

relevant only in embedded contexts, the availability of the set of all possible answers in the case of scope marking simply follows from the syntactic representation of scope marking.

In this subsection I have argued for the need to reconcile the Hamblin-style semantics required for scope marking structures with the Karttunen-style semantics required for cases like (45). One way of doing this, I have suggested, is by making a distinction between a question, which determines the set of possible answers, and an answer, which includes only the true propositions. Although the definition of $Ans(Q)$ will be modified in Chapter IV, the basic idea that question-embedding predicates uniformly denote relations mediated by $Ans(Q)$ will be maintained.

CONCLUSION

In this chapter I have analysed scope marking structures as a standard instantiation of finite complementation in Hindi. Although answers to scope marking structures specify values for the embedded wh, I have demonstrated that a principled way of assigning wide scope is not tenable. I have further argued that wide scope assignment leads to the incorrect prediction that scope marking and extraction structures are equivalent. Defining a compositional semantics on LF representations that respect locality in scope assignment, I have shown, derives the right distinctions between scope marking and extraction. The analysis of scope marking as indirect wh dependency shows that the right account of the semantics of questions is the one presented in Hamblin (1973). The insights in Karttunen (1977) about the truth requirement in questions is built into the answerhood conditions. In the next chapter we turn to another phenomenon that seems to challenge the claim of locality in assignment of scope to Hindi wh in-situ.

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CHAPTER IV

LONG-DISTANCE LIST ANSWERS

INTRODUCTION

In this chapter I focus on the availability of long-distance list answers in Hindi. Such answers are normally analyzed as involving scope interaction between a matrix and an embedded wh. Since LF wh movement out of finite complements is blocked in Hindi, an explanation along these lines is obviously not feasible for it. I show that there are two distinct sources for long-distance lists, neither of which require us to compromise locality in scope assignment. They can arise when the embedded wh is D-linked, in the sense of Pesetsky (1987). However, they display locality effects that cannot be captured in a treatment of D-linking as unselective Q-binding. The alternative I propose treats the finite complement as a quantificational expression that interacts scopally with the matrix wh. The selectional properties of question embedding verbs and the semantic type of the indirect question, I show, account for a number of facts that would otherwise be problematic. Long-distance answers also have a second source which is dependent on plurality. In these cases, long-distance lists represent a cumulative reading of the question and there is no issue of scope interaction. The alternatives developed for Hindi, I argue, are applicable cross-linguistically since they do not appeal to aspects of grammar that are subject to parametric variation. This claim is of particular significance since the possibility of long-distance list answers has proved a powerful diagnostic for LF movement out of wh-islands. The alternatives presented here undermine conclusions based on this diagnostic since they show that answers can list values for matrix and embedded wh while assigning local scope to each.

1. THE PROBLEM OF LOCALITY

1.1. *The Problem for Hindi*

The phenomenon of long-distance list answers is illustrated by the question in (1) and the possible answers in (2), originally discussed by Baker (1970):

- (1) a. Who knows where Mary bought what?
 b. [_{CP}who_i [_{IP}...*t_i*...[_{CP}what_j where_k [_{IP}...*t_j*...*t_k*...]]]]
 c. [_{CP}what_j who_i [_{IP}...*t_i*...[_{CP}where_k [_{IP}...*t_j*...*t_k*...]]]]
 (2) a. John does.
 b. John knows where Mary bought the book and Bill knows where she bought the pen.

(2a) is an individual answer, naming the person or persons who know for each of the things Mary bought where she bought them. (2b) is a long-distance list answer, naming for each of the things Mary bought the person or persons who know where she bought it. Under the assumption that answers specify values for all and only the wh expressions in matrix Spec, the possibility of individual vs. long-distance list answers is taken as evidence that (1) is ambiguous between the LF representations in (1b) and (1c).

The appeal of this approach is that it reduces the problem of long-distance lists to the problem of list answers to ordinary multiple wh questions like (3a):

- (3) a. Who bought what?
 b. John bought the book and Bill bought the pen.
 c. [_{CP}what_j who_i [_{IP}*t_i* bought *t_j*]]

Any semantic account that works in the simple case is expected to transfer over straightforwardly to the long-distance case, once the appropriate dependency between matrix and embedded wh is established in the syntactic representation of the question.

Given that the scope of Hindi wh in-situ embedded inside finite complements is strictly local, we would expect that the Hindi counterpart of (1a) would only allow individual answers. This, however, is not the case. Analogous to the English example, (4) allows an individual or a long-distance list answer:

- (4) kaun jaantaa hai merii-ne kahaan kyaa khariidaa
 who know-PR Mary-E where what buy-P
 "Who knows where Mary bought what?"

Since (4) cannot be assigned an LF like (1c), we are led to conclude that long-distance list answers must be derived in some other way.

It may be worth emphasizing that the facts under discussion are robust. The fact that Hindi finite complements are scope islands has been much discussed in the literature and there is no disagreement about the judgments. The status of (4), however, is worth clarifying since such questions have not received as much scrutiny. In Srivastav (1990) I had first noted the possibility of long-distance list answers to them and every speaker I have consulted since then has confirmed their admissability. Of course, the individual answer is always the expected one. However, if a situation is presented where there is no one who knows all the facts, but several people who each know some of them, speakers have no problem accepting the long-distance list. This preference for the individual answer is not special to Hindi; English speakers have the same response to the paradigm in (1)-(2). I therefore take it that we are faced with a bona fide problem of reconciling intuitions about locality with intuitions about long-distance lists in Hindi.

1.2. *Problems in Other Languages*

Further evidence against the movement account comes from Bulgarian. As demonstrated by Rudin (1988), all wh expressions undergo S-structure movement to Spec in Bulgarian. This means that the counterpart of (1a) will have all embedded wh's in embedded spec position:

- (5) koj znae kakvo kade e kupila Mariya
 who knows what where has bought Maria
 "Who knows where Maria bought what?"

Under standard assumptions the scope of overtly moved wh expressions is set at the S-structure position. (5), however, easily allows for both the individual and the long-distance list answer. It may also be worth pointing out that under a movement approach one might expect the embedded wh to raise to matrix Spec at S-structure, there being no constraint against multiply filled Spec in Bulgarian. My understanding is that this option is marginal, if not unacceptable.

This casts further doubt on the plausibility of a movement-based approach.¹

Japanese provides yet another argument for preserving locality in the derivation of long-distance lists. It has *wh* in-situ but each *wh* expression has to be associated with a question morpheme such as *ka* which determines its scope. Additionally, each question morpheme has to bind at least one *wh* expression to satisfy the ban against vacuous quantification (Nishigauchi 1986, 1990). Thus in (6a) the *wh* has embedded scope while in (6b) it has matrix scope:²

- (6) a. Tanaka-kun-wa [Mary-ga nani-o kat-ta ka] sitte-imasu
 Tanaka Mary what bought Q know
 "Tanaka knows what Mary bought."
 b. Tanaka-kun-wa [Mary-ga nani-o kat-ta koto-o]
 Tanaka Mary what bought Comp
 sitte-imasu ka
 know Q
 "What does Tanaka know that Mary bought?"

Nishigauchi argues that Japanese *wh* in-situ obeys the *wh* island constraint by showing that a question like (7), which has a multiple *wh* as complement, cannot be interpreted with the embedded *wh* *nani* "what" having matrix scope. Note that the embedded *ka* in (7) can bind *doko* "where", so that binding of *nani* "what" by matrix *ka* would not be ruled out as an instance of vacuous quantification with respect to the lower Q morpheme:

- (7) Tanaka-kun-wa [Mary-ga doko-de nani-o kat-ta ka]
 Tanaka Mary where what bought Q
 sitte-imasu ka
 know Q
 "Does Tanaka know where Mary bought what?" NOT
 "What is the thing such that Tanaka knows where Mary bought it?"

¹ I am grateful to Franzisca Bedzyk, Tina Kraskow, Nikola Nikolov and Rossina Petrovna for judgements and discussion of the Bulgarian data.

² Thanks to Keiko Yoshida, Tomo Yoshida, Masaaki Fuji, Yoko Futagi, Takeo Kurafuji and Kyoko Sano for judgements and discussion of the Japanese data. Since the judgments were elicited at various times from different subsets of speakers, no single speaker is responsible for all the facts reported here.

Interestingly, replacing *Tanaka* with *dare* "who", as in (8), makes the long-distance list possible:³

- (8) dare-ga [Mary-ga doko-de nani-o kat-ta ka]
 who Mary where what bought Q
 sitte-imasu ka
 know Q
 "Who knows where Mary bought what?"

The long-distance list cannot be derived by assigning wide scope to embedded *wh* if we want to maintain the explanation for the impossibility of assigning matrix scope to the embedded *wh* in (7). An alternative is clearly needed.

A final piece of evidence in support of locality comes from Persian. As shown by Simin Karimi and Jan Mohammad in work in progress, Persian makes a distinction between verbs like *know* and verbs like *think* with respect to overt and LF *wh* movement. This is illustrated in (9) and (10):⁴

- (9) a. midun-i ke ki un xuna ro xarid
 know-2nd that who that house RA bought
 "Do you know who bought that house?" NOT
 "Who do you know bought that house?"
 b. *ki_i midun-i ke t_i un xuna ro xarid
 who know-2nd that that house RA bought
 (10) a. fekr mikon-i (ke) ki un xuna ro xaride bash-e
 think do-2nd that who that house RA bought is-2nd
 "Who do you think has bought that house?"
 b. ki_i fekr mikon-i ke t_i un xuna ro xaride bash-e
 who think do-2nd that that house RA bought is-2nd

In spite of this, the Persian counterpart of (1a) is ambiguous and allows individual and long-distance list answers of the kind in (2a-2b):

³ Questions like (8) were not considered in Nishigauchi (1986) and I am not sure whether Nishigauchi (1990) allows for the long-distance list answer in these cases. The Japanese speakers I consulted had no problem in accepting them.

⁴ *ra* marks specific oblique NP's; *bash* is the subjunctive form of the verb *budan* "to be". I am indebted to Simin Karimi for discussion of these data. See also Karimi (1989) for analysis of the structure of Persian.

- (11) ki midun-e koja mary chi xarid
 who know-3rd where Mary what bought
 "Who knows where Mary bought what?"

Given that the Persian verb for *know* blocks movement of embedded wh to matrix Spec, the long-distance list could not arise as a result of scope interaction between matrix and embedded wh. It must have another source.

We have seen that even in languages other than Hindi the scope of the embedded wh expression is fixed at the embedded clause level and yet the availability of long-distance lists is not affected. In fact, there is remarkable uniformity across languages with respect to the availability of long-distance lists though there are well-known differences with respect to wh movement. In addition to the languages mentioned above, I have verified the facts for French, Polish, Chinese and Russian.⁵ There is thus more than ample motivation for exploring alternatives to movement-based accounts of the phenomenon. In the rest of this discussion I use English examples, unless I make a point specific to a particular language, to make the exposition easier to follow but I intend the discussion to apply cross-linguistically.

1.3. D-Linking and the Wh Triangle

A means for assigning scope to wh expressions that does not rely on movement has been proposed by Pesetsky (1987). According to him, wh expressions may be operators or D-linked variables. Wh operators must move to Spec positions for interpretation and consequently their scope is constrained by subjacency. Wh expressions that are D-linked variables, however, do not raise but get bound by an unselective Q-operator, along the lines of the analysis of indefinites in Kamp (1981) and Heim (1982).⁶ Since no movement is involved, they may take

⁵ Thanks to Viviane Déprez, Maria Bittner, Chilin Shih and Katya Weiner for discussion of French, Polish, Chinese and Russian data, respectively.

⁶ Although Pesetsky focuses on the syntactic form of the wh, the notion of D-linking he appeals to is clearly a semantic one. Note though that the connection to discourse salient entities aligns D-linked wh expressions with definites, but in order for them to be Q-bound they must be indefinites that could be bound by an operator. A solution to this conceptual problem is provided by Enç (1991, ft.8) who suggests that Pesetsky's D-linking is an instance of specificity, which she analyses in terms of partitivity. Fleshing out her suggestion, wh terms would have, in addition to a referential index, a definiteness index indicating their

scope in apparent violation of subjacency.⁷ In the case of long-distance list answers, for example, this approach leads to the following LF representations:

- (12) a. Which woman knows where Mary bought which book?
 b. [_{CP}which woman_i [_{IP}...t_i...[_{CP}where_{k,j} [_{IP}...which
 book_j...t_k...]]]]
 c. [_{CP}which woman_{i,j} [_{IP}...t_i...[_{CP}where_k [_{IP}...which
 book_j...t_k...]]]]

The wh in-situ in the embedded question is analyzed as a variable. If it is bound by the Q-operator in embedded Spec, as in (12b), we get the individual answer. If it is bound by the operator in matrix Spec, as in (12c), we obtain the long-distance list answer. The question of a Subjacency violation in (12c) is moot since movement is not at issue. This approach to the phenomenon, while it preserves Baker's essential insight that long-distance list answers involve scope interaction between matrix and embedded wh, sidesteps the problem of subjacency violations at LF.

The potential advantage in treating long-distance lists in terms of D-linking is obvious. If D-linked wh can be assigned scope without reference to syntactic islands, the problem of locality in Hindi and other languages would not arise. As I will demonstrate, however, matrix scope for embedded wh is not at issue in these cases. What is crucial is a particular configuration of wh expressions that I call the wh triangle. If the generalization that long-distance lists involve scope in violation of subjacency is itself inaccurate, there is no advantage in adopting the view of D-linking as unselective binding. An alternative account is needed in which the availability of long-distance lists is crucially tied to the wh triangle.⁸

relation to other discourse entities. Although the referential index of a D-linked wh would be novel, making it susceptible to being bound, its definiteness index would require it to be part of a set already in the discourse.

⁷ Actually, it is a matter of some debate whether movement constraints play a role in determining the scope of indefinites. See, for example, Fodor and Sag (1982), Heim (1982) and Abusch (1994).

⁸ Pesetsky's unselective binding approach is meant also to explain the contrast in Superiority Violations between (i) and (ii):

- (i) *What did who read?
 (ii) Which book did which student read?

To see this, consider a question with a single wh complement. (13a) or (13b) cannot be answered by (13c) which gives a list of individuals and books. In terms of the unselective binding approach, this means that the embedded wh does not have the option of being a D-linked variable. It must necessarily be an operator:

- (13) a. Which woman knows which book Mary bought?
 b. ?Which woman knows that Mary bought which book?
 c. Sue knows that Mary bought *The Bean Trees* and Jane knows she bought *Pigs in Heaven*.

One might argue that the wh expression in (13a) is already in Spec so that it cannot be treated as a variable and given a D-linked interpretation. This problem does not arise in (13b) which leaves the wh in situ but this sentence is marginal.⁹ It is unexpected under the view of D-linking as unselective binding that languages like English which have overt wh movement do not allow a question with just one D-linked wh to remain in situ.¹⁰ At any rate, to the extent that (13b) is acceptable, it is incorrectly predicted to allow a long-distance list answer. Q-binding from the matrix would not violate selectional restrictions since the matrix verb can select a -wh complement.

Related to this is the fact that multiple fronting languages need not leave D-linked wh's in situ. In Romanian, for example, all wh's are fronted regardless of their status in the discourse (Comorovski 1989).¹¹ Thus it seems that in a given language the overt movement of wh expressions within the clause does not vary with D-linking.

It is possible though that Superiority effects and long-distance lists do not have a unitary explanation. Cheng and Demirdash (1990), for example, point to differences in the types of grammaticality judgments involved in the two cases. Here I focus on D-linking in long-distance cases only.

⁹ van Riemsdijk and Williams (1986), pg. 216, give a parallel example *Which newspaper reported that his mother liked which candidate?* and note that it is awkward.

¹⁰ Well-known counterexamples are *echo* and *quiz* questions, both of which are known to have non-standard intonation patterns. See Comorovski (1989) and references cited there for discussion of these as well as section 3 for correlations between echo and D-linked questions.

