

**UNIQUENESS AND BIJECTION IN WH CONSTRUCTIONS\***  
Veneeta Srivastav  
Rutgers University

**SECTION 1: INTRODUCTION**

I want to focus in this paper on the fact that questions with one wh NP of the form "which N" have a uniqueness implication while those with more than one such NP allow for a bijective reading. The relevant examples are given in (1):

- (1)a. Which girl saw John?  
b. Which girl saw which boy?

An appropriate answer to (1a) should name only a single girl while an appropriate answer to (1b) can list pairs of girls and boys, as long as each girl who saw a boy saw a unique boy and each boy who was seen by a girl was seen by a unique girl. The fact that (1a) allows only for a unique reading is generally accepted; the fact that (1b) allows for multiple pairings is also uncontroversial but there is some disagreement whether the pairings have to be bijective. I'll follow Higginbotham and May (1981) in taking (1b) to have a bijective reading. While this distinction between single and multiple wh questions has been previously accounted for, namely by Higginbotham and May, it has not been captured within propositional theories of questions, such as Karttunen (1977), Groenendijk and Stokhof (1984) and Engdahl (1986). In this paper I'll show first that by introducing a simple modification it becomes possible to account for this distinction within a propositional theory of questions, such as

---

\* I am indebted to Gennaro Chierchia and Fred Landman for discussion. I would also like to thank the audiences at WCCFL X, where section 5 of this paper was presented, and SALT I for helpful comments. The responsibility for all errors, naturally, is mine.

Karttunen's. I'll then show that the proposed modification has other empirical payoffs as well.

## SECTION 2: BACKGROUND

Let me begin by demonstrating that the phenomenon under discussion remains elusive within standard propositional theories. Karttunen (1977), for example, takes a question to denote the set of propositions which jointly constitute the complete true answer to that question. (1a) and (1b), on his account, denote (2a) and (2b) respectively.

- (2)a.  $\lambda p \exists x [\text{girl}'(x) \ \& \ 'p \ \& \ p = \text{^saw}'(x, j)]$   
 b.  $\lambda p \exists x \exists y [\text{girl}'(x) \ \& \ \text{boy}'(y) \ \& \ 'p \ \& \ p = \text{^saw}'(x, y)]$

Consider (2a) first. In a situation where Mary saw John, this allows the proposition  $\text{^saw}'(\text{mary}, \text{john})$  and prevents the proposition  $\text{^saw}'(\text{bill}, \text{john})$  from being in the denotation of the question. However, it will not prevent another proposition  $\text{^saw}'(\text{sue}, \text{john})$  if this happens to be true in the situation. Thus the uniqueness associated with (1a) is not part of the semantic representation in (2a).

Next consider (2b). Here too the set can include several propositions each linking a girl and a boy such as  $\text{^saw}'(\text{sue}, \text{bill})$  and  $\text{^saw}'(\text{mary}, \text{john})$ . And this is a welcome result since (1b) clearly doesn't impose a uniqueness requirement -- "Sue saw Bill and Mary saw John" is an appropriate answer to "Which girl saw which boy?". There is a problem with the representation only if we take (1b) to involve a bijective reading.

Though judgements on this issue tend to be delicate, there clearly is a strong tendency towards a bijective interpretation of multiple wh questions. The issue to settle is whether the bijectivity requirement is strong enough to be included in the semantic representation of such questions. Engdahl (1986) argues against including it in the semantics. On the basis of question-answer exchanges like (3) she takes bijectivity to be an implicature:

- (3)a. Which table ordered which wine?  
 b. Table A ordered the Ridge Zinfandel, Table B ordered the Chardonay and Table C ordered the Rose and the Bordeaux.

According to her, (3a) uttered by a bartender who has

mixed up his order slips can, and should, be answered by an exhaustive list matching up tables and wines. (3b) thus is an appropriate answer to (3a) even though it includes a table which has ordered more than one wine.

While I share the intuition that (3b) is not an inappropriate answer in the context, I do not think that it provides a definitive argument against including bijectivity in the meaning of the multiple question. If a multiple question really did not include bijectivity, a question answer exchange such as (4) would also be acceptable:

- (4)a. Which girl saw which boy?
- b. Sue saw Bill, John and Harry

Clearly, however, (4b) is not an appropriate answer to (4a).

It seems to me that acceptable violations of bijectivity, such as (3), typically involve situations in which most of the pairings respect bijectivity and seem to be amenable to a pragmatic explanation. The questioner in (3a), for example, probably expects each table to have ordered a single wine. Knowing that questions are usually exhaustive requests for information, a cooperative interlocuter may provide an answer which includes pairings which violate bijectivity, implicitly denying the questioner's presupposition. I take bijectivity to be part of the meaning of multiple questions on the basis of the unacceptability of answers like (4b) and assume some pragmatic explanation along the lines just sketched why mixed answers like (3b) are not completely ruled out.

