THE SYNTACTIC DOMAIN OF ANAPHORA

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ABSTRACT

This thesis deals, primarily, with the structural properties which restrict anaphora options. It is argued that the relation 'precede-and-command,' which has been believed since early stages of transformational grammar to capture these structural restrictions plays, in fact, no role in determining anaphora options.

The discussion introduces the notion 'syntactic domain of a node α' which is defined as the subtree dominated by the first branching node which dominates α. It is argued that anaphora restrictions apply to two given NP's just in case one of these NP's is in the syntactic domain of the other. If this is the case, the anaphora rule requires that the NP which is in the domain of the other should be a pronoun for an anaphoric relation to hold.

It is suggested, further, that the domains defined this way reflect the basic units of the processing of sentences and, consequently, that major linguistic rules are restricted to operate only within the same syntactic domains, which accounts for various correlations between anaphora options and semantic properties of sentences.

Thesis supervisor: Noam Chomsky

Title: Institute Professor

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INTRODUCTION

The only constant in the debates of the last few years concerning anaphoric relations has been the assumption that whatever the rules are, they are to be stated in terms of the relation 'precede-and-command.' This relation was introduced to account for a problem which is independent of the specific theory one adopts concerning the status of anaphoric relations. Any theory of anaphora has to account for the fact that a pronoun cannot be related arbitrarily to any full NP in a sentence. In other words, it is not sufficient that the context, the semantics of the sentence, or the situation in the world permit two NP's to be anaphorically related—certain structural properties of the two NP's impose further restrictions on their coreference options in a given sentence. Thus, not in all of the following sentences can Rosa be coreferential with she

I a) Rosa denied that she met the Shah.
b) She denied that Rosa met the Shah.

IIa) The man who traveled with Rosa denied that she met the Shah.
b) The man who traveled with her denied that Rosa met the Shah.

In (Ib), she and Rosa can only be interpreted as referring to different persons.

That the restriction on anaphora is not so simple as to say that the antecedent must precede the pronoun is indicated by the fact that in (IIb) coreference is possible although the pronoun precedes the antecedent. Sentences like (IIb) are, perhaps, not always fully natural on the coreference reading, and their appropriateness may depend upon the context of their utterance. The crucial point, however, is that while there are contexts which permit coreference in (IIb), no discourse

permits a coreference reading in (Ib). The restrictions on anaphora must, therefore, distinguish these two cases and specify the structural conditions under which two given NP's cannot have an anaphoric relation (or corefer). The relation of precede-and-command (which will be defined and discussed in Chapter 1) has been supposed to capture these conditions. I will argue, however, in Chapter 1, that this relation plays no role in determining anaphora options and has, probably, no other linguistic relevance.

My concern in the discussion to follow is, primarily, to define the structural relations which restrict anaphora options. However, a proper specification of these structural relations has much broader consequences: I will argue that these relations define a more general notion of the syntactic domain of a given node and that anaphora rules are restricted to operate on two given NP's just in case one of these NP's is in the domain of the other. We will see (primarily in Chapter 2) that there are several striking correlations between anaphora facts and various semantic properties of sentences, such as theme-Rhene relations, logical (entailment) relations and relative quantifier scope. In Chapter 5 I will suggest that these correlations are due to the fact that all these semantic properties are determined on the basis of the same syntactic domains, and that, in general, major linguistic rules are restricted, like the anaphora rules, to operate only on nodes within the same minimal domain.

Chapter 1: THE SYNTACTIC DOMAIN FOR COREFERENCE OF DEFINITE NOUN PHRASES

1.1 The relation of precede and command. Following Langacker (1969), who introduced the relation of command, this relation is defined as in (1):

1) a node A commands a node B if neither A nor B dominates the other and the S node most immediately dominating A also dominates B.

Jackendoff (1972) suggested a modification of the definition so that it makes use of the notion cyclic node rather than S. Within the 'Extended Standard Theory', certain NP's are considered cyclic nodes, so Jackendoff's modification allows them to participate in the determination of command relations.

The restriction on anaphora which was suggested by Langacker, and which was adopted in most studies of coreference restrictions, states, roughly, that the pronoun cannot both precede and command its antecedent, or that no coreference is possible between a pronoun, NP_p, and a full NP, NP_{-p}, which follows and is commanded by this pronoun. This restriction captures the difference between (Ib) and (IIb) above, which are repeated in (2) and (3):

2) She denied that Rosa met the Shah.

3) The man who traveled with her denied that Rosa met the Shah.

In (2) the pronoun precedes and commands the full NP, hence they cannot be coreferential. In (3) the pronoun precedes, but it does not command the full NP, and coreference is permitted.

Within a transformational approach to anaphora, as stated e.g. in Ross (1967), this restriction is captured by stating basically two pronominalization rules, one optional, which applies backward (namely NP_2 pronominalizes NP_1 to its left) and is subject to the condition that NP_1 cannot command NP_2, and one obligatory, which applies forward and is unrestricted.

Within an interpretive approach (as in Dougherty (1969) and Jackendoff (1972)), the restriction applies to the semantic interpretation of two NP's as coreferential, and it can be stated in various ways, two of which are:

4a) A pronoun NP_{1p} can be coreferential with a non-pronoun NP_{2-p}, unless NP_{1p} both precedes and commands NP_{2-p} (this is equivalent to stating that the pronoun cannot precede and command its antecedent).

b) NP_1 can be coreferential with NP_2, unless NP_1 precedes and commands NP_2 and NP_2 is not a pronoun.

The formulations in (4a) and (4b) are not equivalent; I return to this question in section 1.3.

1.2 The notion of syntactic domain.

Although it has not been stated this way, the relation of precede and command can be understood as defining the syntactic domain of a given NP. The definition of a domain, given this relation, would be the following:

5) The domain of a node A consists of A together with all and only the nodes that A precedes and commands.

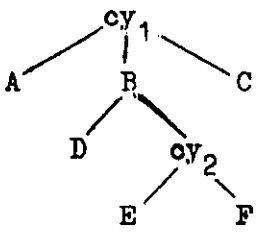
In terms of syntactic domains, the restrictions in (4a) and (4b) can be stated as follows:

6a) NP_p can be coreferential with NP_{-p}, unless NP_{-p} is in the domain of NP_p (i.e., the antecedent cannot be in the syntactic domain of the pronoun).

b) NP_1 can be coreferential with NP_2, unless NP_2 is in the domain of NP_1 and NP_2 is not a pronoun.

To exemplify some domain relations between nodes in a tree, let us look at the abstract tree in (7). (Capital letters stand for any node; 'cy'

stands for a cyclic node.)

7) 

The domain of node A includes all the other nodes in cy_1, since A precedes and commands all these nodes. This will be represented in the following way:

8a) A / B, C, D, cy_2, E, F

((8a) is to be read: nodes B, C, D, etc. are in the domain of node A.) Other domains in the tree (7) are given in (8b).

8b) B / C^1

C / $\emptyset$

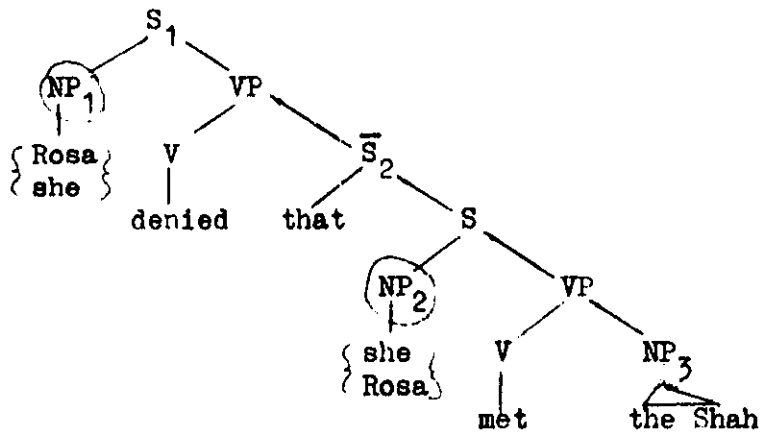
D / cy_2, E, F, C

E / F

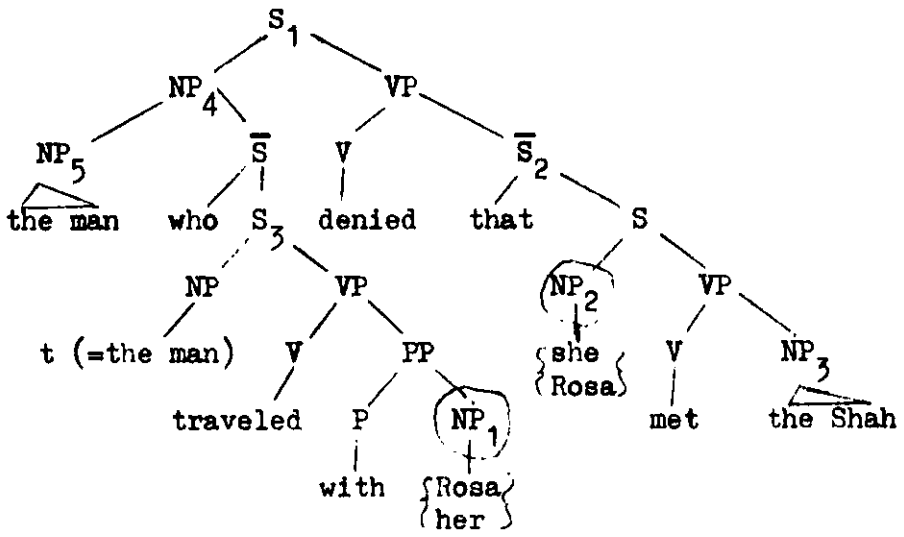
As we see in (8b), node C has nothing in its domain, since although, like A, it commands all the nodes in cy_1, it does not precede them. Node E has in its domain only the node F, since it does not command the nodes A, B, C, or D of cy_1.

For the application of the coreference rule, the only domains which are relevant are those of NP's. We can check now the domains of NP's in some actual trees—those underlying the sentences in (2) and (3).

9a)



9b)



In (9a) the domain of the subject, NP_1, consists of all the nodes in S_1 (since NP_1 precedes and commands them), hence NP_2 is in the domain of NP_1. The coreference restriction in (6) thus applies to these two NP's, and blocks coreference in case NP_1 is a pronoun and NP_2 is not (as in sentence (2b)). If we check now the domain of NP_2, we see that it consists only of the VP of $\overline{S}_2$. NP_1 is not in the domain of NP_2 (since it neither commands nor precedes NP_1), hence the restriction in (6) does not apply, and sentences like (2a), where NP_2 is a pronoun and NP_1 is not, allow a coreference reading.

In (9b), on the other hand, neither of the nodes NP_1 and NP_2 is in the domain of the other: NP_1 has nothing in its domain, and NP_2 has only the VP

of $\overline{S}_2$ in its domain. Hence the restriction on coreference does not apply (coreference between NP_1 and NP_2 is not restricted) and we can get both (3a) and (3b) on the coreference reading.

Looking back at (8a), the nodes (A, B, C, D, cy_2, E, F) constitute a domain; in other words (cy_1) is a domain—the domain of A. Thus, in tree (7), we have the domains (A, B, C, D, etc.); (B, C); (C); (D, cy_2, E, F, C), etc.[2] The node to the left of the slash in (8) will be called <u>the head</u> of the domain. Thus, A is the head of the domain (A, B, C, D, etc.) = (cy_1), B is the head of the domain (B, C), etc. This is an extension of the use of the term <u>head</u>, which has been used, for example, in the case of NP's like NP_4 in (9b) above, whose head is NP_5. In terms of domains, NP_4 constitutes a domain; NP_5 is the head of the domain, and all nodes in $\overline{S}$ are in the domain of the head NP_5. Extending the use of the term <u>head</u> to all kinds of domains enables us to speak of the subject as the head of the sentence (when there are no preposed constituents), etc.

At this stage of discussion, the introduction of the notion of syntactic domain may seem unmotivated. It seems basically equivalent to state that coreference between two NP's is subject to restrictions in case one precedes and commands the other, or to state that coreference is subject to restrictions in case one NP is in the domain of the other, where a domain is defined in terms of precede-and-command. The notion of a domain will become relevant, however, if it can be shown to play a role in the semantic analysis of a sentence. One of the problems with the restriction in terms of precede-and-command (as stated in (4)) is that it has never been explained why coreference should obey such a restriction. In Chapter 5, I will examine the linguistic significance of the notion 'syntactic domain',[3] and I will discuss several dependencies between the head and the nodes in its domain, which may

account as well for the fact that NP's in the domain of the head must be pronouns in order to be coreferential with the head. In sections 1.4 and 1.5 I will argue that the relation of precede-and-command (and hence the syntactic domain defined by it) is actually irrelevant to the coreference rule, and I will suggest an alternative definition for the syntactic domain. It is pointless, therefore, to provide at this stage arguments for the linguistic relevance of the domain defined in (5), since this particular domain has no linguistic relevance; and arguments in favor of the notion syntactic domain will be postponed until Chapter 5. The important point for the discussion to follow, however, is that coreference restrictions apply only when one NP is in the domain of the other. This generalization is not crucially dependent on the specific definition of syntactic domain. Hence, we can take for granted that there is a syntactic domain in which the coreference restriction applies and proceed to examine what the status and the exact content of this restriction are, independently of the formulation of the domain itself.

1.3 The formulation of the restriction on anaphora.

1.3.1 Let us return now to the two formulations of the coreference restriction in (6a) and (6b) in order to see how they differ. Such a comparison requires, first, a more precise formulation of the alternative restrictions which were informally stated in (6). First, as stated, both restrictions incorrectly permit coreference in sentences like Ben hit him, since him, which is in the domain of Ben, is properly a pronoun. However, such sentences permit coreference only if the pronoun is reflexive. So the restriction we have been discussing should be stated so as to apply only to environments which do not obligatorily require the reflexive. For the sake of the present discussion it is sufficient to state that the restriction applies to

NP's which are not in a strict (i.e. obligatory) reflexive environment.[4]

The restriction in (6a) applies strictly to pairs consisting of a pronoun and a full NP (NP_p and NP_{-p}), blocking coreference in case NP_{-p} is in the domain of NP_p (i.e. where NP_p precedes and commands NP_{-p}). The restriction in (6b), on the other hand, applies to any given pair of NP's, stating that if NP_2 is in the domain of NP_1, coreference is blocked if NP_2 is not a pronoun, regardless of whether NP_1 is a pronoun or not. This difference will be clearer once the two restrictions are properly formulated as in (10):[5]

10a) Two NP's in a non strict reflexive environment can be coreferential just in case one is a pronoun, the other is not and the non-pronoun is not in the domain of the pronoun.

b) Two NP's in a non strict reflexive environment can be coreferential just in case if either is in the domain of the other, the one in the domain is a pronoun.

It is easy to see now that the two formulations are not equivalent. Everything covered by (10a) is covered by (10b), but not conversely. This can be illustrated with a paradigm of sentences with the structures of (2a) and (2b), repeated below as (11b,c). Within an interpretive approach to coreference, where pronouns are generated freely in the base, the following four sentences will be generated:

11a) Rosa denied that Rosa has met the Shah.

b) She denied that Rosa has met the Shah.

c) Rosa denied that she has met the Shah.

d) She denied that she has met the Shah.

However, coreference is only possible in (11c) and (11d). Either restriction successfully blocks coreference in (11b), where Rosa is in the domain of she. Either also permits coreference in (11c). ((10a) does not apply to (11c)

since in this sentence we do not have a full NP in the domain of a pronoun; (10b) does not apply since the NP within the domain of the subject is a pronoun.) The two restrictions differ, however, in their application to (11a) and (11d): As formulated, (10a) cannot apply to (11d), since both NP's are pronouns, while (10a) is formulated so as to apply only to pairs consisting of a pronoun and a full NP. An additional condition would be needed, stating that coreference is always free between pronouns. For the same reason, (10a) cannot block coreference in (11a), where, since there is no pronoun involved, the restriction as stated in (10a) simply does not apply. The restriction in (10b), on the other hand, correctly blocks coreference here, since the embedded NP (Rosa) is in the domain of the matrix subject, and it is not a pronoun.

The statement of the coreference restriction in (10b) is based on Lasnik's observation in Lasnik (1976). Prior to Lasnik, all discussions of coreference or pronominalization have basically assumed the restriction in (10a), which meant that a special restriction was needed to limit coreference options between two full NP's (NP_{-p}) in cases like (11a). Thus, Lakoff (1968) suggests a special output constraint for these cases, which, furthermore, assumes crucially that the notions antecedent and anaphor can hold of two full NP's. (On this view, the first Rosa in (11a) might count as the antecedent of the second Rosa.) Lasnik's important observation is that there is no need for two separate restrictions, and that a single condition can capture all the coreference options of two NP's.

The crucial test for this hypothesis is its prediction that given a sentence in which NP_1 does not both precede and command NP_2 (i.e., in our terms, NP_2 is not in the domain of NP_1),

there is no restriction on their coreference options--we can find 'forward pronominalization', 'backward pronominalization' or no pronominalization. The facts in (12) and (13) support this prediction.[6]

12a) People who know Nixon hate him.
b) People who know him hate Nixon.
c) People who know Nixon hate Nixon. (Lasnik, 1976, 5d)

13a) The woman who marries Ben will marry his mother as well.
b) The woman who marries him will marry Ben's mother as well.
c) The woman who marries Ben will marry Ben's mother as well.

The sentences in (c) are perhaps marginal for some speakers, and they are clearly less natural out of context than the sentences in (a). This is due to a general tendency to use a pronoun rather than a full NP, when the referent has already been mentioned in the discourse. The important point, however, is that there is a substantial difference between the (c)-sentences in (12)-(13) and sentences like (11a), where one NP is in the domain of the other and where coreference is impossible and not merely less natural. This difference can be seen as well in the following cases, when we reverse the order of the adverbial and main clauses:

14a) Whenever Ben comes to town, Ben gets arrested.
b) *Ben gets arrested whenever Ben comes to town.

15a) Although McIntosh isn't too smart, McIntosh is still one of our smartest leaders.
b) *McIntosh is still one of our smartest leaders, although McIntosh isn't too smart.

The (b)-sentences are clearly much worse than the (a)-sentences. The reason is that in the (b)-sentences, the first occurrence of the NP precedes and commands the other. Hence, one NP is in the domain of the other, and the restriction in (10b) is violated. In the (a)-sentences, the preceding NP does not command the other. Thus, neither NP is in the domain of the other, and (10b) does not apply.[7]

Lasnik's observation enables us to restate the problem of coreference restriction: the problem is not specifying the conditions under which a pronoun can precede its antecedent or under which an NP cannot be coreferential with a pronoun to its left (as all previous discussions assumed), but rather, specifying the conditions under which coreference between two definite NP's is not free. Stated in terms of syntactic domains, the resulting picture is that given two NP's, the crucial question is whether either of them is in the domain of the other. If this is not the case, there are no restrictions on the coreference options of these two NP's--they can be coreferential (or non-coreferential) regardless of whether they are pronouns or full NP's, and regardless of their linear order, in case only one of them is a pronoun. But, if one of the two NP's in question is in the domain of the other, the coreference restriction permits coreference only if this NP is a pronoun, and again, regardless of whether the other NP, which is the head of the domain, is a pronoun or not.[8]

The generalization in (10b) simplifies the treatment of the restrictions on coreference and avoids problems which are inherent to the previous assumption that the problem is the relations between antecedent and pronoun. The problem for existing interpretive treatments, such as Dougherty (1969) and Jackendoff (1972), which assume a restriction similar to (10a), is not the unacceptability of coreference in (11a) or the (b)-sentences in (14) and (15). Since the rule which assigns coreference applies only to pairs consisting of a pronoun and a full NP, the two occurrences of a full NP in these sentences will not be marked coreferential. The problem, however, is to account for the difference between these sentences and the (c)-sentences of (12)-(13), since, for the same reason, the full NP's in (12c)-(13c) cannot be marked coreferential. Precisely the same problem arises for the

transformational approach; (11a) and (11c)-(13c) will be transformed into the grammatical (11b) and (12a)-(13a), since forward pronominalization is obligatory within this framework. But so will sentences (12c)-(13c). So, if the coreference rule is the one stated in (10a) a further rule would be needed to account for cases of possible coreference between two full NP's. As we saw above, such a formulation of the coreference rule will also require an additional rule that permits coreference between two pronouns. Thus, three separate coreference restrictions will be needed to capture all the facts which are naturally captured by the generalized restriction in (10b).