¹¹ There are dialect differences with respect to fronting of D-linked wh expressions. Alex Grosu (personal communication) allows D-linked wh to remain in situ in his dialect of Romanian. Similarly, Polish is reported to allow D-linked wh in-situ (Pesetsky 1987) but Maria Bittner (personal communication) does not find them acceptable.

A corollary to this is the fact that a question with a single wh complement does not admit lists even if the language is not an overt movement language. Hindi (14), for example, has just one wh in the embedded clause and it is in situ. Since the matrix predicate takes -wh complements and movement is not forced at S-structure, there should be no problem in interpreting the embedded wh as a variable that can be bound by the Q-operator in matrix Spec. It is predicted that this question should allow answers pairing boys and books. Though (14) is fully grammatical, it does not allow such an answer, on a par with (13):^{12,13}

- (14) kaun laRkaa jaantaa hai merii-ne kaun kitaab khariidii
 which boy know-PR Mary-E which book buy-P
 "Which boy knows which book Mary bought?"

We can conclude from such examples that a multiple wh complement is needed in order to license long-distance lists, a requirement that is

¹² The following Japanese example has one Q-morpheme in the matrix binding a wh in the matrix and a wh in the embedded clause. As we have seen in (6b) above a Japanese embedded clause, unlike one in Hindi, is not a scope island. Several Japanese speakers found a multiple list reading possible but not salient here. A straight D-linking account would predict the list answer to be easily available:

- (i) dono sensei-ga [Mary-ga dono hon-o katta to] sitte-imasu ka
 which professor Mary which book bought Comp know Q
 "Which professor knows which book Mary bought?"

Some speakers noted that scrambling of the embedded wh out of the embedded clause aided the possibility of list answers. I don't quite understand why this should be. A possible explanation could be that *ka* cannot simultaneously bind wh expressions in different clauses, and scrambling out of the embedded clause effectively makes the two expressions clause mates, in the sense of Kuno and Robinson (1972).

¹³ It may be worth mentioning another non-movement proposal for assigning wide scope interpretation to wh in-situ. Reinhart (1993) suggests that wh in-situ can be interpreted as choice functions that can be existentially bound from a higher Spec. It would interpret (14) as $\lambda p \exists x \exists f [boy'(x) \wedge p = \hat{know}(x, \hat{bought}'(m, f(book'))]$. While Reinhart's proposal works for the cases she is interested in, including the classic long-distance cases, it too predicts incorrectly that (14) should yield list answers.

quite mysterious if D-linking is simply unselective binding of variables.¹⁴

We obviously need a theory in which apparent non-local scope of a wh expression crucially depends on the presence of a second wh expression in the embedded clause. It was suggested to me by Gennaro Chierchia and Maria Bittner (personal communication) that there may be ways of enforcing this requirement, if wh's in-situ interpreted as variables had to be locally licensed by a +wh Spec but could be bound non-locally. This requirement, apart from being somewhat stipulative, does not make the right empirical generalizations. Recall, in this connection, Nishigauchi's example in (7), repeated below as (15a) with the wh changed to promote a D-linked interpretation:

- (15) a. Tanaka-kun-wa [Mary-ga doko-de dono hon-o
 Tanaka Mary where which book
 kat-ta ka] sitte-imasu ka
 bought Q know Q
 "Does T. know where M. bought which book?" NOT
 "Which book is such that T. knows where M. bought it?"
- b. dono sensei-ga [Mary-ga doko-de dono hon-o
 which professor Mary where which book
 kat-ta ka] sitte-imasu ka
 bought Q know Q
 "Which professor knows where M. bought which book?"

(15a) has the requisite form with a local Q-operator licensing the embedded wh's. It should be possible for one of these wh's to be bound by the higher Q-operator but (15a) does not allow wide scope for either embedded wh.¹⁵ (15b), on the other hand, readily admits long-distance lists. I therefore conclude that the availability of long-distance lists does not have to do with the scope properties of wh expressions or the particular means by which scope is assigned, but

¹⁴ It will be demonstrated in section 4 that this requirement is only for those long-distance lists that are dependent on D-linking. Plurality-based long-distance lists may be possible with single wh complements.

¹⁵ I am relying here on judgments I have elicited. Nishigauchi (1990: 36-40) notes that contextually restricting the D-linked expression makes a wide scope reading possible though he admits that there are speakers who still reject it. It seems to me that D-linking effects are usually more robust than this suggests. In any case, the sharp contrast between (15a) and (15b) is what I want to bring out.

rather with the existence of a triangular configuration of real wh expressions.

Before concluding this section, let me point out a final, rather striking property of the wh triangle. It was noted by Mahajan (1990) that long-distance lists show locality effects. In an English question like (16a), for example, the matrix wh and the embedded wh are separated by an intermediate clause. It does not allow a long-distance list answer of the kind in (16b):¹⁶

- (16) a. [_{CP1} Which student thinks [_{CP2} that Bill knows [_{CP3} where Mary bought which book]]?
 b. John thinks that Bill knows where Mary bought *Pigs in Heaven* and Harry thinks that Bill knows where Mary bought *The Bean Trees*.

Note that subjacency is not relevant in the path from CP₂ to CP₁, as shown by the possibility of extraction [*Which book_i does [_{CP1} John think that [_{CP2} Bill knows [_{CP3} Mary bought t_i]]]]? What (16) establishes is that, contrary to standard assumptions, there is a locality effect in long-distance lists.*

We can conclude that the full generalization about long-distance lists is that there must be two wh expressions in the embedded clause, one of which must be D-linked. Further, there must be a full wh expression in the immediately higher clause. Whether Q-operators are needed to bind the wh expressions or whether the wh expressions themselves move at S-structure to Spec position depends on the nature of wh movement in the particular language. Cross-linguistically, a question will admit a long-distance list answer as long as it has the following schema, [_{CP1} ... wh₁ ... [_{CP2} ... wh₂ ... wh₃ ...]], where CP₁ and CP₂

¹⁶ I have changed Mahajan's example (pg. 180) substituting singular wh to eliminate the possibility of plurality-based interpretations. Mahajan also cites David Pesetsky as pointing out that (i) allows a pairing between *who* and *what*. (ii), the version with singular wh, does not seem to me to do so:

- (i) Who wonders where Bill thinks that John bought what?
 (ii) Which student wonders where Bill thinks that John bought which book?

At any rate, such examples do not prove the irrelevance of locality. For selectional reasons, the complement of the matrix *Where does Bill think that John bought what?* can only be interpreted with both wh's taking scope outside *think*. But, then, (i) and (ii) instantiate the local triangular configuration that I am claiming is crucial to long-distance lists.

are subjacent. It is this configuration that a semantics for D-linking in long-distance cases must explain.¹⁷

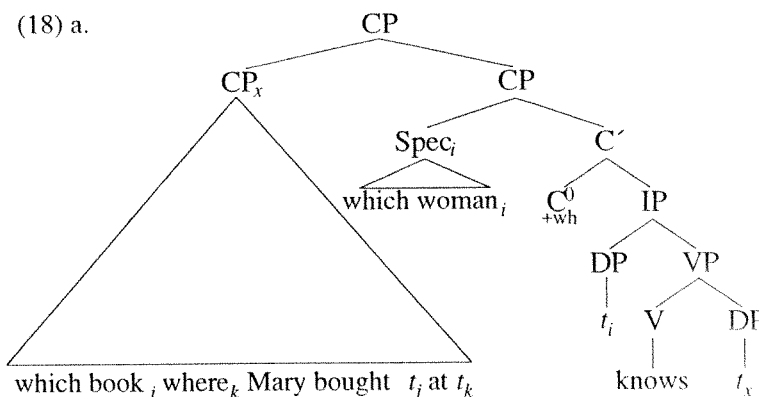
1.4. The QR Approach to Long-Distance Lists

In this section I will outline the approach to D-linked long-distance answers that I want to propose. The basic idea I will argue for is that D-linking effects in long-distance cases result from scope interaction between the matrix wh and the CP complement. The semantic type of the complement, however, is crucial in establishing this dependency. I will argue in sections 2 and 3 that complements with one D-linked wh expression differ in semantic type from those with two. In particular, single wh complements are necessarily interpreted as sets of propositions. Multiple wh questions have the option of being interpreted as sets of questions (i.e. as sets of sets of propositions). For now, let us simply assume this much. Taking the scope of wh expressions to be strictly local, (17a) would have an LF such as (17b):

- (17) a. Which woman knows where Mary bought which book?
 b. [_{CP}which woman_i [_{t_i} knows [_{CP}which book_j [_{CP}where_k Mary bought _{t_j} at _{t_k}]]]]]

Let us suppose that the complement has a second-order interpretation. We must, then, determine how this interpretation can combine with the matrix verb. It is a matter of some debate whether question-embedding verbs uniformly combine with question denotations and various proposals have been made in this regard (see Groenendijk and Stokhof 1984, Berman 1991 and Lahiri 1991 in particular). In discussing scope marking structures I argued that verbs always combine with question denotations via the operation *Ans(Q)*. Now, this operation is not going to be defined for a complement that denotes a family of questions. (17b) is uninterpretable as it stands. Following Lahiri (1991), I propose that one way of resolving the mismatch in types is to QR the +wh complement. This is shown in (18a):

¹⁷ Needless to say, the wh triangle cannot be explained under movement accounts. There is no reason for non-local wh movement in in-situ languages to be dependent on the presence of other wh expressions. And there is no reason why LF wh movement out of wh-islands must stop at the next higher Spec.



- b. $\lambda p \exists x \exists x [Q(Q) \wedge \text{woman}'(x) \wedge p = \text{know}'(x, \text{Ans}(Q))]$
 where Q is the family of questions denoted by CP_x

The scope interaction now is between matrix wh and the +wh complement, not between matrix wh and embedded wh in-situ. One can think of this, for now, as a multiple wh question relating women with (answers to) questions in the denotation of the complement, as shown in (18b). The semantics of multiple wh questions will be further elaborated in section 2 in a way that will impact on the specifics of the interpretation (see section 3.3).

Let us check how this approach explains the requirement of the wh triangle in D-linked long-distance lists. Note that a single wh complement will not trigger QR. Since it can only have a first-order interpretation, *Ans(Q)* will be defined for it. A question like (13a), repeated below as (19a), will have an LF like (19b) and be interpreted in the normal way:

- (19) a. Which woman knows which book Mary bought?
 b. [_{CP_i}which woman_i [_{t_i} knows [_{CP_j}which book_j [Mary bought _{t_j}]]]]]
 c. $\lambda p \exists x [\text{woman}'(x) \wedge p = \text{know}'(x, \text{Ans}(\lambda q \exists y [\text{book}'(y) \wedge q = \text{bought}'(m, y)])))]$

Thus, a multiple wh complement is crucial for triggering QR and the multiple wh reading.

Let us turn next to the requirement for a full wh expression in the matrix. The Japanese examples in (15a)-(15b), which crucially established the need for this, are repeated below in schematic form:

- (20) a. [...[...wh₁...wh₂...Q] Q]
 b. [...wh₃...[...wh₁...wh₂...Q] Q]

Recall that (15a) had only a yes/no question interpretation, both embedded wh being bound by the lower Q-operator. In (15b), however, a list answer was available. In terms of the approach being pursued here, we allow the indirect questions in (15) to have second order interpretations and be QR'd to the matrix clause. Since there is no wh expression in the matrix in (15a), no scope interaction can take place. It remains a yes/no question about Tanaka's knowledge regarding members of the indirect question. In (15b), there is a full wh expression in the matrix clause so that it becomes possible to pair professors with individual questions. That is, we have a case structurally parallel to English (18).

Finally, we have a simple explanation for the locality effects, manifested in (16), and repeated schematically below:

- (21) [CP₁...wh₁...[CP₂...[CP₃...wh₂...wh₃]]]

If QR is clause-bounded, as generally assumed, it follows that the multiple wh reading can only be established if there is a wh expression in the immediately higher clause. Here, for example, if CP₃ were to be interpreted as a second-order question and QR'd, it could interact scopally with a wh expression in Spec of CP₂ but not with the matrix wh which is in Spec of CP₁. Since there can only be one expression in the matrix Spec, we get a single wh interpretation asking for the identity of a student with the relevant information.

To sum up this section, we have focused on the correlation between D-linked long-distance lists, the wh triangle and locality, a correlation that is entirely accidental in standard approaches to the phenomenon. I have proposed that multiple wh complements may have second order interpretations. In such cases they may be QR'd in order to repair type-mismatches. This allows for scope interaction between the wh quantifier in subject position and the set of questions in object position. The long-distance list answer, under this approach, instantiates an ordinary multiple wh structure and there is no need for wide scope assignment to embedded wh expressions. I have shown how some fairly unexpected effects can be explained and now it is time to justify the fundamental assumption behind the explanation. In section 2 I take a close look at the relation between simple questions and answers. I discuss, in particular, various readings of multiple wh questions. Echo questions are shown to be an instance where the number of wh expressions makes a difference in semantic

types. In section 3, I relate D-linking and echo questions and argue for a similar correlation between number and semantic type.

2. THE SEMANTICS OF QUESTIONS

2.1. *The Ambiguity of Multiple Wh Questions*

In this section I want to show that the difference in the semantic type of questions needed to explain long-distance list answers can be motivated on independent grounds. I will begin by examining the types of answers allowed by multiple wh questions and show that this represents a genuine ambiguity that should be encoded semantically. I will then propose a modification of the theories of Hamblin (1973) and Karttunen (1977) to account for the ambiguity of multiple wh. This modification is general enough to derive the right readings for single wh questions as well as the various readings of multiple wh questions. Finally, I will focus on one of the readings argued for and show that the semantic type of the question, under this reading, can shift depending on the number of wh expressions in it.

A multiple wh question can be said to have three different readings, a list reading, a REF-Q reading and an echo-Q reading. These readings have been identified by Bolinger (1978), Wachowicz (1974, 1975) and Pope (1976), under various terms. My exposition here relies on their observations as well as on the discussion in Comorovski (1989). To see the difference between the three, consider three situations in which the multiple wh question *Who cooked what?* can occur and the answers it admits in those situations.

Let us demonstrate the list reading first. Take a context in which there are several dishes on the table and the questioner knows several people who have cooked them. She asks (22a) and gets the response in (22b):

- (22) a. Who cooked what?
 b. John cooked the meat, Bill cooked the rice and Sue cooked the vegetables.

As Wachowicz puts it, the information the questioner is interested in is the proper pairing between two given sets. This reading crucially presupposes that there will be at least two pairs in the list.

Now, let us turn to the echo reading of the question. An appropriate context is one where the questioner only hears part of an utterance and wishes the utterance to be repeated. In the following, subscripting is supposed to indicate a string that is phonetically unclear:

- (23) a. john cooked_{the meat}
 b. *Whó* cooked *whát*?
 c. John cooked the meat.

Echo questions can be distinguished from ordinary questions by their rising intonation.

Finally, consider REF-Questions, which asks for the identity of a unique pair of individuals, as opposed to a list of pairs, whose identity is not clear from the discourse. (24b) uttered in response to (24a) would have a REF-Q reading:

- (24) a. He cooked something.
 b. Who cooked what?
 c. John cooked the meat.

REF-Questions were classified by Wachowicz as a type of echo question but Pope (1976) shows that though they are similar to echo questions they are intonationally distinct. The *wh* expressions do not need emphatic stress and are uttered with the same fall in intonation as ordinary questions. Further, they are not requests to repeat the information already provided in the discourse.

That REF-Questions differ from echo questions can be shown by cases that are clearly not triggered by previous utterances. (25a) and (25b) can be asked without a particular context and be answered with just a single pair of individuals. All that is required is that the questioner know that only a single pair can be named in the answer. (25a), for example, pragmatically rules out a multiple pair answer. Similarly, if there are only two individuals, only one of them can be the first to hit in (25b):

- (25) a. Who killed Robert Kennedy when?
 b. OK, who hit who first?