Note, then, that nothing in (2b) prevents the set from containing several propositions each linking a single girl to several boys, as in  $\wedge\text{saw}'(\text{sue}, \text{bill})$ ,  $\wedge\text{saw}'(\text{sue}, \text{john})$ ,  $\wedge\text{saw}'(\text{sue}, \text{harry})$ . That is, Karttunen's analysis of multiple questions does not rule out answers like (4b) which strongly violate bijectivity.

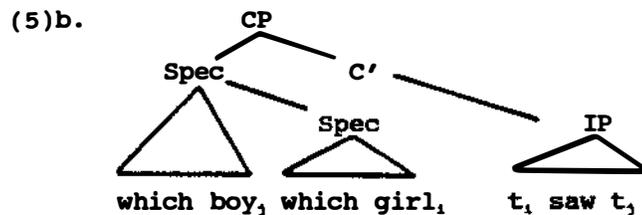
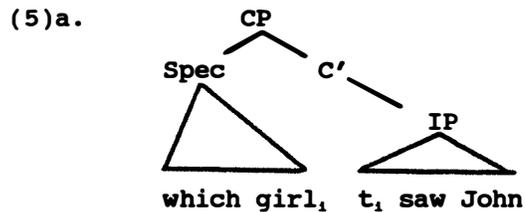
Within Karttunen's theory of questions a pragmatic account would have to be given for the unique reading of questions like (1a) as well as for the bijective reading of questions like (1b). It is not clear, however, what conversational principles could be used to explain these facts. Perhaps, one could suggest that the use of a singular NP is a pragmatic signal of uniqueness but this would leave unexplained the fact

that the same signal is not given in multiple wh structures. Furthermore, the bijective reading of multiple wh questions would still remain elusive.

### SECTION 3: THE PROPOSAL

It is possible, however, to incorporate the switch from uniqueness to bijection within a propositional theory of questions without materially affecting the basic insights of that approach, and I'll now outline one way of doing so. Let us follow Karttunen in analyzing questions as sets of propositions but take the question formation rule to include a condition that the existentially quantified variables be unique.

I'll assume a GB style syntactic representation for questions in which a wh NP raises to spec of CP leaving behind a trace. In the case of questions with more than one such NP, the other wh NPs are assumed to raise at LF. The LF representations of (1a-b) which would be an input to interpretation would be as in (5a -b):



The structures in (5) would be interpreted using a question formation rule, such as the one given in (6):

$$(6) \text{ QUES}^*_n [{}_c P [{}_s \text{pecwh } N^*_1 \dots \text{wh } N^*_n] [{}_c' [IP]]] \Rightarrow \\ \lambda p \exists x_1 \dots \exists x_n [x_1 = \cdot x_1 (P(x_1) \ \& \ \phi) \dots \ \& \\ \dots x_n = \cdot x_n (Q(x_n) \ \& \ \phi) \ \& \ 'p \ \& \ p = \wedge \phi]$$

P and Q in (6) stand for the predicates denoted by the common nouns inside the wh NPs and  $\phi$  stands for the

open sentence denoted by the IP. I assume that wh traces correspond to individual variables. Thus each wh expression existentially quantifies over an individual variable inside IP, just as in Karttunen. The italicized part in (6) is what is new. What this part does is incorporate the uniqueness associated with the wh expression into the semantic representation. This is done by associating each wh expression with an indexed iota operator which binds the position inside the open sentence denoted by IP, having the same index as itself. Further, there is a condition that only those objects identical to the unique object picked out by the iota be considered in the assignment of values to the existentially quantified variables.

Applied to (5a-b), (6) yields (7a-b) as the translations of the questions in (1):

- (7)a.  $\lambda p \exists x [[x = \iota y (\text{girl}'(y) \ \& \ \text{saw}'(y, j))] \ \& \ \text{'p} \ \& \ p = \text{'saw}'(x, j)]$ .  
 b.  $\lambda p \exists x \exists y [ [x = \iota z (\text{girl}'(z) \ \& \ \text{saw}'(z, y)) \ \& \ y = \iota z (\text{boy}'(z) \ \& \ \text{saw}'(x, z))] \ \& \ \text{'p} \ \& \ p = \text{'saw}'(x, y)]$

Let us see if these represent the switch from uniqueness to bijection that we are interested in.

Consider (7a) first. This formula lets into the propositional set all propositions of the form  $\text{'saw}'(x, \text{john})$  iff  $x$  is identical to a unique individual who satisfies the predicate *girl'* and is a member of the set of individuals who saw John. It thus allows  $\text{'saw}'(\text{mary}, \text{john})$ , only if Mary is the unique girl who saw John. In situations where there is no such unique girl, I assume that the iota picks out a dummy object. Since there will be no  $x$  identical to this object the propositional set will be empty.

