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THE SYNTAX AND SEMANTICS OF CORRELATIVES*

This paper argues against the view that Hindi has a single strategy of relativization, traditionally referred to as the correlative construction, which is typologically distinct from relativization in languages like English. It is shown that Hindi, in fact, has two types of relative clauses which are syntactically and semantically distinct. Hindi embedded and right-adjoined relative clauses are generated inside NP and function like noun modifiers. They are similar in essential respects to restrictive relative clauses in English. Hindi left-adjoined relative clauses, on the other hand, are adjoined to IP at D-structure. They do not function like noun modifiers but are quantificational expressions binding variables inside their scope domain. It is suggested that left-adjoined relatives belong typologically with free relatives in English and internally-headed relatives in Quechua, since they have certain significant properties in common with these constructions.

0. INTRODUCTION

It is traditionally accepted that the function of relative clauses is to modify nouns. Typically, they place a restriction on the noun they are adjacent to. Thus in the English sentence,

- (1)a. The girl who is standing is tall.

the relative clause *who is standing* modifies *girl*, which immediately precedes it. Sometimes, a relative clause may appear at the end of the sentence, as in (1b):

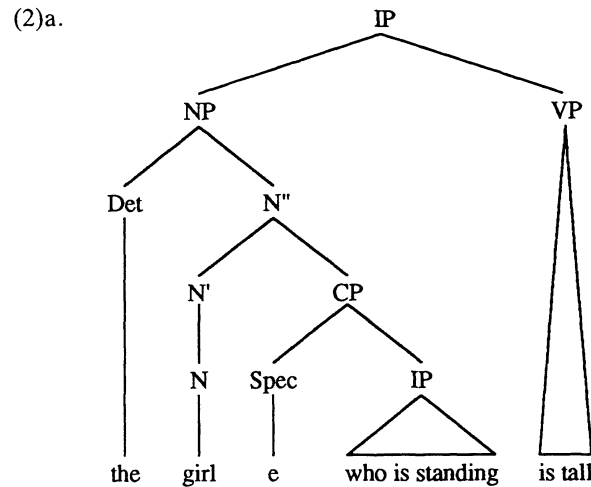
- (1)b. The girl is tall who is standing.

However, this sentence is marked by an intonational break after *tall* and is usually taken to be a stylistic variant of the first.

In the Government and Binding framework the D-structure representa-

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tion of (1a) would look something like (2a) with an optional extraposition rule accounting for (1b).¹



The relative pronoun *who* is analysed as an operator that moves into Spec of CP at LF, yielding the following:

- (2)b. $[_{IP} [_{NP} [_{Det} \text{the}] [_{N'} [_{N'} \text{girl}_i] [_{CP} [_{Spec} \text{who}_i] [_{IP} t_i \text{ is standing}]]]]] [_{VP} \text{is tall}]]]$

At this level, the *wh*-operator is in spec of CP and the CP becomes +WH. Under standard assumptions the +WH CP needs to be a syntactic sister of a projection of the head noun in order for the relative clause to be predicated of the head (Chomsky 1986 and Safir 1986).

Semantically, the predication involved in noun modification corresponds to intersection of the sets denoted by the head of NP and the relative clause. In a truth conditional/model theoretic interpretation of GB syntactic structures, the desirability of syntactic sisterhood is even greater, since compositionality, a fundamental semantic principle, dictates that the meaning of each phrase be determined by the meanings of its immediate subparts. The semantic interpretation of (2b) would be something like the following:

- (2)c. $\lambda P P(\lambda x(\text{girl}'(x) \ \& \ \text{stand}'(x))) \ (\text{tall}')$

¹ I represent the relative clause as attached at the level of the common noun rather than the noun phrase. Though this issue is controversial (see Partee 1975, and Bach and Cooper 1978) the choice is not critical for present purposes. Srivastav (1991) gives arguments in favor of this representation.

Here the determiner *the* corresponds to the iota operator, which encodes the uniqueness associated with the definite article. This view of *the* is standard in Montague grammar and goes back to Russell (1905), but the specific formulation follows Partee (1987). The iota operator combines with an open sentence to yield a phrase that denotes the unique entity that satisfies it. It is well-defined if such a unique entity exists, and is undefined otherwise. In (2c) the iota is defined on the unique individual who satisfies the predicates *girl'* and *stand'*. The resulting expression can then be 'lifted' into a generalised quantifier (see e.g. Barwise and Cooper 1981).² In a model in which there is a single standing girl, it will denote the set of all sets that contain this individual.³ The sentence will be true just in case the set denoted by the VP is in the set denoted by the NP. In an analysis deriving (1b) from (1a), compositionality will be satisfied, since at D-structure the determiner *the* has syntactic scope over the derived constituent [_{N'} *girl who is standing*].

While the view that syntactic sisterhood is a necessary condition for noun modification seems well-motivated in languages like English where relative clauses typically appear next to the head, there are languages where this does not seem to be the case. In Hittite, Warlpiri, and Indic languages like Hindi, Marathi, Gujarati and Bangla, relative clauses do not have to be adjacent to the noun they are construed with. Such constructions are known in typological literature as CORRELATIVES.

In Hindi, for example, the relative clause may precede or follow the main clause, as in (3). The linking between the two clauses is indicated by means of a morpheme, usually a demonstrative, which appears on the main clause nominal, and a relative morpheme which appears on the noun in the relative clause.⁴

- (3)a. **jo** **laRkii khaRii** **hai** vo lambii hai.
REL girl standing is DEM tall is

² Partee's iota operator yields an entity, while in Barwise and Cooper (1981) the function *the* takes a set and yields a generalised quantifier. As Partee points out, the iota operator has the effect of making the noun phrase meaning different from Montague's and more in keeping with Barwise and Cooper's. In particular, in this account the noun phrase lacks a denotation when there is no unique entity which satisfies the sentence. In Montague's system the noun phrase has a denotation but the sentence is false in such cases.

³ In this paper I will deal with extensions only. The semantics can easily be modified to include intensions.

⁴ In Hindi the relative morpheme is distinct from the interrogative. In nominative case it is *jo* for singular and plural; in oblique case, *jis* and *jin*, respectively. The forms of the demonstrative are *vo* and *ve* in the nominative and *us* and *un* in the oblique. I use REL and DEM to gloss the two elements. For the rest of the paper I use boldface to indicate the relative clause and italics to indicate the main clause NP it is construed with.

- b. *vo laRkii lambii hai jo khaRii hai.*
 DEM girl tall is REL standing is
 The girl who is standing is tall.

Since the relative clauses in (3a–b) do not have marked status of English extraposed clauses, it is not clear whether they should be considered constituents of the noun phrase at any level of syntactic representation. If the relative clause is analyzed as having an NP-internal source, the adjacency requirement for modification is satisfied at D-structure. Parametric variation must then account for the fact that the head and the modifier can surface freely to the left or to the right as discontinuous constituents in Hindi, but only to the right in English. If, however, the relative clause is analyzed as base-generated away from the head, the predication relation has to be defined non-locally. The requirement of syntactic sisterhood would then have to be abandoned if a uniform account is to be given for relativization in languages like English and Hindi. Thus correlatives pose a challenge for syntactic and semantic accounts of noun modification.

Despite a number of studies on correlatives (Verma 1966, Donaldson 1971, Downing 1973, Kachru 1973, 1978, Dasgupta 1980, Subbarao 1984, Keenan 1985, Andrews 1985 and Bains 1989), they have remained something of a mystery, usually confined to mention in typological surveys. The aim of the present paper is to bring them out from the realm of the exotic and provide a formal syntactic and semantic account relating them to more familiar kinds of relativization. The paper analyzes the correlative construction in Hindi within a GB approach augmented by truth conditional/model theoretic semantics. The syntax assumed here is that of Chomsky (1986) and May (1986). LF representations are taken to be the input for actual semantic interpretation. In particular, it is assumed that scope is determined at LF and that LF provides structures which are compositionally mapped onto truth conditions, truth being evaluated relative to a model. The semantic map follows the general framework of Montague grammar, in particular its extensions in Barwise and Cooper (1981) and Partee (1987).

The claims made in this paper are for correlatives in Hindi, though they extend to the other Indic languages as well. Since crucial examples in Hittite and Warlpiri are not available to me, I make no claims about them. However, there do not seem to be obvious counterexamples in the literature known to me. The analysis will, therefore, be presented as if it applied to all languages reported to have the correlative construction. I leave it for further research to determine whether this is correct.

As a first step, I will show that it is misleading to use the term 'correlative' to refer to the sentences in (3). I will argue that the two sentences in fact have distinct properties; in (3a) the relative clause is adjoined to IP at D-structure, while in (3b) it originates inside the main clause NP and is moved rightwards at S-structure. This syntactic difference corresponds to a semantic difference. The relative clause in (3a) acts like a quantificational phrase binding a position inside IP, while in (3b) it is a noun modifier. Thus correlatives do not present any evidence against the view that noun modification requires syntactic sisterhood. Further, this approach to the phenomenon leads us to recognize other uses of the relative clause. It is suggested here that the ability of a relative clause to act like a quantificational phrase is not limited to languages with correlatives, but may in fact be universal.

Section 1 introduces in more detail the phenomenon known as correlatives, as it is manifested in Hindi. Section 2 presents evidence that casts serious doubt on the view that Hindi has a single strategy of relativization. Section 3 argues that there are two distinct strategies being used in these sentences, namely noun modification and quantification, and outlines the basic structures involved in each. The range of facts presented in Section 2 is shown to follow from this distinction. Section 4 analyses in specific terms the internal structure of the Hindi relative clause and gives an explicit syntax and semantics for it. In Section 5, theoretical issues related to the functioning of the relative clause as a generalized quantifier are addressed. Section 6 explores some crosslinguistic implications of this view of relative clauses.

1. THE CORRELATIVE CONSTRUCTION IN HINDI

1.1. *Introduction*

Hindi is an SOV language that allows scrambling and has null arguments. A special feature of its phrase structure is that nonfinite complements precede the verb, while finite complements follow it. In the case of noun phrases too, directionality and finiteness seem to interact. Nonfinite relatives must precede their heads, as demonstrated by (4), but the direction of finite relativization is less clear, as shown by (3) above.

- (4)a. māīNE naactii huii ek laRkiiKO dekhaa.
I-ERG dance PARTICIPIAL one girl-ACC saw
 I saw a dancing girl. (= a girl who was dancing)

- b. māINE naacne vaalii ek guRiyaa khariidii.
I-ERG dance ADJ one doll bought.

I bought a dancing doll. (= doll that can dance)

Though the correlation between finiteness and directionality is an important aspect of Hindi syntax, it does not bear directly on the issue being addressed here. Here, then I will focus on finite relative clauses (see Srivastav (1989, 1991) and references cited there for further discussion of finiteness).

The English sentence *The girl who is standing is tall.* has three possible translations into Hindi. As seen in (3), repeated below as (5a–b), the relative clause can precede or follow the main clause. It can also follow the head noun as in English, as in (5c):

- (5) a. jo laRkii khaRii hai vo lambii hai. (left-adjoined)
REL girl standing is DEM tall is
 b. vo laRkii lambii hai jo khaRii hai. (right-adjoined)
DEM girl tall is REL standing is
 c. vo laRkii jo khaRii hai lambii hai. (embedded)
DEM girl REL standing is tall is

The girl who is standing is tall.

Earlier studies of the phenomenon basically fall into two classes. One takes all of them to be underlyingly relative clauses of the English kind; the other assumes that all relative clauses are adjoined to the main clause at the base. While the two approaches differ in the syntactic representation of correlatives, they agree that semantically they are the same – the relative clause in both structures modifies the head noun. Under either approach, the sentences in (5) are analyzed as having a single underlying structure.⁵

1.2. NP Embedded Analysis of Correlatives

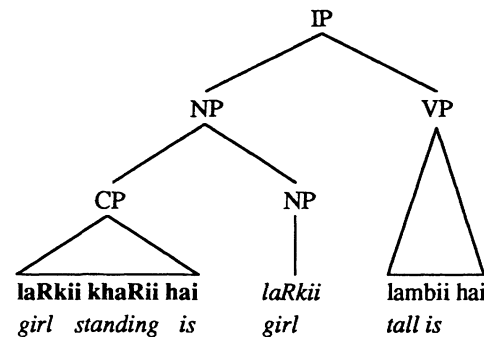
Verma (1966), Kachru (1973, 1978), and Subbarao (1984) consider relative clauses in Hindi to derive from a rule expanding NP, just as in English.⁶

⁵ See Srivastav (1988) for a discussion of problems related to learnability issues in the two approaches.

⁶ According to an *NLLT* reviewer, Kachru (1980), which I have been unable to consult, no longer holds this view though she does not present an alternative analysis. See also Bains (1989) for a somewhat different analysis.

The surface forms result from movement, which is assumed to be freer in Hindi than in English. Junghare (1973) and Wali (1982) take the same view of Marathi correlatives. Abstracting away from the details, on which they differ, these studies would represent the base form of the sentences in (5) as in (6):⁷

(6)



Extraposition to the right accounts for the right-adjoined structure in (5b). In addition, extraposition to the left must be allowed within this approach, since Hindi has left-adjoined relatives construed with nontopicalised objects, as in (7):

- (7) **jo laRkii khaRii hai** raam usKO jaantaa hai.
REL girl standing is Ram DEM-ACC knows
 Ram knows the girl who is standing.
 Literally: Which girl is standing, Ram knows her.