This, of course, does not necessarily mean that the REF-Q reading has an independent status. Most theories of questions simply assimilate them with the list reading. Consider, for example, the translation of (22a)/(24b) in the theory of Hamblin (1973) or Karttunen (1977):

- (26) a. $\lambda p \exists x \exists y [p = \hat{\text{cooked}}(x,y)]$
 b. $\lambda p \exists x \exists y [\bigvee p \wedge p = \hat{\text{cooked}}(x,y)]$

Hamblin's theory leaves it up to context to determine the propositions that are picked out by an answer while Karttunen's theory forces the question to denote only the set of true propositions. It is left open whether in a particular context there will be just one pair of individuals that will yield a true proposition or more than one. In the particular blend of the Hamblin/Karttunen system that I have argued for in connection with scope marking, this lack of distinction between list and REF-Q readings is inherited. Recall that a question is taken to denote Hamblin sets, but an answer to the question picks out the subset that is true, effectively giving us Karttunen sets. Which particular propositions fall into this set is left up to pragmatics. This problem also surfaces in theories like May (1985, 1989).

In the next subsection I will focus on certain properties of the list answer, showing that they must be semantically encoded. Incorporating those properties into the semantics, however, leads to different representations for REF-Q readings and list readings. This is shown to be a positive result.

2.2. Exhaustivity and Uniqueness in List Answers

2.2.1. *Exhaustivity* There are two properties of list answers that I want to focus on here. One, a question with a *wh* in subject and a *wh* in object position presupposes that a list answer will exhaustively pair every member of the subject term, but not necessarily every member of the object term.¹⁸ In addition, the relevant relations are one-one or many-one but not one-many.

The exhaustivity effect in multiple *wh* questions was noted first in Comorovski (1989). In her approach, the quantification associated with *wh* terms varies between universal and existential, the universal being reserved for the wide scope *wh*. To bring out Comorovski's generalization, let us construct a context like (27):¹⁹

- (27) a. Speaker A: We're organizing singles tennis games between men and women. There are three men interested in playing against women, namely Bill, Mike and John. But there are four women interested in playing against men, namely Mary, Sue, Jane and Sarah.

¹⁸ This notion is distinct from the notion of strong vs. weak exhaustiveness discussed by Groenendijk and Stokhof (1984).

¹⁹ I thank Christine Brisson and Strang Burton for judgments and discussion of English data. I also am indebted to the participants of the semantics seminar I taught at Rutgers in Spring '95.

- b. Speaker B: So, which man is playing against which woman?

The fact that there is a woman who is not going to be paired does not seem to matter. Native speakers find the discourse acceptable. Now, take the context in (28), almost like the previous one, except that there are more men than women:

- (28) a. Speaker A: We're organizing singles tennis games between men and women. There are four men interested in playing against women, namely Harry, Bill, Mike and John. But there are only three women interested in playing against men, namely Mary, Sue and Jane.
 b. Speaker B: So, which man is playing against which woman?

This discourse is judged by native speakers as odd or infelicitous. We can conclude from this that multiple wh questions have an exhaustivity requirement for the subject term but not for the object term, or equivalently in English at least, for the term that is in Spec S-structure. Though the judgments are delicate there is a clear contrast which holds up against a wide range of data.

Kiss (1993), looking at the same phenomenon, proposes to derive the universal force of a wide scope wh from a filter on interpretation which requires the wide scope operator to be specific. She suggests that specificity in the wide scope wh is to be interpreted as a universal quantifier. It is hard to definitively evaluate Kiss' account since she does not spell out the semantics needed to ensure that specificity is tantamount to universal quantification but there is an independent problem with the account that, it seems to me, makes it untenable. As it is set up, it does not ensure that the subject term must have scope over the object term. Presumably, the Specificity Filter determines which wh expression should have wide scope by filtering out any derivation in which the wide scope wh is not specific. But the specificity filter cannot play a role when all wh expressions are specific. The contexts in (27)-(28) are set up to factor out considerations of specificity. Both wh expressions have the form *which N*, generally assumed to be specific compared to *what* or *who* (Pesetsky 1987) and the set of men as well as women is fully identified. Thus the filter should be equally satisfied by giving either wh wide scope. The difference in judgments between (27) and (28) is thus unexpected.

2.2.2. *Uniqueness/Maximality* The second property of list answers has to do with uniqueness. It is generally accepted that questions with one wh DP of the form *which N* have a uniqueness implication while those with monomorphemic wh expressions like *who* or *what* do not:

(29) a. Which woman does John like?

b. Who does John like?

(30) a. John likes Mary.

b. John likes Mary and Sue.

(29a) can only be answered by (30a), while (29b) can be answered by (30a) or (30b). In order for (29a) to be answerable by (30b), *which woman* has to be changed to *which women*.

Related to this is the fact that a question with more than one wh DP, even when it is of the form *which N*, allows multiple pairs of individuals in the answer. Let us focus a bit on the nature of the pairings. It is accepted that there is a strong tendency for the pairings in such answers to be bijective but it has been a matter of some debate whether bijectivity should be included in the semantic representation of multiple wh questions or dealt with in pragmatic terms.

Engdahl (1986) argues against including it in the semantics. On the basis of question-answer exchanges like (31) she takes bijectivity to be an implicature that may be cancelled:

(31) a. Which table ordered which wine?

b. Table A ordered the Ridge Zinfandel, Table B ordered the Chardonnay and Table C ordered the Rose and the Bordeaux.

According to her, (31a) 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. (31b) thus is an appropriate answer to (31a) even though it includes a table which has ordered more than one wine.

While I share the intuition that (31b) seems acceptable in the context, I do not think that it provides a definitive argument against bijectivity. In Srivastav (1991a, 1991c) I followed Higginbotham and May (1981) in treating multiple wh questions as having a bijective reading. This was based on the fact that (32a) can readily be answered with (32b) but not by (32c):

- (32) a. Which man likes which woman?
 b. John likes Mary and Bill likes Sue.
 c. John likes Mary and Sue and Bill likes Jane and Sarah.

I argued that acceptable violations of bijectivity, such as (31), typically involve situations in which most of the pairings respect bijectivity and are therefore amenable to a pragmatic explanation. The questioner in (31a), 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.

Though I still think that Engdahl's example has a pragmatic explanation, I no longer think that multiple wh questions force one-one pairings. Consider, (33a) and the possible answers in (33b)-(33c):

- (33) a. Which student read which book?
 b. John read Moby Dick and Bill read Moby Dick too.
 John and Bill both read Moby Dick.
 c. John read Moby Dick and War and Peace.

While speakers accept (33b) as an answer to (33a), they feel the need to change *which book* to *which books* in order to accept (33c) as an answer. We can say that an appropriate answer to a multiple wh question pairs each member of the subject term with a member of the object term. This pairing can be one-one or many-one, but crucially not one-many. The contrast that shows this is quite sharp and calls for an explanation.

There is a potential contradiction between the two properties that I am claiming multiple wh questions have. It might be thought that there should not be any discernible exhaustivity effect if many-one pairings are admitted. Note though that the exhaustivity effect is evident in contexts where such pairings are pragmatically ruled out. In (27)-(28), for example, the context suggests that one event with several singles games is being considered. No individual can therefore be expected to play in more than one game. The contrast to keep in mind is between (27) and (28). There is an expectation that every member of the subject term, but not the object term, will participate in the event. The fact that there remains a residual asymmetry between subject and object positions even when contextual factors are controlled for suggests that exhaustivity and uniqueness must be structurally encoded.

2.3. *The Functional Approach to List Readings*

2.3.1. *Functional Binding in Multiple Wh Questions* Structural asymmetries have, of course, previously been observed in connection with the availability of list answers to questions with quantifiers (May 1985). A question with a universal quantifier in subject position allows list answers while a question with the universal in object position does not. (34a) can be answered with (34b) or (34c) but (35a) can only be answered with (35b):

- (34) a. Which woman does every man like?
 b. Every man likes Mary.
 c. John likes Mary and Bill likes Sue.
 (35) a. Which woman likes every man?
 b. Mary likes every man.
 c. *Mary likes John and Sue likes Bill.

Recall that both Comorovski and Kiss relate the exhaustivity in multiple wh questions with list answers to universal quantifiers. One can also see that uniqueness effects are evident in list answers to both types of questions. There is thus intuitive appeal in finding an explanation for multiple wh questions in terms of questions with quantifiers. My goal here is to make an explicit proposal to this effect.

May's account of subject-object asymmetries is well known but I will briefly summarize it in order to bring out its relation to the issues under discussion. Let us take (34) first. The individual answer is derived from an LF in which the wh has syntactic scope over the universal, as in (36a). Deriving the list answer is not straightforward since an LF like (36b), with the universal having wide scope, is not possible under the view that QR cannot adjoin the universal to CP:

- (36) a. $[_{CP} \text{which woman}_i [_{IP} \text{every man}_j [_{IP} t_j \text{ likes } t_i]]]$
 b. $*[_{CP} \text{every man}_j [_{CP} \text{which woman}_i [_{IP} t_j \text{ likes } t_i]]]$

In order for (36a) to be interpreted with the universal having scope over the wh, May invokes the Scope Principle which says that quantifiers which fall in a Σ sequence, defined in terms of mutual c-command, can be interpreted in any order. The universal in (36a) can now be interpreted with scope over the wh, and the list answer becomes available.

When the quantifier is in object position as in (35a) the two quantifiers cannot fall in a Σ sequence due to the Path Containment Condition of Pesetsky (1982) which says that overlapping A' paths must embed not intersect. This rules out (37a) as a possible LF and the only acceptable LF is one where the universal adjoins to VP as in (37b):

- (37) a. $*[_{CP} \text{which woman}_j [_{IP} \text{every man}_i [_{IP} t_j \text{ likes } t_i]]]$
 b. $[_{CP} \text{which woman}_j [_{IP} t_j [_{VP} \text{every man}_i [_{VP} \text{likes } t_i]]]]]$

The scope principle does not apply since the two quantifiers are too far apart to form a Σ sequence. The only answer to (35a) allowed by the theory is the individual answer in (35b).

It would be obvious that May's account cannot extend to the asymmetries in multiple wh questions, noted in section 2.2. A wh expression in object position would adjoin to Spec of CP but then it should fall in a Σ sequence with the subject wh expression. The Scope Principle would predict that either could take scope over the other:²⁰

- (38) a. Which man likes which woman?
 b. $[_{CP} [\text{which woman}_i [_{Spec} \text{which man}_j]] [_{IP} t_j \text{ likes } t_i]]]$

The proposal I would like to advance maintains Comorovski's and Kiss's analogy between multiple wh questions and questions with quantifiers. It adopts, however, the functional approach to list answers proposed by Chierchia (1991 and 1993).²¹ As Chierchia notes, the distribution of functional answers is similar to list answers. (34a) can be answered with (39), under a bound variable interpretation for the pronoun, but this is not possible for (35a):

- (39) His mother.

Building on the view in Engdahl (1986) that wh expressions can quantify over functions from individuals to individuals, he argues that this is reflected in the syntax. According to him, functional wh expressions leave a doubly indexed functional trace. The subscripted i-index identifying it with the wh operator is the functional variable.

²⁰ And, of course, the problem of interpreting the wide scope wh as universal and the narrow scope wh as existential would still remain.

²¹ Arnim von Stechow informs me that in recent work Ileana Comorovski also uses functions. Her approach will not capture exhaustivity and uniqueness for the same reasons that Chierchia's does not (see below).

The superscripted a-index, which can be bound by a c-commanding argument, is an individual variable. Intuitively, the a-index corresponds to the pronoun in the functional answer and may be taken as having a pronominal character. The LF and interpretation for the functional reading of (34a), under this account, is given below:

- (40) a. $[\text{which woman}_i [\text{every man}_j [t_j \text{ likes } t'_i]]]]$
 b. $\lambda p \exists f [\forall x (\text{woman}'(f(x))) \wedge p = \wedge \forall y [\text{man}'(y) \rightarrow \text{like}'(y, f(y))]]]$
 $\Rightarrow \{ \text{Every man likes his mother,}$
 $\text{Every man likes his wife,}$
 $\text{Every man likes his girlfriend} \}$

The quantification is over variables whose possible values are functions to a set of women, such as *mother-of*, *wife-of* etc. The functional reading of the question denotes for each such function, the set of propositions identical to the proposition that every man likes the individual he stands in that functional relation to. The list answer, roughly speaking, is the graph of the list. It gives for each member of the domain set the individual who stands in the relevant functional relation to that individual.

By positing functional traces for functional wh, Chierchia brings in syntactic structure into the functional account, making room for distinctions between quantifiers in subject and object positions. In order for functional binding to take place in (35a), for example, an LF like (41a) in which the quantifier c-commands the wh trace would be needed. (41a) is ruled out as a case of weak crossover violation since the variable t_j is coindexed with a pronoun to its left, the a-index of the wh term:²²

- (41) a. $*[\text{which woman}_i [\text{every man}_j [t'_i \text{ likes } t_j]]]]$
 b. $[\text{which woman}_i [t_i [\text{every man}_j [\text{likes } t_j]]]]]$

²² The a-index may be anaphoric instead of pronominal in some languages. Presumably, accounts of WCO can accommodate this variation. It should be noted that Chierchia's analysis of functional/list answers is not tied to any particular account of WCO. Two recent proposals treating it in terms of leftness and relating it to functional answers are Williams (1994) and Jacobson (1994). The latter argues for a variable-free semantics to get the same results as Chierchia. Other references for WCO are Koopman and Sportiche (1982) and Safir (1986).

The well-formed LF in (41b) has the quantifier adjoined to VP from which no functional binding can take place. The absence of list answers to questions with quantifiers in object position follows since list answers under this approach are derivative on functional answers. The only available answer here is the individual answer.

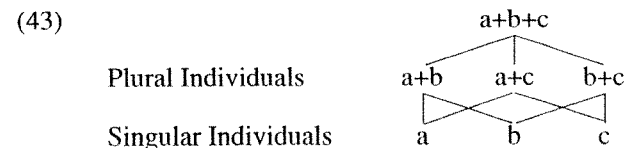
Turning to multiple wh questions, there is an obvious advantage in adopting the functional approach since the explanation for the subject-object asymmetry turns on the relation between the base positions not the landing sites. If we allow multiple wh questions to encode the kind of functional dependencies that questions with quantifiers do, one can say that in a question with two wh expressions, the a-index of one wh can be bound by the other. Taking an example like (38a), repeated below as (42a), we get two potential LF's for it, only one of which is syntactically well-formed:

- (42) a. Which man likes which woman?
 b. [_{CP}[which woman_j [_{CP}which man_i [_{IP}t_i like t_j]]]]
 c. * [_{CP}[which woman_j [_{CP}which man_i [_{IP}t_i like t_j]]]]

In (42b) the subject term binds the a-index of the object term and there is no problem with this binding. In (42c) the object term binds the subject term but this involves a WCO violation since *which woman* crosses over the pronominal a-index of *which man* in order to bind it. We have, then, the familiar asymmetry with respect to which wh can be functional and which wh can be the binder. I should mention that Williams (1994) also proposes that multiple wh questions encode functional dependencies that are subject to WCO effects, in Chierchia's terms. He does not, however, exploit the idea to account for the exhaustivity and uniqueness/maximality effects under discussion here.