Let us turn now to multiple wh questions. (1b), for example, translates as (7b). This formula lets into the set any proposition of the form  $\text{'saw}'(x, y)$  iff  $x$  and  $y$  are the unique pair that satisfy the predicates in the wh NPs and the relation expressed by the open sentence. It allows for more than one proposition since uniqueness of  $x$  is relativized for a value assignment to  $y$  and vice versa. For example, consider the situations in (8):

- (8)a.  $\text{saw} = \{ \langle \text{mary}, \text{john} \rangle, \langle \text{sue}, \text{bill} \rangle \}$   
 b.  $\text{saw} = \{ \langle \text{sue}, \text{john} \rangle, \langle \text{sue}, \text{bill} \rangle \}$   
 c.  $\text{saw} = \{ \langle \text{mary}, \text{john} \rangle, \langle \text{sue}, \text{john} \rangle \}$

(6) will allow the propositions  $\text{^saw}'(\text{mary}, \text{john})$  and  $\text{^saw}'(\text{sue}, \text{bill})$  into the set in a situation like (8a) where the relevant relation is bijective. This is because, when  $x$  is assigned the value *mary* and  $y$  the value *john*, uniqueness is maintained and similarly when  $x$  is assigned the value *sue* and  $y$  the value *bill*. Notice that (7b) will not allow the propositions  $\text{^saw}'(\text{sue}, \text{john})$  and  $\text{^saw}'(\text{sue}, \text{bill})$  into the set in a situation like (8b) which is not bijective. This is because when  $x$  is assigned the value *sue* and  $y$  the value *john*, the iota will not be able to pick out a unique boy seen by  $x$  since John and Bill are both seen by Sue. The iota will pick out a dummy object and the propositional set will remain empty since no value assignment to the existentially quantified variable  $y$  can make the second identity statement true.

Similarly, it will not allow the propositions  $\text{^saw}'(\text{sue}, \text{john})$  and  $\text{^saw}'(\text{mary}, \text{john})$  into the set in a situation like (8c). In this case the iota will not pick out a unique girl who sees  $y$  when  $y$  has the value *john*. There will therefore be no value assignment to the existentially quantified variable  $x$  which can make the first identity statement true. Thus, answers to the question will include only those pairs which respect bijectivity.

Note that though (6) allows for multiple pairs it is not restricted to them. It is possible for the set to contain a single proposition identifying one relevant pair of individuals. This is important because multiple wh questions can be answered with a single pair -- this is what Higginbotham and May call the "singular" interpretation of multiple wh questions, as opposed to their "bijective" interpretation and Pope (1976) calls REF-questions. We do not need a separate representation for this in the present account since the question formation rule simply treats this as a subcase of the bijective interpretation.

The schema in (6), we see, successfully captures the switch from uniqueness in single wh questions to bijection in multiple wh questions. Though I have demonstrated how the rule works for questions with two wh NPs only, it is easy to see that it will extend to those with more than two such NPs as well.

So far we have dealt with complex wh expressions like "which N" where N is syntactically singular. It is easy enough to extend this to the case of plural NPs by adopting a theory of plurals such as Link (to appear) and Landman (1989) and assuming that the iota

is defined on the supremum of the set rather than on absolute uniqueness.

If we simply restrict the interpretation of singular NPs to singular individuals and that of plural NPs to plural individuals we get the desired results. A question like (9a), for example, will also denote a singleton set. Specifically, the set which contains the proposition  $\hat{x}$  came where the assignment function gives  $x$  the value of the maximal plural individual who is a girl and saw John.

- (9)a. Which girls saw John?  
 b.  $\lambda p \exists x [[x = \iota y (\text{girls}'(y) \ \& \ \text{saw}'(y, j))] \ \& \ \forall p \ \& \ p = \hat{\text{saw}}'(x, j)]$ .

If Mary and Sue saw John, the only proposition in the set will be  $\hat{\text{saw}}'(\text{mary+sue}, \text{john})$ .

The evaluation of multiple wh questions with plural NPs follows as expected. This is shown in (10):

- (10)a. Which girls saw which boys?  
 b.  $\lambda p \exists x \exists y [ [x = \iota z (\text{girls}'(z) \ \& \ \text{saw}'(z, y)) \ \& \ y = \iota z (\text{boys}'(z) \ \& \ \text{saw}'(x, z))] \ \& \ \forall p \ \& \ p = \hat{\text{saw}}'(x, y)]$

The semantics outlined above also accounts for questions with monomorphemic wh expressions like "who" and "what" which are known not to have uniqueness implications. Take a question like (11), which can be answered with (12a) or (12b), depending on the situation:

- (11) Who saw John?  
 (12)a. Mary  
 b. Mary and Bill.