Although it is stated here as a rule of semantic interpretation, the generalization in (10b) is independent of any particular theory of anaphora and should be statable within non-interpretational frameworks. Thus, in a theory like Montague's, where pronouns are generated as variables, (10b) would be stated as a restriction on replacement of nouns for variables. It is less clear, however, whether this generalization can also be stated within a transformational approach. Most of the facts discussed above will be captured within such an approach by stating two ordered pronominalization rules: The first, obligatory, rule will transform a given NP_2 into a pronoun in case it is in the domain of a coreferential NP_1. The second, optional, rule will apply freely (forwards or backwards) elsewhere. This would assure that in the same conditions under which 'forward pronominalization' is not obligatory we can get either backward pronominalization (as in the b-sentences of (12) and (13)) by application of the second, optional, rule, or else no pronominalization (as in the c-sentences of (12) and (13)) when this rule does not apply. However, these rules cannot account for coreference between two pronouns. Presumably within the transformational approach, coreference in such cases must be due to the fact that both pronouns are base generated with

identical referential indices. The substantial problem which arises then is the one pointed out by Lasnik (op. cit.): Since, within a transformational approach, there must be two sources for pronouns: one is the base rules, and the other is the pronominalization transformation, there is no way to block the "accidental" generation of sentences like she denied that Rosa has met the Shah, since the pronoun she may be generated in the base with the same referential index as Rosa, but the structural description of the pronominalization transformation is not met by this sentence. A way out of this problem seems to be to abandon the assumption that only a full NP can pronominalize another NP. The rule, then, will be stated as in (16).

16) SD: $X - \underset{+pro}{[NP]} - Y - \underset{-pro}{[NP]} - Z$

$1 \quad 2 \quad 3 \quad 4 \quad 5 \Longrightarrow$ OBLIG

SC: $1 \quad 2 \quad 3 \quad \underset{+pro}{[4]} \quad 5$

conditions: a) 2 has the same referential index as 4

b) 2 commands 4 (or: 4 is in the domain of 2)

Stated in this way, the rule applies equally to (a) and (b) of (17) to yield the grammatical (a) and (b) of (18).

17a) Rosa denied that Rosa met the Shah.
b) She denied that Rosa met the Shah.

18a) Rosa denied that she met the Shah.
She denied that she met the Shah.

Thus, the problem mentioned by Lasnik does not arise, since even if the base generates accidentally an ill-formed sentence like (17b)—with she and Rosa indexed as coreferential—the transformation in (16) will transform it into a grammatical sentence. If pronouns are freely generated in the base, the rule in (16) is, furthermore, the only one which is needed. As we saw in

(12)-(13), if neither of the NP's is in the domain of the other, coreference is possible on any arrangement of the two NP's (NP_{-p}, NP_{p}; NP_{p}, NP_{-p}; NP_{-p}, NP_{-p}; NP_{p}, NP_{p}), and since all these possible arrangements will be generated by the base in any case, there is no need for any special optional pronominalization transformation.

The problem with this solution, however, is that it violates the requirement of recoverability of deletion. Given a sentence like (18b) which is derived transformationally from (17b), there is no way to recover the deleted antecedent. Unless the requirement of recoverability is somehow modified, it appears, therefore, that there is no way to capture the generalization in (10b) within a transformational framework. (In particular, there is no way to block coreference in (17a) and (17b) by the same rule, or to block coreference in (17b) at all without access to an additional output filter.)

In any case, I will assume here the interpretive framework (for additional arguments see Dougherty (1969), Bresnan (1970), Jackendoff (1972), and Wasow (1972)). In summary, then, I will assume that the rule restricting coreference should capture the generalization in (10b), and that it is a semantic interpretation rule which applies to surface structure.[9]

1.3.2 As stated, the generalization in (10b) assumes a semantic interpretation rule which (optionally) marks two NP's as coreferential, and which cannot apply if one of these NP's is in the domain of the other and is not a pronoun. Lasnik (1976) argues that this assumption is wrong, and that instead there exists only a non-coreference rule, marking two NP's noncoreferential in case one is preceded and commanded by the other and is not a pronoun, while leaving all other cases vague with respect to coreference.[10] The

main argument that Lasnik adduces for his proposal is that previous treatments have had to assume two rules—one of coreference (or pronominalization) and one of non-coreference, while a non-coreference rule can handle the same range of facts by itself. This argument holds, however, only with respect to the specific formulation of the rule which Lasnik criticizes. Jackendoff (1972) does indeed stipulate two rules, but this stipulation depends more upon the details of Jackendoff's framework than upon any general requirement of semantic coreference rules. In fact, if the assumption is that coreference within a given sentence is assigned by an interpretive rule, the only NP's which will end up coreferential will be those marked by the rule. All that is needed is a restriction on the application of this rule, as stated in (10b).

Lasnik's proposed rule assigning non-coreference is, then, basically equivalent to a rule assigning coreference stated as in (10b). The rules mention the same condition, the difference being that for the first, this is the condition under which the rule applies, while for the second, this is the condition under which the rule is blocked. (It is possible, perhaps, that the non-coreference rule formulation has more psychological reality, namely, that it can be shown that processing a sentence, we actually note non-coreference rather than mark coreference, but it is hard to see what would count as evidence for such a hypothesis.)

Although the two formulations of the rule are equivalent, a non-coreference rule would turn out to be advantageous if it can be established that all rules obey the condition that they can apply to given nodes A and B only if one of these nodes is in the domain of the other (a possibility which I will argue for in Chapter 5). If this is the case, the exact formulation of the coreference rule is crucial: a rule which would assign coreference

would apply to two NP's regardless of their domain relations (as long as the condition in (10b) is observed) which would violate the condition above, while a rule which would assign non-coreference would apply only if one of the nodes were within the domain of the other, in accordance with the general condition on the application of rules.

1.4 The non-relevance of precede-and-command. One of the problems with the syntactic domain defined in terms of precede-and-command (as given in section 1.2) is that it makes very little sense, since the domains produced are quite arbitrary. If the domain of a node A is everything to its right which is commanded by it, then given a sentence S, we can cut at any arbitrary node and consider it together with all the nodes to its right which are dominated by S as constituting a domain. Given a sentence like Ben introduced Max to Rosa in September, for instance, the domains picked out are, first, the domain of the subject (the whole sentence) and the domain of the verb (the VP, including the PPs). Since these domains are also constituents, their linguistic relevance is obvious. However, the same definition also yields the domains [Max / to Rosa in September], [to Rosa / in September], and [Rosa / in September]. In the same way, given a sentence like The cover of the book is lost, [the book / is lost] is one of the domains produced. If such arbitrary chunks of the tree constitute a syntactic domain, it is hard to see what content the notion of domain could have. It should be quite puzzling, in fact, if it turns out that the coreference rule (or any linguistic rule) operates in such arbitrary domains. The proclaimed relevance of the relation of precede-and-command to linguistic rules other than coreference goes beyond the scope of the present discussion. However, we will see now that at least in the case of coreference, this puzzling situation does

not arise and that the relation of precede-and-command is not what determines the coreference options of NP's.

There are several counterexamples to the precede-and-command rule, many of which were noted by Lakoff (1968). First, the range of backward pronominalization is much wider than the rule predicts. In all the following cases, the pronoun precedes and commands its antecedent (or an NP_{-p} is in the domain of an NP_p, if the domain is defined in terms of precede-and-command) but coreference is still possible.[11]

18a) Near him, Dan saw a snake.
b) In her bed, Zelda spent her sweetest hours.
c) For his wife, Ben would give his life.
d) How obnoxious to his friends Ben is.
e) Fond of his wife though Ben is, I like her even more.
f) (I predicted that Rosa would quit her job and) quit her job Rosa finally did.

19a) The chairman hit him on the head before the lecturer had a chance to say anything.
b) We finally had to fire him since McIntosh's weird habits had finally reached an intolerable stage.
c) Rosa won't like him any more, with Ben's mother hanging around all the time.
d) We'll just have to fire him, whether McIntosh likes it or not.
e) Believe it or not, people consider him a genius in Ford's home town.

Furthermore, cases like (18), with preposed constituents, provide a counterexample to the contention that coreference is always possible when the antecedent precedes the pronoun (or that forward pronominalization is free). In these cases, forward pronominalization is impossible, as can be seen in (20).

20a) *Near Dan, he saw a snake.
b) *In Zelda's bed, she spent her sweetest hours.
c) *For Ben's wife, he would give his life.
d) *How obnoxious to Ben's friends he is.
e) *Fond of Ben's wife though he is, I like her even more.
f) *(I predicted that Rosa would quit her job and) quit Rosa's job she finally did.

There is nothing in the existing restriction on coreference to block these sentences—the pronoun is properly in the domain of the antecedent, given the precede-and-command definition of domain. (Or, in other words, the full NP is not in the domain of the pronoun, since the pronoun does not precede it.) Looking at (18) and (20) alone, one might be tempted to attempt a solution by means of ordering the coreference rule, or pronominalization, before the application of preposing rules, since in all these cases, the coreference options seem to be identical to those which exist before preposing occurs. (Thus, parallel to (18a) and (20a) we find Dan saw a snake near him but not *He saw a snake near Dan.)

Although arguments against any ordering solution to the problems of coreference have been widely discussed (e.g. in Lakoff (1968), Postal (1970), Jackendoff (1972), and Wasow (1972)), let us briefly see why no such solution is available even in the case of preposed constituents. (It should also be noted that even if such a solution were to exist for the cases in (18) and (20), the problem for the precede-and-command rule of coreference still persists in the cases of (19), since in these cases, no transformation has applied, but the pronoun nevertheless precedes the antecedent.) First, observe that not always is 'forward' pronominalization impossible from a preposed constituent. In the following pair (noted in Jackendoff (1975)), coreference is possible in (b):

21a) *In John's picture of Mary, she found a scratch.
b) In John's picture of Mary, she looks sick.

However, in the pre-preposed versions of these sentences, coreference is equally impossible in both sentences.

22a) *She found a scratch in John's picture of Mary.
*She looks sick in John's picture of Mary.

Hence, no ordering solution can account for the difference between (21a) and (21b), and the coreference rule must be able to apply to their surface structure.[12]

In Chapter 4 we will see also that if an NP of a preposed constituent is in a relative clause, there are no restrictions on its coreference options. Compare, for example, (20b) to the acceptable (23a):

23a) In the bed that Zelda stole from the Salvation Army, she spent her sweetest hours.
b) *She spent her sweetest hours in the bed that Zelda stole from the Salvation Army.

Since the source of (23a), namely (23b), is just as bad as the source for (20b), no ordering solution is possible here. (Similar arguments are presented by Jackendoff (1972) for other cases of preposed constituents.)

The most crucial point against ordering solutions is that, as was pointed out in Lakoff (1968), there is an asymmetry between coreference options of subjects and those of objects (or non-subjects) in cases with preposed constituents. Thus, while 'forward' pronominalization is impossible in (20), where the pronoun is the subject, it is possible in (24), where the pronoun is not the subject.

24a) Near Dan, I saw his snake.
b) In Dan's apartment, Rosa showed him her new tricks.
c) How obnoxious to Ben's friends I found him to be!

And compare as well the following pairs:

25a) *Ben's problems, he won't talk about.
b) Ben's problems, you can't talk to him about.

26a) *For Ben's car, he's asking 3 grand.
b) For Ben's car, I'm willing to give him 2 grand.

But, as illustrated in (27), the source of the acceptable sentences in (24)-(26) is just as bad as the source of the unacceptable sentences in (20),

(25a), and (26a):

27a) *I found him to be obnoxious to Ben's friends.
b) *You can't talk to him about Ben's problems.
c) *I'm willing to give him 2 grand for Ben's car.

No ordering solution, therefore, can distinguish between the acceptable and unacceptable cases of 'forward' pronominalization in sentences with preposed constituents. These cases suggest that there must be some structural properties of the surface structure of these sentences which determine their coreference options. These properties cannot be captured by the relation of precede-and-command, which allows all the sentences in (20)-(26) to have equally the coreference reading.

The problem presented by sentences with preposed constituents (which are in any case stylistically marked for some speakers) could perhaps be dismissed as marginal or faced with some ad hoc constraints (some such constraints will be mentioned below). But as we saw in (19), the problem for the precede-and-command rule is not restricted to preposed constituents. The asymmetry of subjects and objects (or non-subjects in general) is even clearer in these areas. No coreference is possible in the sentences in (28), in which the pronoun is a subject.

28a) *He was hit on the head before the lecturer had a chance to say anything.
b) *He was fired since McIntosh's weird habits had finally reached an intolerable stage.
c) *He won't like Rosa any more, with Ben's mother hanging around all the time.
d) *Believe it or not, he is considered a genius in Ford's home town.

It is possible that, given out of context, some speakers will hesitate to accept the judgments in (19) and will claim that there is no substantial difference between (19) and (28). This feeling, however, is due to discourse

(rather than grammatical) constraints on 'backward' pronominalization. Kuno (1972) has argued that even the most innocent cases of backwards pronominalization are discourse-dependent. Thus, a sentence like Although he got there late, Dan managed to get in, which is permitted by the precede-and-command rule, can occur only in a discourse in which Dan is a thematic element, or old information. Whether this is exactly right or not, it is clear that there are some pragmatic constraints on the use of backwards pronominalization.

It is significant that we can find disagreement in judgments concerning the sentences in (19), but not concerning the sentences in (18), which also involve backwards pronominalization. The reason is that in (18), backwards pronominalization is the only grammatical option (since coreference in (20) is impossible), while in the case of (19), forward pronominalization is obviously permitted. Hence, a decision between the two options (of forward or backward pronominalization) is required. The pragmatic constraint which operates here is something like: when the grammar permits both forward and backward pronominalization, use the backward option only if you have a reason to do so. The way to test whether sentences are grammatically or pragmatically impossible (for those who don't get them freely) is to put them in discourses which justify backward pronominalization. One such discourse is the one mentioned by Kuno: namely, a situation in which Ford, or the lecturer, has been previously mentioned. Another test is to embed the problematic sentences in subordinate clauses, as in (29). While (19a) will get improved, (28a) is still impossible.

29a) Since the chairman hit him on the head before the lecturer had a chance to say anything, we'll never know what the lecture was supposed to be about.

b) *Since he was hit on the head before the lecturer had a chance to say anything, we'll never know what the lecture was supposed to be about.

What constitutes a "reason" for using backward pronominalization in a discourse still awaits much further study. (This investigation would attempt to provide an account of why, for example, subordination, as in (29), offers such a reason.) However, it is sufficient for the present discussion that there exist contexts in which the sentences in (19) are appropriate (while no such contexts exist for (28)), since I am dealing here only with the grammatical constraints on coreference, which should block only those sentences which are permitted in no discourse.

The asymmetry between subjects and non-subjects is a crucial problem for the precede-and-command rule. The relation of command, by definition, cannot distinguish between subjects and objects of the same S. (Everything commanded by the subject is commanded by the object, etc.) A desperate proposal to have different rules for subjects and objects will also fail because it is obviously not the case that object pronouns can always precede and command their antecedents. They clearly cannot in (27).

What determines the possibility of coreference in (19) is not just the fact that the pronoun is an object, but rather the fact that the antecedent is not in the VP, since the PP containing the antecedent is sentential. When the PP is in the VP, as in (27), coreference is impossible. Thus, a mere distinction between grammatical relations (subject, object, etc.) is not sufficient.

There have been several attempts to treat the problems posed here. Lakoff believed that the problems he raised should be handled by output constraints (without touching the pronominalization rule itself). However, he

provides only the constraints needed to block forward pronominalization in cases like (20). His conditions and his remarks about them can be collapsed into the constraint stated in (30) (excluding his discussion of stress behavior).

30) When NP_1 precedes and commands NP_2, and NP_1 is [-pro], NP_2 is [+pro], NP_1 cannot be coreferential with NP_2 (or: the sentence is unacceptable when NP_1 and NP_2 are coreferential) if NP_2 is immediately dominated by an S-node which also dominates NP_1.

This ad hoc constraint successfully blocks the sentences in (20), while permitting, correctly, the sentences in (27), which do not meet the conditions of (30), since objects (at least in theories of the 1968 vintage) are not immediately dominated by an S-node. However, it has nothing to say about all the cases of unexpectedly good backward pronominalization.

An alternative ad hoc performance constraint for the same problem was suggested by Wasow (1972) (attributed to Chomsky):

31) [Wasow, 1972, p. 61]: If a preposed NP serves as the antecedent for a pronoun in the same clause which is too close to it, the sentence is unacceptable.

That the distance between the antecedent and the pronoun is not what determines the acceptability of the sentence can be shown by pairs as in (32). In (32b) the antecedent is closer to the pronoun than in (32a); still, only (32b) is good.

32a) *In Zelda's letter, she spoke about butterflies.
b) In the letter Dr. Levin got from Zelda, she spoke about butterflies.

Note also that a sentence like (18a) is not improved if the distance between the antecedent and the pronoun is lengthened:

33) *Near Dan, who is my best friend,
who's been living in the jungle for 20 years,
he saw a snake.

Wasow has also attempted a solution to the problem of unpredicted backward pronominalization. He introduces the relation more deeply embedded than to substitute for (not) command. He suggests that the coreference rule be changed so that it blocks coreference in case the pronoun both precedes the NP and is not more deeply embedded than the NP. This new relation will capture by convention all the relevant cases captured by command, since, if A does not command B, A is, by convention, more deeply embedded than B. The advantage of this relation is that it can also range over cases where A and B are dominated by the same cyclic node. For example, Wasow suggests the following convention:

34) If A is part of the prepositional phrase, B is not, and B commands A, then A is more deeply embedded than B.

Given (34) and the reformulated coreference rule, sentences like (18a)—Near him, Dan saw a snake—are no longer a problem, since the pronoun him is more deeply embedded than the NP Dan.

But, though more adequate than the others, Wasow's rule is not yet sufficient to solve all the problems of backward pronominalization. By definition (34), the pronouns in the sentences of (19) are less deeply embedded than the antecedents (since the antecedent is in a PP, the pronoun is not, and the pronoun commands the antecedent). Wasow's rule, therefore, incorrectly blocks backward pronominalization in these sentences.

In many good cases of backward pronominalization, it is counter-intuitive even to try to find a proper way to define the pronoun as more deeply embedded than its antecedent, e.g.:

35) In his village, everybody believes that the queen has announced (that...) that Bill is a genius.

Wasow's intuitive notion of "depth of embedding" was, however, the first step toward freeing the rule of coreference (or the definition of the syntactic domain) from the relation command. As he himself noted in a footnote, the formal relation which can capture intuitions about "depth of embedding" is superiority (which will be discussed in the next section). Wasow's difficulties are due to the fact that he follows his predecessors in the assumption that the coreference restriction must mention the relation of precede. The crucial step which remains to be taken is dispensing with this assumption.

An alternative framework which has been proposed to face difficulties of the type mentioned above is couched in purely semantic terms. Within this approach the structural properties of NP's has no relevance to their coreference options, and coreference options are determined solely by presupposition relations in the sentence (Bickerton (1975)) or theme-rheme relations (Hinds (1973) and Kuno (1972) and (1975), although the latter does incorporate the syntactic restriction of precede and command). This approach will be discussed in Chapter 5 , where we will see that although semantic or discourse considerations may impose further restrictions on coreference options, it is impossible to state the restriction on coreference in purely semantic terms. To the extent that such proposals seem to work it is precisely because there is a significant correlation between syntactic relations and semantic properties.

1.5 The c-command domain.

1.5.1 I will suggest now that the syntactic domain which is relevant to the application of the coreference restriction is to be stated in terms of a

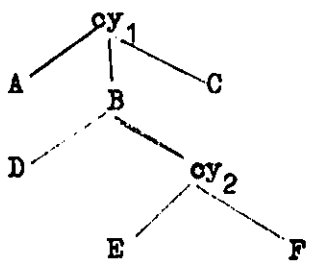
relation which I shall call 'constituent command' (hereafter, 'c-command')[13]—defined in (36).

36) Node A c(onstituent)-commands node B if neither A nor B dominates the other and the first branching node which dominates A dominates B.

The linguistic need for a relation like (36) has been observed before for problems other than coreference: (36) is the converse of the relation <u>in construction with</u> which was suggested by Klima (1964) to account for the scope of negation. (In (36), node B is <u>in construction with</u> node A.)[14,15] It is also very close to the relation <u>superiority</u> suggested by Chomsky (1973), the difference being that <u>superiority</u> is asymmetric—nodes A and B cannot be superior to each other. Thus, sister nodes are excluded from the superiority relation, while definition (36) includes sister nodes (i.e., nodes that c-command each other).

The difference between the relations of command and of c-command is that while the first mentions cyclic nodes the second does not—all branching nodes can be relevant to the determination of c-command relations. Looking back at tree (7), repeated here as (37),

37)



node A both commands and c-commands all the other nodes in (37)—as is also true for node C—but node D, while commanding node C (since it is dominated by <u>cy$_1$</u> which dominates C) does not c-command node C, since the first branching node dominating D, namely B, does not dominate C.

The relation of c-command will be somewhat modified in Chapter 4 to capture cases where a situation of 'A-over-A' arises (e.g., S over S, or VP over VP). For the time being, it will be used as defined in (36), which also will require assuming simplified structures. Thus it will be assumed that a sentence like I [$_{VP}$ put the book in the box] contains only one VP (expanding to V, NP, and PP) and that preposed PP's, for example, are attached to the same S that dominates the subject.