Given the syntactic asymmetry with respect to binding that the functional approach encodes, a consequent asymmetry in interpretation seems intuitively plausible. The list answer can be seen as ruling through members of the domain set in giving the graph of the function, hence the exhaustivity effect. The uniqueness/maximality effect comes from the number feature on the wh determining the range of the function. Assuming an ontology such as Link (1983) and Landman (1989a), we can treat singular wh as ranging over atomic individuals. *Which man*, for example, would be interpreted as *man*' and denote the set {a,b,c} in (43); *Which men* would be interpreted as ranging over over atomic and sum individuals **man*' and denote the set {a,b,c,a+b,a+c,b+c,a+b+c}; monomorphemic

wh such as *who* or *what*, being unspecified with respect to the number feature, as ambiguous between the two:



If a question has a singular wh setting the range of the function, for any argument x , $f(x)$ will denote an atomic individual. If a question has a plural wh setting the range of the function, for an argument x , $f(x)$ can denote an atomic or a sum individual. Although it is technically possible for there to be only atomic individuals picked out by such a function, I assume that the choice of a plural wh carries an implicature that at least some of them be sum individuals.²³

Supporting evidence for the view that functional dependencies are at issue in determining which wh will be exhaustively paired comes from a scrambling language like Japanese. Take the multiple wh question in (44), due to Keiko Yoshida (personal communication):

- (44) a. dono kyaku-ga dono wain-o tanonda no
 which customer-NOM which wine-ACC asked(ordered) Q
 b. dono wain o dono kyaku ga tanonda no
 which wine-ACC which customer-NOM asked(ordered) Q
 "Which customer ordered which wine?"

Assuming a context in which customers have been asked to choose a wine as a special complimentary service, (44a)-(44b) impose different constraints. With normal word order, as in (44a), it is perfectly alright for the number of wines to exceed the number of customers. This is the familiar subject-oriented exhaustivity. Now if the object is scrambled, as in (44b), it is no longer felicitous in contexts where there are more wines than customers. It is the object term that must be exhaustively paired. In the present proposal, exhaustivity is a result of domain setting and an object term cannot set the domain because it leads to WCO violations. As is well-known in the literature on scrambling, however, scrambling countenances WCO violations (Webelhuth 1989, Saito 1985, 1992, Gurtu 1985, Mahajan 1990,

²³ In earlier work I had assumed that plural wh's range over sum individuals only. Yoshida (1993) cites John Whitman as pointing out that this restriction may be too strong.

Déprez 1989, Dayal 1994a). The object-oriented exhaustivity of scrambled sentences is thus expected under the functional approach to multiple wh. These facts are replicated in Hindi as well.

In spite of these strong intuitive correlations, exhaustivity and uniqueness/maximality effects do not follow automatically. In the next subsection we will see that the interpretation Chierchia proposes for the list readings of questions with quantifiers do not yield answers with these properties. I will suggest a way of deriving exhaustivity and uniqueness in multiple wh questions. To the extent that list answers to the two types of questions are similar, I expect that there will be a natural extension of the list reading of multiple wh questions to the list reading of questions with quantifiers.²⁴

2.3.2. *Functional C_{+wh}^0 and List Readings* Chierchia (1993) derives list answers from functional answers via an absorption operation. The quantifier, instead of being interpreted in the scope of the

²⁴ As we will see, the list reading of questions with quantifiers in Chierchia's theory denotes a family of questions but the list readings of multiple wh that I will propose denotes a question, i.e. a set of propositions. One possible advantage in moving to an ordinary question denotation for the list readings of questions with quantifiers is the following. In Chapter III, we saw that scope marking structures were available only with those embedding verbs that select -wh complements, for example *think* and *know* but not *ask*. At the same time, the complement itself had to contain a wh expression, since the complement restricts a propositional variable. If questions with quantifiers, under their list interpretation, denoted sets of questions, we would predict they would occur in scope marking structures with embedding verbs like *ask* but not *think* and *know*. This prediction, however, is not borne out. (ia) can easily be answered with (iia) or (iib) but (ib) is ungrammatical:

- (i) a. jaun kyaa soctaa hai har bacca kaun kitaab khariidegaa
John what think-PR every child which book buy-F
"What does John think, which book will every child buy?"
b. *jaun kyaa puuchh rahaa thaa har bacca kaun kitaab khariidegaa
John what ask-PROG-P every child which book buy-F
"What was John asking, which book will every child buy?"
(ii) a. jaun soctaa hai ki ravi laal phuul khariidegaa aur raam godaan
khariidegaa
"John thinks that Ravi will buy *laal phuul* and Ravi will buy *godaan*."
b. jaun soctaa hai ki har bacca apni man pasand kitaab khariidegaa.
"John thinks that every kid will buy his favorite book."

propositional variable p , combines with the wh expression. This results in a family of questions interpretation. Each member of this family draws on minimal witness sets A of the quantifier and includes propositions of the appropriate form for each member of this set.²⁵ To answer a question is to answer one of the questions in the set. An answer is defined, following Lahiri (1991), as any proposition which is a conjunction of some of the propositions in the question denotation:

- (45) a. Which woman does every man like?
b. $\lambda P \exists A [W(\text{every man}, A) \wedge P(\lambda p [\exists f \in [A \rightarrow \text{woman}] \exists x \in A [p = \wedge \text{like}(x, f(x))]])]$
c. { {John likes Mary, John likes Sue,
Bill likes Mary, Bill likes Sue} }
d. $A_Q(p) = \exists S [S \subseteq Q \wedge p = \cap S]$

The list reading of (34a), repeated as (45a), is given in (45b). If the set of men includes John and Bill and the set of women, Mary and Sue we get the family of questions in (45c). Since *every man* has only one witness set, it denotes a set with just one question. An answer to this question will be the conjunction of any subset of this question. As we can see, exhaustivity and uniqueness would have to be considered pragmatic effects, just as in Hamblin (1973) or Karttunen (1977).

Let us see what it would take to enforce exhaustivity and uniqueness in a functional approach, focusing on multiple wh questions. Assuming that an LF encoding a functional dependency between wh expressions is interpreted as a set of propositions, we would want to ensure that each of the propositions in the set constitutes a complete answer to the question, pairing every individual in the domain of the function with some member in the range of the function. So, for example, we want (42a), under the derivation (42b), repeated below as (46a)-(46b), to denote something like (46c). If John and Bill are the two men in the situation and Mary and Sue the two women, each member of this set constitutes a complete answer to the question, exhaustively pairing each member of the set of men with exactly one woman:

- (46) a. Which man likes which woman?
b. $[_{CP}[\text{which woman}] [_{CP}[\text{which man}_i [_{IP}t_i \text{ like } t'_j]]]]]$

²⁵ Barwise and Cooper (1981) define witness sets of a generalized quantifier as subsets of the common noun that are members of the quantifier. A minimal witness set is one that does not have a proper subset that is also a witness set.

- c. {John likes Mary and Bill likes Sue,
John likes Mary and Bill likes Mary,
John likes Sue and Bill likes Sue,
John likes Sue and Bill likes Mary}

Exhaustivity and uniqueness effects are preserved, if an answer to a question is defined as the only true proposition in the question denotation. If more than one proposition could be true, the uniqueness effect would be dissipated. Answers such as *John loves Mary and Sue and Bill loves Jane and Sarah* would be acceptable, contrary to fact. Thus we change the definition of answerhood we had proposed in Chapter III, repeated here as (47a), to the one in (47b):

- (47) a. $\text{Ans}(Q) = \lambda p[p \in Q \wedge \forall p']$
b. $\text{Ans}(Q) = \lambda p[p \in Q \wedge \forall p' \in Q [\forall p' \rightarrow p \subseteq p']]$

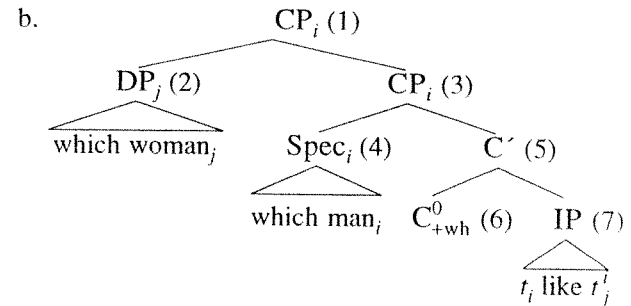
(47b) includes a maximality clause that will be relevant later when we discuss questions with plural or monomorphemic wh expressions.²⁶

Our goal, then, is to interpret functional dependencies in a way that yields sets like (46c). In order to do so, let us take a concrete example and interpret it within the theory of questions we adopted in Chapter III (Bittner 1994a. See, however, Bittner 1996 for a fully worked out proposal). Recall that in this system the essential propositional variable p is introduced as part of the meaning of C_{+wh}^0 . Here I will propose that C_{+wh}^0 is ambiguous between its normal meaning $\lambda p'[p=p']$ and the functional meaning given in (48a). The essential idea here is that a functional C_{+wh}^0 introduces three variables, two of which are property variables and stand for the domain and range of the function. The values of these variables are fixed by the wh expressions, whose basic type I take to be property denoting, as proposed by Bittner. The third variable is what allows the C_{+wh}^0 to combine with IP's with free individual as well as functional variables.

²⁶ It also may be used to distinguish partial and complete answers. A partial answer, under this view, is any true proposition that is entailed by the maximally true proposition. This, I think, preserves Lahiri's (1991) insight about how to distinguish between partial and complete answers in propositional theories of questions. Finally, note that this approach will allow questions and sentential complements to be co-ordinated as in *John knows that Bill is here and who will come later*. Groenendijk and Stokhof (1984) argued on the basis of such cases that questions should denote propositions, not sets of propositions (see also Jacobson 1995).

Its semantic type is a relation between individuals and functions of type $\langle e, e \rangle$.²⁷

(48) a. $C_{+wh}^0 = \lambda Q \lambda Y \lambda X \exists f [\text{Dom } f = Y \ \& \ \forall y [X(f(y))] \ \& \ p = \cap \lambda p' \exists y [Y(y) \ \& \ p' = \wedge Q(y)(f)]]$



7. $\text{like}'(x_i, f_j(x_i))$
6. $C_{+wh}^0 = \lambda Q \lambda Y \lambda X \exists f [\text{Dom } f = Y \ \& \ \forall y [X(f(y))] \ \& \ p = \cap \lambda p' \exists y [Y(y) \ \& \ p' = \wedge Q(y)(f)]]$
5. $\lambda Q \lambda Y \lambda X \exists f [\text{Dom } f = Y \ \& \ \forall y [X(f(y))] \ \& \ p = \cap \lambda p' \exists y [Y(y) \ \& \ p' = \wedge Q(y)(f)]] (\lambda x_i \lambda f_j [\text{like}'(x_i, f_j(x_i))])$
 $\Rightarrow \lambda Y \lambda X \exists f [\text{Dom } f = Y \ \& \ \forall y [X(f(y))] \ \& \ p = \cap \lambda p' \exists y [Y(y) \ \& \ p' = \wedge \lambda x_i \lambda f_j [\text{like}'(x_i, f_j(x_i))](y)(f)]]$
 $\Rightarrow \lambda Y \lambda X \exists f [\text{Dom } f = Y \ \& \ \forall y [X(f(y))] \ \& \ p = \cap \lambda p' \exists y [Y(y) \ \& \ p' = \wedge \lambda f_j [\text{like}'(y, f_j(y))](f)]]$
 $\Rightarrow \lambda Y \lambda X \exists f [\text{Dom } f = Y \ \& \ \forall y [X(f(y))] \ \& \ p = \cap \lambda p' \exists y [Y(y) \ \& \ p' = \wedge \text{like}'(y, f(y))]]$
4. man'
3. $\lambda Y \lambda X \exists f [\text{Dom } f = Y \ \& \ \forall y [X(f(y))] \ \& \ p = \cap \lambda p' \exists y [Y(y) \ \& \ p' = \wedge \text{like}'(y, f(y))]] (\text{man}')$
 $\Rightarrow \lambda X \exists f [\text{Dom } f = \text{man}' \ \& \ \forall y [X(f(y))] \ \& \ p = \cap \lambda p' \exists y [\text{man}'(y) \ \& \ p' = \wedge \text{like}'(y, f(y))]]$
2. woman'
1. $\lambda X \exists f [\text{Dom } f = \text{man}' \ \& \ \forall y [X(f(y))] \ \& \ p = \cap \lambda p' \exists y [\text{man}'(y) \ \& \ p' = \wedge \text{like}'(y, f(y))]] (\text{woman}')$

²⁷ Thanks to Maria Bittner for pointing out a problem with the way in which the range variable was introduced in an earlier version. The present version is closer to Engdahl's original formulation and will account for variable binding for elements inside the object wh more or less along the lines of Engdahl.

$$\Rightarrow \exists f[\text{Dom } f = \text{man}' \ \& \ \forall y[\text{woman}'(f(y))] \ \& \ p = \cap \lambda p' \ \exists y \\ [\text{man}'(y) \ \& \ p' = \text{'like}'(y, f(y))]] \\ \lambda p \exists f[\text{Dom } f = \text{man}' \ \& \ \forall y[\text{woman}'(f(y))] \ \& \ p = \cap \lambda p' \ \exists y \\ [\text{man}'(y) \ \& \ p' = \text{'like}'(y, f(y))]]$$

As would be obvious, the functional meaning is inspired by Chierchia's absorption operation for deriving list answers to questions with quantifiers. Here, the meaning of C_{+wh}^0 introduces existential quantification over functions. It also intersects the propositions obtained by substituting the members of the domain of this function in the translation of IP. The variable p is, as before, introduced at this level and remains free till the highest CP node where it is abstracted over to yield a set of propositions as the denotation of the question.²⁸

Every proposition in this set has the two features we identified as characteristic of answers to multiple wh questions, namely exhaustivity and uniqueness. The effect of universal quantification for wh terms is a consequence of the fact that for each function, the proposition we get is the graph of that function.²⁹ The domain set provides, we might say in terms of Kuno (1982), the sorting key for the relation characterized by the answer. Uniqueness follows from the fact that the number feature on the wh expression determines whether the function will range over atomic or sum individuals. At any world-time index $Ans(Q)$ picks out the unique true proposition in the set. The point to note is that once functional dependencies are recognized in the syntax of multiple wh questions, general properties of functions are expected to play a role in their interpretation. Thus it stands to

²⁸ Note that wh expressions are adjoined to CP instead of to Spec of CP. This is not in keeping with Chomsky (1986a) where adjunction is a debarrierizing process but Déprez (1989), Lasnik and Saito (1992) and Cinque (1990) have argued against this aspect of the Barriers model. The advantage of CP adjunction here is that it allows interpretation to proceed compositionally.

²⁹ I assume that multiple wh questions with more than two wh terms such as (i) have a representation like (ii) and are translated as (iii):

- (i) Which man gave which book to which woman?
- (ii) [which book_{*i*} [which woman_{*j*} [which man_{*k*} [t_k gave t_i^k to t_j^k]]]]]
- (iii) $\lambda p \exists f_1 \exists f_2 [\forall x \text{woman}'(f_1(x)) \wedge \forall x \text{book}'(f_2(x)) \wedge p = \cap \lambda p' \exists y [\text{man}'(y) \wedge p' = \text{'give}'(y, f_2(y), f_1(y))]]$

Alternatively, there could be two functions, one from men to books and the other from books to women that undergo function composition.

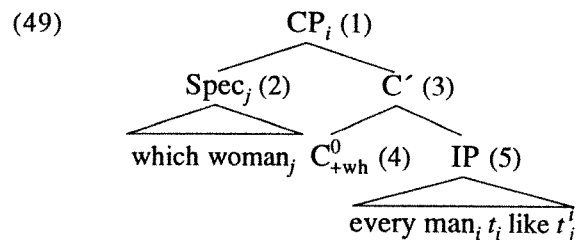
reason that exhaustivity and uniqueness are part of the semantics of multiple wh questions. Perhaps I should point out here that though Engdahl (1986) takes a functional approach to multiple wh questions, she does not posit a functional dependency between wh expressions. Each wh expression denotes an independent 0-place function, which is equivalent to quantification over individuals. As a consequence, exhaustivity and uniqueness are not encoded in her system.