To account for this I make the straightforward assumption that such NPs lack a specification about interpreting them with respect to singular or plural individuals. (11) will then denote (13):

- (13)  $\lambda p \exists x [x = \iota y (\text{person-or-persons}'(y) \ \& \ \text{saw}'(y, j)) \ \& \ \forall p \ \& \ p = \hat{\text{saw}}'(x, j)]$

If this were evaluated in a situation in which two people, Bill and Mary, saw John the iota would pick out the plural individual *bill+mary*. While the proposition  $\hat{\text{saw}}'(\text{bill+mary}, \text{john})$  would be in the set, the

propositions  $\wedge\text{saw}'(\text{bill}, \text{john})$  and  $\wedge\text{saw}'(\text{mary}, \text{john})$  would not be. If it were evaluated in a situation in which only one individual, Mary, saw John the iota would pick out the singular individual *mary*. In either case there would be only one proposition in the set. Specifically,  $\wedge\text{saw}'(x, \text{john})$  where  $x$  would have the value of the maximal individual, singular or plural.

Thus the schema given in (6) captures the switch from uniqueness to bijection in (1a-b) as well the difference between questions with complex wh NPs of the form "which N" such as (1a) and those with monomorphemic wh NPs of the form "who" such as (11).<sup>1</sup>

#### SECTION 4: A COMPARISON WITH OTHER PROPOSALS

The switch from unique to bijective readings in (1a-b), though not so far accounted for in other propositional theories of questions, has been previously accounted for by Higginbotham and May (1981) and May (1989) and I would briefly like to comment on how the three accounts differ.

According to Higginbotham and May (1981) a question like (1a) has an LF of the form (14a), whose meaning can be schematically represented as (14b):

- (14)a. For which girl  $x$ ,  $x$  saw John  
 b. [WH! $x$ :  $x$  a girl]  $x$  saw john

In their system, too, the semantic value of a wh NP of the form "which N" encodes uniqueness as part of its meaning, represented by the symbol ! on the wh operator.

This analysis extends straightforwardly to multiple wh questions yielding (15a) and (15b) as representations for (1b):

- (15)a. For which girl  $x$  and which boy  $y$ ,  $x$  saw  $y$

---

<sup>1</sup> A similar enrichment of other propositional theories such as Groenendijk and Stokhof (1984) is also possible though I will not deal with that here (see Srivastav 1991a). Another relevant construction that do not discuss here is Hindi correlatives which also display a variation between unique and bijective readings depending on the number of wh NPs. Srivastav (1991a and forthcoming) give relevant examples and provide a semantics which is parallel to the one being proposed here for questions.

b. [WH!x: x a girl] [WH!y: y a boy] x saw y

Since the meaning of questions is built up recursively the semantic representation in (15b) requires there to be a unique girl and boy pair in the see relation. That is, it allows for the singular interpretation. In order to get the bijective reading Higginbotham and May propose an optional syntactic operation at LF called *absorption* which combines two or more unary quantifiers, converting (15b) into (15c):

(15)c. [WH!x WH!y: x a girl & y a boy] x saw y

The process of absorption converts the unary quantifiers into a single polyadic quantifier. A semantics for the absorbed polyadic quantifier is then defined which gets the appropriate bijective reading.

Higginbotham and May's account and the one proposed here capture the same range of readings but the two approaches make rather different theoretical assumptions.

Higginbotham and May posit an optional syntactic operation at LF in order to account for the fact that a multiple wh question can be answered by a single pair or by several bijective pairs. In a sense, for them the singular reading of multiple wh questions is basic. The account presented here, on the other hand, treats the bijective reading as fundamental, the singular reading being a special case of it. Intuitively, this seems more satisfactory but as far as empirical predictions go, I do not think that the two accounts can be differentiated.

It is worth pointing out, though, that in the Higginbotham and May account, the bijective reading of multiple wh questions does not build directly on the meanings of the unary quantifiers which are an input to *absorption*. To that extent, then, their semantics is non-compositional. In the semantics proposed here, on the other hand, the bijective reading is compositionally built up out of the uniqueness encoded in each wh NP in the relevant construction. This approach can thus be seen as either doing away with absorption altogether or as treating absorption as a purely interpretive phenomenon involving no syntactic transformation. It is a property of strings of operators in spec that they are interpreted as polyadic quantifiers.

May (1989) develops an account of multiple wh

questions in a somewhat different way from Higginbotham and May (1981). The primary difference is that there is no longer a need for a syntactic operation at LF corresponding to *absorption*. Instead, a series of wh operators in spec of CP are interpreted as polyadic as well as pair operators since they mutually c-command each other, hence fall in what he calls a  $\Sigma$  sequence. In the case of (1b), for example, there would be a pair wh operator *which<sub>1,2</sub>*, and a binary wh operator *<which<sub>1,2</sub>, which<sub>1,2</sub>>*. The pair operator is simply the second degree counterpart of the unary wh operator *which<sub>1</sub>*. As such, it carries along the uniqueness presuppositions associated with such operators and yields the singular interpretation. The binary operator, on the other hand, does not belong to this class and carries weaker presuppositions comparable to the unary operators corresponding to monomorphemic wh expressions like "who" and "what". It can therefore allow for multiple pairs in the answer. As noted by May himself (footnote 16), however, this does not rule out an answer like (4b). That is, polyadic operators in his system do not incorporate bijectivity which has to be imposed by admitting only assignments where each of the individuals is unique relative to other assignments. Recall that this kind of relative uniqueness is precisely what is built into the rule proposed in section 3 for interpreting wh operators in spec.