In Baltin (1985) it is argued that leftward extraposition of modifiers is generally proscribed in languages. The analysis under consideration, if correct, would suggest that Hindi is among those languages in which modifiers can be preposed as well as extraposed.

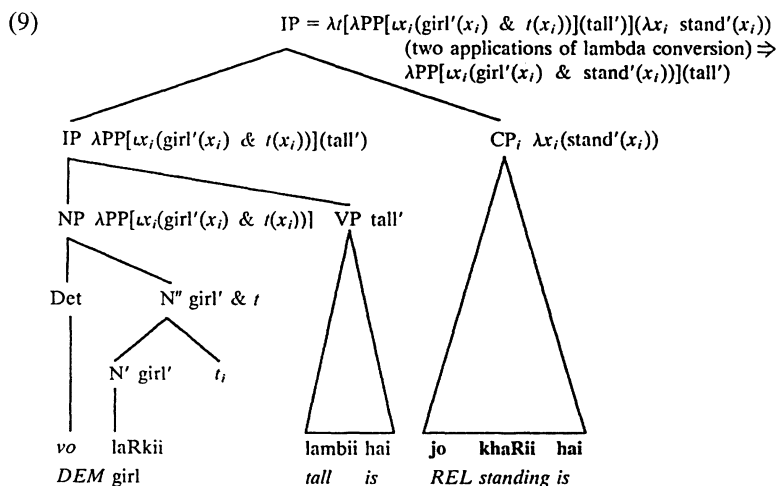
The semantics for the NP embedded analysis of correlatives is not

⁷ The analysis in (6) is essentially Subbarao's, except for the node labels, which have been changed for the sake of uniformity. Transformational rules such as Pronominalisation and Relative Pronoun Insertion yield the surface forms. Individual authors, of course, vary on details depending on their view of complementation.

problematic. Essentially, set intersection, as proposed for English, augmented by rules to interpret moved constituents would suffice. One simple way would be to interpret the noun phrase with a lambda abstract over the trace of the moved CP and then fill in the value of the extraposed/preposed CP by lambda conversion. This is possible if the semantic type of the variable corresponding to the trace is that of a predicate:

- (8) Relative clause: $\lambda z[CP']$
 Main clause: $\lambda t[IP']$
 Sentence: $\lambda t[IP'](\lambda z[CP'])$

Applied to (5b), for example, this would yield the interpretation in (9). DEM is interpreted for now as the iota operator, analogous to the English determiner *the*:



We see in the tree above that the interpretation procedure outlined in (8) yields the result we want. The first IP node in (9) says that the set of tall individuals is in the set of sets which contain the unique individual who is a girl and is in the extension of some predicate *t*. At the topmost IP node the property variable *t* is abstracted over, and the value of the extraposed relative is applied to it. The formula in (9) then says that the set of tall individuals is included in the set of sets which contain the unique individual who is a girl and is standing. Thus the interpretation of (5b) is equivalent to the interpretation of the English sentence with an ordinary relative clause such as (1).

Since the transformational rule of Move-alpha is assumed to leave

traces, rules such as (8) would be needed in any language to interpret moved constituents. Thus, under the NP embedded approach to correlatives, the only question of theoretical interest is whether Hindi allows movement of relative clauses to the left, as it affects Baltin's proposed universal.

1.3. *Adjoined Clause Analysis of Correlatives*

Now let us consider the adjoined clause approach to correlatives, which takes relativization in Hindi to involve a type of phrase structure not attested in English, namely $IP \rightarrow IP_{rel}IP_{main}$ or $IP \rightarrow IP_{main}IP_{rel}$. This is the structure argued for by Donaldson (1971) and is implicit in typological surveys such as Downing (1973), Keenan (1985) and Andrews (1985). The structure of the sentences in (5a–b) would be something like the following:

- (10)
-
- a. **jo laRkii khaRii hai vo lambii hai**
REL girl standing is DEM tall is
- b. **vo laRkii lambii hai jo khaRii hai**
DEM girl tall is REL standing is
- The girl who is standing is tall.

Thus, the adjoined clause approach distinguishes relativization in Hindi and English. Since the syntax is completely different, it is the semantics that must convey the similarity between relativization strategies in the two languages. One implementation of this idea is given by Dasgupta (1980), who analyses sentence-initial relative clauses in Bangla. In his view, the relative morpheme marks an open slot. It is thus a variable that needs to be bound by an antecedent in the main clause. Relativization is effected by means of a binding relationship which identifies the head with the modifier.

Dasgupta's analysis, however, does not address the problem of noncompositionality in this approach to noun modification. Given that the NP is already interpreted by the time the relative clause combines with the sentence, the predication relation cannot be defined locally. This problem

is addressed by Bach & Cooper (1978) and Cooper (1979). They suggest that the relative clause and the main clause are interpreted independently. The main clause NP is understood as having an implicit property variable R , a mnemonic for RELATIVE, which is abstracted over. Then the relative clause is fed in as argument of the lambda abstract. The effect of this rule is to bring the relative clause under the scope of the determiner, thereby accounting for the synonymy of correlatives and relatives across languages:

- (11) Relative clause: $\lambda z[IP'_{rel}]$
 Main clause: $\lambda R[IP'_{main}]$
 Sentence: $\lambda R[IP'_{main}](\lambda z[IP'_{rel}])$

Applied to (5b) this yields the following interpretation:

- (12) Relative clause: $\lambda z(\text{stand}'(z))$
 Main clause: $\lambda R[\lambda PP[\alpha_i(\text{girl}'(x_i) \ \& \ R(x_i))] \ (\text{tall}')]$
 Sentence: $\lambda R[\lambda PP[\alpha_i(\text{girl}'(x_i) \ \& \ R(x_i))] \ (\text{tall}')]$
 $(\lambda z \text{ stand}'(z))$
 (two applications of lambda conversion) \Rightarrow
 $\lambda PP[\alpha_i(\text{girl}'(x_i) \ \& \ \text{stand}'(x_i))] \ (\text{tall}')$

The difference between (8) and (11) is purely syntactic. Instead of the trace of a moved element there is a free variable posited, which modifies the denotation of the NP. Thus the interpretation of a base-generated adjoined relative clause becomes equivalent to the interpretation of a moved relative clause. In this sense Bach and Cooper provide an interpretive analogue of movement, showing that a compositional semantics is possible for correlatives analysed as having discontinuous constituents in their base forms.

1.4. Summary

To sum up, the NP-embedded approach to correlatives suggests that cross-linguistically, relativization is uniform syntactically and semantically. Languages differ with respect to movement possibilities. The adjoined clause approach to the phenomenon, on the other hand, holds that correlatives are syntactically distinct from relatives but semantically alike. The basic premise shared by both approaches is that there is a single strategy of relativization in Hindi, represented by (5a-c).⁸ In the following section,

⁸ Dasgupta's (1980) account is different in that he considers left-adjoined relative clauses to be syntactically distinct from the right-adjoined ones, but he too takes them to be semantically alike.

differences between left-adjoined relative clauses and embedded/right-adjoined relative clauses will be discussed. We will see that the asymmetries can only be explained as a reflex of fundamental structural differences between relative clauses that precede the main clause and those that follow the noun.

2. ASYMMETRIES BETWEEN CORRELATIVES

2.1. Headedness

One important difference between left-adjoined and right-adjoined/embedded relatives has to do with headedness, by which I mean the presence or absence of the common noun with the REL and DEM elements. It has been observed that in left-adjoined structures, both NPs can be realised with a common noun.⁹ Right-adjoined and embedded structures, however, do not allow the relative clause to contain the common noun. Thus the relative clause in (13a), but not in (13b–c), can be INTERNALLY HEADED:¹⁰

- (13)a. **jo laRkii khaRii hai vo lambii hai.**
REL girl standing is DEM tall is
jo laRkii khaRii hai vo laRkii lambii hai.
REL girl standing is DEM girl tall is
jo khaRii hai vo laRkii lambii hai.
REL standing is DEM girl tall is
- b. *vo laRkii lambii hai jo khaRii hai.*
DEM girl tall is REL standing is
**vo laRkii lambii hai jo laRkii khaRii hai*
DEM girl tall is REL girl standing is
**vo lambii hai jo laRkii khaRii hai.*
DEM tall is REL girl standing is

⁹ In Kachru (1973, 1978) sentences like the second one in (13a), that is, those with a common noun with REL and DEM, are represented with a question mark. Though the first sentence may be the basic case, all three are acceptable and need to be accounted for.

¹⁰ One reviewer finds the second item under (13b) acceptable. According to my intuitions the ungrammaticality of such sentences may be somewhat reduced if DEM is stressed rather heavily. Stress, however, is not a factor in the acceptability of the second item under (13a). I would therefore maintain that there is an asymmetry between left- and right-adjoined relatives with respect to headedness which needs to be accounted for.

- c. *vo laRkii jo khaRii hai lambii hai.*
DEM girl REL standing is tall is
- **vo laRkii jo laRkii khaRii hai lambii hai.*
DEM girl REL girl standing is tall is
- **vo jo laRkii khaRii hai lambi hai.*
DEM REL girl standing is tall is

Earlier studies manipulated the rules of Pronominalisation or Relative NP Deletion to derive the forms in (13a). However, no account can extend to (13b–c) in a straightforward way. Capturing the full paradigm reduces to a statement that Pronominalisation/Deletion is less restricted in left-adjoined relative clauses. (In the left-adjoined structure the rule does not apply obligatorily, so both clauses may have full NPs. When the rule does apply, it can either replace the NP in the second clause or the NP in the subordinate clause with a pronominal form.) Such a statement obviously has no significant explanatory force.

2.2. Demonstrative Requirement

A second difference has to do with a demonstrative requirement in left-adjoined structures. Subbarao (1984, p. 13) observes that if the main clause NP is indefinite, the relative clause can only occur to the right.

- (14)a. **jo laRkiyāā khaRii hāi do lambii hāi*
REL girls standing are two tall are
- b. *do laRkiyāā lambii hāi jo khaRii hāi*
two girls tall are REL standing are
- c. *do laRkiyāā jo khaRii hāi lambii hāi*
two girls REL standing are tall are
- Two girls who are standing are tall.

The only way to express (14) in a left-adjoined structure is to use a partitive in the main clause. The partitive provides the demonstrative *un* and makes the main clause NP definite:

- (15) *jo laRkiyāā khaRii hāi un-mē-se do lambii hāi*
REL girls standing are DEM-PARTITIVE two tall are
- Two of the girls who are standing are tall.

Similarly, compare (14) with (16), in which a demonstrative has been added to the main clause NP. All three structures become acceptable:¹¹

- (16)a. **jo laRkiyāā khaRii hāi ve do lambii hāi**
REL girls standing are DEM two tall are
- b. *ve do laRkiyāā lambii hāi jo khaRii hāi*
DEM two girls tall are REL standing are
- c. *ve do laRkiyāā jo khaRii hāi lambii hāi*
DEM two girls REL standing are tall are
- The two girls who are standing are tall.

Note that under either version of the uniform structure hypothesis, (14) and (16) are both equally interpretable. Application either of (8), the rule I have proposed for interpreting moved relative clauses, or of (11), the rule proposed by Bach and Cooper, will yield an interpretation.¹²

(14') $\lambda PP[2\ x(\text{girl}'(x) \ \& \ \text{stand}'(x))]$ (tall')

(16') $\lambda PP[\iota 2x(\text{girl}'(x) \ \& \ \text{stand}'(x))]$ (tall')

The difference between the two operators is in uniqueness – (14') will be well-defined as long as there are at least two individuals who are girls and are standing, while (16') will be well-defined only if there are exactly two such individuals. There is therefore no semantic reason why (14a) should be ungrammatical if it is indeed a variant of (14b–c).

Subbarao's observation that the main clause NP must be definite, however, is not quite accurate. In Hindi, bare noun phrases can function as definites (see Verma (1966) and Porterfield and Srivastav (1988) for discussion), but they are not admissible in left-adjoined structures:¹³

- (17)a. ***jo laRkii khaRii hai laRkii lambii hai.**
REL girl standing is girl tall is
- b. *laRkii lambii hai jo khaRii hai.*
girl tall is REL standing is

¹¹ According to Hock (1989), (16a) is not acceptable. I believe that it is, though an equivalent construction with *ve dono* 'DEM both' may be preferred.

¹² *do* 'two' and *ve do* 'DEM two' are interpreted as the entity level correlates of the functions *two* and *the two* in Barwise and Cooper (1981), in keeping with the semantics adopted for *the*.

¹³ I thank Geoff Pullum for reminding me of this.

- c. *laRkii jo khaRii hai lambii hai.*
girl REL standing is tall is
 The girl who is standing is tall.

It would seem, then, that the restriction on the main clause NP in left-adjoined structures is stricter than definiteness; the NP must contain a demonstrative.

The facts in (14–17) are problematic for standard approaches to correlatives.¹⁴ Under the NP-embedded analysis, it has to be stipulated as a constraint on leftward movement that the quantifier contain a demonstrative. Rightward movement would not be similarly restricted. Such a constraint has no independent motivation. Under the adjoined clause analysis, on the other hand, the problem is to block the left-adjoined relative clause from being interpreted in the scope of certain kinds of quantifiers, while allowing the right-adjoined relative to be so interpreted. These facts about quantification raise serious doubts about the nature of the relationship between the left-adjoined relative clause and the main clause NP. While the relative clause is obviously linked to the NP, it does not seem to modify it in the way that a right-adjoined/embedded relative clause does.