The key modification I have introduced here is a functional interpretation for C_{+wh}^0 . Recall, however, that C_{+wh}^0 was earlier analyzed as denoting a function from propositions to propositions, namely $\lambda p' [p = p']$. The question that arises is whether we must choose between the two meanings or allow C_{+wh}^0 to be ambiguous. As we will see, the regular meaning is crucial for deriving the REF-Q readings of multiple wh questions as well as single wh questions, forcing us to treat it as ambiguous. I would like to point out, in this connection, that all theories of list answers to questions with quantifiers have to say something special about the interpretation of the quantifier (May 1985, Chierchia 1993, Groenendijk and Stokhof 1984).³⁰ The ambiguity of C_{+wh}^0 may be thought of in the same light.

Before moving on to REF-Q readings of multiple wh questions, let us see how the account extends to single wh questions. Let us first consider questions with quantifiers, where the ambiguity of C_{+wh}^0 can be exploited to account for the difference between functional and list readings. In (49) we have a structure in which the universal is interpreted inside C' . Since there is only one variable free inside IP, the ordinary meaning comes into play, and the IP denotation is identified with the propositional variable p . We assume a type-shifting operation of the following form $\lambda Q [\lambda F \exists f [\forall x [Q(f(x))] \ \& \ F(f)]]$ for the wh expression. This is a straightforward generalization of the type-lifting operation that takes the property denoted by the wh term and turns it into a generalized quantifier over functions of type $\langle e, e \rangle$, where the property fixes the range of the function. Something like this is needed to extend the theory of A'-binding to the case of functional wh in any theory that posits functional traces, such as

³⁰ Groenendijk and Stokhof, unlike Engdahl and Chierchia, allow quantification over functions only for functional answers. The list answer, for them, involves quantification over individuals but gives the universal scope over the wh, which entails an extension of normal quantifying in operations. Engdahl, on the other hand, takes the list answer to derive from the functional answer but does not posit any semantic operation for it. That, however, leaves open the question of how list answers are to be restricted to certain quantifiers only (see Groenendijk and Stokhof 1984 and Chierchia 1991, 1993 for discussion as well as ft. 31).

Engdahl (1986), Groenendijk and Stokhof (1984) and Chierchia (1991, 1993):



5. $\forall x[\text{man}'(x) \rightarrow \text{like}'(x, f_j(x))]$
4. $\lambda p'[p = p']$
3. $\lambda p'[p = p'] (\forall x[\text{man}'(x) \rightarrow \text{like}'(x, f_j(x))])$
 $\Rightarrow p = \forall x[\text{man}'(x) \rightarrow \text{like}'(x, f_j(x))]$
2. woman'
 $\Rightarrow \lambda F \exists f[\forall x[\text{woman}'(f(x))] \& F(f)]$
1. $\lambda F \exists f[\forall x[\text{woman}'(f(x))] \& F(f)] (\lambda f_j[p = \forall x[\text{man}'(x) \rightarrow \text{like}'(x, f_j(x))]])$
 $\Rightarrow \exists f[\forall x[\text{woman}'(f(x))] \& \lambda f_j[p = \forall x[\text{man}'(x) \rightarrow \text{like}'(x, f_j(x))]](f)]$
 $\Rightarrow \exists f[\forall x[\text{woman}'(f(x))] \& [p = \forall x[\text{man}'(x) \rightarrow \text{like}'(x, f(x))]]]$
 $\lambda p \exists f[\forall x[\text{woman}'(f(x))] \& [p = \forall x[\text{man}'(x) \rightarrow \text{like}'(x, f(x))]]]$

In order to derive the list reading of the question, on the other hand, the functional meaning of C^0_{+wh} would have to be used. The derivation would proceed as in (48b), the list reading of multiple wh questions, if the universal quantifier is interpreted higher than C' and its witness set used to set the domain. These two departures from standard treatments of the universal quantifier are also part of Chierchia's theory. Under the present approach, however, exhaustivity and uniqueness are captured, something that remained elusive in Chierchia's original version.³¹

³¹ I am assuming that we use unique witness sets in setting the domain of the function, rather than minimal witness sets. This effectively restricts list readings to the set of universal quantifiers and allows us to keep to the view that questions denote sets of propositions rather than sets of questions (cf. footnote 24). A possible advantage of this is that list readings with quantifiers like *most* are disallowed, which under Chierchia's theory are incorrectly predicted to yield lists. Also disallowed are list answers with indefinites like *two*, which I think are amenable to an analysis in terms of plurality such as the one developed in

Turning now to simple wh questions like (50a), we treat the wh as ranging over 0-place functions or, equivalently, over ordinary individuals. Here again the relevant interpretation of C^0_{+wh} is $\lambda p'[p=p']$ since the question does not involve a functional dependency:³²

- (50) a. Which man came?
 b. $[_{CP} \text{which man}_i [_{IP} t_i \text{ came}]]$
 c. $\lambda p \exists x [\text{man}'(x) \wedge p = \text{came}'(x)]$
 d. {John came, Bill came, Harry came}

The question denotes a set of atomic propositions because quantification is restricted to atomic men. At any world-time index exactly one of these will be true and we get the uniqueness associated with single wh questions like (50a). This generalizes readily to plural or unspecified wh. Since such wh expressions quantify over atomic as well as plural individuals, a question like (51a) yields a set such as the one in (51c):

- (51) a. Who/Which men came?
 b. $\lambda p \exists x [* \text{man}'(x) \wedge p = \text{came}'(x)]$
 c. {John came, Bill came, Harry came, John+Bill came, John+Harry came, Bill+Harry came, John+Bill+Harry came}

Here the maximality requirement in the definition of $\text{Ans}(Q)$ given in (47b) plays a crucial role. If John and Harry both came, the answer to (51a) is the maximally true proposition *John+Harry came*, the propositions *John came* and *Harry came* being entailed by it. Thus we can get the variation between the so-called singular and plural readings of questions with *who* without any stipulations. The true answer names an atomic individual only if exactly one individual came, otherwise it names the sum individual who came.

section 4.2. See also Moltmann and Szabolcsi (1994) and Szabolcsi (1994). Such readings will also be disallowed with universal *any*, under the view proposed in Dayal (1995b) that it is a modal determiner whose domain cannot be contextually specified.

³² The fundamental idea of how to capture the variation between uniqueness and maximality is the one proposed in Srivastav (1991a, 1991c) but the details have been changed to fit the answerhood conditions argued for here.

In concluding this section I want to briefly discuss question-answer pairs like (52) which seem to go against the existential presuppositions that propositional theories of questions assume:

- (52) a. Which man came to the party?
b. No man came to the party.

Although the acceptability of (52b) shows that someone could ask (52a) even if there is no individual who has the relevant property, I do not think it constitutes convincing evidence against the existential presupposition in the question. (52b) counts as an appropriate answer because it explicitly denies the presupposition behind the question. Note that in contexts that make it clear that no man came to the party such a question would be inappropriate (see also Comorovski 1989).

It may be worth pointing out that a parallel situation exists with multiple wh. The explanation for the exhaustivity effect I have given crucially presupposes that every member of the domain set is related to some individual in the range set. As shown by the possibility of answering (53a) with (53b), however, there are situations where some member of the domain set is not paired and yet a multiple wh question can be asked:

- (53) a. Which man likes which woman?
b. John likes Mary, Bill likes Sue but Harry doesn't like any woman.

Note though that for this exchange to be acceptable it is crucial that the questioner expect each man to be paired and it is this presupposition that the proposed analysis tries to capture. (53b) is acceptable because it explicitly addresses, and denies, the presupposition about exhaustivity.³³ It is in contexts such as (28) where it is clear that a member of the domain set will be left unpaired that the exhaustivity effect shows up. As Comorovski (1989) notes, in such situations the only way to ask a felicitous question is to ask a conjoined question. *Which men are playing? And which man is playing against which woman?* would first determine a subset of three men, which can then serve as the domain set in the computation of the multiple wh question. The crucial contrast to keep in mind is that such an effect does not show up in (27) where a member of the object term is left unpaired, even though the contexts are parallel.

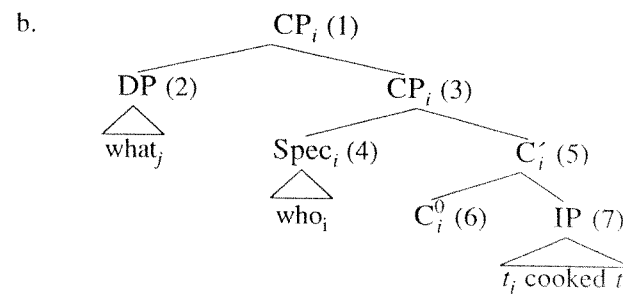
³³ We might assign a dummy or non-existent object as the value of $f(x)$ in those cases where x is not paired, thereby allowing the interpretation to be computed.

To sum up, I have identified exhaustivity and uniqueness as significant properties of multiple wh questions. I have also suggested that functional dependencies play a role in the interpretation of wh questions. This allows us to exploit properties of functions to explain exhaustivity and uniqueness as semantic effects. I have also showed how uniqueness and maximality effects in single wh questions are captured in this approach.

2.4. Deriving REF-Q and Echo-Q Readings

Let us see now how the ambiguity of C_{+wh}^0 can be exploited to account for the other readings of multiple wh questions, namely REF-Q and Echo-Q readings. The normal meaning of C_{+wh}^0 yields the REF-Q readings of multiple wh questions straightforwardly since a wh expression can be treated as functional or regular. (24b), repeated below as (54a), under a non-functional representation will be interpreted as (54b). Since there is no functional dependency, functional C_{+wh}^0 is not invoked and the wh expressions type-shift to ordinary existential quantifiers:

- (54) a. Who cooked what?



7. $\text{cooked}'(x_i, x_j)$
6. $\lambda p' [p=p']$
5. $\lambda p' [p=p'] (\wedge \text{cooked}'(x_i, x_j))$
 $\Rightarrow p = \wedge \text{cooked}'(x_i, x_j)$
4. $*\text{person}' \Rightarrow \lambda Q \exists x [*\text{person}'(x) \wedge Q(x)]$
3. $\lambda Q \exists x [*\text{person}'(x) \wedge Q(x)] (\lambda x_i [p = \wedge \text{cooked}'(x_i, x_j)])$
 $\Rightarrow \exists x [*\text{person}'(x) \wedge p = \text{cooked}'(x, x_j)]$
2. $*\text{thing}' \Rightarrow \lambda Q \exists y [*\text{thing}'(y) \wedge Q(y)]$
1. $\lambda Q \exists y [*\text{thing}'(y) \wedge Q(y)] (\lambda x_j [\exists x [*\text{person}'(x) \wedge$

$$\begin{aligned}
 & p = \hat{\text{cooked}}'(x, x_j)]]) \\
 \Rightarrow & \exists y \exists x [*thing'(y) \wedge *person'(x) \wedge \\
 & \quad p = \hat{\text{cooked}}'(x, y)] \\
 \lambda p \exists y \exists x & [*thing'(y) \wedge *person'(x) \wedge \\
 & \quad p = \hat{\text{cooked}}'(x, y)]
 \end{aligned}$$

- c. { $\hat{\text{John}}$ cooked the meat,
 $\hat{\text{Bill}}$ cooked the meat,
 $\hat{\text{John}}$ cooked the rice,
 $\hat{\text{Bill}}$ cooked the rice}

Here wh expressions are treated like ordinary set-denoting expressions that type-shift to ordinary existential quantifiers, yielding a standard Hamblin-type set as the denotation of the question. The difference comes from the answerhood conditions assumed here. (47b) applied to (54c) picks out a unique proposition, i.e. it identifies exactly one pair of a person and an object as standing in the relevant relation. We have the REF-Q reading of (54a). By positing an ambiguity in the meaning of C_{+wh}^0 , the present account improves over possible pragmatic accounts of the phenomenon. Answers to multiple wh questions can give a single pair or exhaustively pair all members of the domain set. The possibility of answers pairing some members of the domain but not others is ruled out.

Let us turn now to echo questions. Recall that a question like (23b), with echo intonation on the wh words, also identifies a unique pair of individuals. The fundamental difference between an echo-Q and REF-Q or list readings is in the answerhood conditions. An echo question seeks to identify the previous utterance rather than establish the facts in the actual world. Thus, something like (55) is needed (see also Comorovski 1989 for a similar approach and Cooper 1983 for another approach):

$$(55) \text{ Ans}(Q_{\text{echo}}) = \text{tp} [p \in Q \wedge \text{previously-uttered}'(p)]$$

Applied to (54c) it will also yield a single proposition. The echo-Q and the REF-Q readings of (54a) differ only in the relation of the proposition picked to the facts of the world or the discourse. So far echo questions bring nothing unexpected into the discussion.

But now consider the same question with only one wh having echo interpretation. The contrast is between (56a) and (56b). While an appropriate answer to the first is a proposition, an appropriate answer to the second is itself a question. (56b) could be answered, for example, with something like (56c). This could be obtained by

applying (55) to a set such as (56d). That is, a multiple wh question with one echo wh expression is a second order question, as noted by Karttunen (1977):

- (56) a. *Whó* cooked *whát*?
 b. Who cooked what?
 c. Who cooked the meat?
 d. {Who cooked the meat?, Who cooked the rice?, Who cooked the vegetables?}

Following suggestions of Maria Bittner (personal communication) I treat echo wh expressions as bound by a null Echo operator, defined as follows:³⁴

$$(57) \lambda Z \lambda Q [\exists x_1 \dots \exists x_n [Q = Z(x_1) \dots (x_n)]]$$

Let us suppose that the Echo operator is located under CP* which dominates CP. I leave it open whether there is actual movement to CP* at LF. Leaving the semantic type of Z open, it can apply to functions from (sequences of) individuals to propositions or to questions. To see how this would work, let us consider the derivation for (56a) first. I give only the essential steps in the derivation:

(58) a.

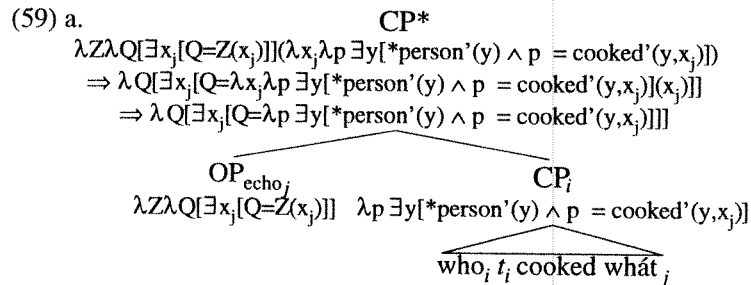
$$\begin{array}{c}
 \text{CP}^* \\
 \lambda Z \lambda Q [\exists x_i \exists x_j [Q = Z(x_i)(x_j)]] (\lambda x_i \lambda x_j [\hat{\text{cooked}}'(x_i, x_j)]) \\
 \Rightarrow \lambda Q [\exists x_i \exists x_j [Q = \lambda x_i \lambda x_j [\hat{\text{cooked}}'(x_i, x_j)]](x_i)(x_j)] \\
 \Rightarrow \lambda Q [\exists x_i \exists x_j [Q = \hat{\text{cooked}}'(x_i, x_j)]] \\
 \begin{array}{cc}
 \text{OP}_{\text{echo}_{i,j}} & \text{CP} \\
 \lambda Z \lambda Q [\exists x_i \exists x_j [Q = Z(x_i)(x_j)]] & \hat{\text{cooked}}'(x_i, x_j) \\
 & \text{Whó}_i \text{ cooked whát}_j
 \end{array}
 \end{array}$$

- b. {John cooked the meat, John cooked the rice, John cooked the vegetables, Bill cooked the meat, Bill cooked the rice, Bill cooked the vegetables}

³⁴ I am not aware of any explicit proposals for deriving echo interpretations. One reference that may be relevant is Reis (1990) but I have not yet had an opportunity to read it.

Since both wh expressions have echo intonation the lower CP denotes an ordinary proposition. At this point, the free variables introduced by the echoed expressions can be abstracted over. OP_{echo} can then combine with the CP, existentially binding the variables and turning the proposition into a set of propositions. We then get sets like (58b) and $Ans(Q_{echo})$ applied to it picks out a unique proposition as the previously uttered one.