The syntactic domain in terms of c-command is defined as in (38).

38) The domain of a node A consists of A together with all and only the nodes c-commanded by A. (OR: The domain of a node A is the subtree dominated by the first branching node which dominates A.)

The definition in (38) makes no mention of linear ordering (the relation of precede). All the nodes c-commanded by A are in the domain of A, whether they precede or follow it. The domains picked out by the two definitions are thus quite different: the domains defined by (38) for the tree in (37) are given in (39b); (39a) repeats the domains defined by the precede-and-command definition of domain (in (5)).

39a) precede-and-command	b) c-command
A/B, C, D, cy_2, E, F	A/B, C, D, cy_2, E, F
B/C	B/A, C
C/$\emptyset$	C/A, B
D/cy_2, E, F, C	D/cy_2, E, F
cy_2/C	cy_2/D
E/F	E/F
F/$\emptyset$	F/E

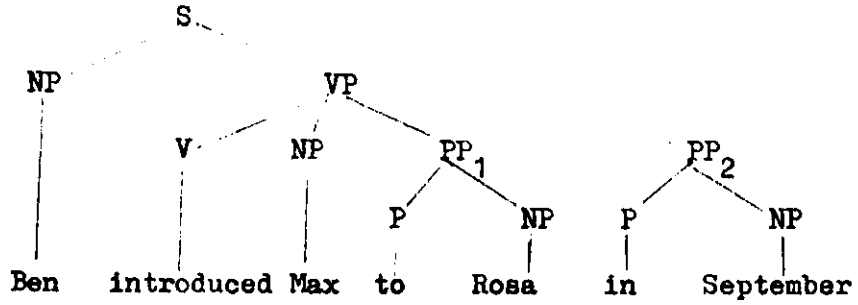
We see that node A has the same domain given either definition (since A happens both to precede-and-command, and to c-command, all the other nodes). Node E also has the same domain on either definition. In other words, for

some nodes, the two definitions of domain give identical domains. In particular, this will be true for the subjects of simple sentences, which have the whole sentence in their domain by either definition. The two definitions differ, however, with respect to the other nodes. While by the precede-and-command definition, C has nothing in its domain, by the c-command definition, the domain of C, just like the domain of A, is the whole sentence (cy_1), since C c-commands all the other nodes in cy_1. The domain of D includes node C by the precede-and-command definition, since C is to the right of D and is commanded by it. But C is not in the domain of D by the c-command definition, since D does not c-command C. Similarly, by (38), C is not in the domain of cy_2, while D is, although D precedes cy_2.

Looking at (39b), it is easy to see that all the domains mentioned are constituents (the head nodes included). This is an obvious result, since (38) defines the domain in terms of c-command (i.e., constituency relations). What the definition in (38) does, basically, is to select the minimal constituent of a node (α), namely all the nodes dominated by the node (β) immediately dominating this node (α). Looking at nodes C and D in tree (37), the minimal constituent of which C is a member is cy_1, since cy_1 immediately dominates C. Since D is also a member of this constituent, D is in the domain of C. However, the minimal constituent of which D is a member is only B, and since B does not dominate C, C is not in the domain of D.

To illustrate further how the domains picked out by the two definitions differ, we can look at the sentence Ben introduced Max to Rosa in September, which was discussed above. As I said, I assume temporarily (and incorrectly) that this sentence has the structure in (40) (namely that there is only one VP):[16]

40)

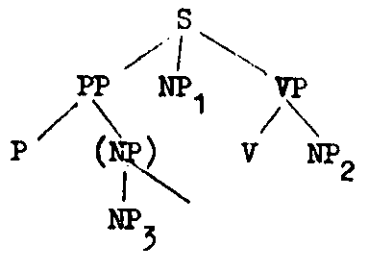


The c-command domain of the verb introduced is the whole VP (just as with the precede-and-command domain). But the c-command domain of the direct object Max is also the whole VP (since this NP c-commands all the nodes in the VP), while its precede-and-command domain consists of the non-constituent to Rosa in September. Similarly, the domain of the nodes PP_1 and PP_2 is the whole VP. The domain of the NP Rosa (if its position in the tree is as in 40) is only PP_1, since PP_1, which immediately dominates it, does not dominate the other nodes in the VP. Similarly, the domain of September is PP_2. The only domains defined are thus: introduced Max to Rosa in September (the VP), to Rosa (PP_1), and in September (PP_2), which are all constituents.

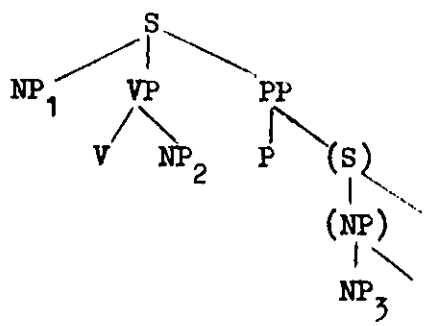
The crucial difference between the two definitions of a domain is thus that while the precede-and-command definition picks out arbitrary chunks of the tree, the c-command definition picks out constituents only as domains, which makes the domains defined by the latter more natural candidates for linguistic rules to operate on. Let us return now to the domain relations of NP's, and see how the coreference restriction applies to c-command domains where it failed to apply to the precede-and-command domain. It will be recalled that the coreference restriction we assume is the one stated in (10b) above, which prohibits an NP from being coreferential with non-pronouns in its domain. The only thing which is changed is the definition of the syntactic domain of an NP.

1.5.2 The problems for the precede-and-command approach discussed in section 1.4 arose typically in two types of structures, illustrated in (41) and (42).

41)



42)



Once we get over the habit of looking at trees from left to right, we can see that the structural relations between the NP's in the two trees are identical. Let us check first the domain relations of NP_1 and NP_3: in both trees NP_1 c-commands (and commands) NP_3, the only difference being that in (41) NP_3 precedes NP_1, while in (42) NP_3 follows NP_1. Therefore, by the c-command definition of domain, NP_3 is in the domain of NP_1 in both trees (in other words, all the nodes in S are in the domain of the subject, regardless of whether they precede or follow it). Hence, the coreference rule (10b) requires that in both trees, NP_3 must be a pronoun in order to be coreferential with NP_1. Applied to sentences with the structure of (41), this restriction blocks coreference in (43),

43a) *Near Dan, he saw a snake.

b) *Near Dan, Dan saw a snake.

in which the first Dan is NP_3 of tree (41). In the same way, 'forward pronominalization' is blocked in all the other cases of (20) above. Applied to sentences with the structure (42), the restriction blocks the 'backward pronominalization' in the sentences of (28), e.g.,

44a) *He was fired since McIntosh's weird habits had finally reached an intolerable stage.

b) *McIntosh was fired since McIntosh's weird habits had finally reached an intolerable stage.

For the precede-and-command definition of domain, NP_3 is in the domain of NP_1 in tree (42) but not in (41), where NP_1 does not precede NP_3. Hence, as we saw in the previous section, the sentences in (43) and in (20) cannot be blocked. The c-command domain, on the other hand, provides an identical account for (43) and (44), permitting the coreference rule to mark them as equally bad.

We saw that NP_3 in both trees is in the domain of NP_1. The next question is, is NP_1 in the domain of NP_3. By the precede-and-command definition it is not in (42), but it is in (41). Hence, as we saw, 'backward pronominalization is blocked incorrectly in the sentences in (18), one of which is repeated in (45).

45) Near him, Dan saw a snake.

However, given the c-command definition of domain, NP_1 is in the domain of NP_3 in neither tree, since the first branching node dominating NP_3 is PP, which does not dominate NP_1, and therefore, nothing blocks coreference in (45). (The same is trivially true for sentences like (44a) with 'forward' rather than 'backward' pronominalization.)

Next, let us consider the relations of NP_3 and the object, NP_2, in trees (41) and (42). This relation is, again, identical in both trees--NP_2 does not c-command NP_3, since it is immediately dominated by the VP, which does not dominate NP_3. Hence, NP_3 is not in the domain of NP_2, the coreference restriction does not apply, and coreference is possible, even if NP_3 is a

full NP (and NP_1 is a pronoun). This means that 'backward pronominalization' is permitted in the sentences of (19), which have the structure (42), e.g.:

46) We had to fire him since McIntosh's weird habits had reached an intolerable stage.

(McIntosh (NP_3) is not in the domain of the pronoun (NP_2); hence coreference is not blocked.)

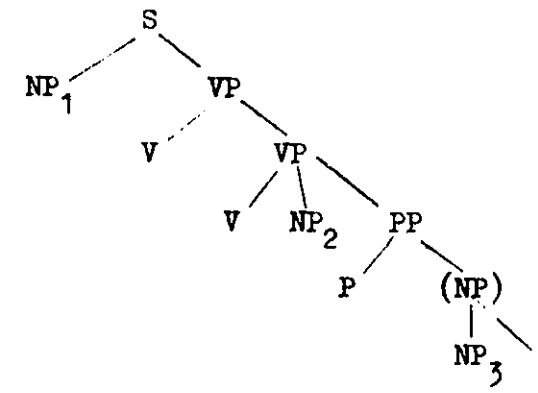
In structures like (41), this means that 'forward pronominalization' which is not permitted with subjects, is permitted with non-subjects, as in the cases of (24)-(26), e.g.:

47) In Dan's apartment, Rosa showed him her new tricks.

We saw that the asymmetry between subjects and objects with respect to coreference—the difference between (44a) and (46) and between (43a) and (47)—was a major problem for the precede-and-command domain. For the c-command domain, this is just the predicted result of the fact that subjects have the whole sentence in their domain while objects have only the VP in their domain. The c-command domain thus naturally distinguishes between subjects and objects. We further saw that there is no way to simply mention the grammatical relations of the NP in the coreference restriction, so that it will apply differently to subjects and objects, since the mere fact that a given NP is an object does not permit free coreference between that NP and any NP to its right, as can be seen in the comparison between (19), or (46), above, and (48a).

48a) *I'm willing to give him 2 grand for Ben's car.

b)



This again indicates that what really determines coreference is the c-command domains of NP. In (48a), the noun Ben is NP_3 of tree (48b), which is in a verb-phrasal PP (unlike NP_3 in structures like (42) which is in a sentential PP). Hence, Ben, in (48a), is in the domain of him and the co-reference restriction blocks the sentence.

The resulting picture correlates basically with Chomsky's (1965) treatment of grammatical relations: In languages with VP, there are structural differences between the different grammatical categories. In terms of syntactic domains, the subject is the head of the S-domain, the object is the head of the VP-domain, and the 'object of a preposition' has only the PP as its domain. Of course, this picture assumes crucially the existence of VP in English. One of the reasons for the popularity of the relation of precede-and-command is that it holds regardless of the existence of VP, and it would give identical results had English been a VSO language. However, the fact that there is no way to capture coreference facts under the precede-and-command assumption, nor to overcome the difficulties by simply marking the grammatical relations, provides just one more way to decide between the SVO and VSO hypothesis for English.[17]

1.5.3 The evaluation of the two alternative definitions of the domain is a well-defined procedure, since the following entailment holds, by definition,

between the relations of command and c-command:

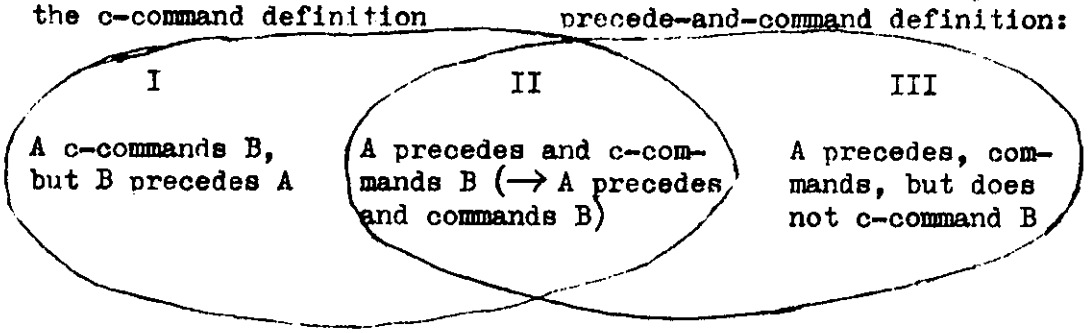
49) A c-commands B ⟶ A commands B

A does not command B ⟶ A does not c-command B.

When the relation 'precede' is also taken into account, the relations between the two definitions are as illustrated in (50).

50) B is in the domain of A by the c-command definition

B is in the domain of A by the precede-and-command definition:



In a right-branching language it is often the case that the c-commanding node precedes the c-commanded node. The intersection, in which both definitions include B in the domain of A, is, therefore, quite large. This may account for how it has been possible for the precede-and-command rule to yield the right prediction in such an amazing number of cases and to nevertheless be the wrong rule. It may also help explain why the relation of precede is believed to play such a crucial role in the grammatical restrictions on coreference. Obviously, in an overwhelmingly large body of the language, forward pronominalization is the only grammatical option. Given the c-command relation, this fact is just an obvious result of the application of the coreference rule to right-branching trees. This is not true for the relation command, where all the nodes dominated by the same S equally command each other. A rule stated in terms of command must therefore introduce the relation precede into the rule of coreference. The failure to distinguish between grammatical and pragmatic constraints has also contributed to the

belief that precede is a major factor in the grammar of coreference.

It is clear that the large correlation between the domains defined by precede-and-command and by c-command holds only for right-branching languages. The sharpest discrepancy between the domains picked up by the two definitions will show up in VOS languages (assuming that these languages have a VP). In such languages a preceding node would often be in the domain of a following node. I have not studied cross-language restrictions on anaphora, and, consequently, I cannot argue for the hypothesis that the c-command restriction on anaphora is universal. However, the following examples from Malagasy (a VOS language with some evidence for a VP) suggest that this hypothesis should be considered. (The examples are from Ed Keenan; personal communication.)

51a) namono azy ny anadahin-dRakoto
hit/killed him the sister-of-Rakoto
Rakoto's sister killed him.

b) *namono ny anadahin-dRakoto izy
hit/killed the sister-of-Rakoto he
he killed Rakoto's sister.

In (51a) the pronoun precedes and commands the antecedent, hence, by the precede-and-command restriction, the sentence should have been blocked. However, since the pronoun is in the VP, and, thus, does not c-command the antecedent (i.e., it is not in the c-command domain of the antecedent), the c-command restriction correctly permits coreference. The sentence in (51b), on the other hand, does not violate the requirement of precede-and-command (since the antecedent precedes the pronoun), but coreference is, nevertheless, blocked. This is precisely the prediction of the c-command restriction, since the pronoun c-commands the antecedent, although the antecedent precedes.

Since the two definitions of the domain differ empirically only in the

relatively small number of structures of the types I and III mentioned in (50), all that is left for the evaluation of the predictions made by the two definitions is to check structures of these types. It is not an accident that the problems for the precede-and-command rule arose in trees like (41) and (42). The structure in (41) is an example of type I, since the subject c-commands but follows the NP in the PP; the structure in (42) is an example of type III—the object precedes and commands but does not c-command the NP in the PP. In fact, structures with PP's like (41) and (42) provide the main and clearest source for types I and III, and I will, therefore, devote the next chapter to these cases.

In a right branching language there are almost no further examples (apart from the cases with preposed PP's) of the type (I) situation in (50), namely cases where the antecedent precedes the pronoun, but the pronoun c-commands the antecedent.[19] The situation of type III is more common, and I will, therefore, continue to exemplify further this type of case.[20]

1.6 Coreference in sentences with extraposed clauses

Sentences with extraposed clauses provide another test for the alternative definitions of syntactic domain discussed above. Suppose we have a pronoun in object position and an antecedent in the extraposed clause to its right. If the extraposed clause is attached to the VP it is in the domain of the pronoun by both definitions of domain and coreference should be blocked. If, on the other hand, the extraposed clause is attached to S we have an example of type III in (50) where the pronoun precedes and commands but does not c-command the antecedent. Hence, by the precede-and-command definition the antecedent is in the domain of the pronoun and coreference should be blocked, while by the c-command definition the antecedent is not in the

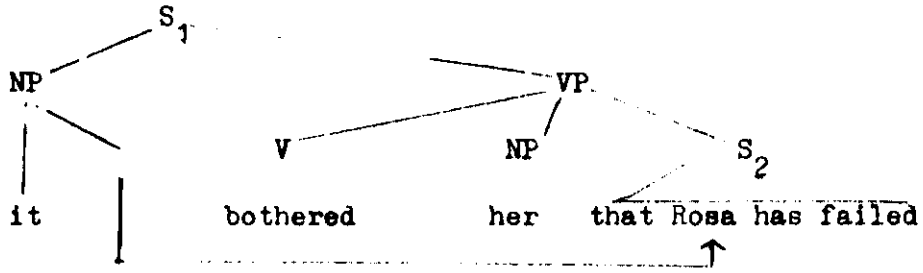
domain of the pronoun, and coreference is permitted.

Starting with Rosenbaum (1967) it has often been argued that the transformation of extraposition which derives sentences like (52b) from the structure underlying (52a) moves the that-clause in (52a) to the VP-final position, yielding a structure like (52c).

52a) That Rosa has failed (should have) bothered her

b) It (should have) bothered her that Rosa has failed

c)



Given this analysis of the position of extraposed clauses, the c-command definition of domain yields the right coreference result: In the sentence (52b) coreference between her and Rosa is correctly blocked since Rosa, in S_2 is in the domain of the pronoun her (the pronoun is immediately dominated by the VP, which dominates S_2).[21] However, if we look now at other types of extraposition we see that the situation is different. Thus (53b) is derived from (53a) by extraposition from NP (namely, extraposition of S_2) but, unlike (52b), the sentence in (53b) permits 'backwards pronominalization.'

53a) $[_{S_1}$ Nobody $[_{S_2}$ who knows anything about Rosa's weird sleeping habits$]_{S_2}$ would ever call her before noon$]_{S_1}$

b) $[_{S_1}$ Nobody would ever call her before noon $[_{S_2}$ who knows anything about Rosa's weird sleeping habits$]_{S_2}]_{S_1}$

c) $[_{S_1}$ So many people wrote to him $[_{S_2}$ that Brando couldn't answer them all$]_{S_2}]_{S_1}$

Similarly 'backwards pronominalization' is permitted in (53c) which, as

argued in Williams (1974), is derived by extraposition of the result clause (S_2) from its initial position in the Determiner of the subject NP.[22]

If all extraposed clauses are attached to the VP-final position, then the objects in (52b), (53b) and (53c) have identical domains, and there is no way to account for the difference in their coreference options. (Coreference in (53b) and in (53c) would be equally blocked in this case by the precede-and-command rule and by the c-command rule). An alternative analysis for extraposition was suggested in Williams (1974 1975). He argued that all extraposed clauses are attached to the matrix S node, rather than to the VP. Under this analysis the acceptability of coreference in (53b) and (53c) would be accounted for by the c-command rule, since the object in this case, does not c-command S_2. However, for the same reason coreference should be permitted in (52b) as well. The precede-and-command rule will still successfully block coreference in (52b), but it would also incorrectly block coreference in (53b) and (53c).

In view of this difficulty, it is appropriate to check the common assumption that extraposition is a unified phenomenon, and all extraposed clauses are attached to the same position. We saw that there are two views: one, that all extraposed clauses are attached to the VP, and the other, that all such clauses are attached to S. Emonds (1976), who elaborates the first view (arguing, further, that extraposition is structure-preserving, namely that the extraposed clause is moved into the S position that is independently present in the VP) supports his proposal with the fact that extraposition is impossible when the VP contains a filled S position, as in (54).

54a) That Rosa smokes proves (that) she is nervous

b) *It proves (that) she is nervous that Rosa smokes

However, the same test does not hold for extraposition from NP, as indicated in the following sentences from Williams (1975).[23]

55) Many people said they were sick who weren't sick

Extraposition of result clauses is also possible in such contexts, as is seen in (56).

56) So many people told Bill he is a genius that he started believing it

So, in fact, Emonds' strongest argument for his analysis of extraposition holds only for the extraposition of 'sentential subject' of the type illustrated in (52), but not for all types of extraposition.

A similar difficulty shows up in Williams' (1975) argument for the alternative view that all extraposed clauses are attached to the S position. In fact, his arguments hold only for extraposition from NP and Result-clause extraposition. His main argument is that extraposed clauses cannot show up before sentential prepositional clauses (If they were to be attached to the VP, they should have been permitted in this position). As we see in (57), this is true indeed for the two types of extraposition in (57b) and (57c), where the although clause cannot be construed as modifying the matrix S, but the sentence in (57a) is perfect, in violation of Williams' prediction.[24]

57a) It shocked Rosa that she lost the case, although she had no reason to believe she would win

b) *A man came in who looked very threatening, although the office was officially closed

c) *So many people wrote to Brando that he couldn't answer them all, although they did not know him

These facts suggest that extraposed clauses are not always attached to the same position. Further, there is also a more decisive argument which

shows that this is indeed true: If the extraposed clause is attached to the VP it should be possible to prepose it along with the VP, when the VP is preposed. This is indeed true for extraposition of sentential subjects, as illustrated in (58a). However the same movement in the case of the other two types results in the nonsensical (58b) and (58c). (The sentence (58a) is perhaps not a most natural one, but it is obviously grammatical.)[25]

58a) I warned you that it would upset Rosa that you smoke, and upset her that you smoked it certainly did

b) It was predicted that many people would resign who disagreed with the management's policy,

*and resign who disagreed with the management's policy many people did

c) I was afraid that so many people would show up that we wouldn't have enough room

*and showed up that we didn't have enough room so many people did

The same point can be illustrated by 'though movement' (which presumably derives the (b) sentences below from the structures underlying the (a) sentences): The extraposed S_2 in (59) can be dragged along with the VP, as in (59b), but the extraposed S_2 in (60) cannot.