2.3. Multiple Relativization

Finally, sentence-initial relative clauses may have more than one relative element, each construed with an NP in the main clause. This option for multiple relativization is not available to the other two. Consider (18), in which two REL elements are linked to two DEM elements:

- (18)a. *jis laRkiiNE_i jis laRkeKO_j dekhaa usNE_i*
REL girl-ERG REL boy-ACC saw DEM-ERG
usKO_j passand kiya.
DEM-ACC liked

¹⁴ It has been suggested by a reviewer that there may be a pragmatic explanation for this. Relative clauses that precede the head may set up an antecedent to which only definite noun phrases may then refer. This does not seem plausible, however, since there is no such restriction with non-finite relatives which also precede the head, as was shown by (4). Further, it fails to account for the restriction against bare noun phrases which are definite, as shown by (17). The demonstrative requirement is specific to left-adjoined constructions and thus cannot be subsumed under some general principle of language organization based on linear order alone.

- b. **us laRkiiNE_i us laRKeKO_j pasand kiyaa jisNE_i*
DEM girl-ERG DEM boy-ACC liked REL-ERG
jisKO_j dekhaa.
REL-ACC saw
- c. *Impossible to construct.
 Which girl saw which boy, she liked him.

Sentence (18c) is impossible to construct, since the same relative cause cannot be simultaneously adjacent to two different nouns.¹⁵

The problem for the NP-embedded analysis is clear. There is no source for the left-adjoined relative clause as shown by the impossibility of constructing (18c). The problem for the adjoined clause analysis is to provide an interpretation for (18a) while ruling out one for (18b). Note, furthermore, that the Bach-Cooper semantics does not extend to such sentences. Since its effect is to bring the relative clause under the scope of the main clause NP, its application is blocked, because it cannot bring a single relative clause into the scope of two different NPs at the same time. In fact, any semantics adopted for the left-adjoined relative clause would have to be blocked from applying to the right-adjoined relative clause. The fact that Hindi has multiple relativization only on the left suggests that left-adjoined relative clauses may be base-generated in that position, while right-adjoined relative clauses may be produced by movement.

2.4. Summary

In this section it has been shown that left-adjoined relative clauses systematically behave differently from embedded/right-adjoined relative clauses. Specifically, they differ with respect to headedness, the demonstrative requirement, and multiple relativization. It was noted earlier that correlatives pose a challenge for a characterization of the predication involved in noun modification. The facts presented here, however, show that the problem is more fundamental. Syntactic and semantic accounts of noun

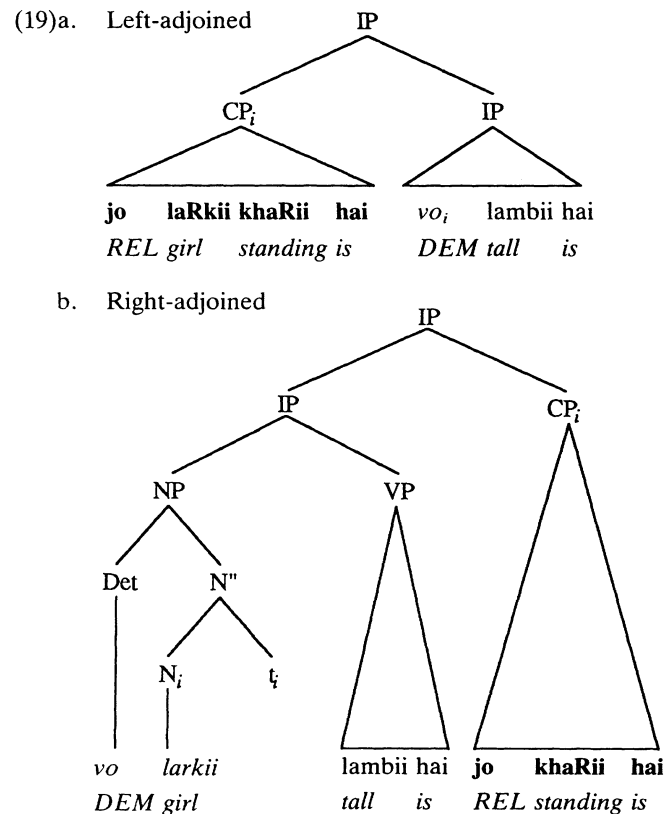
¹⁵ Sometimes right-adjoined sentences are accepted by speakers. Usually, such sentences do not have more than two linked elements and do not contain common nouns with REL and DEM. There is also an intonational break between the clauses. Since these constraints do not hold for left-adjoined relatives, the two must be distinguished. It is possible that the acceptable right-adjoined structures are in fact instances of left-adjoined structures in which the main clause has been fronted. This would suggest that the two differentiating characteristics mentioned above may be explained in terms of constraints on main clause fronting. At this point, however, this must remain a suggestion rather than a claim.

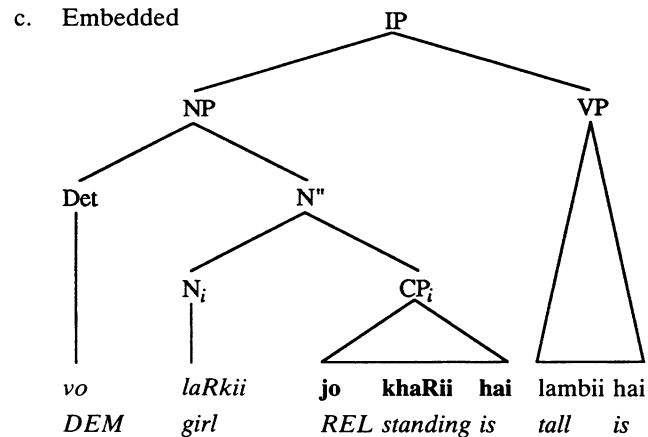
modification extended to cover correlatives fail to account for more than a few basic cases. In each instance, it is the left-adjoined structure that does not behave in the expected manner. This casts doubt on any analysis that posits a uniform underlying structure for Hindi relative clauses. In the next section I propose a structural distinction between left-adjoined and right-adjoined/embedded relatives which provides a principled way of organizing the data presented above.

3. DERIVING THE ASYMMETRIES

3.1. Structure

Let us assume the following syntactic representations for the sentences in (5) and see whether the asymmetries noted in Section 2 can be derived:





The basic syntactic difference between (19a) and (19b–c) is that in the first, the relative clause is base-generated away from the main clause NP, while in the second it originates inside it.¹⁶ Thus, in (19b–c) but not (19a) there is a level of representation, namely D-structure, at which the relative clause is adjacent to the main clause nominal. This syntactic distinction can be related to a semantic distinction. As discussed earlier, it has been well established that syntactic sisterhood is a requirement for predication. In fact, the problem posed by correlatives to a theory of relativization was to define a semantics for noun modification in the absence of an appropriate syntactic configuration. If the requirement of syntactic adjacency is not weakened, (19b–c) will be the only structures in which noun modification can take place. The question then arises as to what sort of interpretation (19a) should have. I would like to suggest that it is a quantificational structure in which the relative clause binds the main clause nominal.¹⁷

A consequence of this analysis is that the relative clause is not in the scope of the main clause nominal in left-adjoined structures, while it is in the other two. We might expect this fact to be reflected in the language in some way, and indeed, it is. In (20) we have a sentence in which the main clause NP has a singular determiner, *har ek* 'each'. However, the agreement on the verb in the left-adjoined relative must be plural, while the agreement in the other two relatives must be singular:

¹⁶ I represent the relative clause as a CP rather than an NP. I return to this issue in section 6.

¹⁷ The nature of this binding will be made precise in sections 4 and 5.

- (20)a. **jo laRke khaRe hāī** *har ek meraa chaatr hai.*
REL boys standing are each one my student is
- a'. ***jo laRkaa khaRaa hai** *har ek meraa chaatr hai.*
REL boy standing is each one my student is
- b. *har ek laRkaa meraa chaatr hai* **jo khaRaa hai.**
each one boy my student is REL standing is
- b'. **har ek laRkaa meraa chaatr hai* **jo khaRe hāī.**
each one boy my student is REL standing are
- c. *har ek laRkaa* **jo khaRaa hai** *meraa chaatr hai.*
each one boy REL standing is student student is
- c'. **har ek laRkaa* **jo khaRe hāī** *meraa chaatr hai.*
each one boy REL standing are my student is

The verb in the left-adjoined relative clause is plural in agreement with the plural subject of the clause. What we have to determine, however, is which variable in the main clause is bound by the left-adjoined clause. Though (20a) does not have an overt demonstrative, it can be analysed as having a null demonstrative since the sentence has a variant with a partitive construction in the main clause *un-mē-se har ek meraa chaatr hai* 'DEM-PARTITIVE each one my student is'. The plural morphology in the relative clause is explained, since it is linked to *un*, the plural demonstrative inside the partitive phrase, and not to *har ek*, a singular determiner. In (20b–c), on the other hand, the relative clause has singular morphology, as is expected if it originates inside the scope of a singular determiner. Thus (20) provides fairly concrete evidence of the claim embodied in the representations in (19).¹⁸

3.2. Asymmetries in Light of Structure

Let us now consider the asymmetries between left-adjoined and right-adjoined/embedded relatives noted in section 2 from the perspective of (19).

Let us look first at the facts about headedness presented in (13). Given (19), only right-adjoined and embedded relatives can be considered noun

¹⁸ See Hock (1989) for arguments, primarily from Sanskrit, against the claim of asymmetry between left- and right-adjoined relatives. It is worth pointing out here that Hock cannot account for the facts in (20) which are rather striking confirmation of the claim of asymmetry, at least for Hindi. I thank a reviewer for bringing the article to my attention.

modifiers. The absence of the common noun is not surprising since relative clauses in noun modification structures, such as restrictive relative clauses in English, do not contain internal heads. What (19a) claims is that internally headed relatives are permissible in quantificational structures. This difference in the distribution of internally-headed relatives will have an explanation when the semantics of the relative clause is discussed in section 4 below. Briefly, it will be argued that internally-headed relatives and relative clauses without internal heads have different semantic types. Internally-headed relatives are generalised quantifiers, while ordinary relatives can be set-denoting terms. As such, the former can appear only in a structure like (19a) where a quantifier is needed, while the latter can appear in structures like (19b–c) where intersection with a common noun, another set-denoting term, is needed.

The demonstrative requirement for left-adjoined relative clauses, noted in (14–17), can also be better understood in view of (19). Since we are taking (19a) to be a quantificational structure in which the relative clause binds a variable in the main clause, a proper characterization of the phenomenon amounts to a classification of appropriate variables in the language. I suggest that only NPs with demonstratives qualify as variables that can be bound in such configurations.¹⁹ The Hindi DEM is a pronominal element and can be interpreted as a free variable. Specifically, its interpretation would be ' $\lambda PP(x_i)$ ', in case there is no common noun with DEM, or ' $\lambda P(P(x_i) \ \& \ CN'(x_i))$ ' if there is a common noun. The variable can remain free and refer deictically or be bound by other expressions from outside. The demonstrative requirement follows from the fact that a base-generated relative clause, being a quantifier, must bind a variable, and the demonstrative provides this variable. Sentences (14a) and (17a) are ruled out as cases of vacuous quantification, since there is no DEM in the main clause NP and the relative clause does not have a variable to bind. In the case of right-adjoined/embedded sentences, on the other hand, the relative clause forms a constituent with the common noun. It may then remain bare, as in (17), or combine with a determiner, as in (14). Since the determiner has scope over this derived constituent, it makes no difference what kind of determiner it is.

There remain two issues to settle with reference to this account of the demonstrative requirement. The first is why a definite noun phrase such as the bare NP *laRkii* 'girl' in (17a) cannot satisfy the variable requirement

¹⁹ Of course, it is possible for the argument that the relative clause binds to be null. This is not problematic, since under standard theories of pro-drop such as Huang (1982) null arguments can function like syntactic variables.

of the relative clause. Most theories of definites (Cooper 1983 and Heim 1982, for example) do not differentiate between NPs with *the* and those with a demonstrative. It is obvious from the Hindi data, however, that we need a way of differentiating demonstratives from other definites. Suppose that the meaning of a demonstrative includes a free individual variable, as suggested earlier, while a definite is quantificational, as per Cooper (1983). We would then have something like ' $\lambda PP(\lambda x(\text{girl}'(x) \ \& \ P(x)))$ ' for the term in the main clause of (17a). Here the variable x is bound by the iota operator and cannot be bound again by the relative clause. The relative clause will remain a vacuous quantifier and the sentence will therefore be ruled out.²⁰

A second question has to do with the possibility of null demonstratives. If the demonstrative in (20a) can be null, it is not clear why (14a) cannot also contain a null demonstrative. Consider in this connection (21), also acceptable without overt demonstratives:

- (21) **jo laRke khaRe hāī sab/dono mere chaatr hāī.**
REL boys standing are all/both my students are
 All/both boys who are standing are my students.

The basic difference between examples like (20–21) and (14) is that the determiners in (20) and (21) are universal quantifiers, while the determiner in (14) is a numeral. While I do not have an explanation for this fact, it is worth noting that the determiners that are allowed without an overt demonstrative coincide with the class of floating quantifiers. Sportiche (1988) has argued that floating quantifiers actually involve null partitive constructions. It is possible that the apparent violations of the demonstrative requirement in the Hindi examples being considered here may also be explained as cases involving null partitive constructions. More work, however, is needed to establish this correlation, and I will leave it here as a plausible line of inquiry.