The semantics proposed here, then, has a general schema which applies uniformly to questions with complex wh expressions of the form "which N", where N can be singular or plural as well as to those of the form "who" or "what" which may be syntactically singular but which are semantically unspecified with respect to number. It also applies to wh constructions with one or more wh NPs in spec position and yields unique and bijective readings for single and multiple questions respectively. It thus accounts for the range of readings that Higginbotham and May (1981) and May (1989) do, but does so by incorporating the uniqueness associated with wh expressions into the standard propositional theory of questions in a simple and straightforward extension of that theory.<sup>2</sup> The

---

<sup>2</sup> Not all multiple wh questions allow for both bijective and singular readings, as noted by Higginbotham and May (1981) and May (1989). When the wh expressions are identical, for example, as in *Which character admires*

proposed innovation thus represents an alternative to those accounts as well as an enrichment of the propositional theory of questions.

#### SECTION 5: EMPIRICAL CONSEQUENCES

While the modification which I have presented is designed to capture uniqueness vs. bijection and should be evaluated on its own merits, I would like to show that it has other empirical advantages as well. In order to do so, I will introduce a problem posed by certain facts of Hindi.

It has been noted that a Hindi *wh*, though in-situ at S-structure, can only take narrow scope when it occurs inside a finite complement. (16), for example, can only be interpreted as an indirect question:

- (16) *raam jaantaa hai merine kyaa khariidaa*  
 Ram knows Mary what bought  
 "Ram knows what Mary bought." NOT  
 "What does Ram know Mary bought?"

This is unexpected, given what we know about Chinese *wh* in-situ. The Chinese counterpart of (16) is ambiguous between a direct and an indirect question reading. As argued by Huang (1982), the verb *know* can take a plus or a minus *wh* complement, leaving the embedded *what* free to move at LF to the lower or the higher spec, yielding the two readings.

Clearly, finite clauses in Hindi are different from Chinese in that they are scope islands for *wh* interpretation. In Srivastav (1989) and (1991a) I have shown that Hindi finite clauses are syntactic adjuncts and that extraction is ruled out as a subjacency violation. Davison (1984) and Mahajan (1987 and 1990) provide alternative explanations but for the purposes

---

*which character in Gone with the Wind?* only the singular interpretation is available. As far as I can tell, none of the analyses, including the one proposed here, can derive this fact. Something more needs to be said in order to prevent *absorption* in Higginbotham and May (1981), to make unavailable the binary operator in May (1989) and to force there to be only a single assignment of values which makes the formula true in the semantics proposed here. On this count, then, all three theories are comparable. For a discussion of other cases where both readings are not available, see Srivastav (1991a).

of this discussion it is not important to choose between the various accounts. We need only accept it as a descriptive fact that movement of Hindi *kyaa* "what" to the higher spec is ruled out in sentences like (16), the only well-formed LF for it being (17a):

- (17) a. [<sub>CP</sub> [<sub>IP</sub> ... [<sub>CP</sub> what<sub>j</sub> [<sub>IP</sub> ... t<sub>j</sub> ... ]]]]  
 b. \* [<sub>CP</sub> what<sub>j</sub> [<sub>IP</sub> ... [<sub>CP</sub> t'<sub>j</sub> [<sub>IP</sub> ... t<sub>j</sub> ... ]]]]

(18) provides further illustration of the fact that Hindi *wh*'s cannot escape out of finite complements:

- (18) *raam jaantaa hai meri ne kahãã kyaa khariidaa*  
 Ram knows Mary where what bought  
 "Ram knows where Mary bought what." NOT  
 "For which x, Ram knows where Mary bought x?"

Consider, however, a Hindi question like (19), a counterpart of the well known English example:

- (19) *kaun jaantaa hai merine kahãã kyaa khariidaa*  
 who knows Mary where what bought  
 "Who knows where Mary bought what?"

This can be answered with an individual answer or with the pair list answer, just as its English counterpart would be. Now, the standard explanation for pair list answers, deriving from Baker (1970), is that the embedded *wh* "what" raises to matrix spec and the answer yields a pairing of "who" and "what". Under this view, the pair list answer to (19) would have to derive from an LF like (20), where the lower *wh* moves up into matrix spec:

- (20) [<sub>CP</sub> what<sub>j</sub> who<sub>i</sub>  
 [<sub>IP</sub> ... t<sub>i</sub> ... [<sub>CP</sub> where<sub>k</sub> [<sub>IP</sub> ... t<sub>j</sub> ... t<sub>k</sub> ... ]]]]

But we know, of course, from (16) and (18) that this is not possible in Hindi. It would be completely ad hoc to posit movement out of the finite complement in (19) while preventing such movement in (16) and (18). The pair list answer, clearly, has to be accounted for without scope interaction of the kind standardly assumed.