59a) Though it was unlikely $\lceil_{S_2}$ that she would pass$\rfloor$, Rosa still decided to take the exam

b) Unlikely that she would pass though it was, Rosa still decided to take the exam

60a) Though many people are unhappy $\lceil_{S_2}$ who live in New York$\rfloor$, nobody thinks of moving

b) *Unhappy who live in New York though many people are, nobody thinks of moving

We can conclude therefore, that while extraposed 'sentential subjects' are attached to the VP the other types of extraposed clauses are attached to

the VP the other types of extraposed clauses are attached to S (hence they cannot be preposed with the VP). Consequently the coreference facts in (52)-(53), repeated in (61)-(63) are no longer a mystery.

61) *[$_{S_1}$ It should have [$_{VP}$ bothered her [$_{S_2}$ that Rosa has failed]]]

62) [$_{S_1}$ Nobody would ever [$_{VP}$ call her before noon]][$_{S_2}$ who knows anything about Rosa's weird sleeping habits]]

63) [So many people [$_{VP}$ wrote to him]][$_{S_2}$ that Brando couldn't answer them all]]

Given the c-command definition of domain, Rosa is in the domain of the pronoun in (61), hence coreference is blocked. In (62) and (63), on the other hand, the antecedents (Rosa and Brando) are not in the domain of the pronoun since their clauses are outside the VP. Hence the restriction on coreference does not apply to block coreference in these cases. By the precede-and-command definition of domain the object pronouns have identical domains in (61)-(63) since in all three cases the pronoun precedes and commands the antecedent. Hence the precede-and-command restriction blocks coreference in all three sentences. It could have, perhaps, been argued that coreference in (62)-(63) would be permitted by the precede-and-command rule if the extraposed clauses are attached to a higher S ($\bar{S}$), and, thus, are not commanded by the objects. Note, however, that the same subject-object asymmetry which posed a problem to the precede-and-command rule in the examples discerned in section 1.4 shows up in the case of extraposition: coreference is impossible in (64) and (65).

64) *He met a woman in Chicago who went to school with Dan's mother

65) *She was approached by so many people in Rome that Rosa couldn't do any work

If the object does not command the extraposed clause, the subject does not either. Hence if the suggested solution could be true, coreference should have been permitted in (64) and (65). The c-command restriction correctly blocks coreference in these sentences, since the subject, unlike the object, c-commands clauses which are attached to S. Extraposition from NP and extraposition of result clauses, thus, provide one more argument for the preference of the c-command definition of domain.

FOOTNOTES

1. B has in its domain only C, since in Langacker's definition, in (1), the relation of command holds between two nodes only if neither of the nodes dominates the other. Since in (7), B dominates D and cy_2, by definition (1), it does not command these nodes. An alternative formulation of the command relation which does not have this requirement is also possible. See Jackendoff (1972: 312) for discussion.

2. It takes little effort to see that if the domain is defined in terms of precede, this notion is quite arbitrary, since it takes chunks of the tree which are not constituents. Given a tree like (7), there is no intuitive sense in which B and C, for example, can be considered to constitute a domain. I will argue directly that the relation precede-and-command is irrelevant to the definition of domain, and suggest an alternative definition in which the notion of domain will make more sense. In this section I am only introducing the terminology connected with the notion of domain, which is independent of its definition.

3. I will argue there that, once syntactic domains are properly defined, it may be the case that one of the conditions on application of linguistic rules of all levels is that no rule applies to nodes A and B if neither is in the domain of the other.

4. Within the framework of Chomsky (1973), coreference in sentences like Ben hit him is blocked by the application of the rule of disjoint-reference-interpretation. This rule marks any two NP's as non-coreferential, but its application is subject to conditions like the Tensed S Condition and the Specified Subject Condition. Consequently it actually marks

non-coreference (roughly) only in simplex S's, that is, precisely in the environments in which the rule which interprets an NP and a reflexive pronoun as coreferential can apply. Within this framework, the restriction on the application of the rule of coreference in (6) will be achieved by ordering this rule after the rule of disjoint-reference-interpretation, thus restricting it to apply only to NP's not already marked as non-coreferential by the disjoint-reference rule.

5. The formal statement of the alternative restrictions in (10) is given in (10') below:

10'a) $\forall NP_1, NP_2(\text{Possib Coref } (NP_1, NP_2)) \longleftrightarrow (\lceil(NP_1 \text{ is } +P \ \& \ NP_2 \text{ is } -P)$ or $(NP_2 \text{ is } +P \ \& \ NP_1 \text{ is } -P)\rceil \ \& \ \lceil(NP_2 \text{ is } -P \longrightarrow \sim NP_1/NP_2) \ \&$ $(NP_1 \text{ is } -P \longrightarrow \sim NP_2/NP_1)\rceil))$

b) $\forall NP_1, NP_2(\text{Possib Coref } (NP_1, NP_2) \longleftrightarrow \lceil(NP_1/NP_2 \longrightarrow NP_2 \text{ is } +P)$ $\& \ (NP_2/NP_1 \longrightarrow NP_1 \text{ is } +P)\rceil)$

6. Throughout the discussion, coreference will be indicated by underlining coreferential NP's.

7. Some speakers claim that they see no difference in the acceptability of the (a)-sentences and the (b)-sentences of (14) and (15), or between (11a) and (12c)-(13c). (They find them all equally bad.) For the time being, we will have to assume that for these speakers there exists an additional coreference restriction which blocks coreference between any two full NP's. But I believe that once the discourse restrictions on the use of two full coreferential NP's are understood, it will turn out that the judgments of these speakers will differ if the sentences are presented within the right context.

8. One consequence of this statement of the coreference restriction is that the terms antecedent and anaphor are superfluous. As we have seen, the

problem is not defining the required structural relations between antecedents and anaphors, but rather defining the structural conditions which affect the coreference options of any two NP's. The fact that the pronoun (or the anaphor) cannot precede and command its antecedent is merely a consequence of the coreference rule as stated in (10b)—in this case no coreference is possible, since the supposed antecedent is not a pronoun.

9. That the coreference rule applies to surface structure is an oral agreement within the interpretive approach, although as far as I know, it has never been argued for in print. Jackendoff (1972) assumed that the rule was cyclic (in order to collapse it with the reflexive rule, which he believed to be cyclic). Wasow (1972) shows that Jackendoff's arguments for the cyclicity of the rule do not hold; however, he concludes that the status of the rule is unclear, since there are a few very marginal cases which seem to support a cyclical application. Aside from being marginal, these cases will not hold for the modified restriction that I will suggest, so I will not consider them here.

10. Lasnik's non-coreference rule should not be confused with Chomsky's (1973) rule of disjoint-reference (although in the exact formulation of his rule, Lasnik uses the term <u>disjoint in reference</u> rather than <u>non-coreferential</u>). Chomsky's rule applies to any given pair of NP's. Thus in all the sentences of (i) it interprets the two NP's as disjoint in reference.

i. a) Ben hit Ben.
   b) He hit Ben.
   c) Ben hit him.
   d) He hit him.

while Lasnik's rule applies only to (a) and (b) (since (c) and (d) do not violate the condition of the rule). Chomsky's disjoint-reference rule is,

furthermore, subject to constraints like the Tensed-S and Specified Subject conditions, while Lasnik's rule is not. Thus, given the sentences in (ii),

ii. a) Ben said that he hit Rosa.
b) He said that Ben hit Rosa.

the disjoint-reference rule is blocked in both (due to the Tensed-S condition), but Lasnik's rule still applies to block coreference in (iib). The two rules, therefore, are needed independently and cannot be collapsed.

11. Given Jackendoff modification of the definition of command which was discussed in section 1.1—namely, that it mentions cyclic nodes rather than just S-nodes—the sentences in (18b-e) are not a counterexample to the precede-and-command relation, since the pronoun does not command the antecedent by this definition of command. However, this modification does not help to account for (18a) and (18f), nor does it have anything to say about the sentences in (19) where the pronoun is not in a possessive NP, and, thus, commands the antecedent under Jackendoff's definition as well. Another problem with this solution is that it marks sentences like (iii) just as grammatical as the sentences in (18b-e).

iii) Her father loves Rosa.

But, as is well known (see, e.g., Lakoff (1968)), there are dialect differences with regard to sentences like (iii), and there are speakers who do not accept them, while no such dialect differences exist for (18b-e). The precede-and-command relation cannot account for such dialectical differences, which will be discussed in detail in section 4.2.

12. It could, perhaps, be argued, as proposed in Kuno (1971, 1975), that in (21b), unlike (21a), there is no preposing and that the PP originates in initial position. Thus, since the sentence is not derived from (22b),

'forward pronominalization' is not blocked. But the question will then be, what permits backward pronominalization in a case such as (iv),

iv) In John's picture of her, Mary looks sick.

since the acceptability of (iv) cannot, in this case, be explained by the ordering of coreference prior to the preposing of the PP. This solution will also fail to hold in the next example, (23), where there is no reason to argue that the PP originates in initial position.

13. I want to thank Nick Clements for suggesting to me the felicitous name 'c(constituent)-command' for the relation in (36).

14. Kilma's treatment of negation in terms of 'in construction with' was challenged in Ross (1967, Ch. 5). The details of Ross's objections and possible replies to them need not concern us here, since we are not dealing with the analysis of negation.

15. A restriction on coreference in terms of the relation 'in construction with' was independently suggested in a recent paper by Culicover (1976). His restriction applies only to 'backwards pronominalization' and it states, roughly, that a pronoun can be coreferential with a full NP to its right, only if the latter is not in construction with the pronoun (or, in our terms, only if the pronoun does not c-command the full NP). Culicover still shares with his predecessors the assumption that 'forward pronominalization' is free and what is needed is a special restriction on 'backwards pronominalization.' Consequently his restriction says nothing about the impossibility of coreference in sentences like *Near Dan, he saw a snake. However, it is only a small step to the generalization below that the same restriction applies to 'forward pronominalization' and the linear order plays no role in determining coreference.

16. It is also assumed here that indirect objects are analyzed as PP's, an assumption which will be revised in Chapter 4.

17. Of the examples mentioned in section 1.4 I have not accounted yet for the pairs in (21) and (22) and for the difference between the (a) and (b) sentences in (23) and (32). The first two cases will be discussed in Chapter 2 and the others in Chapter 4.

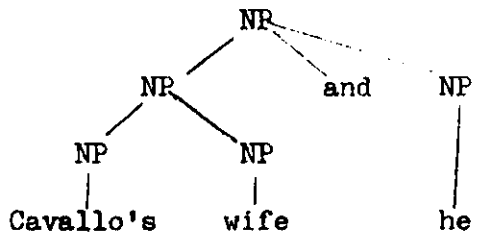
18. Within a VSO hypothesis which allows Raising of the subject (like McCawley's), there is a sufficient structural equivalent to the VP for the c-command rule to operate (i.e., there is an additional S in place of the VP). However, there is no obvious way to distinguish within this framework between sentential and verb-phrasal PP's, a distinction needed to account for the coreference difference between (48) and (46).

19. A possible example of a situation of type I is provided by coordinate NP's. For many speakers coreference is impossible in sentences like (va) and (vb).

va) ?Cavallo's wife and he are getting on my nerves

b) ?I met Cavallo's wife and him in the office

c)



If the coordinate NP's in (va) and (vb) have the structure in (vc) the impossibility of coreference in due to the fact that the pronoun c-commands the antecedent, although the pronoun follows it. However, it is not clear that the NP's in (v) have the structure in (vc): Alternatively and might be

attached to a higher NP dominating he, in which case he does not c-command Cavallo. Furthermore, the awkwardness of these sentences seems to have an independent semantic (or pragmatic) account in terms of 'empathy' (a notion developed in Kuno (1975) and Kuno and Kaburaki (1975)): Cavallo is the center of empathy in these sentences (which is indicated by the fact that his wife is not introduced independently, but rather identified as a function of Cavallo).

Kuno's rule that the center of empathy should not be pronominalized intro-sententially accounts, therefore, for the inappropriateness of (va) and (vb).

Another potential example of a situation of type I is a double object construction as in (vi).

vi) *I sent the book's owner it

In (vi), the pronoun it c-commands the antecedent the book and coreference is indeed blocked. However this type of example carries only little force, since for most dialects of English a pronoun cannot occur in this position anyway, as illustrated in (vii).

vii) ??I sent Bill it

20. I will not deal in this chapter with coreference between NP's inside the VP. The c-command restriction as given so far yields in these cases several wrong results. (It predicts for example that an indirect object can be coreferential with non-pronouns which follow it inside the VP, since it does not c-command them). These cases will require certain modifications that will be discussed in Chapter 4.

21. The occurrence of the modal should've in the examples of (52)

assures that the inappropriateness of coreference is not merely due to a conflict in point of view. It was argued in Kuno (1972b) and in Reinhart (1975) that when an embedded clause can be interpreted as representing the point of view of a person designated by a noun in the matrix sentence, a noun in the embedded clause can refer to this person only if this noun is a pronoun. However, this restriction does not apply in cases involving a modal like should've, as indicated by the fact that (52a) is acceptable. (The point-of-view restriction applies equally forwards and backwards, and would have otherwise blocked coreference in (52a) as well).

22. It is possible that sentences like (53c) are not derived transformationally (as was pointed out by Mark Liberman. p.c.). This, however, is irrelevant for the present discussion. My question is where is the that clause attached to, regardless of whether it originates in this position or moved into it.

23. Emonds (1976, n.19, p. 146) is aware of the fact that judgments concerning extraposition from NP in the case where the S position in the VP is filled do not support his analysis of extraposition, and he suggests some performance account for this fact. However, his account is based on the assumption that a judgment of such cases as acceptable is only possible if the extraposed clause is exceptionally long, which is certainly not the case in (55).

24. In his dissertation (1974) Williams is aware of such difficulties and he concludes that 'sentential subject' extraposited clauses are attached to S while the other types are attached to $\bar{S}$. The arguments below will show that this solution is not sufficient and extraposed sentential subjects are attached to the VP.

25. In Emonds' (1976) framework, VP preposing is a root transformation, hence it should be possible to apply it to the output of the structure-preserving transformation of extraposition. If, as argued in Ross (1964) extraposition is last cyclic, it should in any case be ordered before VP-preposing to allow for sentences like (58a).

Chapter 2: PREPOSITIONAL PHRASES AND PREPOSED CONSTITUENTS

Sentences with prepositional phrases (hereafter PP's) provide crucial tests for the coreference restriction I proposed in Chapter 1 and for the notion of syntactic domain. We saw that in these cases, the precede-and-command definition of domain has failed most impressively, precisely because in these structures the domains defined by the alternative definitions (precede-and-command vs. c-command) are clearly distinct. In the previous chapter, I mentioned some clear examples of sentential and verb-phrasal PP's. However, sentences with PP's are particularly interesting, since many of them provide what look like coreference mysteries: sentences which look identical syntactically differ in their coreference options, and, furthermore, the same PP in the same sentence may behave differently with respect to coreference if it is lengthened. Such mysteries have led several scholars to believe that there can be no grammatical account of coreference in sentences with PP's (or in general), and that they should be faced with performance constraints (Wasow, 1972) or purely semantic restrictions in terms of presuppositions (Bickerton, 1975).

We will see that in fact, all these seemingly mysterious coreference differences correlate with syntactic differences among sentences with PP's which are captured naturally by the c-command definition of domain. Thus, these cases provide further support for this notion of domain. A partial semantic (theme-rheme) account for these cases may seem possible because, as we will see, there are certain correlations between the syntactic domain and semantic relations in these cases. In fact, in many cases the syntactic position of a PP depends crucially upon the interpretation given to the sentence, and it may vary from speaker to speaker. This provides a systematic

way of accounting for disagreement on judgments among speakers. The point is that there should be a correlation between the interpretation given to the sentence by a given speaker and his judgments concerning both coreference and the syntactic tests which distinguish the PP's structurally.

The main purpose of this chapter is to make clearer the notion of domain and to establish the correlation between the coreference options of NP's and their syntactic domains. However, the further striking correlations between syntactic domain and semantic relations in sentences with PP's also provide an example of the potential power of the notion of syntactic domain, and thus anticipates the discussion of Chapter 5, which deals with the linguistic significance of the domains defined by the c-command definition. I will therefore include some detailed examples of such semantic correlations.

2.1 Sentential and verb-phrasal prepositional phrases.

Like adverbs, certain PP's are inherently sentential or verb-phrasal, i.e., their position in the tree is fixed. Thus, as Williams (1974) points out, in order to-phrases can only be attached to S, while infinitive to-phrases, as in We sent Rosa home to please her father, can be attached either to S or to VP.[1] Other sentential PP's discussed by Williams (1974, 1975) are although..., (causal) since..., whether or not..., and with-phrases of the type illustrated in (1c).[2] (I am following Emonds (1976) in his analysis of although clauses etc. as PP's.) PP's which are always verb-phrasal (according to Williams and many others) are instrumental (with...) and manner (by...) PP's. In certain other cases, the PP itself is not inherently marked as to its position, yet its occurrence in a sentence with a verb which is strictly subcategorized to require a PP determines its obligatory position in the VP. Thus, locatives (e.g., in NP) are obligatorily verb-phrasal following verbs

like dwell, reside, or put. Similarly the verb flirt requires a with-phrase, which will then be verb-phrasal.

In cases where the position of the PP is clear-cut, we get clear coreference judgments. While the sentences of (1), which were mentioned in section 1.4, are possible in a proper discourse, no discourse will permit coreference in sentences like (2).

1a) We sent him to West Point in order to please Ben's mother.

b) We'll just have to fire him whether McIntosh likes it or not.

c) Rosa won't like him anymore, with Ben's mother hanging around all the time.

2a) *Rosa tickled him with Ben's feather.

b) *It's time to put him in the baby's bed.

As we saw, given the c-command definition of domain, sentential PP's are not in the domain of the object. Hence the coreference restriction does not apply to block coreference in (1). Verb-phrasal PP's, on the other hand, are in the domain of the object (c-commanded by the object). In the sentences in (2), then, the antecedent is in the domain of the pronoun, which violates the coreference requirement.

However, in many cases, the PP itself is not inherently marked (nor do selectional restrictions force its occurrence in only one position) and, as was first observed in Kuno (1975b), its position in the sentence seems to depend upon subtle semantic considerations.[3] I will illustrate this situation with the two pairs of sentences with locatives in (3) and (4).[4]

3a) Rosa { looks sick / is riding a horse } in Ben's picture.

b) Rosa found a scratch in Ben's picture.

4a) People worship Kissinger in Washington.

b) The gangsters killed Hoffa in Detroit.

Several syntactic tests indicate that the same PP is sentential in the (a)-sentences and verb-phrasal in the (b) sentences. It should be kept in mind, however, that the position of the PP is dependent upon various aspects of the interpretation of the sentence, and thus it can be relative to speakers and to contexts. In particular, I have found several speakers who can interpret the PP in (4b) as sentential. What I want to illustrate is the correlation between the semantic interpretation of the PP, judgments of the tests indicating its syntactic position, and judgments of its coreference options. If the interpretation given to the PP is different from mine (which would be indicated by a disagreement of judgments concerning the syntactic tests), so should the coreference judgments be.[5]

2.1.1 Syntactic tests.

a. Two tests with pseudo-clefts (from Ross, 1973). The predicate part of pseudo-cleft sentences can contain only VP material. The what-clause, on the other hand, can contain only non-VP material. We thus get the following two tests, where the subscript indicates the node that immediately dominates PP:

5) I. a. *[what...did] is VP + PP_s

b. [what...did] is [...+PP_{vp}...]$_{VP}$

II. a. [what...did + PP_s] is ...

b. *[what...did + PP_{vp}] is ...

Subjecting the sentences in (3) and (4) to these two tests shows that the PP

in the b-sentences is part of the VP. Therefore, its occurrence is permitted in constructions like (5 Ib) and is blocked in (5 IIb). But the PP in the a-sentences is not in the VP. Hence its occurrence is permitted in the complementary environment. (In judging the sentences below, their intended reading should be kept in mind. For example (6 IIb) is acceptable if Rosa is depicted in Ben's picture as finding a scratch, which is not the intended reading.)