Finally, let us look at the facts about multiple relativization presented in (18). Since right-adjoined relative clauses are produced by movement, (18b) will never be generated. There is no syntactic source for it, as shown by the impossibility of constructing (18c). I have analysed left-adjoined

²⁰ This is, of course, an oversimplification. While the variable x is bound and therefore unavailable for binding from outside, there is the possibility of P containing a free variable. This possibility is exploited, for example, by Cooper to account for donkey anaphora. In order to rule out sentences like (17a), that is those in which the main clause provides a definite rather than a demonstrative, we would need to block a free variable inside P from being the element bound by the relative clause. To address this issue fully is beyond the scope of this paper. See Srivastav (1991) for discussion.

structures as quantificational, with the relative clause binding a variable in the main clause. In order to interpret multiply-relativized structures, I propose to extend this idea to cover cases of multiple binding. While a relative clause with one REL element is analysed as a unary quantifier, those with more than one REL will be analysed as polyadic quantifiers. This will ensure that the main clause contains the same number of DEM elements as the REL elements in the relative clause. The semantics involved in interpreting polyadic quantifiers will be made explicit in section 4.6.

This account of the asymmetries is, admittedly, sketchy. The idea, however, was not to give full explanations but to show that the present analysis provides a means for organizing the facts in a way that does not call for ad hoc stipulations. Given the structures in (19), the asymmetries can be derived from general structural principles.

3.3. *Previous Analyses*

To put the present analysis in the perspective of earlier studies, the view that one type of adjoined relative clause is base-generated while another is produced by movement is not completely radical. Though Keenan (1985) does not argue that Hindi left- and right-adjoined relatives have distinct structures, he mentions that right-adjoined relatives could involve extraposition (p. 168). Prior to that he proposes an adjoined clause analysis for correlatives generally.

Dasgupta (1980, pp. 306–7) claims that Bangla left- and right-adjoined structures are syntactically distinct. Semantically, however, they are essentially the same, he believes. He focuses on left-adjoined structures, indicating that an appropriate semantics for this will naturally extend to the other. My proposal differs crucially in correlating the syntactic difference with a corresponding semantic distinction.

To sum up, I agree with the NP-embedded approach to correlatives that adjoined relative clauses can result from movement, but claim that this is true only of those relative clauses that follow the main clause NP. A consequence is that Hindi remains consistent with the observation in Baltin (1985) that modifiers cannot move to the left. I agree with the adjoined clause approach that it is possible to base-generate relative clauses adjoined to IP, but claim that this only happens with left-adjoined structures. And I differ in the characterization of the relationship between such relative clauses and the main clause NP. Instead of modifying the main clause nominal, the relative clause actually binds it.

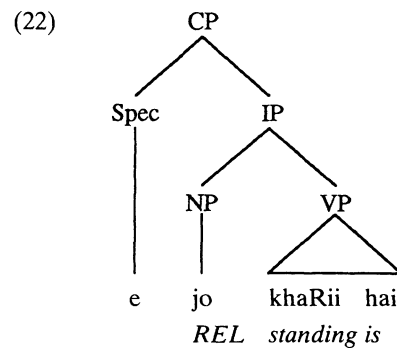
It remains, however, to justify the structures in (19) within the general

framework of GB and truth conditional/model theoretic semantics. I address these issues in the following sections, placing relativization in Hindi within a general theory of relativization.

4. THE INTERNAL STRUCTURE OF RELATIVE CLAUSES

4.1. Syntax

Let us begin with the syntax of relative clauses. A prototypical relative clause in Hindi could have the following D-structure:



In (22) the relative pronoun *jo* occupies a position inside IP. The arguments for this are the standard ones from GB literature. The theta role of *jo*, as well as its case marking, is determined by the predicate in the relative clause itself. In this example, it has nominative case as expected of the subject of the predicate *khaRaa honaa* 'to stand'.

The question that needs to be addressed, however, is whether the *wh*-element remains in situ. It is obvious in languages like English that the *wh*-expression moves into a clause-initial position. Thus it lends itself quite easily to an analysis in which it is taken to be an operator which moves into an A' position, Spec of CP, forming a chain with a trace inside IP. This is not as clear in Hindi. While *jo* tends to be clause-initial, it can also remain in its normal position inside the clause, or be scrambled like any other constituent.

The issue is of general relevance, since interrogative words in Hindi do not move to clause-initial position either. Direct evidence of S-Structure movement of *jo*, however, is available where it has to take scope over a higher clause:

- (23)a. **jo** [**tumKO lagtaa hai** [**ki acchii hai**]] *vo* aayii hai.
REL you-ACC think that nice is DEM come
 b. *vo* aayii hai **jo** [**tumKO lagtaa hai** [**ki acchii hai**]].
 c. *vo* **jo** [**tumKO lagta hai** [**ki acchii hai**]] aayii hai.

The one who you think is nice has come.

In these sentences *jo* is not an argument of the predicate *lagnaa* 'to think', but of the predicate *acchaa honaa* 'to be nice'. *lagnaa* takes a dative subject, and in (23) it is *tum* 'you' which has dative marking. *acchaa honaa*, on the other hand, requires a nominative subject, and the only nominal that is a possible candidate is *jo*. The point of this example is to establish that the *wh*-element in Hindi essentially has the same properties as the *wh*-element in English, i.e. it originates in an A position and can move to an A' position at S-Structure.

Within the GB framework it is assumed that all operators must move to an A' position for interpretation. As shown by Huang (1982) and subsequent work, this is as true of in-situ languages as of languages with overt movement. Therefore whether there is movement at S-structure or not, Hindi *jo* would have to move at LF to an A' position if it is an operator. An indirect piece of evidence that *jo* is an operator is the following. Hindi is a language which freely allows null arguments. However, the relative pronoun can never be dropped:

- (24)a. ***khaRii hai** *vo* lambii hai.
standing is she tall is
 b. *vo* **laRkii** lambii hai **khaRii hai**.
 c. **vo* **laRkii** **khaRii hai** lambii hai.

The girl (who) is standing is tall.

Therefore, it does not seem that *jo* is an ordinary argument. We may assume that it is an operator and that Hindi does not allow null operators in relative clauses.²¹

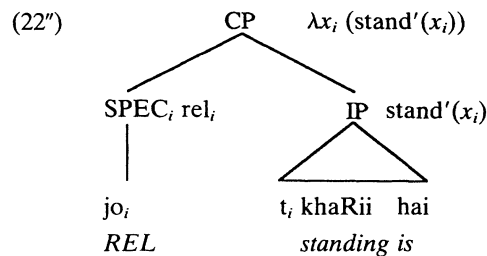
²¹ Null operators in relative clauses are, of course, possible as evidenced by English. The impossibility of such null operators would be a language-specific constraint in Hindi. It should also be mentioned that Hindi, being a pro drop language, may very well allow null Topic operators in the sense of Huang (1982). I do not, however, wish to take a stand on this issue here. The point relevant to the present discussion is the following. While null arguments are fairly unrestricted in Hindi, null operators are not. The fact that *jo* cannot be null fits in with a characterization of it as an operator rather than as an ordinary argument.

4.2. Semantics of Right-Adjoined/Embedded Relatives

In order to be interpreted, an operator must occupy an A' position at LF. We may then safely posit the following LF configuration for (22):

$$(22') \quad \begin{array}{ccc} [\text{CP } j\text{o}_i & [\text{C}' & [\text{IP } t_i \text{ khaRii } \text{ hai}]]] \\ \text{REL} & & \text{standing is} \end{array}$$

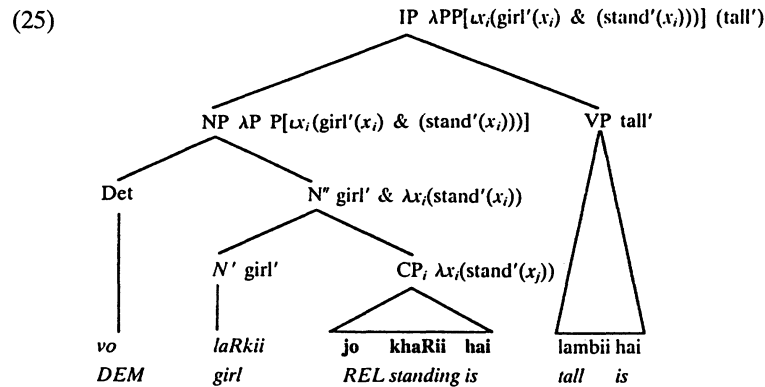
Let us now see what kind of semantics the relative clause has. Intuitively, (22') denotes a set – the set of individuals who are standing. We can define *jo* as an operator, called '*rel_i*', that takes an open sentence and abstracts over the variable in the sentence that has the same index as itself. Thus it yields a set of individuals. The semantic analysis of (22') would be as follows:



The denotation of (22'') in a given model would be the set of individuals who are standing.²²

This means that relative clauses can modify common nouns, which also denote sets, by intersecting with them. Thus the occurrence of relative clauses like (22) in Hindi right-adjoined/embedded structures like (19b–c) is predicted to be semantically well-formed, since these structures involve noun modification. For explicitness I give below the interpretation tree associated with structures like (19c)

²² Since the argument on the verb shows feminine gender, the set would only include female members. Presumably, inanimate objects with grammatical feminine gender would also be excluded. I leave it open whether this is a matter of presupposition or semantic representation.



4.3. Semantics of Left-adjoined Relatives

Defining *jo* as an operator that yields a predicative term is hardly controversial. In fact, this is precisely the semantics assumed in standard accounts of relative clauses. The more interesting issue is the semantics of the relative clause in left-adjoined structures. Under the view that they are generalised quantifiers, their denotation must be a set of sets. Let us see how this can be derived.

The relative clause in (19a) differs from (22) in having an internal head; it contains the common noun *laRkii* 'girl'. At LF the constituent *jo laRkii* 'REL girl' would raise, yielding the following:

$$(26) \quad [{}_{CP} [[{}_{Det} jo_i] [{}_{N''} laRkii]] [{}_C [{}_{IP} t_i khaRii hai]]]$$

REL girl standing is

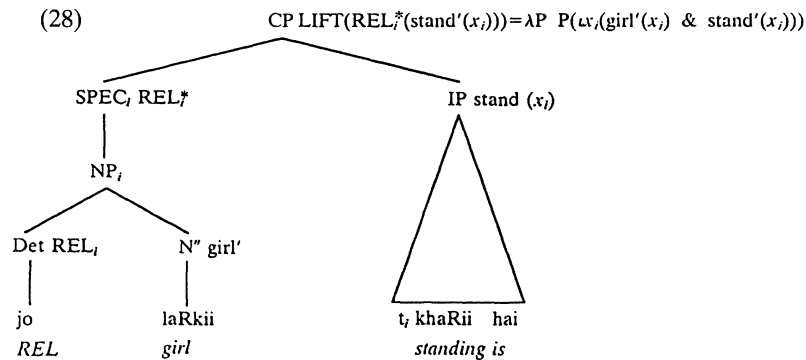
What we want this to denote is the set of all sets that include the individual in the intersection of *girl'* and *stand'*.

To obtain the desired result, let us define *jo* as a curried two-place operator, called 'REL', in the following way:

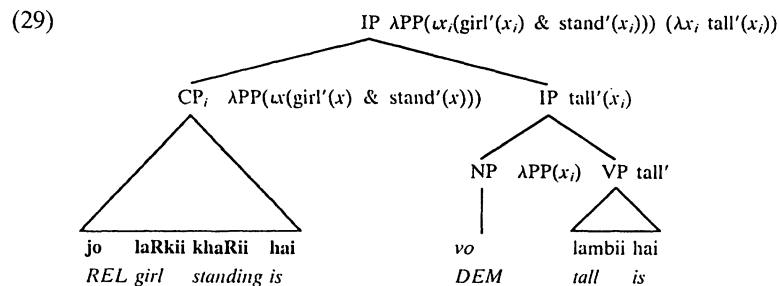
$$(27) \quad \begin{aligned} \text{REL}_n(N'') &= \text{REL}_n^*, \text{ where} \\ \text{REL}_n^*(IP) &= \lambda x_n (N''(x_n) \& IP(x_n)) \end{aligned}$$

jo, we see, corresponds to a two-place indexed operator REL_n . This operator combines with a common noun meaning to yield another operator REL^* which also carries the index of the noun phrase. REL^* combines with the open sentence denoted by the IP inside the relative clause to yield the unique entity that satisfies the predicates in the common noun

and the relative clause. This, of course, has to be lifted in order to get a generalized quantifier meaning. We get this result by assuming that structures of the form $[_{CP} [_{SPEC} jo N'']_n [C' [IP]]]$ are interpreted as 'LIFT(REL_n*(IP))', where LIFT is a type-shifting rule taking an entity-denoting term and yielding a generalized quantifier by abstracting over the properties of that entity. The whole relative clause thus denotes the set of sets that contain the unique individual who is in the denotation of the common noun as well as the predicate in the relative clause. In (28) I give a derivation to make this clear:



A relative clause like (28), being a generalized quantifier, is expected to occur in left-adjoined structures. If we assume that structures of the form $[CP_i IP]$ are interpreted as $[Q_i \lambda x_i IP]$, a left-adjoined structure like (19a) can be interpreted in the following way:



By interpreting the demonstrative in the main clause as a variable bound by the relative clause, we get the desired result. Sentence (29) will be true just in case the set denoted by the main clause is a member of the set of sets denoted by the relative clause.

4.4. *Plurals*

This semantics for *jo* makes the relative clause analogous to a definite description, and this seems to yield the correct results for sentences like (29) in which the relative clause has singular morphology. Consider, however, the plural counterpart of (29):

- (30) **jo laRkiyāā khaRii hāī ve lambii hāī.**
REL girls standing are DEM tall are
 The girls who are standing are tall.
 Literally: Which girls are standing, they are tall.