Now, let us take (56b) where there is one regular wh and one echo wh. Again, I give only the essential steps in the derivation:



- b. { { ^John cooked the meat, ^Bill cooked the meat }
 { ^John cooked the rice, ^Bill cooked the rice }
 { ^John cooked the vegetables, ^Bill cooked the vegetables } }

The chief difference here is that one of the wh expressions is a regular wh operator that moves to Spec. It triggers an interrogative C^0 and the lower CP is interpreted as a set of propositions. The free variable introduced by the echoed expression is then abstracted over. OP_{echo} combines with CP and existentially binds the free variable. It also turns the set of propositions into a set of sets of propositions. We get denotations like (59b). $Ans(Q_{echo})$ applied to this picks out a unique question as the previously uttered one.

An interesting consequence of this approach is that an echo question with just one wh expression is interpreted as an ordinary question:

- (60) a. Who cooked the meat?
 b. { ^John cooked the meat, ^Bill cooked the meat }

Since the lower CP does not have an interrogative C^0 , it will denote a proposition. The effect of OP_{echo} , then, is to lift a proposition into a set of propositions. Note that no third order questions are predicted under this approach.

To sum up the discussion of the semantics of questions, I began by noting that multiple wh questions have three distinct readings, a list reading, a REF-Q reading and an echo question reading. I then focused on two properties of list readings, exhaustivity and uniqueness/maximality, and argued that these are reflexes of a functional dependency between wh expressions. I then proposed that C_{+wh}^0 is ambiguous between a functional and a regular interpretation. The functional meaning comes into play when there is a functional dependency in the IP denotation and yields a set of propositions, each of which gives the graph of a function. An appropriate answer picks the unique proposition that holds in the actual world. The ordinary meaning of C_{+wh}^0 comes into play when there is no functional dependency involved. In these cases we get a set of propositions that simply pairs individuals. An appropriate answer picks the unique true proposition in the set, identifying a single pair of individuals in the relevant relation. Echo questions involve a null operator that is defined on propositions as well as questions. This results in a second order interpretation if the question has echoed wh expressions in addition to one ordinary wh expression.

3. D-LINKING AND LONG-DISTANCE LISTS

3.1. *Parallels Between D-Linked and Echo Questions*

In section 2.4, I showed that the requirement for a triangular configuration of wh expressions in long-distance lists and unexpected locality effects are explained if the +wh complement can interact scopally with the matrix wh. That is, I argued that a long-distance list answer is a multiple wh question between the matrix wh and the +wh complement. The crucial assumption I made was the following. A +wh complement with just one wh expression has an ordinary question denotation and combines directly with the matrix verb. A multiple wh complement with at least one D-linked wh has the option of being interpreted as a family of questions. In this case it cannot combine with the matrix verb and QR is forced. We have seen in section 2 that the semantic type of echo questions varies between sets of propositions and sets of questions depending on the number of wh expressions in it. In this section I will show that D-linked questions and echo questions share several properties, thereby presenting

indirect evidence in support of that the claim that the semantic type of D-linked questions also correlates with the number of wh expressions in it.

Note, first of all, that there are combinations of wh expressions that do not yield well-formed multiple wh questions, under the list or the REF-Q reading. They readily yield well-formed echo questions, however:

- (61) a. Did Mary do *what/whát?
 b. How did Mary do *what/whát?
 c. Why did Mary do *what/whát?

Such combinations are also acceptable in complement position of questions when the embedded wh in-situ is stressed or interpreted as linked to a contextually salient set. This latter reading is more accessible when an inherently D-linked wh is used. This is shown in (62):

- (62) a. Who knows whether Mary bought *what/whát/which book?
 b. Who remembers how Mary solved *what/whát/which problem?
 c. Who knows why Mary bought *what/whát/which book?

Hirschbuhler (1978) observed that these questions obligatorily yield long-distance answers. He argued that in these cases the embedded wh in situ is forced to move to matrix Spec because movement to the lower Spec is ruled out, as shown by the unacceptability of questions like (61).³⁵

Under the present approach, an alternative explanation that also draws a parallel with (61) while maintaining locality is available. Since the complements in (62) can only be given a second order interpretation, the complement cannot combine directly with the verb and an individual answer is ruled out. QR is forced, leading to an obligatory multiple wh question reading. The same may apply to the other examples that have been cited in the literature as supporting obligatory long-distance movement, such as (63) taken from Lasnik and Saito (1992: 118):

³⁵ Note though that there is no explanation currently available for why the examples in (61) are not acceptable multiple wh questions. The ECP does not explain their deviance, since the wh in-situ is lexically governed. I leave this as an open problem here.

- (63) Who wonders what who bought?

There are other correlations between D-linking and echo questions that one can make. It has been noted that in some languages D-linked expressions tend to stay in-situ (Pesetsky 1987 and Obenauer 1994), just as echoed expressions do.³⁶ This correlation, however, is not strong. In languages like English, for example, questions with just one wh expression do not leave them in-situ even if they are D-linked. There is, however, stronger evidence from Romanian. Comorovski (1989) points out that Romanian is a multiple-fronting language in which the order of moved wh expressions is fixed. (64a), for example, is ungrammatical because the direct object precedes the subject. Read with echo interpretation on both wh's, however, it becomes acceptable. Similarly, (64b) is acceptable with with a D-linked direct object preceding the subject:

- (64) a. [Despre ce_i cine_j [e_j ti - a vorbit e_i]]
 About what who to-you has told
 "Who told you about what?"
 b. [Despre care_i cine_j [e_j ti - a vorbit e_i]]
 About which who to-you has told
 "Who told you about which one?"

Another point she makes is that D-linked wh expressions and echoed wh expressions can be extracted out of wh-islands. (65a) is acceptable only if read with echo question intonation:

- (65) a. [Ce_i [nu stii [cine_j [e_j a spus e_i]]]]
 what not you-know who has said
 "What don't you know who said?"
 b. [Pe care_i [nu stii [cine_j [e_j a cumparat-o_i e_i]]]]
 prep.which not you-know who has bought her
 "Which don't you know who bought?"

I should emphasize here that I do not intend to conflate echo and D-linked questions completely. The primary difference between them has to do with locality constraints. Echoed wh expressions

³⁶ Obenauer (1994) also has an in depth study of so-called aggressively non-D-linked wh expressions such as *what the hell*. I have not had a chance to incorporate his insights here.

obligatorily take widest scope, as pointed out by Karttunen (1977). In (66), for example, the variable introduced by *which book* can be bound by OP_{echo} from outside the wh island. This correctly yields a set of propositions as the denotation of (66a) and a set of questions as the denotation of (66b):

- (66) a. Mary isn't sure whether to read which book?
 b. Who isn't sure whether to read which book?

The thesis I have advanced about D-linked wh expressions, on the other hand, requires them to take scope over the clause in which they occur at S-structure. The point I want to emphasize here is simply that there are some properties that separate echo and D-linked wh from ordinary wh expressions. And if we take the possibility of second order interpretations to be one such property, a number of facts about long-distance lists are explained. Put another way, I am suggesting that operations associated with CP* are triggered by discourse-sensitive elements such as echoed or D-linked wh expressions. The connection here with a theory of focus is obvious (Rooth 1985).

3.2. Some Further Effects

The QR approach to long-distance lists has interesting consequences for verbs that select propositions, instead of questions.³⁷ To see this, consider a question like (67a) which allows a list answer and a question like (68a) which does not:

- (67) a. Which kid thinks/believes which teacher is nice?
 b. Johnny thinks/believes that Miss Alice is nice and Billy thinks/believes that Miss Susan is nice.
 (68) a. Which kid knows which teacher is nice?
 b. *Johnny knows that Miss Alice is nice and Billy knows that Miss Susan is nice.

Such contrasts, to the best of my knowledge, have not been previously studied. Under normal assumptions, (67a) should be ungrammatical. A wh in embedded Spec it cannot move to matrix Spec but the matrix

³⁷ Thanks to Ken Safir for making me think of embedding verbs that select -wh complements.

verb does not select +wh complements.³⁸ In the present approach, however, we can derive the long-distance list answer to (67a) by quantifier raising the complement in order to satisfy the selectional requirements of the matrix verb. The resulting configuration $[[_{CP} \text{which teacher}_j [t_j \text{ is nice}]] [_{CP} \text{which kid}_i [t_i \text{ thinks/believes } t_q]]$ allows a functional dependency between propositions of the form $\exists x[\text{teacher}'(x) \wedge p = \text{'nice}'(x)]$ and kids who stands in the *think/believe* relation to these propositions. Not surprisingly, an intermediate clause between the complement and the matrix wh leads to ungrammaticality:

- (69) *Which kid thinks (that) Bill believes which teacher is nice?

One question one might wonder about is how general the phenomenon is. For example, it is not entirely clear whether the possibilities are also available with wh expressions in the object position of the embedded clause. *Which kid believes Mary will see which movie?* seems acceptable and lends itself to a list reading but *Which kid believes which movie Mary will see?* does not seem acceptable. Though these effects bear further investigation, I will suggest here that S-structure movement is to Spec of CP and such movement results in the CP being marked +wh. Thus, this option is ruled out for verbs like *think* or *believe*. LF movement, on the other hand, can be to CP*. There is no problem of selection and QR is available to repair the type mismatch that is created.

The question that remains to be addressed here is why a long-distance list answer to (68a) is not similarly available. If complement clause QR is forced only when the types do not match, we have an explanation for the difference between (67) and (68). Since the indirect question can be interpreted in situ, there is no QR and consequently no multiple wh reading. Though more work is needed on the topic, I take the contrast between (67) and (68) as further confirmation that long-distance lists derive from QR of the complement, not from extraction of individual wh expressions.

Finally, recall from Chapter II that finite complements in Hindi have a variant in which a pronoun occurs in preverbal position. Although Hindi bare complements readily allow long-distance lists, as

³⁸ See Hegarty (1991) for differences between factive and non-factive complements with respect to adjunct extraction. His analysis does not apply directly to the cases under consideration since arguments are at issue. Some discussion on issues related to such examples can be found in Lasnik and Saito (1992:123) but the contrast between the two cases is not discussed there.

discussed in section 1.1, *yeh* complements never do. (70) contrasts sharply with (4) in only allowing individual answers:³⁹

- (70) kaun yeh jaantaa hai merii-ne kahaan kyaa khariidaa
 who this know-PR Mary-E where what buy-P
 "Who knows it where Mary bought what?"

I showed in Chapter II that in spite of their similarity, *yeh* complementation is syntactically and semantically distinct from bare complementation. I explained the difference in the following way. In bare complementation structures, the adjoined CP originates in preverbal position and is extraposed at S-structure to satisfy CRP. In *yeh* complementation, however, the pronoun occupies the preverbal position and the CP is base generated in adjoined position. Following Rothstein (1995), I treated the pronoun as having independent reference, the actual complement being licensed by a shared index. Now, under the present account a long-distance list will only be possible if a QR'd +wh complement can bind the argument position of the matrix verb. This cannot happen in (70) since *yeh* is a referring expression.

Thus we see that the approach to long-distance lists is able to account for several interesting facts. In the next section I turn to a few aspects of long-distance list answers that remain open in this approach, as well as in other approaches to the phenomenon.

3.3. Some Open Problems

As is well-known, long-distance lists typically give values for the matrix wh and the embedded wh in-situ not for the one in embedded Spec. Under the movement account this is an ECP effect; under the standard D-linking account it is a consequence of the fact that a D-linked wh is a variable which does not move. Under the present approach too there is an explanation for the propensity of wh in-situ to have its values specified. In a multiple wh question with one ordinary wh and one D-linked wh, it is the D-linked wh that remains in-situ and triggers second order interpretations when it moves to CP*. And it is values for this wh that are used in identifying the question being paired. What we don't have yet is a complete understanding of what determines fronting possibilities. Recall that there are languages like Bulgarian and Romanian where all wh expressions are fronted, though D-linking has an effect on their

³⁹ I thank Utpal Lahiri for confirming these judgments.

ordering. Positing a distinction between CP* and CP, it seems to me, goes some way towards an explanation of these facts.⁴⁰

Another aspect of long-distance answers that remains open in all accounts is exhaustivity. Recall from section 2 that an answer to an ordinary multiple wh question exhaustively pairs every member of the wh in Spec but not every member of the wh in-situ. But in long-distance cases the situation is reversed. In answers like *Jane knows where Mary bought the book and Sue knows where she bought the pen* the intuition is clear that there may be individuals left unpaired but no item bought by Mary can be left out. Under present terms, this means that the functional dependency we want is the one in (71b), not the one in (71c):

- (71) a. Which woman knows where Mary bought which book?
 b. $[[_{CP_q} \text{which book}_j \text{ where}_k \text{ Mary bought } t_j \text{ at } t_k] [_{CP} \text{which woman}_i t_i^q \text{ knows } t_q]]$
 c. $[[_{CP_q} \text{which book}_j \text{ where}_k \text{ Mary bought } t_j \text{ at } t_k] [_{CP} \text{which woman}_i t_i \text{ knows } t_q^i]]$

The problem with (71b) is that it represents a WCO violation, in the sense of Chierchia, and one would expect this derivation to be unacceptable. Note that this problem surfaces in all current approaches to the phenomenon of long-distance lists. Under the movement account, for example, in simple multiple questions the wh in Spec is exhaustively paired but in long-distance cases the wh that is in situ would be exhaustively paired. Similarly, in D-linking as Q-binding approach normally it is the overtly moved wh that is exhaustively paired but in long-distance cases it would be the Q-bound wh that would be exhaustively paired.

I do not have a complete answer for this but I will speculate that it may be that clauses do not trigger WCO violations in the same way that noun phrases do (see also Nishigauchi 1986, 1990 for relevant discussion). Alternatively, the kind of QR we see here might belong with instances of A'-movement, namely scrambling, that do not show WCO effects (see Dayal 1994a for arguments showing that scrambling is not an instance of A-movement). Again, the distinction between movement to a discourse-sensitive CP* and movement to regular CP may provide an explanation for this otherwise puzzling fact (see Bittner 1996 for an alternative within the functional approach).

⁴⁰ Note that these facts are quite elusive in ECP-based or D-linking as Q-binding accounts.

4. PLURALITY AND LONG-DISTANCE LISTS

4.1. *Long-Distance Lists with Single Wh Complements*

In the preceding sections I have argued that long-distance list answers are only possible if there is a triangular wh configuration. In this section I want to turn to some cases where this generalization does not hold. These cases, I will show, have different restrictions and require a separate explanation.

The cases at issue were first discussed by Kuno and Robinson (1972). They pointed out that questions with single wh complements like (72a) also allow for individual and list answers:

- (72) a. Who knows where Mary bought these books?
 b. John does.
 c. John knows where Mary bought *The Lover* and Bill knows where she bought *Past Continuous*.

It is not possible to treat such cases in terms of LF movement since the embedded expression is a plural definite.⁴¹ And if an alternative explanation exists for these cases, they argued, it would also apply to cases where LF movement of a wh in-situ is theoretically possible. Their conclusion is that there is no evidence from long-distance list answers for LF wh movement out of wh-islands.

While I am in agreement with Kuno and Robinson's claim that long-distance lists do not derive from LF extraction of wh in-situ, I do not agree that a uniform explanation can be given for all cases of long-distance answers. To see this, consider the following which all have singular wh in the matrix subject position:

- (73) a. Which woman knows where Mary bought these books?
 b. Which woman knows where Mary bought what?
 c. Which woman knows where Mary bought which book?

The question in (73a) does not allow a long-distance list answer while the question in (73c) easily allows it. The question in (73b) is interesting because it resists the list answer when presented out of context. When embedded in a context such as (74) where there is a salient set of objects, a list answer becomes completely acceptable.