6) I. a. *What Rosa did was ride a horse in Ben's picture.

b. What Rosa did was find a scratch in Ben's picture.

II. a. What Rosa did in Ben's picture was ride a horse.

b. *What Rosa did in Ben's picture was find a scratch.

7) I. a. *What people do is worship Kissinger in Washington.

b. What the gangsters did was kill Hoffa in Detroit.

II. a. What people do in Washington is worship Kissinger.

b. *What the gangsters did in Detroit was kill Hoffa.

b. <u>Two test with VP-preposing</u> (from Ross 1973). Only constituents inside the VP can be taken along when the VP is preposed. Checking what can be preposed with the VP thus provides one test for VP-constituency (test 8 I). Furthermore, when preposing a VP, the tendency is to move the whole VP. Hence, if a constituent is left following the auxiliary, it is likely to be sentential (test 8 II). The later test, however, is less decisive than test (8 I). Some speakers permit movement of the lower VP alone.

8) I. *$\lceil \overline{VP} + PP_s \rceil$ he did...

II. $\overline{VP}$ he did PP_s

$*PP_{vp}$

Here again we see that the PP in (3a) and (4a) cannot be preposed with the VP (i.e., it is not verb-phrasal), while the PP in (3b) and (4b) must be preposed with the VP (i.e., it is verb-phrasal):

9) I wanted Rosa to ride a horse in Ben's picture,

I. *and ride a horse in Ben's picture she did.

II. and ride a horse she did, in Ben's picture.

10) They wanted Rosa to find a scratch in Ben's picture,

I. and find a scratch in Ben's picture she did.

II. *and find a scratch she did in Ben's picture.

11) It was predicted that people would worship Kissinger in Washington

I. *and worship Kissinger in Washington they did.

II. and worship Kissinger they did in Washington.

12) It was predicted that the gangsters would attack Hoffa in Detroit

I. and attack Hoffa in Detroit they did.

II. *and attack Hoffa they did in Detroit.

c. PP preposing. Jackendoff (1972) noted that there is a difference in the preposing options of sentential and verb-phrasal adverbs. Verb-phrasal adverbs cannot be attached to S inside the sentence, e.g., between the subject and the VP, while sentential adverbs can, e.g.,

13) John $\begin{matrix}\text{probably}\\ \text{*slowly}\end{matrix}$ was eating a carrot.

The same difference holds for sentential and verb-phrasal PP's, and it clearly distinguishes the (a) and (b) sentences of (3) and (4). (To avoid the reading on which people in Washington in (15a) is a constituent, I have added anyway to the PP's in these examples.)

14a) Rosa, in Ben's picture (anyway), looks sick.

b) *Rosa, in Ben's picture (anyway), found a scratch.

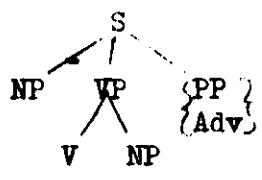
15a) People, in Washington anyway, worship Kissinger.

b) *The gangsters, in Detroit (anyway), killed Hoffa.

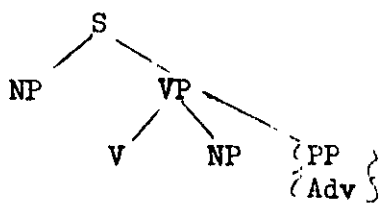
2.1.2 Some semantic differences between sentential and verb-phrasal PP's.

An ordinary intuitive description of the semantic difference between sentential and verb-phrasal adverbs (which can be extended to the two types of PP's) is that the first modifies the sentence, while the second modifies only the VP. A problem with this description, however, is that it is not clear what it means exactly. Nor is it clear what could count as semantic indications of this difference in the range of 'modification.' It should be noted, in passing, that the relevance of this question to the notion of syntactic domain goes beyond the establishment of the coreference options in the pairs under consideration. So far, we have concentrated on the domain relations of NP's (questions like is the NP in a PP in the domain of the object, etc.). However, the definition of the domain (in (38) of Chapter 1) does not mention NP's. It defines the domains of all the nodes in a sentence, stating that the domain of a given node is everything c-commanded by it. If we check now the domains of PP's (or adverbs), it is obvious that sentential PP's (as in 16a) and verb-phrasal PP's (as in 16b) have different domains. (Again, I assume temporarily the simplified trees of (16), an assumption which has no bearing on the point at issue):

16a)



b)



The PP in (16a) c-commands all the nodes dominated by S (since it is immediately dominated by S). Hence the domain of a sentential PP (or adverb) consists of all the nodes in S, or of the whole sentence. The PP in (16b) c-commands only (and all) the nodes in the VP; hence the domain of a verb-phrasal PP (or adverb) consists only of the VP. If it were possible to establish a general correspondence between domain relations and semantic relations, the difference in the semantics of the two types of PP might be merely a consequence of these general correspondence rules.[6] However, at this point, I shall not attempt to establish this correspondence. (Some of the problems involved will be discussed in Chapter 5.) Rather, I will only list some of the semantic indications for a PP's being sentential or verb-phrasal, and show that they apply to the pairs in (3) and (4).

a. Quantifier scope. Ioup (1975) has observed that a quantifier in a PP cannot have a wider scope than a quantifier in subject position. Although she doesn't distinguish between sentential and verb-phrasal PP's, all her examples are from verb-phrasal PP's. In accordance with this observation, in the pairs under consideration here, the (b) sentences (with verb-phrasal PP) have only one possible scope reading, namely the one in which the quantifier in the PP is in the scope of the subject quantifier. Thus, the sentence in (17b) has only the reading on which there is someone such that he found a scratch in all of Ben's pictures, and similarly, (18b) does not have the reading on which some is inside the scope of all.

17a) Someone is riding a horse in all of Ben's pictures.

b) Someone found a scratch in all of Ben's pictures.

18a) Some reporters worship Kissinger in every capital he visits.

b) Some gangsters ambushed Marcello in every town he visited.

The (a) sentences (with sentential PP), on the other hand, are amgibuous with respect to quantifier scope. (17a) can have, like (17b), the reading on which the PP quantifier is inside the scope of the subject quantifier, but also the reading on which the subject quantifier is inside the scope of the PP quantifier, namely that all the paintings of Ben are such that someone is riding a horse in them (not necessarily the same person). The same is true for (18a). (The reading with wider scope for the subject quantifier requires imagining a situation in which a certain group of reporters follow Kissinger from capital to capital and worship him wherever he is.) This situation is consistent with Ioup's framework, since she observed also that topics have scope options similar to subjects, and, as we will see shortly, sentential PP's, but not verb-phrasal PP's, can be considered to be topics.[7]

b. Entailments. It has been observed in Montague-oriented discussions of adverbs (e.g., Bartsch & Vennemann (1972) and Cooper (1974)) that an affirmative sentence with a manner (VP) adverb always entails the same sentence without the adverb. But a negative sentence with a manner adverb does not have such an entailment. The same holds, in the pairs under consideration, for the sentences with verb-phrasal PP's:

19a) Rosa found a scratch in Ben's picture.

⟶ Rosa found a scratch.

b) Rosa didn't find a scratch in Ben's picture.

$\sim$ ⟶ Rosa didn't find a scratch.

20a) The gangsters killed Hoffa in Detroit.

⟶ The gangsters killed Hoffa.

b) The gangsters didn't kill Hoffa in Detroit.

$\sim$ ⟶ The gangsters didn't kill Hoffa.

In sentences with sentential adverbs or PP, no predictable entailments hold (though entailment may be forced by particular adverbs). In our pairs, Rosa rides a horse in Ben's picture does not entail Rosa rides a horse, nor does the negation of this sentence entail Rosa doesn't ride a horse.[8]

c. Theme-rheme relations. The two types of PP's differ also in their thematic (theme-rheme) functions in the sentence. Kuno (1975b) has argued that while sentential PP's are part of the old information of a sentence, verb-phrasal PP's usually provide new information. As suggested by Kuno and many others, this difference in function can be checked with questions. A question (with 'normal' question intonation) usually questions only the new information part of the sentence.[9] (Below, the symbol '#' stands for pragmatic or semantic awkwardness.)

21a) A: Is Rosa riding a horse in Ben's picture?

b: #No, in Max's picture.

b) A: Did Rosa find a scratch in Ben's picture?

B: No, in Max's picture.

22a) A: Do people worship Kissinger in Washington?

B: #No, in Detroit.

b) A: Did the gangsters kill Hoffa in Washington?

B: No, in Detroit.

In the (b) sentences, a response denying the PP is appropriate, which indicates that it is the PP which is questioned in this case (or that the PP is the new information); in the (a) sentences, such a response is inappropriate, indicating that the PP is not new information.

Another test that can be suggested for the theme-rheme distinction is the occurrence of expressions like anyway or at least. Such expressions

indicate topichood, or afterthought, and they cannot modify new information. (Thus, they can never occur in clefted phrases, which always convey new information; compare Ben's father, anyway, will never allow it to #It's Ben's father, anyway, who will never allow it.) Consequently, anyway can occur in our examples only with the sentential PP's as in (a) of (23) and (24).

23a) Rosa looks sick, in Ben's picture anyway.

b) #Rosa found a scratch, in Ben's picture anyway.

24a) People worship Kissinger, in Washington anyway.

b) #The gangsters killed Hoffa, in Detroit anyway.

2.1.3 Coreference facts. The discussion above has established the difference in the status of the PP in the pairs under consideration. The structure of the (a) sentences in (3) and (4) is the one given in (16a), while the (b) sentences have the structure (16b). If we focus now on the domain relations of the NP's involved in these structures, we see first that the NP in the PP is in the domain of the subject in both cases. The coreference restriction (6b of Chapter 1) requires therefore that the NP in the PP must be a pronoun in order for coreference to hold. It correctly predicts, then, that there will be no difference in the coreference options of the subjects and the NP in the PP in the two types of sentences, and indeed, the (a) and (b) sentences in (25) and (26) are equally impossible.

25a) *She is riding a horse in {Rosa's high school picture. / Ben's picture of Rosa.}

b) *She found a scratch in Rosa's high school picture.

26a) *He is considered a genius in Kissinger's home town.

b) *He was killed in Hoffa's home town.

However, the two types of sentences differ in the domain relations of

the objects. While the verb-phrasal PP is in the domain of the object, the sentential PP is not. The coreference restriction, therefore, puts restrictions only on the coreference options of the object and the NP in the verb-phrasal PP, while in the case of sentential PP, coreference is free (which means that coreference is possible even if the object is a pronoun and the NP in the PP is not). Thus we get the following differences in coreference options:

27a) Rosa is kissing him passionately in Ben's high school picture.

b) *I can't even find him in your picture of Ben.

28a) People worship him in Kissinger's native country.

b) *The gangsters killed him in Hoffa's hometown.

The (a) sentences have the same status as the sentences in (1) (and in (19) of Chapter 1): they may need some discourse justification for their usage, due to discourse constraints on backwards anaphora. ((28a), for example, would seem more natural in a discourse like: Although people still worship him in Kissinger's native country, I can assure you that his glory won't last for long.) But (for speakers who agreed to the judgments in the tests mentioned above), the (b) sentences are ungrammatical even in a proper context. ((28b) is still bad in a discourse like: *Although the gangsters killed him in Hoffa's hometown, I can assure you that he won't be forgotten for some time.)

2.2 Preposed PP's

In section 1.4, we saw that pairs like (29) and (30) show that the coreference restriction cannot apply to deep structure, before preposing the PP.

29a) *She is riding a horse in Ben's picture of Rosa.

b) *She found a scratch in Ben's picture of Rosa.

30a) In Ben's picture of Rosa, she is riding a horse.

b) *In Ben's picture of Rosa, she found a scratch.

Although the sources (in (29)) of both the sentences in (30) are equally bad, when the PP is preposed, (30a) is possible, but (30b) is still bad. At the same time, the examples in (30) show that marking the grammatical relations will not help, since in both cases, the pronoun is the subject and the antecedent is in a PP. Obviously, the linear order does not matter either, since the antecedent precedes the pronoun in both sentences of (30). Jackendoff (1975) attempted a semantic account for the pair in (30) which has to do with the fact that the sentences involve pictures (or images). However, this fact is accidental, since as we see in (31), the same distinction appears in the other pair which was discussed here (as well as in pairs like (32) and (33), which do not involve images. (32a) was noted in Kuno (1975)).

31a) In Ford's home town, he is considered a genius.

b) *In Hoffa's hometown, he was killed by the gangsters.

32a) In Ben's family, he is the genius.

b) *In Ben's office, he spends a lot of time.

33a) With Rosa's new job, she'll end up in the hospital.

b) *With Rosa's new boss, she doesn't argue.

In all these cases, the PP in the (a) sentences originates as a sentential PP, while in the (b) sentences, it originates asa verb-phrasal PP. (If the PP is not preposed, coreference is equally blocked in the (a) and the (b) sentences.) If sentential and verb-phrasal PP's are preposed to the same position, the (a) and (b) sentences in (30)-(33) have identical surface structures, and hence identical domain relations, and the difference in their

coreference options remains a mystery.[10] However, we will see now that there are syntactic differences between the (a) and (b) sentences, which suggests that they do not have the same surface structure.[11]

2.2.1 The syntax of preposed PP's. Within the COMP theory (as developed by Bresnan (1972)) it would be assumed that if there is a transformation of PP-preposing, the PP is moved into COMP position. (This analysis of PP preposing is developed in Emonds (1976).) Since it is currently believed that there is only one COMP position in the sentence, this means that if a PP is preposed, the COMP is filled and no other constituent, such as a wh-word, can be moved into it, or, alternatively, that if the COMP position is filled either by a moved wh-word, or by a Q(uestion) or Imp(erative) marker, PP-preposing cannot take place.[12] If we look now in the sentences below, we will see that this is indeed true in the case of preposed verb-phrasal PP's, but the sentential PP's do not obey any such restrictions. Thus, wh-questions are possible after the sentential PP in (a) of (34), though not after the verb-phrasal PP's in (b).

34a) In Ben's picture of her, how does she look?

b) *In Ben's picture of her, what did she find?

35a) In Washington, who do they worship?

b) *In Detroit, who did the gangsters kill?

36a) In Ben's family, who is the genius?

b) *In Ben's office, who spends a lot of time?

37a) With her new job, why can't Rosa be more cheerful?

b) *With her new boss, why does(n't) Rosa argue?

Yes/no questions are also possible in the case of preposed sentential PP's,

as in (38a) and (39a), but not in the case of preposed verb-phrasal PP's, as in (38b) and (39b).

38a) In Ben's picture, does Rosa look her best?

b) *In Ben's picture, did Rosa find a scratch?

39a) With her new job, can she spend more money?

b) *With her boss, does she argue?

The same is true for imperatives:

40a) In my next picture, look more cheerful, please!

b) *In my next picture, find a scratch, if you can!

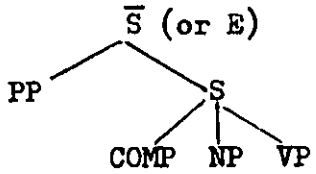
41a) With your new job, go spend more money!

b) *With your boss, stop arguing!

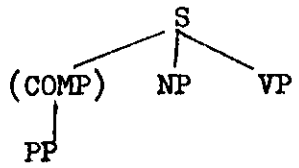
These facts show that preposed verb-phrasal PP's are indeed moved into COMP position, but that sentential PP's require different treatment. They occur in a position preceding the COMP, and since COMP is the leftmost constituent of a sentence, this suggests that they are attached to a higher sentence than the one dominating COMP. (Alternatively it is possible that these PP's are not moved at all and that they can be generated both in final and in higher initial positions.) Banfield (1973) has suggested that certain presentential elements like exclamations, or conjoined predicates or NP's (e.g., the first conjunct in the sentence <u>One more glass of beer and/or I'm leaving</u>) are to be generated under a higher category E(expression), which can expand to a presentential constituent and S. This proposal was adopted in van Riemsdijk & Zwarts (1974) for the analysis of left-dislocated (as opposed to topicalized) constituents. Preposed sentential PP's share some properties with left-dislocated and presentential constituents--they are not semantically

dependent on the sentence (as we saw in section 2.1.2), and they can be described as 'setting the scene' (in the words of Kuno (1975)) for the rest of the sentence. (I will return to their semantic function in the sentence in section 2.2.3.) They seem, therefore, possible candidates for generation under E. This decision, however, is not crucial, and I will not elaborate on it.[13] What is crucial, though, is that there is a syntactic difference between the two types of sentence, which is illustrated in (42). (The trees in (42) are, again, simplified; see footnote 13.)

42a) (preposed) sentential PP's



42b) preposed verb-phrasal PP's



Another possible indication of the structural difference is provided by quantified sentences of the two types. We saw in (17), repeated here as (43), that there are scope differences between the two types when the PP appears S-finally:

43a) Someone is riding a horse in all of Ben's pictures.

b) Someone found scratches in all of Ben's pictures.

Roughly, the difference was that in (43a) it can be either the same person in all of John's pictures or a different person, while in (43b) it must be the same person who found scratches in all the pictures (which means that someone must have wider scope). Now let us see what happens if we prepose the PP:

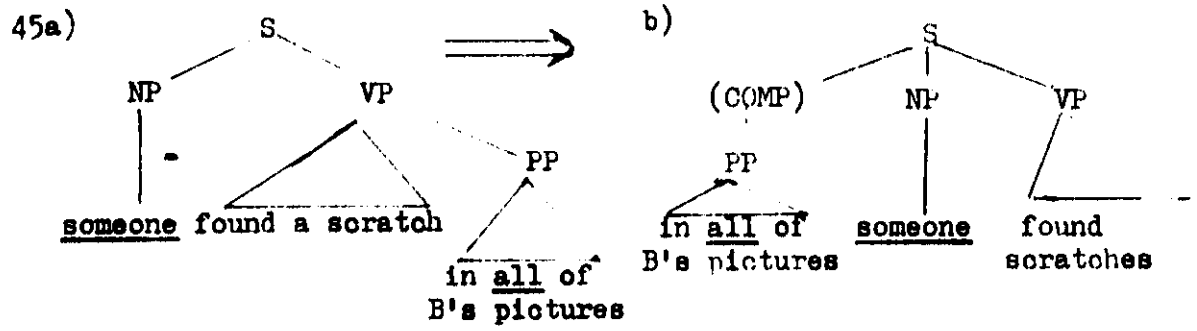
44a) In all of Ben's pictures someone is riding a horse.

b) In all of Ben's pictures someone found scratches.

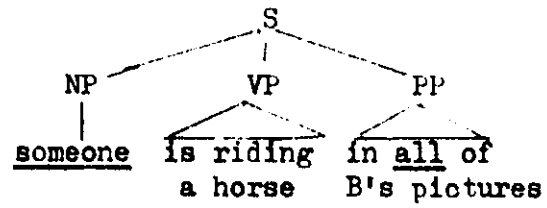
The (a)-sentence loses its ambiguity: (44a) has only the reading with

wider scope for all (i.e., it need not be the same rider in each picture). The (b)-sentence, on the other hand, becomes ambiguous. Some speakers cannot assign any reading to (44b), probably, for semantic reasons that will be discussed in the next section, but those who get the sentence (and a stress on all should help) agree that it is ambiguous: it can be one person or different people who found scratches in all the pictures. These facts do not yet supply us with evidence for the structural differences between (44a) and (44b), since I haven't established the correlation between domain (or syntactic) relations of quantifiers and their scope. However, note that there is very little hope of finding a nonsyntactic account of this difference. Ioup (1975) has argued that topics and subjects have identical status with respect to scope (with a slight preference for a wide scope for topics). However, the major function of preposing, is to make the preposed constituent a topic (which means that preposed constituents are always topics, unless they have a special intonational marking). Consequently, in (44), both PP's are topics, so by this criterion they should have identical scope options.

If we look now at the syntax of the sentences, we will see that if the verb-phrasal PP of (43b) is preposed, it becomes structurally identical with the sentence in (43a), with a sentential PP in final position--the only difference being in linear order of the quantifiers. A comparison of (45b) and (45c) makes this clear.



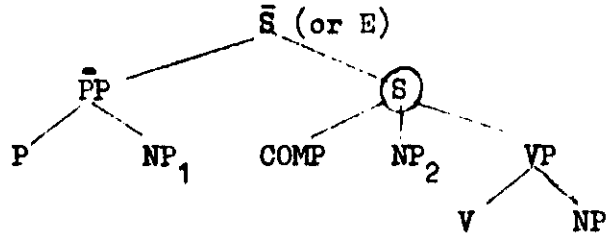
c)



In both (45b) and (45c), the NP and the PP are sister nodes (or, are in each other's domain). In both of these cases, we get scope ambiguity. Other things being equal, if the sentence in (44a) had a structure identical with that of (44b)—namely (45b)—the two sentences should have identical scope options. It is plausible, therefore, to conclude that they do not have identical structures.[14]

2.2.2 Coreference in preposed PP's. Given the structures in (42), the coreference difference between the (a) and (b) sentences in (30)-(33) is no longer a mystery. The a-sentences (one of which is repeated in (47)) have the structure of (42a), repeated in (46), in which the subject NP_2 does not c-command NP_1 in the PP (since the first node which dominates the subject—the circled S—does not dominate the PP). In other words, NP_1 in the PP is not in the domain of the subject NP_2. Also, the subject NP_2 is not in the domain of NP_1 (since the latter c-commands only the nodes in the PP). The coreference rule, therefore, puts no restrictions on the coreference options of these two NP's, and we can get 'forward pronominalization,' as in (47a), 'backward pronominalization,' as in (47b), or no pronominalization at all, as in (47c).