The quantificational force of the relative clause here seems to be universal. The sentence would be true if every girl who is standing is tall. The question we have to decide on, therefore, is whether *jo* is ambiguous between a definite and a universal quantifier.

If we adopt a theory of plurals such as Link (to appear) and Landman (1989a, 1989b), a very simple solution to the problem becomes available. Basically, they allow the domain of discourse to comprise singular and plural individuals. In a model in which there are three singular individuals *a*, *b*, and *c*, for example, there will be a total of seven members in the domain, namely $\{a, b, c, a + b, a + c, b + c, a + b + c\}$. Of these, *a*, *b* and *c* are atomic individuals, i.e. they have no individual parts. The others are *i*-sums built up out of atomic individuals.

Let us see if this solves the problem. Let us evaluate (30) in a model with three standing girls, *a*, *b* and *c*. Assuming that plural morphology selects only plural individuals, in this model the iota operator will apply to $\{a + b, a + c, b + c, a + b + c\}$. Since this set does not contain a unique individual, the iota operator will be undefined and the relative clause will fail to denote anything. This, however, is not the result we want. We want (30) to be true if the girls who are standing are a subset of the individuals who are tall, and false otherwise.

This can be accomplished by ensuring that the iota is defined on the supremum of the set rather than on a unique individual in the absolute sense.²³ If we now evaluate (30), we will get the result we want. The relative clause will denote the set of sets that contain $a + b + c$, since it is the unique maximal individual which satisfies *girl'* and *stand'*. From this, one can infer that the *i*-parts also satisfy the two predicates. This

²³ Thus ι here corresponds to the σ operator in Link (to appear). It should also be mentioned that this semantics allows collective as well as distributive readings when the relative clause picks out plural maximal individuals.

yields the force of universal quantification for (30) without affecting the definite reading for (29). The dichotomy between definite and universal readings of the correlative, then, depends on whether the *iota* picks out a unique singular or a unique plural individual. When it picks out a singular individual the relative clause has a definite reading; when it picks out a plural individual it has a universal reading. There is no ambiguity in the type of quantification involved. We will see in section 6 that a similar solution for the variation between universal and definite readings of free relatives has been proposed by Jacobson (1988).

To sum up so far, I have suggested that a generalized quantifier meaning for the relative clause can be obtained by thinking of *jo* as a special kind of determiner, corresponding to a two-place operator, which denotes the properties of a unique individual. The relative clause, being a generalized quantifier, can combine with the main clause, a set-denoting category, by standard rules of quantification. This account can be extended to cover multiple relativization cases as well.

4.5. Closely Related Sentences

Before moving on to multiple relativization structures, however, one point remains to be clarified. Consider the sentences in (13a), repeated below.

- (31)a. **jo laRkii khaRii hai vo lambii hai.**
REL girl standing is DEM tall is
- b. **jo khaRii hai vo laRkii lambii hai.**
REL standing is DEM girl tall is
- c. **jo laRkii khaRii hai vo laRkii lambii hai.**
REL girl standing is DEM girl tall is
- Which girl is standing, that girl/she is tall.

The three sentences are roughly synonymous, but (31a) seems to be the basic case. This is reflected in earlier analyses, which proposed a linear order for Pronominalisation/Deletion. The semantics given here also represents this version of the sentence as basic. The meaning we obtain for it is ' $\lambda PP(\lambda x(\text{girl}'(x) \ \& \ \text{stand}'(x))) (\lambda x \text{tall}'(x))$ '. Let us see if the meanings we obtain for (31b–c) are related to it in a principled way.²⁴

The relative clause in (31b) will denote ' $\lambda PP(\lambda x(C(x) \ \& \ \text{stand}'(x)))$ ', where *C* is a context variable. The NP in the main clause contains *vo*

²⁴ I would like to thank Gennaro Chierchia and Maria Bittner for helpful discussion on this issue.

laRkii 'DEM girl'. Let us assume its meaning is ' $\lambda PP(x_i) \ \& \ \text{girl}'(x_i)$ ', where x_i is a free variable. When the NP meaning combines with the VP meaning 'tall', it will yield an open sentence with x_i free: ' $\lambda P(P(x_i) \ \& \ \text{girl}'(x_i) \ (\text{tall}'))$ ', which after lambda conversion becomes ' $\text{tall}'(x_i) \ \& \ \text{girl}'(x_i)$ '. Example (31b), therefore, will be interpreted as ' $\lambda PP(\omega(C(x) \ \& \ \text{stand}'(x))) \ (\lambda x_i(\text{tall}(x_i) \ \& \ \text{girl}(x_i)))$ '. This is not equivalent to (31a). If we reduce (31b) further by lambda conversion, we get ' $\text{tall}'(\omega(C(x) \ \& \ \text{stand}'(x))) \ \& \ \text{girl}'(\omega(C(x) \ \& \ \text{stand}'(x)))$ '. This says that the unique entity who is standing and has some contextually specified property is in the extension of 'girl' and 'tall'. This does not say the same thing as (31a). For example, if the sentence was uttered during a discussion about girls in grade 1, a likely value for C would be 'girl-in-grade-1'. Suppose that there were two girls standing, one from grade 1 and one from grade 2; uniqueness would be satisfied in (31b) but not in (31a). Out of context, of course, C will tend to be interpreted as 'girl', giving the impression of semantic equivalence. It should be noted that the semantic procedure will rule out 'woman' as a likely value for C since the unique standing woman will not be in the extension of 'girl'.

Example (31c), on the other hand, is equivalent to (31a), since its reduced form ' $\text{tall}'(\omega(\text{girl}'(x) \ \& \ \text{stand}'(x))) \ \& \ \text{girl}'(\omega(\text{girl}'(x) \ \& \ \text{stand}'(x)))$ ' says that the unique standing girl is in the extension of 'girl' and 'stand'. Thus the semantics provided in section 4.4 captures the intuitions correctly with regard to these sentences.

To sum up, we have shown that internally headed relative clauses are necessarily to be analyzed as generalized quantifiers, while those without internal heads may be analyzed either as generalized quantifiers or set-denoting terms. This explains the facts about headedness presented in (13), namely that internally headed relatives can only occur in left-adjoined structures, while those without internal heads may appear in any of the three structures.

4.6. *Clauses with Multiple REL and DEM*

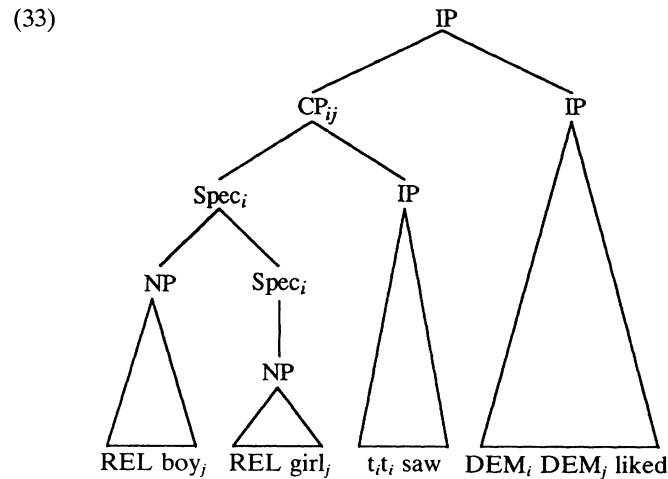
Section 4.4 showed how relative clauses with a single pair of REL and DEM can be interpreted. We now extend this to relative clauses with more than one pair of REL and DEM.

Consider a multiple correlative like (32) and its syntactic analysis in (33):

- (32) **jis laRkiiNE jis laRkeKO dekhaa usNE**
 REL girl-ERG REL boy-ACC saw DEM-ERG

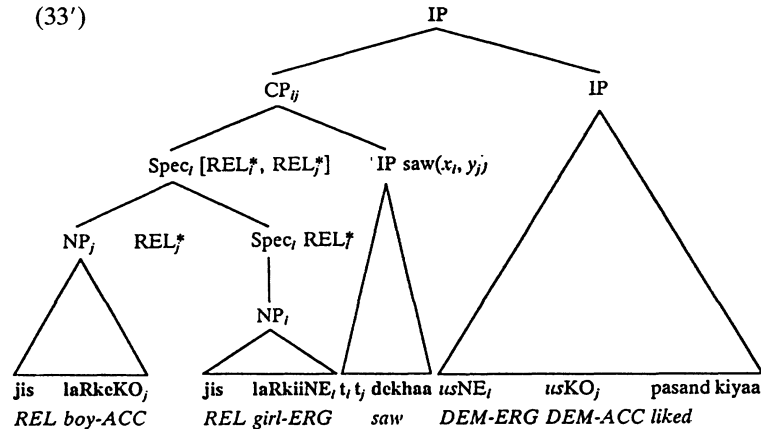
usKO pasand kiya.
DEM-ACC liked

Which girl saw which boy, she liked him.



In dealing with the single case, we took relative clause to denote a set of sets of individuals, and the main clause to denote a set of individuals. This represents unary quantification, which is the standard type of quantification found in natural language. Sentences like (32) can be accommodated into the present analysis if the interpretation procedure is extended to include polyadic quantification. That is, we need to treat the relative clause as a set of relations and the main clause as denoting a relation. The relative clause in (32) would be a polyadic quantifier which can bind the two variables in the main clause simultaneously. Intuitively, in (32) the relative clause would denote the set of relations that obtain between a girl and a boy she sees, the main clause would denote the relation *like* and the sentence would be true iff *like* is in the set denoted by the relative clause. Let us see how this can be done formally.

The first problem is to build up the meaning of the relative clause appropriately. Consider a full analysis tree for (32):



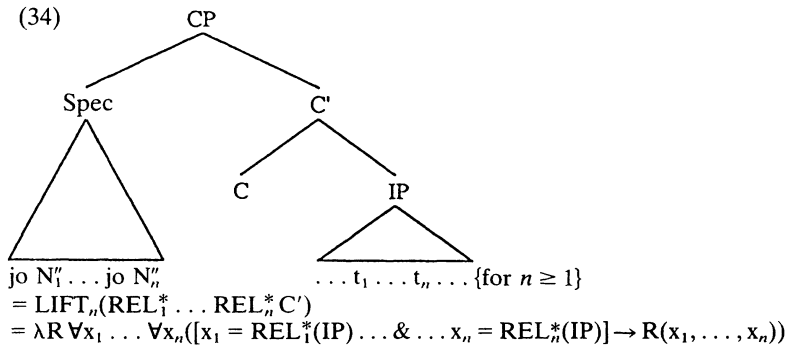
Which girl saw the boy, she liked him.

There are two *wh*-NPs in the relative clause, and both are raised at LF. We know, from the single case, that each of them corresponds to a two-place operator. The question of interest is how these two operators in Spec of CP are to be combined.

One of the best-known accounts of the semantics of multiple *wh*-structures is Higginbotham and May (1981). Very briefly, they claim that a multiple *wh*-question denotes a polyadic quantifier, the polyadic quantifier being built up out of a series of monadic quantifiers by a transformation called ABSORPTION which applies optionally at LF. If we look at (33'), however, we see that their semantics cannot be applied directly, since the transformational rule of Absorption takes as input two or more unary quantifiers. In (33'), however, we do not have a sequence of unary quantifiers to work from. What we have are two indexed operators REL_i^* and REL_j^* in an adjunction structure, combining with an open sentence *saw* x_i, y_j . What we need is an interpretative procedure for this structure.

Let us assume that Spec adjunction of one operator to another corresponds to simple juxtaposition. Thus at the topmost Spec node in (33') we will get a sequence of two operators $[REL_i^*, REL_j^*]$. By allowing the open sentence to be an argument to both operators, each operator can yield an entity-level meaning. This is obtained via the iota in each operator which can bind the position inside IP with the same index as itself. We then need to adjust the lifting operation in such a way that we end up with a set of relations, specifically that set of relations that hold between the girl and the boy she sees.

Let us replace the lifting operation we had in (27) with a more general type shift that would include the unary relative clause as a particular case:



LIFT_n takes the operators in Spec of CP and the open sentence in IP to yield a generalized quantifier. This procedure relates the entity-level meanings that the individual REL^* operators yield by universally quantifying over variables identical to them. Thus LIFT_n gives us the set of relations between all x and y that satisfy the common nouns in the *wh*-NPs and the predicate in the relative clause. Note that this way of forming polyadic quantifiers applies, in principle, to any number of adjunctions. So for example, if there are three *wh*-elements in the relative clause, all three will be raised, giving us a series of three indexed operators. At the level of CP, we will get a set of three-place relations, since the predicate in the relative clause will denote an open sentence with three argument positions, each of which can be bound by one operator in Spec of CP. Deriving a generalized quantifier meaning for relative clauses through a type-shifting rule like LIFT_n thus has the obvious advantage of providing a general procedure for interpreting relative clauses with one or more REL elements.