⁴¹ Note that this example remains recalcitrant also under the view of D-linking as Q-binding, since a definite cannot be bound.

Note, however, that (73a) does not admit a long-distance list even when embedded in such a context:^{42 43}

- (74) Mary is a kleptomaniac who forgets where she picks up what. John usually returns the things she brings home. One day he finds a vase and a book on the table. He knows that Mary goes shopping only with her friends and also that on any shopping spree she only picks up one item. Knowing that Mary went out shopping twice, he asks his daughter, "*Which woman would know where Mary picked up what?*" And his daughter answers, "*Well, Jane would know where she picked up the vase, and Sue would know where she picked up the book.*"

In the semantics of questions spelt out in section 2, a singular wh expression ranges over atomic individuals and the answerhood conditions pick out a uniquely true proposition from the set of propositions denoted by the question. Uniqueness effects are diluted in the case of multiple wh questions like *Which woman likes which man?* because the quantification ranges over functions from one set of atomic individuals to another. Given this, we can see why the uniqueness effects are overridden in (73b)-(73c). When the embedded clause is a multiple wh question with a D-linked wh expression, it can get a second order interpretation. It then enters into a functional relation with the matrix wh. The difference between (73b)-(73c) follows from Pesetsky's observation that *which book* is inherently D-linked, while context is needed to promote the D-linked interpretation of *what*. The embedded clause in (73a) cannot get a second order interpretation and no multiple wh question is formed. The absence of a long-distance list answer for it is predicted. The possibility of long-distance list answers to questions like (72a), however, remains to be settled since a QR approach cannot apply to them.

Kuno and Robinson (1972) suggest that long-distance lists are dependent on plurality and are possible only in situations where an

⁴² It bears emphasizing that the variations we see here are replicated in other languages where wh expressions have number marking, for example, French, Polish, Bulgarian, Persian and Hindi.

⁴³ The context is contrived to rule out the possibility that an answer not strictly admitted by the question may still be given. For example, someone might ask (73b) expecting only a single woman to have the relevant information. The list answer might seem acceptable, under Gricean conditions, since it would provide the essential information the questioner is after.

individual answer is ruled out. As they put it, an individual answer would be counterfactual in a situation which allows the long-distance list. They point to the fact that in any given situation one tends to have either an individual or a long-distance list but not both. The thrust of their arguments is that the long-distance list is not a true semantic answer to the question, but one that may be acceptable if there is no proper semantic answer possible. In this section I will argue that long-distance list answers to questions with single wh complements are indeed dependent on plurality but I will show that they are not incompatible with individual answers. A plurality-based long-distance list answer, in the account to be presented, is a bona fide semantic answer to the question. In order to make this case, however, I will make an explicit proposal for deriving plurality-based list answers in simple questions before extending the analysis to the long-distance cases.

4.2. Simple List Answers and Plurality

4.2.1. Questions with Plural Definites We noted in section 2 that multiple wh questions and questions with universal quantifiers admit simple list answers. There is a third type of question that allows list answers, namely those with plural definites. These I will argue are a separate phenomenon from the other two. This goes against the assumption, implicit or explicit in many accounts, that all questions with universal terms have the same properties. Krifka (1992) and Srivastav (1992) have drawn attention to the fact that quantifiers and definites have distinct semantic properties and behave differently across languages in a variety of contexts (Kamp 1981, Heim 1982, Kroch 1974, Link 1983 and Landman 1989a, 1989b). Given inherent differences between the universal terms, they argue, list answers to questions with plural definites cannot be analysed in the same way as questions with quantifiers and must be treated in terms of their individual answers. In this section I draw on my own work, noting simply that virtually the same points are made independently by Krifka.⁴⁴

There are two pieces of evidence supporting the need for separate treatments of questions with quantifiers and those with plural definites. As noted in section 2, a list answer to a question with a universal quantifier is available when the universal is in subject position and the wh in object position, but not when the order is reversed. Positioning,

⁴⁴ Funding for the research on which this section is based was provided by a Rutgers University Research Council Grant during 1991-1992.

however, is not relevant in questions with plural definites, as observed by Pritchett (1990). The question-answer pairs in (75a)-(75c) are perfectly acceptable:

- (75) a. Who likes these men ?
Mary likes John and Sue likes Bill.
- b. Who is looking after John and Sarah?
My sister is looking after John, and the babysitter is looking after Sarah.
- c. Who is teaching your classes in your absence?
John is teaching the syntax class and Bill is teaching the semantics class.

In fact, all the questions noted in the literature as ruling out list answers systematically admit them once the universal term is changed to a plural definite.

Pritchett follows May's analysis of questions with quantifiers where structural constraints on the universal adjoining to a position from where it can take scope over the wh account for subject-object asymmetries. He claims that plural definites, unlike quantifiers, adjoin to CP at LF as an instance of left dislocation. According to him, (75a) has the following LF:

- (76) [_{CP}these men_j [_{CP}who_i [_{IP}t_i likes t_j]]]

Here the plural definite can take scope over the wh without violating the PCC. The absence of the subject-object asymmetry follows as a consequence.

As Krifka (1992) notes, Pritchett's claim that left dislocation at LF applies to plural definites because they are referential but results in scope interaction is inconsistent. As we will see below, the claim of scope interaction is also undercut by facts that Pritchett does not consider. In (77)-(79) a rather striking difference between questions with quantifiers and those with plural definites becomes evident:

- (77) a. Who does every man love?
b. Which woman does every man love?
c. Which women does every man love?
- (78) a. John loves Mary and Bill loves Sue.
b. John loves Mary and Sue and Bill loves Jane and Alice.

- (79) a. Who do these men love?
 b. Which woman do these men love?
 c. Which women do these men love?

The relevant effects have to do with the answerability of questions with monomorphemic *who* vs. those with *which N*. As we noted in section 2, when the universal term is a quantifier a singular *wh* term as in (77b) requires the list answer to link each man to a single woman as in (78a). A plural *wh* as in (77c) requires the answer to link some, if not all, men to more than one woman as in (78b). In contrast, when the universal term is a plural definite, a singular *wh* as in (79b) disallows a list answer altogether. The only possible answer is one in which all the men love the same woman, that is, a singular individual answer *Mary*. A plural *wh* as in (79c) admits a list answer but this answer can link each man with one woman as in (78a) or with more than one as in (78b).

It is quite obvious from the above diagnostics that questions with universal terms involve two strategies. One is operative in questions with quantifiers and yields subject-object asymmetries and reflects in its pairings the singular-plural requirements of the *wh*, and another is operative in questions with plural definites and has neither of these properties. We know from the discussion of multiple *wh* questions how list answers to questions with quantifiers are handled in the functional account. I will now turn to an explication of the manner by which list answers to questions with plural definites come about.

4.2.2. Functional Answers and Plural Definites In this subsection I will argue that list answers to questions with plural definites cannot be derived via quantification over functions. Towards this end, I will show that due to the nature of the universal term involved such questions do not have genuine functional answers, distinguishable from their individual answers, which can be the source of the list.

Consider (80a), which has a singular definite, and can be answered with (80b) or (80c):

- (80) a. Who does the man like?
 b. Mary.
 c. His wife.

One might say that (80b) is the individual answer while (80c) is the functional answer. However, the two cannot be truth conditionally distinguished if Mary happens to be the man's wife. The reason, intuitively, is that a functional reading yields different results from the

individual reading only if there are at least two members in the domain of the function. In the case of (80b) *Which woman does every man love?*, for example, the functional and the individual readings can pick out different propositions since the former but not the latter allows the choice of women to vary with the members of the domain set. Since the domain set in (80a) is a singleton, this does not happen. One might simply think of (80b)-(80c), then, as alternative ways of saying the same thing. List readings too are indistinguishable from individual answers. Since list answers give the extension of the function involved, a domain with a single individual yields a one-membered list answer. We can think of (80b) either as an individual answer or a trivial one-membered list answer. The point is that the question denotes the same set of propositions under its individual, functional and list readings. The maximally true proposition picked out by *Ans(Q)* can be expressed as (80b) or (80c).

Turning now to questions with plural definites we can expect a parallel situation. In the theory of plural individuals we have adopted (cf. (43) in section 2), singular and plural definites both denote single individuals, i.e. the maximal element in the set. A singular definite denotes an atomic individual while a plural definite denotes an individual with parts. In a sense, then, the representation of (79a), repeated below as (81a) is the same as that of (80a). If John and Bill are the two men in the relevant context, the individual denoted by *the men* is $j+b$ and the functional reading of the question looks for functions from $\{j+b\}$ to women, and the list reading gives the extension of this function, drawing on members of this set. As in the case of singular definites, the theory predicts that we get the same set of propositions whether we take the question under its individual, functional or list readings. (81a), for example, will denote something like (81b) and yield sets like (81c):⁴⁵

- (81) a. Who do these men love?
 b. $\lambda p \exists x [*person'(x) \wedge p = \hat{=} \text{'like'}(\sigma y *man'(y), x)]$
 c. $\{j+b \text{ love } m, j+b \text{ love } s, j+b \text{ love } m+s\}$

Now, consider the possible answers to (81a) given below:

- (82) a. John and Bill love Mary and Sue
 b. John loves Mary and Bill loves Sue.
 c. John and Bill love their mothers.

⁴⁵ Incorporating the view of plural definites as denoting individuals into a scope-based theory would yield similar results.

None of these can be felicitously uttered in a context where *Ans(Q)* picks out either the first or the second proposition in (81c) as true. This means that the three answers in (83) express the third proposition in the set, namely $j+b$ love $m+s$. That is, there is no list/functional answer distinct from the individual answer.

While it seemed intuitively plausible to club together the possible answers to questions with a singular definite, the view that (82a)-(82c) are the same propositions needs to be defended. Leaving aside (82b) for the moment, let us consider the status of individual and functional answers in (82a) and (82c). A diagnostic that separates the two kinds of answers in the case of questions with quantifiers is the possibility of continuation with a list. Thus:

- (83) a. Who does every man love?
 b. *Every man loves Mary and Sue. For example, John loves Mary and Bill loves Sue.
 c. Every man loves his mother. For example, John loves Mary and Bill loves Sue.

The contrast between (83b) and (83c) explicates Chierchia's claim that the list answer is a spell out of the functional answer. *Every* being a distributive determiner entails that in the case of the individual answer, each man love the individuals named. The functional answer, on the other hand, allows the value of the individual to vary with each man. The distributivity of *every* entails that each man love his mother, not that they all have the same mother. We see that individual and functional answers can be distinguished in terms of their entailments; the list is consistent only with the entailments of the latter.

In contrast, functional and individual answers cannot be distinguished in the case of plural definites since both can be felicitously followed by the list:

- (84) a. Who do these men love?
 b. These men love Mary and Sue. So, John loves Mary and Bill loves Sue.
 c. These men love their wives. So, John loves Mary and Bill loves Sue.

The list being consistent with both, individual and functional answers must have the same entailments here.

Another diagnostic showing that functional answers to questions with plural definites are not independent of individual answers is the

fact that they are possible even when the plural definite is in object position, as in (85) through (87):

- (85) a. Who loves these men?
 b. Their wives.
 (86) a. Who is looking after the children?
 b. Their mothers.
 (87) a. Who is teaching your classes in your absence?
 b. My colleagues.

This is in contrast to questions with quantifiers which do not allow such answers when the quantifier is in object position:

- (88) a. Who loves every man / no man / most men?
 b. *His mother / *Their mother.

Under Chierchia's account the functional binding required for these answers yields a WCO violation. Individual answers are possible to questions like (88a) because such binding is not required for them. We can safely conclude that the so-called functional answers in (85) through (87) cannot involve functional binding either. They must be individual answers which use a definite description instead of referring to individuals by name. For all practical purposes, then, there is only one semantic answer to questions with plural definites which we will refer to as the individual answer. It follows that the so-called list answer must be derived from it.⁴⁶

4.2.3. *Lists as Plural Individual Answers* The claim I want to advance here is that list answers to questions with plural definites are simply one reading of their individual answers. This is possible when such answers are ambiguous between distributive and cumulative readings. To see the relevant distinction between distributive and cumulative readings, compare sentences like (89a)-(89b):⁴⁷

⁴⁶ I will continue to refer to answers like (82b) as "list answers" for convenience. The list reading of questions with plural definites, in the technical sense, is equivalent in these cases to the individual and the functional readings, as I have demonstrated above.

⁴⁷ Thanks to Fred Landman for pointing out Scha's distinctions when I began looking at list answers in these terms.

- (89) a. The boys solved the problems.
 b. The boys solved the problem.

Scha (1981) claims that sentences like (89a), with two plural terms, have three readings: a *collective* reading in which all boys worked jointly on all problems; a *distributive* reading in which each boy worked on all problems, but separately; and a *cumulative* reading in which each boy worked on one or more problems and all problems got solved. While Scha's identification of the cumulative reading is well-accepted at the descriptive level, its formal status is a matter of some debate. One view, espoused by Scha, is that cumulativity has a distinct semantic representation from collectivity and distributivity. Another is that it simply describes one type of situation in which distributivity holds (see Landman 1995 for a recent discussion). The correct representation of cumulativity, though interesting and important, is orthogonal to the present discussion which seeks simply to establish its relevance to the analysis of questions. As such, I will use Scha's terminology without any commitment to the semantic status of cumulativity. The point to keep in mind is that *collective/distributive* readings are sometimes possible even with one singular argument but *cumulative* readings require both arguments to be plural. (89b), for example, can be interpreted distributively or collectively but not cumulatively.

Returning now to the individual answers admitted by (81a), such as (82a), note that they are expected to be ambiguous between distributive and cumulative readings, the predicate *love* being incompatible with the collective reading. Floated quantifiers and adverbs in (90a)-(90b) help disambiguate the two readings. A version with *these men* is also ambiguous though one cannot test the second reading by adding *respectively* because the adverb requires a conjoined DP:

- (90) a. John, Bill, and Harry each love Mary, Jane and Sue.
 b. John, Bill and Harry love Mary, Jane and Sue respectively.
 c. *John, Bill and Harry each love Mary, Jane and Sue. In particular, John loves Mary, Bill loves Sue and Harry loves Jane.

Recall that in connection with (84a) we determined that a list can follow an individual answer, thereby making it more specific. Note, however, that such a continuation of (90a) leads to deviance. The incompatibility of the list answer with the distributive reading shows that it represents the other reading of the individual answer, namely

the cumulative reading. We can conclude, then, that list answers to questions with plural definites are a disambiguation of individual answers rather than independent readings of the question.⁴⁸

We are now in a position to explain the differences between questions with quantifiers and those with plural definites noted in section 4.1. The absence of subject-object asymmetries in the case of plural definites follows straightforwardly from the fact that they are derivative on individual answers, which are always available.

To explain the differences with respect to the number feature on the wh, I propose that the relation between individual answers and list answers is restricted by the following constraint:

- (91) Cumulativity Constraint-1: A list answer of the form $a_1 R b_1, \dots, a_n R b_n$ to a question Q is acceptable iff $a_1 + \dots + a_n R b_1 + \dots + b_n = Ans(Q)$.

The notion of cumulativity that (91) draws on is meant to be neutral with respect to the semantic status of cumulativity. In particular, whether the list answer and the semantic answer denote the same propositions or whether the list answer describes one of the situations in which the semantic answer is true is left open. I expect the relation of list answers to individual answers that (91) characterizes can be easily transported into specific accounts of cumulativity.

Let us see how list answers to questions with plural definites can be analyzed from the perspective of (91). Recall that such answers are only possible with plural or unspecified wh. Thus (92a), but not (92b), can be answered by (92c):

- (92) a. Who/Which women do these men love?
 b. Which woman do these men love?
 c. John loves Mary, Bill loves Jane and Harry loves Sue.