46)



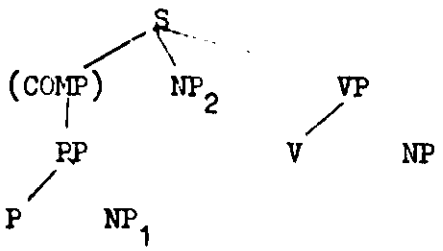
47a) In Ben's family, he is the genius.

b) In his family, Ben is the genius.

c) In Ben's family, Ben is the genius.

The b-sentences of (30)-(33), one of which is repeated in (49a), have the structure (42b), repeated in (48). In this structure, the subject NP_2 does c-command the PP, which means that NP_1 in the PP is in the domain of the subject. The coreference restriction therefore requires that NP_1 must be a pronoun in order to be coreferential with NP_2, hence blocking coreferenoe in (49a) and (49c). As in tree (46), however, the subject is not in the domain of NP_1 (whose domain is only the PP). Hence the rule does not block (49b). In sentences with the structure (48), then, the only grammatical way to express coreference is as in (49b) (unless, of oourse, both NP_1 and NP_2 are pronouns).

48)



49a) *In Ben's office, he spends a lot of time.

b) In his office, Ben spends a lot of time.

c) *In Ben's office, Ben spends a lot of time.

It should be mentioned that the decision concerning where the PP is attached, when preposed, does not depend on any semantic properties of the PP itself. The rule is purely structural: constituents preposed from the VP are attached to a higher node if they are preposed, or, more plausibly, they can be generated both in final position under S and in initial position higher

than S. For example, in sentence (50), the PP <u>in his next picture</u> is sentential in its own clause (S_2).

50) $[_{S_1}$ Ben promised Rosa $[_{S_2}$ that she would look more attractive in his next picture$]]$

However, S_2 itself is in the VP of S_1; hence when the PP is preposed, it behaves like a VP constituent and is attached to COMP of S_1. This is confirmed by the fact that the COMP position in this case cannot be filled by a <u>wh</u>-word, as in (51).

51) *In his next picture, how did he promise Rosa that she would look?

Consequently, the preposed PP in such cases is in the domain of the subject; hence the NP in the PP must be a pronoun, and (52a) is blocked.

52a) *In <u>Ben</u>'s next picture, <u>he</u> promised Rosa that she would look more attractive.

b) In <u>his</u> next picture, <u>Ben</u> promised Rosa that she would look more attractive.

The last point is, perhaps, not too convincing since preposing a PP out of an embedded clause is not free, and, for some speakers, it is impossible.[15] Hence, for these speakers the sentences in (52) are unacceptable regardless of coreference. The argument holds, therefore, only for speakers who can prepose in such cases: Speakers who can get the (a) sentences below (which do not involve coreference problems) clearly distinguish between the (b) and (c) sentences.

53a) In her wedding picture, she $[_{VP}$ hopes $[_{S_2}$ that she will look attractive$]]$

b) In <u>her</u> wedding picture, <u>Rosa</u> hopes that she will look attractive

c) *In Rosa's wedding picture, she hopes that she will look attractive

d) In Rosa's wedding picture, she looks attractive

54a) In his family, he [$_{VP}$ told me [$_{S_2}$ that he is considered a genius]]

b) In his family, Ben told me that he is considered a genius

c) *In Ben's family, he told me that he is considered a genius

d) In Ben's family he is considered a genius

The PP in (53) and (54) is sentential in its clause (and consequently, if this clause is not embedded, as in the (d) sentences, 'forward pronominalization' is possible when the PP is preposed). However, since in the (a)-(c) sentences the S node which dominated the PP before preposing (S_2) is dominated by the VP, the PP behaves as a V-phrasal PP when it is preposed, and 'forward pronominalization' as in (53c) and (54c) is impossible.

PP's that consist of P and S (such as after-, when- or because-clauses) can always be sentential (with respect to their clause), which explains why coreference can go both ways when they are in initial position (as in (55)). However, in cases where it is clear that these PP's must have originated in a sentence in a VP, no 'forward pronominalization' is possible, as illustrated in (56).

55a) When Rosa finishes school, she will go to London.

b) When she finishes school, Rosa will go to London.

56a) *When Rosa finishes school, she has promised Ben that she will go to London.

b) When she finishes school, Rosa has promised Ben that she will go to London.

Here again, questions are possible after the PP in (55), as in (57a), but not after the one in (56) (as in (57b)), which indicates that only the PP in

(56) is in COMP position, or, in other words, that in (56), but not in (55), the PP is in the domain of the subject.

57a) When she finishes school, will Rosa go to London?

b) *When she finishes school, has Rosa promised Ben that she will go to London.

These facts further support the claim made here to the effect that the coreference options of NP's are determined on the basis of their surface structure domains. Needless to say, neither the relation of precede and command nor the distinction between grammatical relations (subject, object, etc.) provides an adequate account of these facts.

Preposed PP's still provide other coreference mysteries, such as the change in coreference options when the PP is lengthened. Since such cases depend even more crucially on the interpretation given to the sentence, before attempting an account of them, we should have a brief look into the semantics of preposed PP's.

2.2.3 Some aspects of the semantics of preposed PP's. The semantics of preposed PP's is quite puzzling. Of the semantic criteria that distinguished the two types of PP's in final position (see section 2.1.2), only the one concerning entailments still distinguishes them in initial position: the sentence In Ben's picture Rosa found scratches still entails Rosa found scratches, and its negation still does not entail Rosa didn't find scratches. Similarly, the sentence In Ben's picture, Rosa looks attractive behaves with respect to entailment in the same way that it did with the PP in final position: namely, there is no entailment. We have already seen, in section 2.2.1, that quantifier scope does change with preposing, and we will see now that theme-rheme relations change as well. Preposed (or topicalized)

constituents are known to be topics in a sentence--they express old information. (This holds for 'normal intonation': as noted by Gundel (1974), topicalized constituents can also serve as contrastive focus with the proper contrastive intonation.) Thus, when verb-phrasal PP's are preposed, they function as themes (or topics), and theme-rheme tests no longer distinguish them from sentential PP's. Thus, anyway, which is impossible in final verb-phrasal PP's, as in (c) below, is possible both in the case of (a) and of (b).

58a) In Ben's picture anyway, Rosa looks sick.

b) In Ben's picture anyway, Rosa found a scratch.

c) *Rosa found a scratch in Ben's picture anyway.
/construe anyway in (c) as attaching to the PP/

59a) In his family anyway, Ben is considered a genius.

b) In his office anyway, Ben spends a lot of time.

c) *Ben spends a lot of time in his office anyway.
/construe anyway in (c) as attaching to the PP/

So, a PP in initial position is a thematic element, or a topic, regardless of whether it originates as sentential or verb-phrasal. Still, intuitively, we feel that there is some difference in the function of the two types of PP in these sentences. Kuno (1975) has described, without much detail, sentential PP's like those in the (a) sentences above as 'setting the scene' for the rest of the sentence. Although this seems intuitively right, there is also some intuitive sense in which the verb-phrasal PP's in the (b) sentences are also 'scene-setting' (since they are topics as well). However, since there seems to be a difference in the functions of the two PP's which, furthermore, correlates with syntactic differences and differences in quantifier scope and coreference possibilities, it is worthwhile to try and make somewhat more explicit the intuitions which underlie such descriptions as

'setting the scene.'

We have already seen that the explanation for the different functions of the two PP's in the sentence cannot come from examining the information status of the PP's themselves, since both are topics. The answer must lie, therefore, in the information status of the rest of the sentence, or in the exact relation of the PP to the sentence. To see this, let us focus on the subjects of sentences with preposed PP's. As we see in (60), sentential PP's can be followed by indefinite subjects. But indefinite subjects are much worse in sentences with preposed verb-phrasal PP's, as in the sentences of (61). (Contrastive intonation of the subject, or a 'list reading,' in the sentences of (61) should be excluded.)[16]

60a) In Ben's picture a fat woman is riding a horse.

b) In Ben's family, a cousin always did the dishes.

c) With such poor security arrangements, a thief managed to walk off with the office football pool.

d) In spite of the efforts of the police, a bomb exploded yesterday in the courthouse.

61a) #In Ben's picture, a fat woman found a scratch.

b) #In Ben's office, a stranger spent the night.

c) #With the boss, a client has been arguing bitterly.

d) #With a loud noise, a bomb exploded yesterday in the courthouse.

e) #In a great huff, someone just left the boss's office.

Since indefinite nouns carry no existential presupposition, they usually convey new information and they cannot easily serve as topics. The fact that their occurrence in subject position in the sentences of (61) results in somewhat weird sentences suggests, therefore, that constituents in this position tend to be interpreted as old information. In other words, it is not

only the preposed PP which must be the theme in such structures, but the subject as well. The function of PP-preposing in the case of verb-phrasal PP's is not just to make the PP a theme, but rather to make the VP the rheme (new information). Hence, given the vague notion of 'aboutness,' sentences with preposed verb-phrasal PP's state something 'about' the PP and 'about' the subject. The fact that, as we saw in the sentences of (60), subjects in sentences with initial sentential PP's do not have to be definite suggests that they do not function as topic. In these cases, the whole main clause is the new information, and the PP alone is the topic.

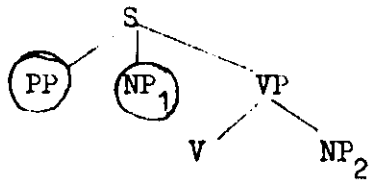
The sentence In Ben's picture, Rosa is riding a horse can be interpreted as stating that Rosa's riding a horse is a member of the set of things that took place in Ben's picture (or the set of properties of Ben's picture). The sentence with the verb-phrasal PP--In Ben's picture, Rosa found a scratch--on the other hand, is interpreted as stating that finding a scratch is a member of the intersection of the set of the properties of Ben's picture (things that happened in or to it) and Rosa's properties (things that Rosa did), or, in other words, that it's a member of the set of things that Rosa did to Ben's picture.[17]

The difference in the information (theme-rheme) relations in sentences with preposed sentential and V-phrasal PP's suggest another type of correlation between syntactic domains and semantic properties. The structures underlying the two types of sentences are repeated in (62b) and (63b), where the constituents which serve as topics are circled.

62) Preposed V-phrasal PP's

a) In Ben's picture, Rosa found a scratch

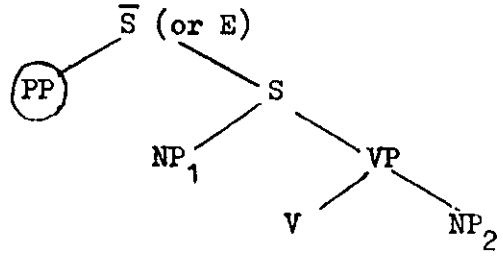
b)



63) Preposed Sentential PP's

a) In Ben's picture, Rosa is riding a horse

b)



Roughly stated, the generalization which is suggested is that (in "normal" or intonationally unmarked situations) only constituents which are heads of a given S domain can function as topics of this domain. The term head of a domain α is used as defined in section 1.2, namely it would be a node which c-commands all the other nodes in the domain α (Note that defined this way there can be more than one head per domain since sister nodes c-command each other). Thus in (63b) the PP is a head of the domain $\bar{S}$, but the subject, NP_1, is not. Hence the PP, but not the NP, is the topic of $\bar{S}$. In (62b), on the other hand, both the PP and the NP are heads of the S domain, hence both can serve as topics. Obviously this generalization is not sufficient, since, given the definition of head, there are, in (62b) for example, three heads of the S domain: the PP, the subject NP_1, and the VP. Still only the first two are topics. The specification of the complete conditions for topichood goes well beyond the present discussion. The point here, however, is that whatever further specification may be needed, in unmarked cases, only heads of sentences serve as topics. This generalization provides also an account for the difference in the information status of non-preposed PP's. In section

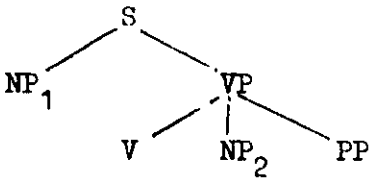
2.1.2 we saw that while V-phrasal PP's in final position always carry new information (i.e., with normal sentence intonation they cannot serve as topics), sentential PP's in final position tend to be part of the old-information (or topics). This was illustrated, for example, with the occurrence of anyway in (23a) and (23b), repeated in (64) and (65) below.

64) #Rosa found a scratch, in Ben's picture anyway

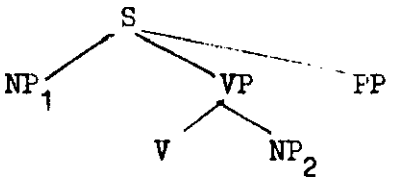
65) Rosa is riding a horse, in Ben's picture anyway

The two types of structures which are involved are repeated in (66) and (67).

66)



67)



The V-phrasal PP in (66) is not a head of the S-domain (since it c-commands only nodes in the VP). Hence this PP cannot be a topic of the sentence. The sentential PP in (67), on the other hand, is a head in the S domain, hence it can serve as a topic.

The correlation between domain relations and theme-rheme relations may account for the partial success of non-syntactic accounts of coreference. Bickerton (1975) and Kuno (1975) have argued in different ways that the topic (or Kuno's predictable theme) of a sentence cannot be pronominalized intra-sententially. We saw that usually the topic of the sentence will also be the head of the S-domain, hence it cannot be a pronoun coreferential with a non-pronoun in its domain. In the case of a preposed sentential PP (i.e.,

structures like (63b)) where the subject is not the head of the S-domain, it is also not a theme in that domain, and hence both the syntactic (c-command) restriction, and the semantic restriction on topics permit the subject to be "pronominalized" as in (30a) or (31a), repeated as (68) and (69) below.

68) In Ben's picture of Rosa, she is riding a horse

69) In Ford's home town he is considered a genius

In Chapter 5, section 5.1.1, we will see why the coreference rule cannot, nevertheless, apply directly to semantic representations involving theme-rheme distinctions, and where the semantic oriented approach consequently fails.

2.2.4 Further coreference mysteries. Lakoff (1968), Akmajian & Jackendoff (1970), and Wasow (1972) all noted that in certain cases, if the preposed PP's are lengthened, 'forward pronominalization' becomes acceptable. Thus, while in Lakoff's famous sentence in (70a) coreference is impossible, for many speakers it improves in (70b). The same is true for pairs like those in (71)-(73).

70a) *In John's apartment, he smoked pot.

b) In John's newly renovated apartment on 5th Avenue, he smoked pot.

71a) *For John's car, he managed to get over two grand.

b) ?For John's badly battered old jalopy, he managed to get over two grand.

72a) *In Zelda's letter, she speaks about butterflies.

b) In Zelda's latest letter, she speaks about butterflies.

73a) *In Ben's picture of Rosa, she found a scratch.

b) ?In Ben's most recent picture of Rosa, she found a scratch.

Wasow (1972) suggested that these facts indicated that 'forward pronominalization' is, in fact, permitted by the grammar, but some performance constraint prohibits a preposed antecedent from being too close to a coreferential pronoun in surface structure. Arguments as to why such a constraint cannot be right were mentioned in section 1.4. Note also that for some speakers, (73b) is much better than (73a), despite the fact that the distance between the antecedent and the pronoun is identical. ((73b) is not as good as, say, (72b), for some speakers, but as we will see, this is not due to the antecedent's distance from the pronoun.)[18]

Given all we have seen above concerning the syntax and semantics of PP's, it can be argued now that the explanation for the differences between the (a) and (b) sentences lies in the function of the PP in the sentence, namely, that in the (b) sentences, but not in the (a) sentences, the PP is sentential. So far I have concentrated mainly on cases where the decision as to whether the PP was sentential or verb-phrasal was clear-cut: the sentences behaved the same way with respect to all the tests. However, as we saw in the last section, the semantic relations of a preposed PP in a sentence are very subtle, since they are dependent basically upon the information relations in the sentence In cases where the PP does not obligatorily have to be verb-phrasal, its interpretation as sentential or verb-phrasal in initial position may depend on complex considerations.

Let us see first that the claim that those who accept the (b) sentences in (70)-(73) interpret the PP of these sentences as sentential (i.e., as attached to a position higher than COMP) has syntactic support: after the PP's in the (b) sentences questions are possible (while they are not possible after the (a) sentences). Again, this holds for speakers who agree to the

coreference judgments in these sentences: The (a) sentences are not all equally bad. Thus, for many speakers (72a) is, in itself, much better than (73a) and, consequently, for these speakers (75a) will be better than (76a).

74a) *In his apartment, does he smoke pot?

b) In his newly renovated apartment on 5th Avenue, does he smoke pot?

75a) *In her letter, what does she talk about?

b) In her latest letter, what does she talk about?

76a) *In Ben's picture of her, did she find any scratches?

b) In Ben's most recent picture of her, did she find any scratches?

Semantically, we saw that in the case of initial sentential PP's, the whole main clause is a statement 'about' the PP. And, intuitively, we could, perhaps, explain the difference between the (a) and (b) sentences in (70)-(73) by saying that the 'lengthened' PP in the (b) sentences is becoming relatively more important, or more independent of the rest of the sentence. Hence the rest of the sentence can be more easily interpreted as a statement about this PP.

We noted in section 2.2.2 that in cases where the PP could only have originated in the VP, for the sentence to make sense, its attachment to COMP is obligatory (namely, it obeys purely structural restrictions). Consequently, in these cases, 'forward pronominalization' will not improve with lengthening. Thus the (b) sentence in (77) is not better than the (a) sentence (which was discussed in section 2.2.2, example (52)).

77a) *In Ben's picture, he promised Rosa that she would look attractive.

b) *In Ben's next picture for Vogue magazine, he promised Rosa that he would make her look attractive.

In these cases, the PP must be interpreted as being in COMP, which indicates its semantic association with the VP. Otherwise, the sentence would not make sense. The PP, therefore, is obligatorily in the domain of the subject, and coreference is blocked if an NP in the PP is not a pronoun.

For the same reason, PP's which can be only verb-phrasal, like instrumental PP's, are not improved when lengthened:

78a) *With Rosa's feather, she tickled Dan.

b) *With Rosa's most magnificent peacock feather, she tickled Dan.

In the sentences of (73), there is a strong association between the locative and the verb (much stronger, say, than in (70) or (72)). However, the verb find is not strictly subcategorized to require a PP. Therefore, it is still possible for some speakers to interpret the PP in initial position as sentential, though it is harder than in (70b) and (72b). With a verb like put, which is strictly subcategorized for a locative, the PP can only be attached to COMP position and hence coreference will not be improved.[19]

79a) *In Ben's box, he put his cigars.

b) *In Ben's most precious Chinese box, he put his cigars.

In summary, unless the PP must obligatorily be attached to COMP (for the sentence to make sense), its position in front of the sentence may vary with speakers and with sentences. If a given sentence makes sense (for a given speaker) when the PP is interpreted as sentential, in applying the coreference restriction, this PP will be treated as sentential, and as being outside the domain of the subject. The fact that the position of the PP depends so crucially in these cases upon the interpretation of the sentence, explains also why we find such a variety of judgments concerning coreference acceptability.[20]

2.3 Topicalization and left dislocation.

Sentences with topicalization provide further support to the c-command definition of domain. Consider, first, paradigms of the following type, which were noted in Postal (1971).

80) (Postal (1971): 197)

a) John keeps a snake near him

b) *Him, John keeps a snake near

c) Near him John keeps a snake

81a) Sonya's husband would give his life for her

b) *Her, Sonya's husband would give his life for.

c) For her, Sonya's husband would give his life.

In both (b) and (c) of (80)-(81), the pronoun precedes and commands the antecedent. Still, the sentences differ in acceptability. For the c-command restriction on anaphora this is precisely the predicted result. In the (c) sentences of (80)-(81), where the whole PP is preposed, coreference is not blocked, since the pronoun is dominated by the PP and, thus, does not c-command the antecedent (i.e., the antecedent is not in the domain of the pronoun). In the (b) sentences of (80)-(81), on the other hand, the pronoun is dominated directly by S. Hence it c-commands the antecedent, and the sentence is correctly blocked.

Next, let us check cases of 'forward pronominalization', which are always permitted by the precede-and-command rule. The c-command restriction correctly predicts that 'forward pronominalization' is blocked in topicalization-sentences when the pronoun is the subject, as in (82), but it is permitted in (83), where the pronoun is not immediately dominated by S and, therefore, does not c-command the topicalized NP:[21]

82a) *Sonya, she denies that Hirschel admires.

b) *Sonya's recipes, she will never give you.