Before we see whether LIFT_n adequately characterizes the semantics of multiple relatives, however, let us see how it affects the semantics of structures with single REL elements. Taking (29) as an example, we get the interpretation in (35b) by the operation given in (27), and (35c) by the one in (34):

- (35)a. which girl is standing
 b. $\text{LIFT}(\text{REL}^*_i, C'(\text{IP})) = \lambda \text{PP}(\omega(\text{girl}'(x) \& \text{stand}'(x)))$
 c. $\text{LIFT}_1(\text{REL}^*_i, C') = \lambda \text{P}[\forall x_i (x_i = \omega(\text{girl}'(x) \& \text{stand}'(x))) \rightarrow \text{P}(x_i)]$

The crucial difference between LIFT and LIFT_n is that there is universal

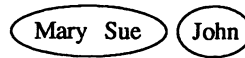
quantification built into the latter. Note, however, that the universal force is restricted by the iota operator. This ensures, as we will see, that the result of applying $LIFT_n$ to (29) is equivalent to the result of applying LIFT to it.

Let us evaluate (35b) and (35c) in the three situations in (36):

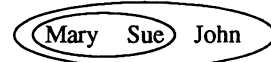
(36)a. girl' stand'



b. girl' stand'



c. girl' stand'



In (36a) the uniqueness requirement is satisfied and the iota will pick out *Sue* as the unique individual who is a girl and is standing. The relative clause in (35b) will yield properties of *Sue*. The relative clause in (35c) will yield the properties of all individuals who are identical to *Sue*. Since the only such individual will be *Sue*, it will yield the set of her properties. Thus in the situation where uniqueness is satisfied, the two come out equivalent.

Turning to situations where the uniqueness requirement is not satisfied, such as (36b–c), we have to decide what happens when the iota is undefined. In the case of (35b) we may say that when the iota is undefined, so is LIFT. Consequently, the relative clause fails to denote. In the case of (35c) we have to decide what happens to ' $x = \iota y(\Phi)$ ' when the iota is undefined. One option is to say that it lacks a truth value. This would mean that $LIFT_n$ yields partial relations, based only on assignments which yield a truth value for ' $x = \iota y(\Phi)$ '. Another alternative is to assume that in situations where uniqueness is not satisfied, the iota picks out a dummy object, possibly outside the domain of discourse. This would allow ' $x = \iota y(\Phi)$ ' to be evaluated. Specifically, it will be evaluated as false for all value assignments to x . This means that the consequent will always be true. That is, the relative clause will let every property through. Strictly speaking, (29) will be true in these situations. However, the relative clause will not be a proper quantifier or SIEVE, in the terms of Barwise and Cooper (1981), and we may take this as a basis for the intuition that it is odd or inappropriate in these situations. Thus the uniqueness requirement we had for relatives with one REL element under LIFT is preserved under $LIFT_1$.

Now consider interpretation provided by $LIFT_2$ for the multiple relative

in (32). At the CP level we get the interpretation in (37) for the relative clause:

- (37) which girl saw which boy, she liked him = $\lambda R \forall x_i \forall y_j [(x_i = \omega(\text{girl}'(x) \ \& \ \text{saw}'(x, y_j)) \ \& \ y_j = \iota y \ (\text{boy}'(y) \ \& \ \text{saw}'(x_i, y))) \rightarrow R(x_j, y_j)]$

That is, the relative clause yields the set of relations which hold between a unique girl and the unique boy she sees. In a situation where *Sue* is a unique girl who sees *Bill* and he is the unique boy seen by her, the relative clause will denote the set of relations between them. Thus LIFT_n provides the desired interpretation for multiple relatives. In order to interpret the main clause as a relation, we simply extend the quantification rule to cover polyadic quantificational structures. That is, assuming that structures of the form $[\text{QP}_{ij} \text{IP}]$ are interpreted as $[\text{Q}_{ij} \lambda x_i \lambda y_j (\text{IP})]$, the main clause in (32) will denote the relation *like*. If the relative clause includes this relation, the sentence will be true, and false otherwise.

An immediate consequence of interpreting the relative clause by LIFT_n is that it captures a rather subtle aspect of the meaning of multiple correlatives. While relative clauses with one singular *wh*-NP presuppose uniqueness, an interesting switch happens when there are two singular *wh*-NPs in the relative clause. Uniqueness is replaced by bijection.²⁵ In addition to the reading where a unique girl sees a unique boy, (32) also allows for multiple pairings in which each girl who saw a boy saw a unique boy, and each boy who was seen by a girl was seen by a unique girl.

This switch from a unique reading in the unary case to a bijective reading in the binary case can be better understood in terms of the difference in meaning between single *wh*-questions and multiple *wh*-questions in English.

- (38)a. Which girl saw the boy?
b. Which girl saw which boy?

As discussed by Higginbotham and May (1981), a single *wh*-question such as (38a) presupposes the existence of a unique girl who saw the boy, while a multiple *wh*-question such as (38b) presupposes multiple pairings between girls who saw boys, and the boys who were seen by girls.²⁶ The case of relatives like (32) is analogous.

²⁵ I would like to thank Vijay Gambhir for confirming judgments about the bijective readings of sentences like (32).

²⁶ The claim that the relation is bijective has been challenged by Engdahl (1986). See Srivastav (1991) for arguments in favor of bijectivity.

Let us see if (37) captures the bijective reading of (32). Again for clarity, let us evaluate it in three different situations, given in (39). The arrow indicates that the relevant relationship holds and its absence that it does not:

- (39)a. girl saw boy girl liked boy
 Sue → Bill Sue → Bill
 Jane → Harry Jane → Harry
 Mary John Mary John
 Which girl saw which boy = {saw, liked}
- b. girl saw boy girl liked boy
 Sue Bill Sue Bill
 Jane ↗ Harry Jane Harry
 Mary John Mary John
 Which girl saw which boy = {saw, liked}
- c. girl saw boy girl liked boy
 Sue → Bill Sue Bill
 Jane ↗ Harry Jane Harry
 Mary John Mary John
 Which girl which boy = {saw, liked}

In situation (39a), the relation *see* is bijective and we want the relative clause to denote the set of relations that hold between ⟨Sue, Bill⟩ and ⟨Jane, Harry⟩. In situation (39b), however, the relation is not bijective since *Jane* sees two boys – *Bill* and *Harry*. Situation (39c) is also not bijective, since *Bill* is seen by two girls – *Sue* and *Jane*. It is easily verified that the semantics outlined above yields the right results. In the first case, the relative clause acts like a proper quantifier, while in the other two it will let every relation into the set.²⁷ Thus LIFT_n ensures bijectivity in the polyadic case just as it ensures uniqueness in the unary case.

This account of polyadic quantification is by no means complete. To go into the topic in greater detail, however, is beyond the scope of this paper (see Srivastav (1991) for some extensions). I have demonstrated, however, that a reasonable account for multiple relativization structures is possible

²⁷ In Higginbotham and May (1981), questions with multiple WH have two representations which correspond to the singular and bijective readings. In the system outlined here, however, there is only one representation. Any model in which only a single pair of individuals satisfies the antecedent in the binary quantifier will have a singular reading. There is thus no need for a separate representation to account for it.

within an approach that treats left-adjoined relatives as generalised quantifiers.

4.7. *Summary*

To sum up, it has been shown that the relativized NP in a relative clause originates inside IP, where theta role and case assignment is satisfied. It moves into Spec of CP at LF. The relative clause is associated with two semantic types – a predicative term whose value is a set of individuals and a generalised quantifier whose value is a set of sets of individuals. Right-adjoined and embedded relative clauses are of the first type, left-adjoined relatives of the second kind. Relative clauses with more than one relativized NP denote a polyadic quantifier, i.e. a set of relations between individuals, and quantify over more than one variable simultaneously. From here on I will concentrate on the use of the relative clause as a generalised quantifier in Hindi left-adjoined structures. The use of the relative clause as a noun modifier in Hindi right/embedded structures can be accounted for within standard theories of relativization.²⁸

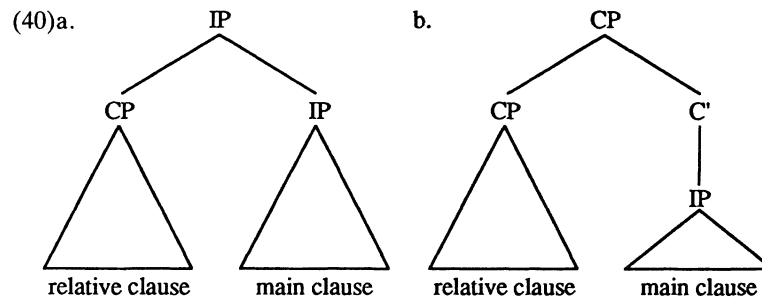
5. RELATIVE CLAUSES AND VARIABLE BINDING

5.1. *Another Structural Possibility*

In this section I discuss some further consequences of the analysis being proposed. So far, I have argued that in a left-adjoined structure such as (19a), the relative clause is a generalised quantifier, adjoined to IP at D-structure, and the main clause NP is a variable bound by it. I now address some of the implications of this analysis and justify the assumptions behind it.

Let us discuss the syntactic structure first. It was established in section 4.1 that a relative clause must be a CP since the relative pronoun is an operator which moves into an A' position, presumably Spec of CP, and that the main clause is an IP. I have assumed that the two combine via adjunction at the IP level. A priori, however, there is another option, namely that the relative clause is in Spec of CP. Compare (40a–b):

²⁸ I assume that differences in noun modification structures in English and Hindi can be explained with reference to their different phrase structures. For example, the fact that extraposition is much freer in Hindi may relate to the fact that finite clauses typically occur clause-finally in the language. See Srivastav (1991) for discussion.



There are two arguments that favor (40a) over (40b), even though such adjunction structures are not generally posited at D-structure. The first has to do with the fact that an embedded left-adjoined structure follows the complementizer, as shown in (41):

- (41) māī jaantii hūū [_{CP}ki [_{IP}[_{CP} jo laRkii khaRii hai]
I know that REL girl standing is
 [_{IP} vo lambii hai]]].
DEM tall is

I know that which girl is standing, she is tall.

If *ki* 'that' is taken to be the head of CP, it should take an IP complement. The left-adjoined structure must then be an IP, arguing for (40a) over (40b).²⁹

A second argument for (40a) is that it represents an adjunction structure, analogous to the one produced by Quantifier Raising. Thus, if left-adjoined relative clauses in Hindi are base-generated quantifiers, it is not implausible that they should occur in the canonical position for quantifier construal.

²⁹ It has been argued by Mahajan (1987) that *ki* 'that' is not in head of CP, but rather in pre-Spec position. In Suñer (1988) it is proposed that there are languages in which the following structure exists: [_C·C [_{CP} spec [_C·C IP]]]. In such an analysis *ki* could take a CP complement. If this were so (41) would not constitute evidence against (40b), but see Srivastav (1991) for arguments why *ki* is not in pre-Spec position.

For these reasons I have used (40a) rather than (40b), though the choice between the two is not crucial to the analysis.

5.2. Nonconstituency of Relative Clause and Bound NP

In the present account, the relative clause and the NP it binds do not form a constituent. In this connection, however, consider the following examples from Wali (1982):³⁰

- (42)a. QUES kaun ayaa? ANS **jo vahāā rahtii hai**, vo.
who came? REL there lives, DEM
- b. QUES kisNE kisKO pasand kiya?
who-ERG who-ACC liked
- ANS *jisNE jisKO dekhaa, usNE
REL-ERG REL-ACC saw DEM-ERG
- usKO.*
DEM-ACC

According to Wali, the relative clause with one REL must form a constituent with the NP, since the short answer to (42a) cannot omit the NP (**jo vahāā rahtii hai*. 'REL there lives'). The relative clause with two RELs does not form a constituent with the two NPs in the main clause, since it is not possible to answer (42b) with the relative clause and the two NPs. Consequently, she is forced to argue that left-adjoined relative clauses with one REL have a different structure from those with more than one REL. This, it seems to me, misses the basic similarity between the two. We would like to account for the facts in (42) without giving up the insight that all left-adjoined structures are quantificational.

While all Hindi speakers do not agree with Wali's judgement with regard to these facts, I believe that her claim that left-adjoined relatives with one REL can form a constituent with the main clause NP is valid. Examples like (43) clearly show the need for this:

- (43) **jo aaye unKAA kaam, jo gaye unKE kaam**
REL came DEM-GEN work REL left DEM-GEN work
se behtar hai.
than better is

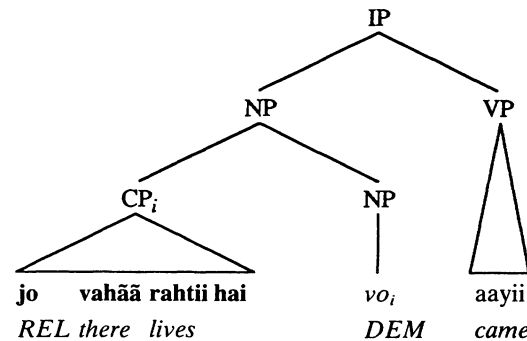
³⁰ The judgements are Wali's. It should be noted that some speakers accept (42b). In my account, this would be a case where the main clause VP is null.

Those who came, their work is better than those who left, their work.

(= The work of those who came is better than the work of those who left.)

In (43) there are two relative clauses construed with two arguments in the main clause. It would seem, on the face of it, that cases like this cannot be accounted for under the present approach, but these examples, in fact, are not problematic if they are analysed as cases of adjunction to NP. The answer in (42a) would be a short answer using the subject NP of the full sentence (42a'):

(42)a'.