Let us see if an alternative account, which does not involve extraction of embedded *wh*, can be developed. Let us take (21) as the only well formed LF of the Hindi question in (19), and (22) as its

translation, using for the moment Karttunen's original theory:

- (21) [<sub>CP</sub> who<sub>i</sub>[<sub>IP</sub>...t<sub>i</sub>...  
                   [<sub>CP</sub> what<sub>j</sub> where<sub>k</sub>[<sub>IP</sub>...t<sub>j</sub>...t<sub>k</sub>...]]]]  
 (22) λp ∃x [∧p & p=<sup>^</sup>know'(x, λp ∃y ∃z [∧p &  
                   p=<sup>^</sup>bought(mary, y, at z)]]

Now, an answer to this question can only provide values for *kaun* "who", following the standard assumption that an answer only provides values for those wh's which have matrix scope. We know that a wh expression like "who" allows for one or more individuals to be specified in the answer. Suppose, I answer (19) with *John and Bill*, I am giving an individual answer which uses a plural term to identify the matrix subject. If we take the indirect question in (19) to denote a set of propositions we can say that the group of individuals picked out by the plural term *John and Bill* stands in a particular relation to a set of propositions. The answer can be said to have the form: R(X, Q), where R = know'; X = the set of individuals who know Q and Q = the set of true propositions denoted by the indirect question.

In a situation in which Mary bought a book at Borealis and a pen at Hills, and John and Bill know where she bought what, an answer to (22) would have the form: know'(John and Bill, .) where . = (p1, p2), p1 = <sup>^</sup>mary bought the book at Borealis; p2 = <sup>^</sup>mary bought the pen at Hills.

Note that there is a conventional implicature that if I answer (19) with *John and Bill*, I imply that they each know the two propositions in the denotation of the complement. Though the answer does not specify whether the know relation distributes down to the members of the two groups, it conventionally implicates it.

But what if the situation is such that this implicature does not hold? What if John and Bill jointly know the two propositions but neither of them know both? Well, that is precisely the situation where the pair list answer will be used: *John knows where Mary bought the book and Bill knows where she bought the pen*. We can say, that when an individual answer involves groups, the distributive reading is conventionally implicated. The pair list answer cancels the implicature that there is a distributive reading by making explicit that the individuals jointly know the set of propositions. The pair list answer, we

can say, involves a cumulative interpretation of the relation between the two groups.

This distinction between distributive and cumulative readings is based on Scha (1981). Briefly, Scha suggests that sentences which relate two plural NPs, that is, group denoting terms, are ambiguous between, collective, distributive and cumulative readings. Consider (23), for example:

(23) Two boys solved three problems.

This has a collective reading which says that the two boys collaborated in solving three problems; a distributive reading which says that two boys solved three problems each as well as a cumulative reading which says that, working independently, they solved a total of three problems. The point I am making is that this distinction also applies to the answer which derives from the LF in (21), since both arguments of the verb can denote groups.

Treating pair list answers in terms of the distinctions made by Scha rather than in terms of scope interaction makes a strong prediction. Take a question like (24), which is like (19) in that it is a direct question with an indirect question complement:

(24) *kaun laRkaa jaantaa hai merine kaun kitaab*  
       which boy knows Mary which book  
       *khariidii*  
       bought  
       "Which boy knows which book Mary bought ?"

Unlike (19), however, (24) does not allow for a pair list answer. This is a problem for standard accounts of pair list answers. Remember that we are dealing here with a *wh* in-situ whose extraction is somehow restricted when it is inside a finite complement. Presumably, there would have to be some way of overriding the fact that Hindi finite clauses are scope islands in order to account for the pair list reading of (19). But in that case, it should also be possible to extract *kaun kitaab* "which book" out of the finite complement in (24) and move it to matrix spec. If there is scope interaction between "which boy" and "which book" at the matrix clause level, however, we should be able to get a pair list answer, which we do not.

Under the account of pair list answers I have

proposed, the absence of the pair list reading for (24) is actually predicted. The difference between (24) and (19) is that the two arguments of *know* in (24) cannot refer to groups. The *wh* in the matrix clause is "which boy" and presupposes that there is only one relevant boy. Further, the indirect question can only contain one proposition, namely the one which identifies the unique book Mary bought. Since the semantic answer to (24) does not relate plural objects, no ambiguity between distributive and cumulative readings is possible. Put another way, if the semantic answer picks out John, for example, as the individual who knows the proposition *^Mary bought War and Peace*, there is no meaningful sense in which we can talk about the distributive-cumulative distinction. Since pair list answers, under the proposed account, is a way of canceling the implicature that the relation between the matrix subject and the indirect question object is distributive by making the cumulative reading explicit, it is predicted that a pair list answer to (24) will not be available. Thus the contrast between (19) and (24) argues strongly in favor of the account based on plurality that I just sketched over the standard account of the phenomenon.

If we look a little more closely at the arguments just presented, we will see that the contrast between (19) and (24) is explained more clearly if we use, not the original Karttunen theory of questions, but the modified version I have presented in section 3. Let us see why.