83a) Sonya's recipes, you'll never get from her.

b) Sonya, her husband would give his life for.

It is interesting to observe, now, that coreference options in Left-Dislocation (henceforward LD) sentences differ from those in topicalization sentences. Compare, for example, the sentences in (82) to those in (84):

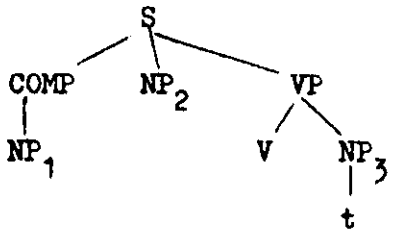
84a) (As for) Sonya, she denies that Hirschel admires her.

b) (As for) Sonya's recipes, she will never give them to you.

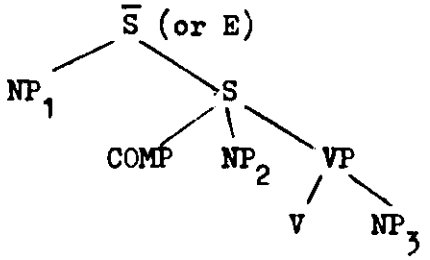
The difference between coreference options in Topicalization and in LD sentences is, thus, parallel to the difference we observed between sentences with preposed V-phrasal PP's and those with preposed sentential PP's. In fact, this difference in coreference options is due to the fact that topicalized and left-dislocated NP's differ structurally in precisely the same way that the two types of preposed PP do: van Riemsdijk & Zwartz (1974) offer several strong arguments to the effect that LD cannot be a transformation. (Their discussion concerns the analogue of LD in Dutch, but most of their arguments hold for English as well.) Although space prevents a recapitulation of all their arguments here, they suggest that 'left-dislocated' elements are generated in the initial position under a category higher than the S which dominates the rest of the sentence. (Under their analysis, this category is E.) Within this analysis LD sentences will have the structure in (86) (i.e., a structure identical to that of preposed sentential PP's). While topicalization sentences may have the structure in (85), or an equivalent structure (with respect to domain relations), which is consistent with Chomsky's hypothesis that topicalization involves wh-movement.[22] (The trees

are, again, simplified.)

85) Topicalization sentences:



86) LD sentences:



This structural distinction is supported by the same type of facts that supported the distinction between preposed V-phrasal and sentential PP's. Thus, in structures like (86) the COMP position is free, hence it can be filled by a wh-word as in the (b) sentences of (87)-(88). But, as indicated by the (a) sentences of (87)-(88), this is impossible in sentences with the structure (85), since the COMP position is filled.

87a) *Rosa, when did you last see?

b) (As for) Rosa, when did you last see her?

88a) *Rosa, who can stand, anyway!

b) (As for) Rosa, who can stand her, anyway!

(Further syntactic differences between these two types of sentences are surveyed in detail in van Riemsdijk & Zwartz, op. cit.)

Given this structural difference between topicalization and LD sentences the difference in their coreference options has a straightforward account in

terms of c-command domains. In (85), the topicalized NP_1 is in the domain of the subject, NP_2. Consequently coreference is blocked if the topicalized NP_1 is not a pronoun, as in (82b) (*Sonya's recipes, she will never give you). In (86), on the other hand, the left-dislocated NP_1 is not in the domain of the subject, NP_2, hence the coreference restriction does not apply and coreference is possible, e.g., in (84b) (Sonya's recipies, she will never give them to you). However, the subject in (86), is in the domain of the left-dislocated NP_1, hence coreference is blocked in case the subject is not a pronoun, as in (89). (In other words, coreference in (89) is blocked, since the pronoun c-commands the antecedent.)

89) *(As for) her, Sonya denies that Hirschel admires her

It would be observed, further, that the structural difference between topicalization and LD sentences correlates with semantic (functional) differences identical to those we noted between preposed v-phrasal and sentential PP's. We saw in section 2.2.3 that subjects of sentences with preposed V-phrasal PP's are still topics in their sentences (e.g., they cannot be indefinite NP's), but in sentences with preposed sentential PP's, the PP is the only topic (and, consequently the subjects can be indefinite NP's). Precisely the same difference holds between LD and topicalization: While in LD sentences the left-dislocated NP is the only topic, in topicalization sentences both the topicalized NP and the subject are topics. This is illustrated by the fact that the subject can be indefinite in the (b), but not in the (a) sentences below:

90a) #Sonya, a gangster attacked yesterday

b) (As for) Sonya, a gangster attacked her yesterday

91a) #Sonya's recipes an expert has praised in the contest.

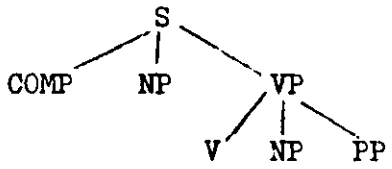
b) (As for) Sonya's recipes, an expert has praised them in the contest.

Topicalization and left-dislocation, thus, provide a further example of the correlation between c-command domains, coreference options and semantic relations.[23]

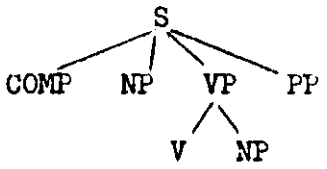
2.4 Summary

The discussion in this chapter has shown that independent syntactic tests distinguish between four structures with PP's, two of which (in (93)) are identical with respect to domain relations:

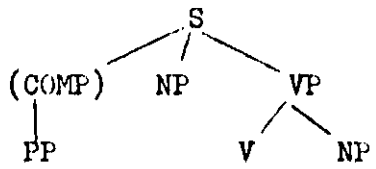
92) verb-phrasal PP's in final position



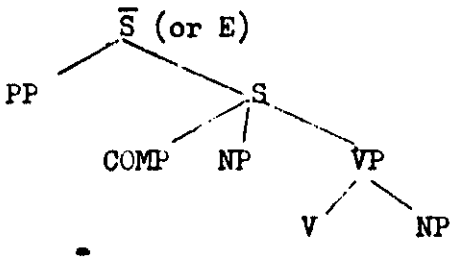
93a) sentential PP's in final position



b) verb-phrasal PP's in initial position



94) sentential PP's in initial position



Thus, with respect to domain relations, there are only three cases of sentences with PP's: those of (92), (93), and (94). We found that these

cases are distinguished typically with respect to coreference, theme-rheme relations, and quantifier scope. All three of these criteria seem to correlate with the domain relations. (Topicalized NP's pattern with preposed V-phrasal PP, as in (93b), and left-dislocated NP's pattern with preposed sentential PP's, as in (94), and they exhibit the same type of correlation between syntactic domains, coreference, and semantic properties.)

a. Theme-rheme relations: In (92) the PP cannot be the theme (cf. examples like (24b) #The gangsters killed Hoffa, in Detroit, anyway). The normal reading is the one where the subject, which is a head of the S domain, is the theme, and the VP is the new information part (although other arrangements are possible). In (93) there is a tendency for both heads of the S domain—the subject and the PP—to function as themes. Although this tendency is clearer in the structure (93b), it shows up in (92a) as well. A fuller account will be needed here, since the VP can also be considered as the head of the domain—so the decision as to what is theme and what is rheme is not only structural.7 In (94), where there is only one head of the $\bar{S}$ (or E) domain, this head is the only theme and the rest of the sentence (S) is the new information.

b. Scope: In (92), where the PP is in the domain of the subject, but the subject is not in the domain of the PP, there is no scope ambiguity—the quantified subject must have wide scope (cf. sentences like (17b) Someone found a scratch in all of Ben's pictures). In both (93a) and (93b), where the subject and the PP are in each other's domains, scope ambiguity is possible (cf. sentences (17a) Someone is riding a horse in all of Ben's pictures and (44b) In all of Ben's pictures someone found a scratch). In (94), where the subject is in the domain of the PP, but the PP is not in the domain of

the subject, there is no scope for ambiguity—the quantified subject is within the scope of the quantified PP (cf. sentence (44a) In all of Ben's pictures someone is riding a horse).

c. Coreference. In (92), the PP is in the domain of the object. Hence sentences like (95) are impossible.

95) *Rosa tickled him with Ben's feather.

In both (93a) and (93b), the PP is not in the domain of theobject. Hence, we can get (96) for (93a) and (97) for (93b):

96) Rosa is kissing him passionately in Ben's high school picture.

97) For Ben's car, I'm willing to give him two grand.

In the three structures (92), (93a) and (93b), the PP is in the domain of the subject. Hence we do not get (98)-(100), respectively.

98) *She tickled Ben with Rosa's feather.

99) *She is kissing Ben passionately in Rosa's high school picture.

100) *For Ben's car, he is asking two grand.

In (94), on the other hand, the PP is not in the domain of the subject. Hence we can get (101):

101) In Rosa's high school picture, she is kissing Ben passionately.

In Chapter 5, I will suggest an explanation for the correlations which were observed in this chapter.

FOOTNOTES

1. Faraci (1974), who was the first to study in detail the distinction between in order to- and to-phrases, suggested that in order to-phrases are attached to the node Predicate Phrase, while to-phrases can be attached either to PredP or to the VP. However, this is not crucial to his analysis. Following Faraci's basic distinctions, Williams (1974) has shown that the relevant structural distinction is between sentential and verb-phrasal positions.

2. Williams distinguishes, in fact, between four positions into which PP's can be inserted: VP, PredP, S, and $\overline{S}$. In this discussion, I will collapse the first two as verb-phrasal PP's and the second two as sentential PP's. Williams also lists during, before, after, while, and because phrases as sentential (attached to S). However, he does not provide strong arguments to show that these cannot be verb-phrasal PP's (PredP PP's in his system). It is possible that these PP's, like the ones that will be discussed below can be attached to either position, depending upon the semantics of the sentence.

3. This is, perhaps, true for many adverbs as well. Heny (1973) has argued against the common assumption that the distinction between sentential and verb-phrasal adverbs is inherent in the adverbs themselves. In many cases, the same adverb can be sentential or verb-phrasal, depending upon the semantics of the sentence. His example is the occurrence of lavishly in (i) and (ii).

i a) John furnished all the rooms of his house lavishly.

b) *John lavishly furnished all the rooms of his house.

ii) John lavishly filled all his bathtubs with beer.

In (i), lavishly functions like a verb-phrasal PP (and cannot have wider scope than all); in (ii) it functions like a sentential PP (and does have wider scope).

4. Examples of the type of (3) (with the PP preposed) were noted by Jackendoff (1975); their relevance to the distinction between verb-phrasal and sentential PP's was noted by Kuno (1975).

5. I presented these sentences to a group of about 10 people. All of them agreed to the judgments concerning (3); some disagreed (consistently) with the judgments concerning (4). Their tendency was to interpret both (4a) and (4b) as sentential. (This interpretation is less possible for (3b), since, although the verb find is not strictly subcategorized to require a locative (cf. I found a penny), there still is a stronger association between this verb and a locative than between kill and a locative.) As was argued by Kuno (1975b), sentences like (4b) can always be interpreted either way, given the right context. This means that it is possible that in the syntactic tests, some speakers may count (4b) both ways (as sentential and verb-phrasal), and consequently, when it comes to coreference, they will not have a clear judgment.

It is also important to note that some tests are better than others, and also, as always, slight variations in judgments, in violation of my consistency-expectations, are still possible.

6. The following is an example of such possible correspondence: Within Montague grammar (e.g., Montague (1974), Cooper (1974)) sentential adverbs are defined syntactically as functions from sentences to sentences, while

verb-phrasal adverbs are functions from a VP to a VP, with the corresponding semantic distinctions. The verb-phrasal adverbs are thus a restricting (or subsection) function, from functions to functions, which gives an account of the entailment facts discussed in (b) below. Since this analysis depends crucially on the constituent structure of the sentence (assuming a correspondence between syntactic functions which represent the constituent structure and semantic functions), it can be stated in terms of syntactic domain. Very roughly, the correspondence rule will state that a function can take as arguments only elements within its syntactic domain.

7. These facts provide another example for a correspondence between domain and semantic relations. Suppose there is a correlation between domain and scope, so that A can be in the scope of a quantifier B only if A is in the syntactic domain of B (a possibility that I will argue for in Chapter 5). In this case, the difference in quantifier scope in the examples above follows from their domain relations: in the (b) sentences, the PP is in the domain of the subject, but not conversely; in the (a) sentences, the subject and the PP (being sister nodes) are in the domain of each other, hence both scope arrangements are permitted.

8. Several other semantic tests that distinguish sentential and verb-phrasal adverbs were suggested in Thomason and Stalnaker (1973). Some of their tests are controversial (see Heny (1973) and Lakoff (1970)) or do not apply at all to PP's. However, at least one of their tests clearly applies to pairs under consideration here. Only sentential adverbs or PP's can be paraphrased by sentences in which the adverb or PP modifies the matrix <u>it is true</u>. Accordingly, the (a) but not the (b) sentences below are possible (the mark # stands for semantic weirdness).

i a) It's true in Washington that people worship Kissinger

b) #It is true in Detroit that the gangsters killed Hoffa

iia) It's true in Ben's picture that Rosa looks sick

b) #It's true in Ben's picture that Rosa has found a scratch

9. Semantically, the description of a phrase as 'new information' or 'rheme' does not differ significantly from Chomsky's (1971) assignment of focus. (Chomsky suggests also the same question test suggested below.) However, whereas Chomsky's focus is defined as the phrase containing the intonation center in the sentence, in the case of PP's in final position, it seems that there is no intonation difference (at least not an obligatory one) between the sentences with the two types of PP's—in both cases the PP can carry the intonation center.

10. Kuno (1975) attempted to solve this problem by arguing that sentential PP's originate in initial position, while verb-phrasal PP's originate in final position. The verb-phrasal PP's in final position meet the conditions for reflexivization (which applies prior to PP-preposing) and, thus, the NP in the PP is marked [+reflexive], while the sentential PP (in initial position) does not meet these conditions. Since an NP which is marked [*reflexive] must be a pronoun, forward pronominalization is still impossible when the verb-phrasal PP is preposed. The problem with this solution is that the sentential PP can be postponed to final position, and since they are not marked [+reflexive], what would prevent the sentence *She looks sick in Ben's picture of Rosa? Kuno assumes also the regular precede-and-command constraints, which, supposedly, could still block this sentence, but they would equally block backward pronominalization to objects, as in: Rosa is kissing him passionately in Ben's high school picture. If, in order to

distinguish between the last two sentences, we establish the c-command definition of domain, there is no need for Kuno's reflexivization and ordering solution, since, as we shall see directly, this general coreference restriction is sufficient to take care of pairs with preposed constituents in (30)-(33) as well.

11. Similar facts were noted in van Riemsdijk & Zwartz (1974), for the case of Topicalization and Left Dislocation.

12. I argued in Reinhart (1975) that there are many problems with the assumption that there is only one COMP position per S. Thus, sentences like the following cannot be generated under this assumption:

i) Here is a fact which$_1$ I don't understand how$_2$ you could have ignored t_1 t_2.

ii) Here is a book which$_1$ I forgot who$_2$ t_2 gave me t_1.

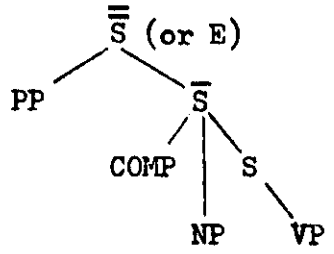
In any case, if, as I suggested there, there are two COMP positions in a sentence, there would also be needed a surface filter to block sentences in which both COMP positions are filled, as in:

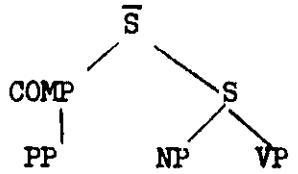
iii) *How what I have ignored t t?

iv) *Who what books t borrowed t?

This surface filter would also block sentences in which both wh-movement and PP movement into COMP have applied.

13. The decision concerning the category under which pre-sentential PP's are generated (or preposed into) will be more crucial in the discussion of Chapter 4, where we will see that the definition of domain has to be modified to incorporate a situation parallel to that of A-over-A. The more accurate structure of the two cases under discussion is the one given in (i) below.

i a) 

b) 

Though the COMP is dominated by a node higher than the node immediately dominating the subject, we still want the COMP, i.e., $\bar{S}$, to be in the domain of the subject, but not the PP in (ia). If the sentential PP (in (ia)) is dominated by E, the definition of the domain will simply be modified to pick the higher node in a situation of A-over-A (and E will be excluded by virtue of being a different node from S). If the PP in (ia) is dominated by $\bar{\bar{S}}$, the modification will have to be slightly more complicated, stating that picking the higher node cannot extend above the node dominating COMP.

It should be mentioned that there is still a substantial problem to be solved if we want to include PP's (and left-dislocated constituents) in the pre-sentential position under E. In Banfield's proposal, E is non-embeddable. As we see in II, her examples cannot indeed occur in any form of embedding. Left-dislocated constituents can be embedded in some constructions, as in (iiia), but not in others, as in (iiib). Pre-sentential PP's seem to be embeddable in all constructions:

ii) *Rosa said that one more glass of beer and/or she's leaving.

iiia) Rosa said that (as for) beer she really likes it.

b) *That (as for) beer Rosa likes it amazes me.

iva) Rosa said that in Ben's picture she looks sick.

b) That in Ben's picture Rosa looks sick amazes me.

If the E solution for sentential PP's is to be accepted, E must be embeddable, but special constraints will be needed to distinguish between (ii) and (iiib)

and the other cases above.

14. If the correlation between scope and domain which was mentioned in footnote 7 can be established, the structural difference between (42a) and (42b) will account automatically for the difference between (44a) and (44b): in (44b), the subject and the PP are in each other's domains (hence ambiguity is possible); in (44a), on the other hand, the subject is in the domain of the PP, but not vice versa (hence no ambiguity is possible, and the subject quantifier must be in the scope of the PP quantifier). However, even if this correlation cannot be established, the difference in scope options indicates that the two sentences must differ structurally (since no other presently known semantic facts distinguish them), which is the only point I want to make here.

15. This was argued, for example, in Lakoff (1972). Still such preposing is not always blocked, though the conditions which affect its acceptability are not too well understood. For some examples, see Postal and Ross (1970).

16. In what follows, I am using the term 'topic' to refer to what Kuno (1972) has called 'predictable theme', namely a sentence-topic which is also a discourse-topic, or old information. It should be noted that we are dealing here with tendencies, rather than strict rules. The theory of theme-rheme (or focus-presupposition) relations is, in any case, far from being formal enough to state any rigorous restrictions.

17. A possible line for formalizing this distinction using lambda abstraction is illustrated below. It follows in principle (though not in detail) Jackendoff's (1972) treatment of focus and presupposition, in which abstraction is applied to the new information (focus) expression of the

sentence. First, we assume that the logical (function-argument) structures of the (a)-sentences of (i)-(ii) is represented (at least in part) by the (b)-sentences (namely, that in (i) in Ben's picture is a function from VP to VP, i.e. from a function to a function, and that in (ii), it is a function from S to S).

i a) Rosa found a scratch in Ben's picture.

b) (in Ben's picture (find a scratch))(Rosa)

iia) Rosa is riding a horse in Ben's picture.

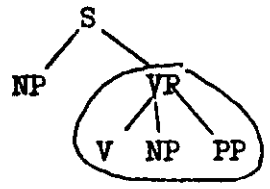
b) in Ben's picture (rides a horse (Rosa))

We can represent the theme-rheme relations of the sentences involved as follows, where the argument (the underlined expression) represents the new information of the sentence.

iiia) Rosa found a scratch in Ben's picture.

b) $\lambda F(F(Rosa))$ find a scratch in Ben's picture

c)

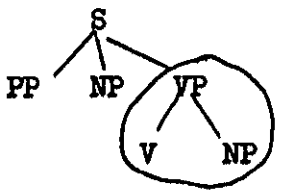


The reading in (iiib) assumes 'normal intonation', whereby Rosa is topic. It further assumes that the whole VP is the new information. Other analyses are possible (e.g. abstraction of in Ben's picture alone).

iva) In Ben's picture Rosa found a scratch.

b) $\lambda F((\text{in Ben's picture}(F))(Rosa))$ find a scratch

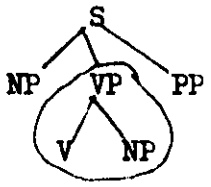
c)



va) Rosa is riding a horse in Ben's picture.

b) $\lambda F(\text{in Ben's picture}(F(\text{Rosa})))$ ride a horse

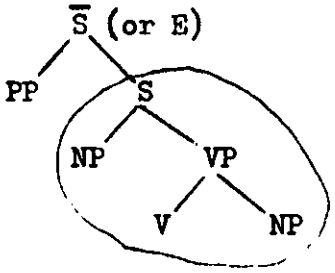
c)



via) In Ben's picture Rosa is riding a horse.

b) $\lambda x(\text{in Ben's picture } (x))$ Rosa is riding a horse

c)



The advantage of this analysis is that it captures simultaneously thematic properties (new and old information) of the sentences and logical properties which determine entailments. This is crucially illustrated in (iv) and (v). The sentences in (iva) and (va) have an identical displacement of thematic material. However, they still differ in their entailments. In other words, while the thematic relations in sentences like (iiia) change when the PP is preposed, their entailments do not change. The analysis in (ivb) and (vb) gives precisely this result. In both formulas the VP (find a scratch, ride a horse) is the focus (which, in this analysis, is indicated by being the major argument expression in the formulas). However, the internal analyses of the predicates differ in (ivb) and (vb). These analyses still follow the distinction between (ib) and (iib), which, as was mentioned in footnote 6, assures the correct entailments of (ia) and (iia). Thus, in (ivb) the PP in Ben's picture is a function on F (namely, a function from functions to functions), while in (vb) the PP in Ben's picture is a function

applied to the formula F(Rosa), to yield a formula. Consequently (ivb) entails correctly [λF(F(Rosa))] find a scratch (which would be a representation for Rosa found a scratch), but (vb), correctly, does not entail [λF(F(Rosa))] ride a horse. This captures simultaneously properties that seem to be determined by the deep structure (the entailments) and surface structure (theme-rheme relations). Within the interpretive approach this is possible since constituents in Comp positions (or any constituent which leaves traces) are interpreted in logical form as being in the position marked by the trace.