This structure represents quantification over NPs of the kind proposed for inverse linking in May (1986). The NP is a variable bound by the quantifier. This can be shown by the following diagnostics, familiar from the discussion of relative clauses adjoined to IP. Answer (42a) could also have a common noun along with DEM: *jo larkii vahāā rahtii hai vo laRkii*. 'REL girl lives there DEM girl' (cf. section 2.1). And there is also the expected restriction on quantification (cf. section 2.2). In order to say 'two girls who live there', a partitive is necessary: *jo laRkiyāā vahāā rahtii hai un-mē se do* 'REL girls live there DEM-PARTITIVE two'. Thus although Wali may be right in claiming that the relative clause and DEM form a constituent, the constituent structure is not the one used for modification of noun phrases but the one used for quantification. The semantic procedure for interpreting structures like (42a') follows straightforwardly.

Rooth (1985, pp. 112–19) provides a semantics for quantification which applies crosscategorially. Applying his schema to (42a), the meaning of the CP ' $\lambda PP(\lambda x(C(x) \ \& \ \text{lives-there}'(x)))$ ' combines with the meaning of the NP ' $(\lambda QQ(x_i))$ ' in the following way. The NP meaning is made into something of predicative type by adding a variable of this type to its

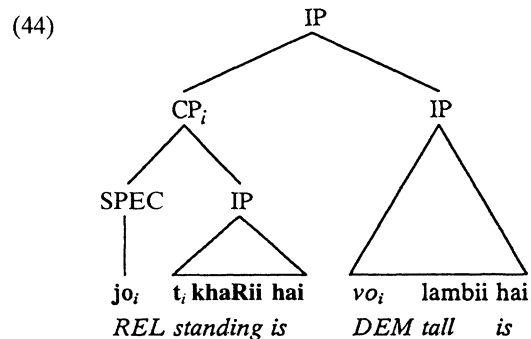
meaning ' $\lambda QQ(x_i)(Z)$ '. The individual variable is then abstracted over, yielding something of the right type to be an argument to the CP meaning ' $\lambda x_i[\lambda QQ(x_i)(Z)] \Rightarrow \lambda x_i Z(x_i)$ '. This is then applied to the meaning of the CP ' $\lambda PP(\lambda(C(x) \ \& \ \text{lives-there}'(x)))(\lambda x_i Z(x_i)) \Rightarrow \lambda x_i Z(x_i)(\lambda(C(x) \ \& \ \text{lives-there}'(x))) \Rightarrow Z(\lambda(C(x) \ \& \ \text{lives-there}'(x)))$ '. A generalised quantifier is obtained by abstracting over the property variable Z which remains after lambda conversion ' $\lambda Z Z(\lambda(C(x) \ \& \ \text{lives-there}'(x)))$ '. This says that (42) denotes the set of sets that contains the maximal individual who lives there and is in the extension of some contextually specified predicate. The same procedure will also work for (43). Thus the semantics given in section 4 for relative clauses adjoined to IP extends to those adjoined to NP.

The examples of relative clauses occurring on the left of NPs discussed in this subsection could not be explained as adjunction to IP. They had to be analysed as forming a constituent with the NP and as such were potential counterexamples to the claim in (19a) that relative clauses that occur to the left of the NP bind variables inside their scope domain. I have shown, however, that these too represent adjoined quantificational structures although at the level of NP. The essential insight that relative clauses which occur to the left are quantificational is therefore maintained.

5.3. Binding

Let us now turn to the nature of the binding between the relative clause and the main clause nominal. In earlier analyses (Kachru 1973, 1978; Subbarao 1984; Dasgupta 1980, for example) it was assumed that there is a direct linking between REL and DEM, with REL being dependent on DEM. In the present analysis, however, a direct linking is ruled out on formal grounds.

Let us look at the following left-adjoined structure:



In the present analysis DEM is taken to be a bound element but its antecedent cannot be REL for two reasons. As shown in section 4.1, *jo* is an operator which binds a trace inside the relative clause. For it to bind a position inside the main clause as well would violate the Bijection Principle (Koopman and Sportiche 1982), as well as the Parallelism Constraint on Operator Binding (Safir 1986), principles proposed to ensure a one-to-one correspondence between operators and variables.

Another problem is that *jo* does not c-command the variable *vo*, and syntactic binding requires c-command. In the present analysis the quantifier that binds the main clause nominal is the c-commanding category dominating the whole relative clause. Of course, this argument only holds if it can be shown that the anaphoric link in this structure requires syntactic binding, since anaphora is also possible in the absence of c-command.

DONKEY PRONOUNS, analysed by Kamp (1981) and Heim (1982), are well-known examples of anaphora without c-command, but it is easily seen that DEM in the left-adjoined structure does not behave like a donkey pronoun. In (45a) the antecedent *koi* *gadhaa* 'some donkey' is embedded inside a relative clause. The bare definite NP inside VP can be anaphorically linked to this non-c-commanding antecedent. As discussed in section 2.2 this is not possible in a left-adjoined structure. Sentence (45b) is not grammatical:

- (45)a. *har aadmii jis ke paas koi gadhaa hotaa hai*
 every man REL with some donkey has
 gadheKO maarta hai.
 donkey-ACC beats
 Every man who has one donkey beats it.
- b. **jo aadmii aayaa aadmii acchaa hai.*
 REL man came man nice is
 Which man came, man is nice."

While the semantics of definites remains an open problem (see footnote 20), (45) shows that the binding of DEM by a relative clause must be distinguished from the discourse binding involved in donkey anaphora.

Another significant difference between the two kinds of binding is that while donkey pronouns are completely optional, relative clause binding is not. That is, in (45a), the VP need not contain any reference to the antecedent. The sentence could easily have the form *har aadmii jis ke paas koi gadhaa hotaa hai khush rahtaa hai*. 'Every man who has a donkey is happy'. This is not possible in (45b); the main clause must contain an

argument referring back to the relative clause.³¹ Treating the relative clause as a quantificational phrase provides a simple explanation for this. Natural language is known to prohibit vacuous quantification. Given that the relative clause is a base-generated quantifier, the main clause must provide a variable for it to bind.

There is thus strong evidence for characterizing the link between the relative clause and the main clause nominal in terms of syntactic binding.

5.4. *A' Bound Pronominal in Main Clause NP*

By viewing the anaphoric link in this light, I have in effect analysed the main clause NP as containing an A' bound pronominal. This claim needs to be explored. Let us consider first the syntactic status of DEM. According to Sells (1984, p. 16) a resumptive pronoun is a pronoun that is coindexed with an operator position. If we can show that DEM behaves like an A' bound element, we can identify DEM as a resumptive pronoun.

Complex noun phrases in Hindi can be islands for extraction, as shown by the ungrammaticality of topicalization in (46a) and LF movement of WH in (46b). Sentence (46c) shows that DEM is also barred in this configuration, arguing for its status as a variable. For some speakers (46c) may be marginally acceptable. The impossibility of binding into a complex noun phrase can be demonstrated for such speakers by the fact that a null argument, which is generally possible in left-adjoined structures, is completely unacceptable here:

(46)a. *ravii māl [yeh baat ki nahī aayaa] jaantii hū.

Ravi I this matter that not came know

Ravi, I know the fact that (he) did not come.

b. *māl [yeh baat ki kaun nahī aayaa] jaantii hū?

I this matter that who not came know

Who is such that I know the fact that he did not come?

³¹ The structure under discussion is different from cases like (i) in which there is no DEM in the main clause:

(i) (caahe) jo aaye māl nahī jaaūgii.

no matter REL come I not will go

No matter who comes I will not go.

The relative clause here has optative tense and may contain the morpheme *caahe* 'no matter'. Such sentences are to be classed with concessive clauses and treated perhaps as involving quantification over worlds.

- c. ***jo vahāā rahtaa hai** māī [yeh baat ki vo nahī ayaa]
REL there lives I this matter that he not came
 jaantii hū.
know
 who lives there, I know the fact that he did not come.

Left-adjoined structures also show Weak Crossover Effects typical of variable-binding constructions, though this is not very strong.

- (47) ***jo vahāā rahtaa hai**_i [[ek aurat jisSE vo_i pyaar
REL there lives a woman REL-ACC he loves
 kartaa hai] [_{usSE_i} shaadii nahī karegi]].
DEM-ACC marriage not will-do

Who lives there, a woman whom he loves will not marry him.

This example has the schema [_{CP}relative clause]_i [_{IP} [_{NP}...pronoun_i...][_{VP}...DEM_i...]]. The pronoun inside the subject noun phrase cannot be the element bound by the relative clause, since it is inside an island; cf. (46c). Therefore it is the pronoun in the VP that the relative clause binds. Coreference is not possible between the two pronouns now. DEM being a bound variable, coindexation with a pronoun to its left leads to a weak crossover violation.³²

Thus DEM seems to be on a par with variables created by movement. This is somewhat problematic, however, since resumptive pronouns and variables do not usually have the same distribution. McCloskey (1990) observes that the binding of resumptive pronouns is not constrained by Subjacency or the ECP as is the binding of variables. Examples (46) and (47) show that Hindi DEM is subject to these constraints.

Sells (1984) and (1987) provide a diagnostic for distinguishing resumptive pronouns and variables. Sells argues that the former force extensional readings, while the latter are ambiguous between extensional and intensional readings.³³ If this is true then it is easily shown that DEM behaves like a variable. The following clearly allow for intensional interpretations:

³² If there were no relative clause in (47) coreference between the two pronouns would be possible.

³³ Actually, Sells uses the notion of a 'concept' reading to distinguish the two. I use the more familiar term 'intension' to make the point here.

- (48)a. **jo ciiz mujhe caahiye thii vo usKO mil gayii.**
REL thing I-ACC need was DEM he-ACC got

Which thing I needed, he got it.

- b. **jo aadmii sabhii bhaashaayē bol sake vo paidaa**
REL man all languages speak can DEM born

nahī huaa.

not has

Which man can speak all languages, he has not been born.

The situation in Hindi seems comparable to Swedish. Engdahl (1985) argues that resumptive pronouns in Swedish are “phonetically realized traces” since they have the same properties as traces created by movement (see also Zaenen et al. (1981)).³⁴ DEM, we might say, is also such a phonetically realized trace. Notice that this fact follows from the interaction of two claims basic to this analysis. The relative clause, being a quantifier, needs a variable to bind in its local domain. Since the relative clause originates in an A' position, a trace is not possible. Therefore the only option is a locally A' bound pronominal.

5.5. Summary

In this section I have tried to show that the assumptions implicit in the analysis of left-adjoined structures stand up to close inspection. In the next section I explore some crosslinguistic implications of this approach to relative clauses.

6. SOME CROSSLINGUISTIC IMPLICATIONS

6.1. Free Relatives in English

I turn now to English free relatives and show that there are striking similarities between them and Hindi left-adjoined relatives.

Syntactic inquiry into the structure of free relatives has focused mainly on the issue of headedness (Bresnan and Grimshaw 1978, Groos and van Riemsdijk 1979, Harbert 1982). Though it is not yet settled whether there

³⁴ For example, resumptive pronouns in Swedish license parasitic gaps, and in structures where subadjacency violations obtain, their presence does not lead to grammaticality. Unfortunately, parasitic gaps are not testable in Hindi.

is an NP dominating free relatives, it is accepted as a descriptive fact that they can occur in positions where we expect noun phrases:

(49) I will do **what(ever) she tells me**.

It can therefore be safely assumed that a free relative must have the semantic type of a noun phrase. In (49) it clearly has a quantificational force. Interestingly enough, the quantification involved seems to vary between a definite and a universal exactly in the way that the quantification in Hindi left-adjoined relatives does.

This aspect of the quantification in free relatives has been analysed by Jacobson (1988). She shows that the variation between universal and the definite does not depend on the presence or absence of *-ever*.³⁵ She argues that the basic semantic type of relative clauses is predicative, but general type-shifting principles, as proposed in Rooth and Partee (1982) and Partee (1987), account for its functioning as a noun phrase.³⁶ The iota operator allows a relative clause to type-shift into a referential meaning if the set denoted by it contains a singleton, yielding the definite reading. She then argues that the so-called universal reading is really a plural definite reading. That is to say, in the case of plurals it denotes the maximal plural entity with the relevant property. This semantics is similar to the one given in section 4 for Hindi left-adjoined relatives.

Given that a free relative has quantificational force, we can assume that it is subject to Quantifier Raising. Example (49) should therefore have the following LF:

(49') [IP_{[NP_i e [CP_i what(ever) she tells me]] [IP I will do t_i]]}

This is parallel to the structure proposed for left-adjoined relative clauses in Hindi. The only difference between the two languages, then, is that Hindi allows such adjunctions at D-structure while English does not; that is, Hindi generates relative clauses in adjoined positions while English allows them to be generated in argument positions.

Downing (1973, p. 11) notes that "correlatives" are typically found in

³⁵ Another significant correlation between Hindi left-adjoined relatives and English free relatives is the possibility of a particle *bhii*, which has the same properties as *-ever* (see Srivastav 1991). As expected under the present analysis, *bhii* is not possible in embedded or right-adjoined relatives.

³⁶ Partee (1987), drawing on Rooth and Partee (1982), departs from traditional Montague Grammar in suggesting that noun phrases do not denote a single semantic type. They may be referential or predicative, or they may be generalised quantifiers. A given noun phrase can type-shift from its basic category if the structure in which it occurs requires another type. For example, proper nouns are referential but when they occur in conjoined structures with quantificational noun phrases their type is raised.

SOV languages which are not rigidly verb-final. The present analysis suggests that some property of the phrase structure of such languages licenses or forces adjunction at D-structure. Based on the facts of Hindi, I will suggest a possible explanation for this.