The explanation for the absence of pair list answers hinges crucially on the fact that the arguments of *know* in (24) are singular terms. In Karttunen's theory we saw that this was not part of the semantics and the matrix subject could easily be associated with several boys, and the indirect question with several propositions linking Mary with books bought by her. The uniqueness of single *wh* questions, in that account, is not part of the semantic representation. Thus, we would have to ensure that the cumulative-distributive distinction that pair-list answers express be made sensitive to the pragmatic restrictions imposing uniqueness. In the modified version of the theory, the semantics itself ensures that the two arguments of *know* be singular, accounting straightforwardly for the absence of the pair list answer.

However, the problem with the original theory is not simply that the explanation for the absence of the

pair list reading in (24) is somewhat complicated. There are cases where it simply makes the wrong prediction. Consider a question like (25), which differs minimally from (24):

- (25) *kaun jaantaa hai merine kyaa khariidaa*  
 who knows Mary what bought  
 "Who knows what Mary bought?"

The difference with (24) is that the two terms need no longer refer uniquely. Under Karttunen's theory, this would mean that there would be no pragmatic restriction on the semantic representation which could freely pick out plural objects. That is, the matrix *wh* subject could be associated with several individuals; and the indirect question could contain several propositions, each linking Mary with some object she bought. Thus, in an account of pair list answers which uses plurality of objects, the prediction would be that a question like (25) should allow for a pair list answer. This, however, is not the case. (25), like (24) and unlike (19), cannot be answered with a pair list.

This is where the proposed modification yields the right results. In the modified account, although (25) has *kyaa* "what" in place of *kaun kitaab* "which book", the indirect question would still denote a set with only one member even if Mary bought two books. It would contain the single proposition  $\wedge$ *mary bought emma + ivanhoe*, where *emma + ivanhoe* refers to the plural object that Mary bought. Thus the semantic answer would relate an individual with a singleton propositional set. Since pair list answers express cumulative readings, and cumulative readings are only possible when both terms are plural, it is correctly predicted that a pair list answer to (25) is not possible.

The fact that pair list answers are available with multiple embedded questions and unavailable when the embedded question has only one *wh* expression seems to be a general phenomenon. This is the case in languages as diverse as English, Hindi, Bulgarian, Russian, Chinese and Japanese.<sup>3</sup> Under the non-movement account

---

<sup>3</sup> See Srivastav (1991b) for a fuller discussion of the cross-linguistic application of this idea as well as for an explanation for the possibility of pair list answers to questions like *Who knows where Mary bought*

combined with the modified semantics of section 3 this is not surprising. Indirect questions with more than one *wh* expression, but not those with just one, can denote sets which may contain more than one proposition. That is, questions with "who" in the matrix and a multiple *wh* complement can represent a relation between plural objects and may therefore have a cumulative reading; questions with single *wh* complements necessarily represent a relation with a singleton propositional set in object position so that a cumulative reading is ruled out.

#### SECTION 5: SOME LOOSE ENDS

In this section I want to address two problems that remain open in the approach to pair list answers being taken here. In each case, I will outline the problem for the proposed as well as for the standard account. It is predicted on the present account that pair list answers in embedded contexts will only be available when both terms are plural. This was demonstrated by (24) and (25). Now consider (26):

- (26)a. Which boy knows where Mary bought what?
- b. Which boy knows where Mary bought which book?

Under our account these questions represent a relation between the singular individual picked out by *which boy* and a possibly plural subject, the set of propositions denoted by the indirect question. The prediction is that a pair list answer should not be possible since cumulative readings require both terms to be plural. While the prediction is borne out for (26a), it is not so clear that it holds for (26b). Intuitions may vary but it seems that at least for some people (26b) allows for the pair list answer. This is also true for their Hindi counterparts.

The possibility of a pair list answer to (26b), at first glance, seems to favor the standard approach where the *wh* in-situ is moved at LF to matrix spec. But this does not quite explain why the same is not true for (26a) since scope interaction between *which boy* and *what* should allow for multiple answers. Though there may be a tendency for all *wh* expressions to be

---

*these books?*, noted by Kuno and Robinson (1972) to be problematic for the standard movement-based account.

either complex or monomorphemic, this is not a strict requirement. (27a), for example, uttered in a context where children and activities are being discussed can readily be answered with (27b):

- (27)a. Which kid did what?  
 b. John cleared up the mess in the living room and Liz took care of the dishes.

Further, it is not clear how Hindi examples like (26b) would be handled since extraction is not possible in the language. Thus the paradigm in (26) is problematic for the standard account as well as for the present one.

The second problem has to do with the fact that pair list answers typically supply values for the matrix wh and that wh in the embedded clause which remains in-situ.<sup>4</sup> Pair list answers to (28a), for example, would pick out people and objects, while answers to (28b) would pick out people and stores:

- (28)a. Who knows where Mary bought what?  
 b. Who knows which book Mary bought in which store?

