999), inspired by work of Kuroda (1965), discusses the 'discontinuous' construction involving the *wh*-phrase and the 'quantificational particle' (QPt) *mo*.

(23) Dare-ga   ki-te mo, hookoku si-te kudasai.
      who -Nom come QPt report   do   please
      'For all *x*, if *x* comes in, please report that to me.'

The speaker of this sentence is requesting that every visitor should be reported. The *wh*-phrase here, thus, is inducing universal quantification in collaboration with the QPt *mo*.

These facts indicate that children learning to speak Japanese must come to know at some point that *wh*-phrases in Japanese have multiple functions — or to be more precise, they do not have their own inherent meanings, their meaning in particular contexts being determined by some quantificational elements that occur with them in the given construction.

Sumiyoshi (1995) conducted an experimental study on Japanese children's acquisition of quantification involving universal quantifiers, based on such example sentences as:

(24) a. Kitune-wa minna baggu-o mot-teru?
          fox-Top   all   bag-Acc have-be
          'Do all foxes have a bag?

      b. Dono kitune-mo baggu-o mot-teru?
          which fox-Q   bag-Acc have-be
          'Do all foxes have a bag?

Sumiyoshi's findings have two important points to notice:

1. Given a context in which all foxes have a bag while, in addition to the foxes, there were some irrelevant agents such as elephants which do not carry bags, children's judgement was affected by the presence of the irrelevant agents, which made the children judge the given sentences as being false while the adult judgment of the same sentence in the same context would be expected to be as being true.

2. Quite a few children interpreted (24b) as a *wh*-question, giving an answer such as 'This one has a bag', pointing to one or all of the foxes.

The first of these is in support of the 'Quantifier-Spreading' phenomenon that we observed in the previous section.

The second of these points is probably specific to Japanese. One way of looking at it may be to say that it is contradictory to what we have been saying about children's acquisition of *wh*-constructions based on English data, for here children are seen to be overgeneralizing the interrogative force of the *wh*-phrase when it has a universal force.

There may be other ways of looking at the same point: Here also some of the children who interpreted the *wh*-phrase in (24b) as an interrogative pronominal still appear to stick to the exhaustive listing of the individuals conforming to the question — this aspect of the matter is quite reminiscent of RdV's findings.

So, nothing conclusive can be said at this point about our understanding of Japanese children's acquisition of quantificational and *wh*-constructions. Nevertheless, the connection between the semantics of *wh*-constructions and universal quantification is an important topic, not just in the theoretical approach to the problem area, it poses a number of interesting questions to the acquisition of the syntax and semantics.

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