In Srivastav (1989, 1991) it is shown that CPs in Hindi cannot appear in case-marked positions. Thus finite complements of verbs must appear postverbally, thereby accounting for the non-rigid SOV pattern of the language. If we assume that Hindi relative clauses are CPs, not dominated by NPs, they would be barred from argument positions. The only option then would be for relative clauses to occur adjoined to IP (or NP as suggested for examples (42–43)) and be linked to an argument inside IP which could bear case and theta role. In English, perhaps, free relatives are dominated by NP, which would account for the fact that they may occur in case and theta marked positions. I suggest this here as a possible line of inquiry for the future rather than as a claim.

6.2. *Internally-headed Relatives*

Finally, I would like to consider briefly the implications of the present study for languages with internally-headed relatives. Relative clauses in languages such as Quechua or Lakhota have been recognised as typologically distinct from ‘correlatives’ (Keenan 1985, Cole 1987, Williamson 1987 and Culy 1990). However, there clearly is some overlap between the two.³⁷ Hindi left-adjoined relatives allow internal heads, as we have seen. English, to the extent that it has internally headed relatives, has them in free relatives. The following is from Andrews (1985, p. 48):

- (50) I drank what beer was provided.

The semantics given in section 4 for such relatives, in fact, assigns a noun phrase meaning to them by treating the *wh*-expression in such constructions as a special kind of operator which is defined on two arguments. The question raised by the present analysis is whether internally-headed relatives in languages like Quechua are a subtype of the quantificational relative clause or belong to a separate class.

It has been observed that the languages which allow internally-headed relatives have the same properties as those which allow correlatives (Downing 1973, Keenan 1985 and Cole 1987, among others). They too are non-rigidly SOV and have null arguments. At the same time, there is

³⁷ It has been pointed out to me by a reviewer that Cole mentions Bach as having observed a similarity between the two.

considerable evidence that relative clauses in these languages have very different syntactic properties (Cole 1987, Williamson 1987, Culy 1990). No matter what their syntactic structure, however, their semantic type would have to be that of a noun phrase, since they appear in positions where noun phrases occur. This, however, is not the standard view of their semantics. Cole (1987) argues that while internally-headed relatives and ordinary headed relatives, both of which are found in Quechua, may have distinct syntactic representations at D- and S-structure, they have similar LF representations. He suggests that their interpretation may therefore be the same (p. 298). Since relative clauses in ordinary headed relatives are standardly assumed to be of predicative type, we could take this to imply that internally-headed relatives are also predicative.

The semantics given in this paper for Hindi left-adjoined relatives, which are internally headed, makes them definite quantifiers. If the same semantics is at play in languages like Quechua, we would expect internally-headed relatives in Quechua to be definite also. And indeed, it is worth noting that examples of internally-headed relatives in published literature are usually definite. In (51a) I give an example from Ancash Quechua, taken from Cole (1987), and in (51b) I add a numeral to it. The quantification in (51b) is definite; the relative clause contains the information that the total number of horses bought by the man is two. So, for example, (51b) could not be continued by 'and two were bad'. In the case of headed relatives there would be no such information conveyed, and a similar continuation would be possible.³⁸ This fact suggests that internally-headed relatives and externally-headed relatives in Quechua have distinct semantics, contrary to Cole's suggestion:

- (51)a. nuna bestya-ta ranti-shqa-n alli bestya-m
man horse-ACC buy-PERF-3 good horse-VALIDATOR
 ka-rqo-n.
be-PAST-3
 The horse that the man bought was a good horse.
- b. nuna ishkay bestya-ta ranti-shqa-n alli
man two horse-ACC buy-PERF-3 good
 bestya-m ka-rqo-n.
horse-VALIDATOR be-PAST-3
 The two horses that the man bought were good horses.

³⁸ I am indebted to Don Sola for this information.

Thus there seems some justification for considering these internally-headed relatives as semantically, if not syntactically, akin to quantificational relatives and distinct from restrictive relatives.

6.3. Summary

In this section I have shown that free relatives in English are quantificational in the same sense as Hindi left-adjoined relatives. The difference between the two languages may lie in the fact that unlike English, Hindi relatives are unable to bear case. They must thus occur in A' positions and be linked to NPs in A positions. I have also suggested that internally-headed relatives in languages like Quechua may have the same semantics as left-adjoined relatives in Hindi and free relatives in English.

7. CONCLUSION

This paper suggests that it is a mistake to classify languages as having or not having correlative constructions. Evidence from Hindi shows that relative clauses can be set-denoting terms or generalised quantifiers. Right-adjoined and embedded relatives are set-denoting terms which originate inside NP and modify nouns. Left-adjoined relatives originate in A' positions and are generalised quantifiers which bind A positions.

Given this analysis, there is no evidence in languages like Hindi to suggest that noun modification can take place in the absence of strict syntactic sisterhood. The only possible connection between a relative clause and a non-local nominal is one involving quantification. I have suggested that the quantificational use of the relative clauses is not unique to languages like Hindi but may be universal. Typological surveys of relativization have so far focused on relative clauses as noun modifiers. As such, languages seem to vary greatly in relativization strategies. The present study implies that a more cohesive account may emerge if the distinction between relative clauses as modifiers and as quantifiers is used in crosslinguistic studies of relativization.

REFERENCES

- Andrews, Avery: 1985, *Studies in the Syntax of Relative and Comparative Clauses*, Garland Publishing, New York.
- Bach, Emmon and Robin Cooper: 1978, 'The NP-S Analysis of Relative Clauses and Compositional Semantics', *Linguistics and Philosophy* 2, 145–150.
- Bains, Gurpreet: 1989, *Complex Structures in Hindi-Urdu: Explorations in Government and Binding Theory*, unpublished Ph.D. dissertation, New York University.
- Baltin, Mark: 1985, *Toward a Theory of Movement Rules*, Garland Publishing, New York.

- Barwise, Jon and Robin Cooper: 1981, 'Generalized Quantifiers and Natural Language', *Linguistics and Philosophy* 4, 191–219.
- Bresnan, Joan and Jane Grimshaw: 1978, 'The Syntax of Free Relatives in English', *Linguistic Inquiry* 9, 331–91.
- Chomsky, Noam: 1986, *Barriers*, Linguistic Inquiry Monograph No. 13. MIT Press, Cambridge, MA.
- Cole, Peter: 1987, 'The Structure of Internally Headed Relative Clauses', *Natural Language and Linguistic Theory* 5, 277–302.
- Cooper, Robin: 1979, 'The Interpretation of Pronouns', *Syntax and Semantics* 10, 61–92.
- Cooper, Robin: 1983, *Quantification and Syntactic Theory*, D. Reidel, Dordrecht.
- Culy, Christopher: 1990, *The Syntax and Semantics of Internally Headed Relative Clauses*, unpublished Ph.D. dissertation, Stanford University.
- Dasgupta, Probal: 1980, *Questions and Relative and Complement Clauses in a Bangla Grammar*, unpublished Ph.D. dissertation, New York University.
- Donaldson, Susan K.: 1971, 'Movement in Restrictive Relative Clauses in Hindi', *Studies in the Linguistic Sciences* 1, 1–74.
- Downing, Bruce: 1973, 'Correlative Clauses in Universal Grammar', *Minnesota Working Papers in Linguistics and Philosophy of Language* 2, 1–17.
- Engdahl, Elisabet: 1985, 'Parasitic Gaps, Resumptive Pronouns and Subject Extractions', *Linguistics* 23, 3–44.
- Engdahl, Elisabet: 1986, *Constituent Questions*, D. Reidel, Dordrecht.
- Groos, A. and Henk van Riemsdijk: 1979, 'Matching Effects in Free Relatives', in Adrianna Belletti et al. (eds.), *Theory of Markedness in a Generative Grammar: Proceedings of the IV Glow Conference*, Pisa, pp. 171–216.
- Harbert, Wayne: 1982, 'On the Nature of the Matching Parameter', *Linguistic Review* 2, 237–284.
- Heim, Irene: 1982, *The Semantics of Definite and Indefinite Noun Phrases*, unpublished Ph.D. dissertation, University of Massachusetts, Amherst.
- Higginbotham, James and Robert May: 1981, 'Questions, Quantifiers and Crossing', *The Linguistic Review* 1, 41–80.
- Hock, Hans H.: 1989, 'Conjoined We Stand: Theoretical Implications of Sanskrit Relative Structures', *Studies in the Linguistic Sciences* 19, 1–34.
- Huang, C.-T. James: 1982, *Logical Relations in Chinese and the Theory of Grammar*, unpublished Ph.D dissertation, MIT.
- Jacobson, Pauline: 1988, 'The Syntax and Semantics of Free Relatives', paper presented at LSA Winter Meeting, New Orleans.
- Junghare, Indira: 1973, 'Restrictive Relative Clauses in Marathi', *Indian Linguistics* 34, 251–62.
- Kachru, Yamuna: 1973, 'Some Aspects of Pronominalization and Relative Clause Construction in Hindi-Urdu', *Studies in the Linguistic Sciences* 3, 87–103.
- Kachru, Yamuna: 1978, 'On Relative Clause Formation in Hindi-Urdu', *Linguistics* 207, 5–26.
- Kachru, Yamuna: 1980, *Aspects of Hindi Grammar*, Manohar, New Delhi.
- Kamp, Hans: 1981, 'A Theory of Truth and Semantic Representation', in J. Groenendijk, T. Janssen and M. Stokhof (eds.), *Formal Methods in the Study of Language*, Mathematisch Centrum, Amsterdam.
- Keenan, Edward: 1985, 'Relative Clauses', in T. Shopen (ed.), *Language Typology and Syntactic Description II*, Cambridge University Press, New York, pp. 141–170.
- Koopman, Hilda and Dominique Sportiche: 1982, 'Variables and the Bijection Principle', *The Linguistic Review* 2, 139–160.
- Landman, Fred: 1989a, 'Groups I', *Linguistics and Philosophy* 12, 559–605.
- Landman, Fred: 1989b, 'Groups II', *Linguistics and Philosophy* 12, 723–744.
- Link, Godehard: to appear, 'Plural', in Wunderlich and von Stechow (eds.) *Handbook of Semantics*.

- Mahajan, Anoop K.: 1987, 'Notes on Wh Questions in Hindi', Paper presented at Sala, Cornell and Syracuse Universities.
- May, Robert: 1986, *Logical Form: Its Structure and Derivation*, Linguistic Inquiry Monograph No. 12, MIT Press, Cambridge, MA.
- McCloskey, James: 1990, 'Resumptive Pronouns, A' Binding and Levels of Representation in Irish', in R. Hendrick (ed.), *The Syntax of the Modern Celtic Languages*, Syntax and Semantics 23, Academic Press, pp. 199–248.
- Partee, Barbara: 1975, 'Montague Grammar and Transformational Grammar', *Linguistic Inquiry* 6, 203–300.
- Partee, Barbara: 1987, 'Noun Phrase Interpretation and Type-Shifting Principles', in Groenendijk, J., D. De Jongh, and M. Stokhof (eds.), *Studies in Discourse Representation Theory and the Theory of Generalized Quantifiers*, GRASS 8, Foris, Dordrecht, pp. 115–144.
- Porterfield, Leslie and Veneeta Srivastav: 1988, '(In)definiteness in the Absence of Articles: Evidence from Hindi and Indonesian', *Proceedings of WCCFL* 7, 265–276.
- Rooth, Mats: 1985, *Association With Focus*, unpublished Ph.D. dissertation, University of Massachusetts, Amherst.
- Rooth, Mats and Barbara Partee: 1982, 'Conjunction, Type Ambiguity, and Wide Scope Or', *Proceedings of WCCFL* 1, 353–362.
- Russell, Bertrand: 1905, 'On Denoting', *Mind* 14, 479–493.
- Safir, Ken: 1986, 'Relative Clauses in a Theory of Binding and Levels', *Linguistics Inquiry* 17, 663–690.
- Sells, Peter: 1984, *The Syntax and Semantics and Resumptive Pronouns*, unpublished Ph.D. dissertation, University of Massachusetts, Amherst.
- Sells, Peter: 1987, 'Binding Resumptive Pronouns', *Linguistics and Philosophy* 10, 261–298.
- Sportiche, Dominique: 1988, 'A Theory of Floating Quantifiers and its Corollaries for Constituent Structure', *Linguistic Inquiry* 19, 425–449.
- Srivastav, Veneeta: 1988, 'Hindi Relative Clauses and Learnability', *Cornell Working Papers in Linguistics* 8, 133–160.
- Srivastav, Veneeta: 1989, 'Hindi Wh and Pleonastic Operators', in *Proceedings of NELS* 20, 443–457.
- Srivastav, Veneeta: 1991, *WH Dependencies in Hindi and the Theory of Grammar*, unpublished Ph.D. dissertation, Cornell University.
- Subbarao, K. V.: 1984, *Complementation in Hindi Syntax*, Academic Publications, Delhi.
- Suñer, M.: 1988, 'Indirect Questions: Implications for the Structure of CP', unpublished Cornell ms.
- Verma, Manindra K.: 1966, *The Noun Phrase in Hindi and English*, Motilal, New Delhi.
- Wali, Kashi: 1982, 'Marathi Correlatives: A Conspectus', *South Asian Review* 6, 78–88.
- Williamson, J.: 1987, 'An Indefiniteness Restriction for Relative Clauses in Lakota', in Reuland, E. J. and A. ter Meulen (eds.), *The Representation of Indefiniteness*, MIT Press, Cambridge, MA, pp. 168–190.
- Zaenen, Annie, Elisabet Engdahl and Joan Maling: 1981, 'Resumptive Pronouns can be Syntactically Bound', *Linguistic Inquiry* 12, 679–682.

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