The problem for the present account is obvious. Since the values of the embedded wh is simply a way of identifying the proposition known by each atomic individual picked out by the matrix wh, there is no reason why one rather than the other should be chosen.

Again, at first glance, (28) seems to be amenable to an explanation in terms of the movement account. The trace of the wh in-situ is lexically governed and can therefore move to matrix spec at LF without violating the ECP. Note, however, that the trace of the fronted wh in (28b) is also lexically governed so that there is no reason why this wh could not move at LF to matrix spec, thereby allowing for answers listing people and books. This is ruled out by stipulating that LF movement cannot originate in operator positions (Chomsky 1986). This, however, cannot be maintained universally.

Consider the Bulgarian example in (29). Both embedded wh expressions are in operator positions and yet the question can be answered with a pair list, on

---

<sup>4</sup> See Srivastav (1991a), however, for some counterexamples.

par with the English example:

- (29) *koj znae katvo kade e kupila Maria*  
 who knows what where has bought Maria  
 "Who knows where Maria bought what?"

In order to derive the pair list answer, the movement account must allow *kakvo* "what" to move from an operator position at LF. But note that in doing so the explanation why the pair list answer to (28b) does not name people and books is lost.

It is clear that more work needs to be done in order to explain the facts in (26)-(29). What I hope to have shown, however, is that they do not a priori argue against the present account since they are also problematic for standard accounts of the phenomenon.

#### SECTION 6: CONCLUSION

To sum up, I have argued that the uniqueness and bijection associated with single and multiple wh questions such as (1a) and (1b) should be incorporated into the semantic representation of questions. I have presented a modification of Karttunen's theory that accomplishes this by providing a single rule which applies uniformly to single and multiple wh questions having wh NPs of the form "which N" as well as of the form "who". I have also argued that pair list answers do not involve scope interaction between a matrix wh and a wh extracted from the embedded clause and developed instead an account of pair list answers based on the plurality of the arguments involved. I have shown that, combined with the modified semantics of section 3, this accounts for the uniform pattern in the availability of pair list answers found across fairly divergent languages.

#### REFERENCES

- Baker, C.L. (1970) "Notes on the Description of English Questions: The Role of an Abstract Question Morpheme," *Foundations of Language* 6.  
 Chomsky, N. (1986) *Barriers*, MIT Press: Cambridge MA.  
 Davison, A. (1984) "Syntactic Constraints on Wh in-situ: Wh Questions in Hindi-Urdu", Paper presented at LSA.  
 Groenendijk, J. and M. Stokhof. (1984) *Studies in the Semantics of Questions and the Pragmatics of Answers*.

- Higginbotham, J., and R. May (1981) "Questions, Quantifiers and Crossing", *The Linguistic Review* 1, pp.41-80.
- Huang, C.-T. J. (1982) *Logical Relations in Chinese and the Theory of Grammar*, Ph.D. thesis, MIT.
- Karttunen, L. (1977) "Syntax and Semantics of Questions", *Linguistics and Philosophy* 1, 3-44.
- Kuno, S. and J. Robinson, (1972) "Multiple Wh Questions", *Linguistic Inquiry* 3, 463-487.
- Landman, F. (1989) "Groups I and II", *Linguistics and Philosophy* 12.
- Link, G. (to appear) "Plural", in Wunderlich and von Stechow (eds) *Handbook of Semantics*.
- Mahajan, A.K. (1987) "Notes on Wh Questions in Hindi" Paper presented at SALA, Cornell and Syracuse Universities.
- Mahajan, A.K. (1990) *The A/A-bar Distinction and the Theory of Movement*, Ph.D. dissertation, MIT.
- May, R. (1989) "Interpreting Logical Form", *Linguistics and Philosophy* 12.
- Pope, E. (1976) *Questions and Answers in English*, Mouton, The Hague.
- Nishigauchi, T. (1986) *Quantification in Syntax*, Ph.D. dissertation, University of Massachusetts: Amherst.
- Rudin, C. (1988) "On Multiple Questions and Multiple WH Fronting", *Natural Language and Linguistic Theory* 6.
- Scha, R. (1981) "Distributive, Collective, and Cumulative Quantification", reprinted in Groenendijk, Janssen and Stokhof (eds) (1983) *Truth, Interpretation, Information*, GRASS 2, Foris, Dordrecht.
- Srivastav, V. (1989) "Hindi Wh and Pleonastic Operators", in *Proceedings of NELS 20*.
- Srivastav, V. (1991a) *WH Dependencies in Hindi and the Theory of Grammar*, Ph.D. thesis, Cornell University.
- Srivastav, V. (1991b) "Pair List Answers Without Movement", in *Proceedings of WCCFL X*.
- Srivastav, V. (forthcoming) "The Syntax and Semantics of Correlatives", in *NLLT*.

Department of Linguistics  
Rutgers University  
18 Seminary Place  
New Brunswick, NJ 08904

srivastav@zodiac.rutgers.edu