The explanation for this is straightforward. The summed version of the list answer relates two plural terms $j+b+h$ loves $m+j+s$ but as we

⁴⁸ As noted by Chierchia (1993), questions with *both* do not admit list answers. This follows in the present account if *both* is the distributive version of *the two*, as proposed by Ladusaw (1982). If list answers are not compatible with distributive readings, it is predicted that they will be inadmissible with *both* even though questions with *the two* readily allow lists. For a different approach to the relation between *both* and *the two* see Brisson (to appear). See also Déprez (1994) for interaction between distributivity and list readings in French.

know from section 2, questions with a singular wh expression quantify over atomic individuals. An answer to (92b) would necessarily relate the plural definite to an atomic individual, something like $j+b+h$ like *m. Cumulativity Constraint-1* correctly rules out the possibility of list answers to it.

Recall also, that questions with quantifiers and those with plural definites differ with respect to the types of pairings they admit in their list answers. (93a) admits an answer like (92c) but (93b) carries an implicature that some men, if not all, love more than one woman. This can also be seen by comparing the so-called functional answer to (93a) given in (94a) with the genuine functional answer to (93b) given in (94b):

- (93) a. Which women do these men love?
 b. Which women does every man love?
- (94) a. These men love their wives.
 b. Every man loves his wives.

Though it is possible to interpret (94a) as referring to men being married to more than one woman, it is most naturally interpreted as each man loving the one woman he is married to. Under the present account, (94a) has the same form as the answer to (92a), namely $j+b+h$ loves $m+j+s$. It is left up to the pragmatics to determine how the relation distributes over the members of the two plural terms. *Cumulativity Constraint-1* admits any list answer that sums up in the right way. What we have in the case of questions with plural definites, then, is the phenomenon known as *dependent plurals* (Chomsky 1975, see also Roberts 1986 for discussion). The flexibility of interpretation and the influence of pragmatic factors is therefore not surprising. On the other hand, the functional answer in (94b) must be given a polygamous interpretation. Because the wh term fixes the range of the function, plurality is encoded in the semantics.

The point is worth stressing since plurality provides a very strong diagnostic for separating out those cases where list answers do not arise from the interaction of two quantificational elements. May (1985) observes that (95a) does not have a list answer and takes this as indicative of the subject-object asymmetry. Note, however, that the list answer becomes available once the wh term is made plural as in (95b):

- (95) a. Which student admires those two professors?
 b. Which students admire those two professors?

May's analysis cannot account for this difference, but it is precisely what is expected under the approach I am suggesting since (95b) but not (95a) will allow individual answers with two plural terms, thereby licensing a list answer.

The idea that list answers may derive from a plural reading of the question is, of course, not new. In the debate between May (1985, 1988) and Williams (1988), Williams suggests that list answers derive from a plural reading. May, on the other hand, argues that the plurality feature can be treated as universal quantification. The problem with both Williams' and May's accounts is that they try to provide a single analysis for questions with quantifiers and for questions with plural definites. What should be abundantly clear from the discussion above is that the two phenomena are distinct and cannot be given a unitary account.

4.3. Plurality in Long-Distance Lists

Having shown that list answers may be a cumulative reading of a plural individual answer in ordinary questions, I want to return now to the long-distance cases discussed in section 4.1 and show that a similar explanation can be given for them. In order to do so, however, some adjustment has to be made since the relata at issue are different. A long-distance list characterizes a relation between individuals and questions as opposed to a relation between pairs of individuals. An extension of the sum formation operation to the domain of propositions is needed to adapt *Cumulativity Constraint-1* to the case of long-distance lists. Assuming the parallel between the domain of individuals and the domain of propositions, argued for by Lahiri (1991) in connection with quantificational variability effects, I propose the following:

- (96) *Cumulativity Constraint-2*: A long-distance list answer of the form $a_1 R Q_1, \dots, a_n R Q_n$ to a question Q is acceptable iff at every world, $a_1 + \dots + a_n R \text{Ans}(Q_1) \cap \dots \cap \text{Ans}(Q_n) = \text{Ans}(Q)$.

As I will show here, *Cumulativity Constraint-2* and the semantics for questions developed in section 2 together accurately predict which questions will yield long-distance lists.

Let us begin with Kuno and Robinson's example in (72a), repeated below:

- (97) a. Who knows where Mary bought these books?

- b. $\lambda p \exists x [* \text{person}'(x) \wedge p = \text{know}'(x, \text{Ans}(\lambda q \exists y [* \text{place}(y) \wedge q = \text{bought}'(m, \sigma z * \text{books}(z), \text{at } y)]))]]$
 c. John knows where she bought *The Lover* and Harry knows where she bought *War and Peace*.

Let us assume the following scenario. The set of individuals other than Mary are John and Harry, the set of books are *The Lover* and *War and Peace*, the set of shops are Borders and Rutgers Bookstore. The indirect question in (97a) will denote the set in (98a), with each proposition naming the place(s) at which the plural object *l+w* is bought. Suppose that Mary, in fact, buys *The Lover* at Borders and *War and Peace* at Rutgers Bookstore, the first two propositions in the set will be false. The third proposition in (98a) will be true, under its cumulative interpretation. In fact, this proposition does not have a distributive interpretation because it is pragmatically implausible for the same objects to be bought at more than one place. Since the matrix verb is extensional, the whole question will denote the set in (98b). Of these, exactly one will be the maximally true answer:

- (98) a. { $\text{m bought } l+w \text{ at } b,$
 $\text{M bought } l+w \text{ at } r,$
 $\text{M bought } l+w \text{ at } b+r$ }
 b. { $\text{j knows } \text{m bought } l+w \text{ at } b+r,$
 $\text{h knows } \text{m bought } l+w \text{ at } b+r,$
 $\text{j+h know } \text{m bought } l+w \text{ at } b+r$ }

The long-distance list in (97c) satisfies *Cumulativity Constraint-2*. The summed version of the long-distance list is $\text{j+h know } (\text{m bought } l \text{ at } b \cap \text{m bought } w \text{ at } r)$. Whether this is the same proposition as the semantic answer $\text{j+h know } \text{m bought } l+w \text{ at } b+r$ or describes one of the situations in which the semantic answer is true depends on the theory of cumulativity adopted. I assume that *Cumulativity Constraint-2* is satisfied under either version of cumulativity.

Recall that a fundamental constraint on cumulative readings is that there be two plural terms at issue. This was shown to affect the availability of list answers to questions with plural definites. A version with a singular wh *Which woman do these men like?* does not license list answers. Since long-distance lists also represent cumulative readings of individual answers, it follows that (73a) *Which woman knows where Mary bought these books?* does not allow long-distance list answers. Since the individual answer to the question will always

have an atomic individual as one of its arguments, *Cumulativity Constraint-2* can never be satisfied.

Note, however, that cumulative readings crucially require two plural arguments. Since the other argument of the individual answer in the long-distance cases is propositional, it is not immediately obvious what notion of plurality to apply to it. It is possible, though, to isolate constraints on indirect questions that appear related to plurality. Consider the question in (99a) which does not admit the list answer in (99b):

- (99) a. Who knows in which shop Mary bought these books?
 b. John knows in which shop Mary bought the Lover and Harry knows in which shop she bought War and Peace.

In demonstrating how list answers can be treated as a subcase of plural individual answers above, we considered a case in which the summed version of the list answer had to be identified with the semantic answer in the actual world. To explain (99), however, identity at every world has to be checked. The singular wh in the indirect question in (99a) requires that both books be bought in one shop. That is, it would denote a set like (100a), one of whose members would be true in any world where the question could be asked:

- (100) a. { $\text{m bought } l+w \text{ at } b,$
 $\text{m bought } l+w \text{ at } r$ }
 b. { $\text{j knows } \text{m bought } l+w \text{ at } b,$
 $\text{h knows } \text{m bought } l+w \text{ at } b,$
 $\text{j+h know } \text{m bought } l+w \text{ at } b$ }

Let us assume that the first proposition in (100a) happens to be true in the actual world and let us further assume that John and Harry know this. That is, (99a) denotes (100b), and *Ans(99a)* picks out the proposition $\text{j+h know } \text{m bought } l+w \text{ at } b$. When we do the sum operation on (99b) the proposition we get $\text{j+h know } (\text{m bought } l \text{ at } b \cap \text{m bought } w \text{ at } b)$, which is identical to *Ans(99a)*. However, *Cumulativity Constraint-2* requires that the identity relation between summed propositions and semantic answers hold at every world. Now, there will be some worlds in which the two books are bought in different shops. In such worlds *Ans(Q)* will be defined for the indirect questions in the list answer in (99b), namely *in which shop Mary bought The Lover* and *in which shop Mary bought War and Peace*. It

will not be defined for the indirect question in (99a) *in which shop Mary bought these books* and identity will not be verifiable. It is therefore predicted that (99a) will not admit a long distance list answer.⁴⁹

What this discussion reveals is that *Cumulativity Constraint-2* actually checks the presuppositions of the long-distance list answer against those of the question. The matrix *wh* as well as the nature of the indirect question both affect the possibility of long-distance lists. The claim that long-distance lists are a subcase of plural individual answers, we can see, has some empirical bite to it. Although I have focused on questions with single *wh* complements here, this account of long-distance lists will also apply to questions with multiple *wh* complements.⁵⁰ I will not demonstrate this here though.

An individual answer that picks a plural entity as the value of the matrix *wh* under this approach, then, is ambiguous between distributive and cumulative readings and a list answer makes the cumulative reading explicit. This is demonstrated in (101a) where the choice of an adverb like *each* clarifies that the relation is distributive. It also shows that continuation with a list is not possible in this case. When there is no disambiguating adverb present, as in (101b), the individual answer tends to carry the implicature that the relation between the two arguments is distributive. But this implicature is easily cancelled. (101b) can be continued with a list without any problem. That long-distance lists explicate one reading of the individual answer is also brought out in (101c) where adverbs like *jointly* or *together* force the cumulative reading. These adverbs may be somewhat awkward but the point to note is that they allow the relevant continuation. The contrast with (101a) is quite sharp:

⁴⁹ This is also needed for intensional question-embedding verbs like *wonder*, which do not relate to answers directly. There is some disagreement in the literature whether they license long-distance lists. My own research has shown that although extensional verbs admit long-distance lists more readily, intensional verbs also license them.

⁵⁰ The possibilities can be summed up with reference to the following:

- (i) Which woman knows where Mary bought which book?
- (ii) Who knows where Mary bought which book?
- (iii) Who knows where Mary bought these books?

(i) can only support a D-linked long-distance list. (ii) can support a D-linked or a plurality-based long-distance list. (iii) can only support a plurality-based long-distance list.

- (101) a. John and Bill each know where Mary bought what/these books. *In particular, John knows where Mary bought *The Lover* and Bill knows where she bought *War and Peace*.
- b. John and Bill know where Mary bought what/these books. In particular, John knows where Mary bought *The Lover* and Bill knows where she bought *War and Peace*.
- c. John and Bill jointly/together know where Mary bought what/these books. John knows where Mary bought *The Lover* and Bill knows where she bought *War and Peace*.

The parallel with list answers to questions with plural definites discussed in section 4.2 is clear. We can conclude that in this case too, list answers are simply more co-operative ways of giving an individual answer.

In concluding this section, then, let me briefly point out the difference between my approach to the phenomenon and Kuno and Robinson's. Like them, I take long-distance list answers to be dependent on plurality but I differ from them in its relation to the individual answer. Recall that Kuno and Robinson consider long-distance list answers to be felicitous only in contexts where no individual answer is possible. (101b)-(101c) clearly show that there is no fundamental incompatibility between the two. In fact, there are situations in which a truly mixed answer may not only be possible but required. Suppose Harry knows that Mary bought *The Lover* at Borders and *War and Peace* at Rutgers Bookstore, John knows that she bought *The Lover* at Borders and Bill knows that she bought *War and Peace* at Rutgers Bookstore. If the context makes it clear that the question is a genuine request for information about the details of Mary's shopping, the simplest and most informative answer would be the individual answer naming Harry. However, there may well be contexts where this would not be enough. For example, if Mary is charged with a crime where the details of her shopping are relevant to establishing her case, her lawyer may ask the question with full knowledge of the facts. What he is interested in finding out is who else knows them so he can prepare the case. Here a fully informative answer would require a combination of the individual and the list. The incompatibility between individual and list answers that Kuno and Robinson note is due to the fact that we normally do not think of such situations. In normal question-answer situations mixed answers violate the Gricean principle of quantity, but are strictly speaking possible. I therefore take long-distance lists to be bona fide semantic answers, representing one reading of the corresponding individual answers.

CONCLUSION

In this chapter, I have explored the semantics of questions and argued that questions denote sets of propositions, though echo and D-linked multiple wh questions may denote sets of sets of propositions. Question-embedding verbs uniformly combine with sets of propositions via *Ans(Q)*. In the case of extensional verbs, *Ans(Q)* picks out the maximally true proposition. The truth requirement is not built into the question denotation but is introduced by *Ans(Q)*.

A possible answer to a question is constrained by the number marking on the wh expression. Single wh questions with singular morphology denote propositions naming atomic individuals while those with plural morphology denote propositions with plural individuals. This accounts for uniqueness/maximality effects. Multiple wh questions encode functional dependencies. Each possible answer exhaustively pairs the members of the domain of the function. In the absence of functional dependencies a multiple wh question denotes propositions naming single pairs of individuals, yielding the REF-Q reading. While list answers involve functional dependencies in the case of multiple wh and questions with quantifiers, they derive from a cumulative reading of individual answers in the case of questions with plural definites.

I have also argued against the standard view that long-distance list answers indicate matrix scope of embedded wh in-situ and presented alternatives that interpret all wh expressions in the clause where they occur at S-structure. The apparent conflict between the absence of wide scope readings of wh in-situ and the existence of long-distance lists in a language like Hindi is thereby resolved. I have argued that these alternatives are needed cross-linguistically by presenting evidence from a number of languages that is problematic for standard approaches. This approach to long-distance lists appeals to universal semantic properties and is predicted to apply universally.

To sum up our investigation into Hindi questions, we have seen, in the case of scope-marking as well as long-distance list answers, that the heuristic of using specification of values as an indicator of syntactic scope is flawed. In each of these cases, principled alternatives to matrix scope assignment of embedded wh were shown to provide greater empirical coverage. Specification of values in the answer has, however, been standardly used to establish syntactic scope. This has proved particularly powerful in the case of wh in-situ, where it is taken as evidence of LF movement in violation of subjacency. The approach argued for here shows that a reappraisal of claims about the nature of LF is needed and we will return to this issue in Chapter VII. The next two chapters enlarge the domain of inquiry by focusing on relative clauses in Hindi and issues of locality having to do with them.

CHAPTER V

RELATIVIZATION STRUCTURES IN HINDI

INTRODUCTION

We now turn to a consideration of relativization structures in Hindi, which are distinguished by the fact that relative clauses readily occur at the periphery of the main clause. As mentioned in chapter I, central to the issue of locality here is the relation between the adjoined relative clause and the main clause DP with which it is construed. The basic thesis I advance is that there are two different types of relativization involved. While right-adjoined relatives are noun modifiers, left-adjoined relatives are generalized quantifiers. Though they enter into different relations with the nominal in the main clause, locality is respected in each case.¹

I begin this chapter by introducing Hindi relativization structures, noting their implications for a compositional semantic interpretation. I then present syntactic and semantic evidence distinguishing left-adjoined and right-adjoined relatives. I show that the properties of right-adjoined relatives follow from the standard analysis of relative clauses as originating inside the DP they modify and optionally extraposing to the right. Using the difference between left-adjoined and right-adjoined relatives as evidence, I argue for an alternative syntactic analysis of left-adjoined relatives in which they are base-generated in adjoined positions. I demonstrate that such relative clauses are not interpreted as noun modifiers but as operators that A' bind a variable.

¹ This chapter and the next contains some material that was previously published in Srivastav (1991d). The specifics of the interpretation have changed, particularly with respect to the analysis of multiple correlatives. I am indebted to Barbara Partee, Peter Hook, Kashi Wali and Maria Bittner for many helpful