The particular second-order logical notation which I have used is not crucial and is used only for its convenience. It is possible that the new information can be represented (in a more cumbersome way) within first order logic.

18. Another indication that surface distance is not what matters can be observed in Hebrew, where the possessor occurs in final position in a noun phrase. Thus, the only way to express Zelda's latest letter is the equivalent of the latest letter of Zelda (hamixtav haaxaron sel Zelda). Still, the Hebrew translation of (72b) is better than that of (72a), though in both cases, the pronoun immediately follows the antecedent. These examples also show that Akmajian & Jackendoff's (1970) requirement that the antecedent must have reduced stress cannot give a full account (though it may play some role): as far as I can tell, Zelda would receive identical stress in Hebrew in both cases (being the final constituent in the NP).

19. In fact, the (b) sentences in (77)-(79) are somewhat funny even with the right (i.e. 'backward') order of pronominalization, since all the additional information in the PP pushes it toward sentence-topichood, while

its syntactic position in COMP forces its association with the VP.

20. Another puzzling fact which has been observed with preposed PP's is the improvement of 'forward pronominalization' when only or even are involved, e.g.:

i) In John's apartment, only he smokes pot.

ii) In Zelda's letter, even she speaks about inflation.

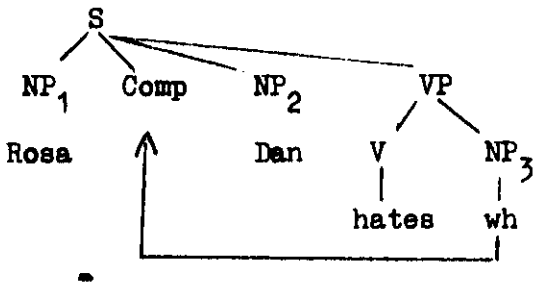
Although I do not sufficiently understand the semantics of even and only to account for these facts, it has been observed, at least for even (in Jackendoff (1972)), that even always introduces new information, or focus. Hence, by the semantic criterion of section 2.2.3, the main clause in (ii) represents new information, which means that the PP is sentential.

21. (83b) would not be acceptable in some dialect (the one which blocks coreference in sentences like His mother loves Dan). These dialectical differences will be discussed in section 4.2.

22. Chomsky (1976) has suggested that topicalization is an instance of wh-movement. Thus, the sentence in (ia) is derived from the (simplified) underlying structure in (ib).

ia) Rosa Dan hates.

b)



The wh is later obligatorily deleted by a surface filter rule (in Chomsky's analysis, NP_1 is dominated by a category E which is, however, distinct from Banfield's E which we have been considering here). Chomsky assumes, further,

that LD sentences have an identical structure to that in (ib), except that in these cases no wh-movement has applied.

Note, however, that if we accept the analysis of topicalization as wh-movement it does not necessarily follow that LD sentences have identical structures. We still can assume the structure in (ib) for topicalization sentences and the one in (86) for LD sentences. The examples which follow in the text ((87)-(88)) do not decide between these two hypotheses, since it can be argued that the COMP position in the case of topicalization is marked as filled (although the wh-word is deleted) hence no further wh-movement is possible. However, there exists at least one argument which suggests that a structural distinction between LD and topicalization sentences is required: We can find topicalized NP's following left dislocated NP's as in (ii), but not conversely, as in (iii).

ii) (As for) Rosa, my next book I will dedicate (t) to her.

iii) *My next book, Rosa, I will dedicate (t) to her.

If LD and topicalization sentences have identical structures, in order to derive (ii) we have either to permit two NP's in pre-COMP position or to assume a structure with two COMP positions, like: $\overline{S}$ NP COMP $\overline{S}$ COMP NP VP]]). But, then, what prevents wh-movement from yielding (iii) as well? In the alternative analysis which I proposed, on the other hand, the difference between (ii) and (iii) is the predicted result: Since left dislocated constituents are attached to a higher S than the one dominating COMP (i.e. $\overline{S}$ NP $\overline{S}$ (NP) COMP NP VP]]), wh-movement is possible only into the COMP position controlled by the 'topicalized' NP, as in (ii).

23. The difference in relative scope that we observed between preposed V-phrasal and sentential PP's is inapplicable to topicalization and LD. The

pattern established by preposed constituents suggests that LD sentences should allow wide scope only to the left dislocated NP. However, the relevant sentences with LD, e.g. (i), are unacceptable regardless of relative scope, since, as observed in Gundel (1974), left dislocated NP's can never be indefinite or quantified.

i) #Two languages, everybody speaks them.

(The parallel topicalization sentence Two languages, everybody speaks is ambiguous, as predicted.)

Chapter 3. THE RESTRICTION ON NON-DEFINITE ANAPHORA

3.1 The problem

3.1.1 So far I have discussed the general restriction on anaphora options. However, it is not an accident that the only examples mentioned were of definite NP's. It is well-known that the general restriction which governs definite NP's anaphora is not sufficient to account for several other cases: in particular, cases involving indefinite NP's. Thus, while 'backward pronominalization' is permitted in (1I), it is not possible in (1II).

1 I a) Those who have met him say that the guy is dangerous.

b) The fact that she has already climbed this mountain before encouraged Rosa to try again.

c) In his apartment, I saw Bill washing the dishes.

II a) *Those who have met him say that a guy is dangerous.

b) *The fact that he has already climbed this mountain before encouraged someone to try again.

c) *In his apartment, I saw nobody washing the dishes.

Postal (1970, 1971), who was the first to discuss such cases in detail, suggested that indefinite NP's obey a special restriction blocking any kind of 'backward pronominalization.'

A similar famous problem arises in sentences to which wh-movement has applied, as we see if we compare (1I) to (2I).

2 I a) *Who did those who have met him say t was dangerous?

b) *The guy who those who have met him say t was dangerous was arrested.

c) *Who did the fact that he had climbed this mountain before encourage t to try again?

II a) *Who did he say t was brave?

b) *The guy who I told him that I like t was offended.

3a) Who t insisted that those who like him are crazy?

b) Who did you accuse t of killing his mother?

These cases have received several analyses that will be mentioned below. Within trace theory (as in Wasow, 1972, and Chomsky, 1975b), which I will assume here, the problem presented by (2I) concerns coreference options of traces. Thus, in (3), it would be assumed that the trace 't' (rather than the wh-word itself) is anaphorically related to the pronoun to its right. Within this framework, the coreference restriction suggested in Chapter 1 is sufficient to block the sentences in (2II): the trace is not defined as a pronoun, hence in the sentences in (2II), we find a non-pronoun ('t') in the domain of a pronoun, which violates the requirements for coreference. These sentences are, then, blocked in the same way as sentences like *He said that Bill was brave and *I told him that I like Bill. This same coreference restriction, however, is not sufficient to block the sentences in (2I): the traces in (2I) are not in the domain of the pronouns (the pronouns do not c-command the traces). Hence, the coreference restriction as stated so far permits coreference in these cases (as indeed is true for the definite NP's in (1I)). The sentences in (3) indicate that it is not the case that traces can never have anaphoric relations with pronouns. In (3), where the trace happens to precede the pronoun, coreference is permitted, while in (2I), where the pronoun precedes the trace, coreference is blocked. It is clear, therefore, that a special restriction is needed to determine the conditions for coreference of traces.

Another exception to the coreference restriction stated so far consists

of emphatically stressed definite NP's which function as the focus of their sentence. If the NP's of (1I) are emphatically stressed, coreference is no longer possible:

4a) *Those who have met him say that the GUY is dangerous.

b) *The fact that she has already climbed the mountain before encouraged ROSA to try again.

c) *In his apartment, I saw BILL washing the dishes.

On the basis of the facts discussed in (1)-(4), it seems that indefinite NP's, traces, and focus NP's do not permit 'backwards pronominalization.' Facts such as these have led, indeed, to the belief that in these cases, the coreference restriction states that the antecedent must precede the pronoun. Needless to say, if this is the correct restriction, the syntactic domains defined in Chapter 1 are completely irrelevant for these cases, and there is no way to account for all coreference restrictions in the language on the basis of a unified notion of domain. Furthermore, if this restriction is correct, it turns out that, contrary to the claim made in the previous chapters, the relation 'precede' is a crucial syntactic relation. However, we will see below that just as in the case of 'precede and command,' the relation of 'precede' is in fact irrelevant for the cases under consideration, and that corference options in these cases are determined on the basis of the same syntactic domains that were defined in Chapter 1 (though the restriction is different).

3.1.2 To facilitate the discussion, I will label NP's of the three types mentioned above 'non-definite NP's.' Non-definite NP's are thus all NP's except definite NP's not functioning as foci. This is an arbitrary label, since definite focus NP's are, obviously, definite. However, for the sake

of the discussion, it will do. A more substantial problem than the choice of a label for this class of NP's is the question of how they constitute a class: why do they obey the same coreference restriction? An answer to this question has been suggested in Chomsky (1975b). He argues that all (and only) these three cases involve bound variables in their semantic representations. Within Chomsky's framework the sentences below will be assigned a semantic representation as in (b)

5 I a) Someone kissed Rosa

b) There is a person x such that ⌜x kissed Rosa⌝

II a) Who t kissed Rosa

b) For which person x, ⌜x kissed Rosa⌝

III a) The man who t kissed Rosa is my friend

b) The man x such that ⌜x kissed Rosa⌝ is my friend

IV a) BEN kissed Rosa

b) The person x such that ⌜x kissed Rosa⌝ is Ben

(The translation of focus-sentences like (IVa) should, probably, use the existential quantifier rather than the iota since no uniqueness presupposition is involved here, but this is irrelevant to Chomsky's point.)

This solution opens the way to capture the one property that the three sentences in (5II)-(5IV) have in common: All of them share the presupposition $\exists x$(x kissed Rosa), namely, the proposition asserted in (5I). (While a sentence like (5 IVa) with normal, non focus, intonation does not have such presupposition.) Within this framework, thus, the problem at issue is under what conditions a pronoun can be interpreted as the (same) variable which corresponds in the logical form of the sentence, to the quantified or non-definite NP. As the examples above indicate, the conditions governing

such interpretation do not follow from logical considerations. Thus, in sentence (1 IIa)—Those who have met him say that a guy is dangerous.—the existential quantifier which binds the variable corresponding to a guy has in its scope also the pronoun him, so no logical considerations block anaphoric relations here, and interpretation options must be restricted by the structural relations of the NP corresponding to the variable (a guy) and the pronoun.[1] For this reason I will continue, in the following discussion, to use the traditional teminology which refers to anaphora options of non-definite NP's in sentences and not directly to variables in the corresponding logical form of these sentences.

Obviously, there are still many problems with the analysis outlined above. One of them is the fact that generic and specific indefinite NP's are not subject to the strict restriction on anaphora (although they are commonly believed to correspond to bound variables as well). Consider the following sentences from Wasow (1972: 53) (the first two are quoted from Postal):

6a) If he has an ugly wife, a man should find a mistress.
b) The fact that he is being sued should worry any businessman.
c) That he was not elected upset a certain leading candidate.
d) The woman he loved betrayed a man I knew.

In all these cases the antecedent is an indefinite NP, but 'backwards anaphora' is possible. Attempting to define the class of NP's which obey the strict (non-definite) restriction on anaphora, Wasow (ibid.) has distinguished between two classes of NP's: Determinate NP's include definite NP's, generic indefinites as in (6a,b), and specific indefinites, as in (6c,d). Indeterminate NP's are nonspecific, nongeneric indefinite NP's.

It is only the last class of NP's that requires a stricter anaphora restriction, which prohibits 'backwards anaphora.'

Wasow offers several convincing examples showing similarities between the types of NP's included in the determinate NP class. However, the precise logical analysis of determinate NP's, which distinguishes them from indeterminate NP's, is still an open question. In particular, if we adopt Chomsky's definition of the set of NP's which obey the strict-anaphora restriction (namely, NP's which correspond to bound variables in the logical form of the sentence), the conditions under which NP's are interpreted as bound variables should be much more rigorously defined. I will not attempt a solution to this problem here. Although the logical analysis of generic and specific indefinites is still unknown, intuitions concerning the distinction between these two types and non-specific indefinite NP's are usually quite clear. I will, therefore, use in the following sections examples that seem to me unlikely to be interpreted as specific or generic. And, if such an interpretation is still possible, it should be ignored in judging anaphora options in these examples.

In summary, the problem of anaphoric relation of non-definite and quantified NP's involves many unsolved semantic problems. A full account of the restriction on this type of anaphora is impossible in the absence of the appropriate semantic analysis, and I do not attempt here a full account. Rather, my question is the following: Suppose the exact semantic conditions which determine which NP's obey the strict restriction on anaphora were defined, what is the structural restriction they obey? We saw that under any semantic analysis, structural properties of the NP's at question affect their anaphora options, it is, therefore, in place to ask what are these

structural properties.

3.2 The non-relevance of 'precede'

The anaphora restriction which is believed to hold for the cases under consideration is repeated in (7).

7) A non-definite NP (i.e., an indefinite NP, a trace, or a focus-definite NP) cannot be coreferential with a pronoun to its left.

That this restriction is incorrect can be shown in two ways: first, there are many cases of impossible anaphoric relations not blocked by these restrictions; second, there are a few cases where the restriction incorrectly blocks permitted anaphoric relations. Let us see this first in the case of indefinite NP's.

In discussions of the anaphora restriction in (7), it has often been the case that the examples brought forth to support it have been asymmetrical. Thus, consider the following pair from Postal (1970).

8a) *The fact that he lost amused somebody in the crowd.

b) Somebody in the crowd was amused by the fact that he lost.

It is true that in this pair coreference is permitted 'forward,' as in (b), but not 'backward,' as in (a). However, the two sentences differ structurally. The hypothesis that the linear order of the antecedent and the pronoun is the only factor that determines their coreference options should be checked, first, with identical structures: namely, we should compare (8a) to (9), which differs only in the order of the antecedent and the pronoun.

9) *The fact that somebody in the crowd lost amused him.

We see that (unless somebody in the crowd is interpreted as specific) (9) is bad as well, although the antecedent precedes the pronoun.[2] Looking back at the sentences in (2), repeated in (10a), which were used as examples of the coreference restriction in (7), we see that these sentences are not improved if the antecedent and the pronoun are switched, as in the b-sentences of (10).[3]

10 I a) *Those who have met him say that a guy is dangerous.

b) *Those who have met a guy say that he is dangerous.

II a) *The fact that he has already climbed this mountain before encouraged someone to try again.

b) *The fact that someone has already climbed this mountain before encouraged him to try again.

III a) *In his apartment, I saw nobody washing the dishes.

b) *In nobody's apartment, {I saw / did I see} {him} washing the dishes.

The problem with 'forward pronominalization' of indefinite NP's can be further illustrated by the following cases:

11a) The nurse expected one more patient to cancel his appointment.

b) *The fact that the nurse expected one more patient {to cancel his appointment / to be late} embarrassed him.

c) *Since the nurse expected one more patient {to cancel his appointment / to be late}, she shouted at him.

In (11a), where the indefinite NP one more patient precedes the pronoun, they can be coreferential. However, the same relation of 'precede' holds between one more patient and the matrix pronoun in the b- and c-sentences. Still, in these cases, the pronoun cannot be anaphorically related to the indefinite NP (i.e., it must refer independently), which indicates that

some restriction independent of 'precede' is needed.

An alternative formulation of the restriction on anaphoric relations of indefinite NP's was suggested by Ross (1972). This formulation too makes crucial use of the relation 'precede.' However, it adds a further restriction that the pronoun cannot have primacy over the antecedent, where A is defined as having primacy over B roughly when either A asymmetrically commands B (A commands B but B does not command A) or A symmetrically commands B and also precedes B. This restriction on coreference of indefinites amounts, therefore, to stating that the antecedent must precede the pronoun and the pronoun cannot, furthermore, asymmetrically command the antecedent. This restriction accounts for the inappropriateness of (9) and (11b), where the antecedent precedes the pronoun, but the pronoun asymmetrically commands it, and, thus, still has primacy over the antecedent, in violation of Ross's proposed restriction.

However, the fact that this restriction works here is quite accidental. In (10 Ib), where the pronoun does not command the antecedent, coreference is still not possible. Similarly, if the pronoun in (9) or in (11b) is embedded, coreference is just as impossible, e.g., *The fact that the nurse expected one more patient to be late amused the woman who told him about it. Sentence (10 IIIb) is also not blocked by this restriction—in this case the pronoun symmetrically commands the antecedent, and since the antecedent precedes the pronoun, the antecedent has primacy over the pronoun, but not conversely.

Ross suggested a stronger restriction to account for anaphora options in cases where the antecedent is nobody. This restriction states that the antecedent must both precede and have primacy over the pronoun, which

amounts to saying that the antecedent must both precede and command the pronoun. (A similar restriction in terms of precede-and-command was suggested briefly in Lasnik (1976).) If we suppose that this stronger restriction applies, in fact, to all the cases of indefinite NP's (and if the exceptions Ross mentions in the cases with somebody can be accounted for on semantic grounds), we come much closer to a correct account of the facts. This restriction blocks all the sentences in (9), (10 I), (10 II), and (11b,c).

The problems for a restriction couched in terms of 'precede-and-command,' rather than 'precede' alone, arise in environments similar to those which provide counter-examples to the 'precede-and-command' restriction on the coreference of definite NP's. Thus, in (10 IIIb) above and in (12b,c) below, the antecedent both precedes and commands the pronoun, but an anaphoric relation is nevertheless impossible. Even if some further restriction could be added to block these sentences, a restriction which makes crucial use of the relation of 'precede' still fails, since, as we will see now, such a restriction is not only insufficient but also incorrect, since there are cases where the pronoun can precede the antecedent:

12a) Near his child's crib, nobody would keep matches

b) Near him, nobody sane would keep a gun.

c) *Near nobody sane $\left\{\begin{matrix}\text{would he}\\ \text{he would}\end{matrix}\right\}$ keep a gun.

d) *Near $\left\{\begin{matrix}\text{somebody}\\ \text{nobody}\end{matrix}\right\}$ I saw his gun.

13a) In his (own) apartment, nobody would ever put cigarets out on the floor.

b) *In his (own) apartment, you'll see nobody putting cigarets out on the floor.

c) You'll see nobody putting cigarets out on the floor in his own apartment.

In (12a,b) and (13a), the pronoun precedes (and also commands) the antecedent, but anaphoric relations are still possible. In (12c), where the antecedent precedes (and commands) the pronoun, no anaphoric relation is possible. The inappropriateness of (12c) can be accounted for by the general restriction offered in Chapter 1, which blocks coreference if a nonpronoun is in the domain of a pronoun, but this same restriction will not account for the inappropriateness of (12d), where the pronoun his does not c-command the antecedent nobody (which explains why we can get coreference in Near Ben, I saw his gun).

We have already seen in Chapter 1 (section 1.4) that no ordering solution is possible for coreference problems. However, one may still be tempted to try to dismiss cases like (12a,b) and (13a) by suggesting a separate rule for indefinite anaphora which, unlike the anaphora rule for definite NP's, does apply to deep structure (and since (12a,b) and (13a) are acceptable before the preposing of the PP, they remain acceptable after it has been preposed). That such a solution (which has not been proposed) would fail here as it did in the case of definite NP's is indicated by (13b) and (13c). We see that in (13b), unlike (13a), an anaphoric relation is impossible, although prior to the preposing of the PP, as in (13c), the same sentence is acceptable on the anaphoric reading. The differences between (13a-c) also indicate that as was the case with definite NP's, a mere distinction between anaphora options of subjects and objects will not do, since in both (13b) and (13c), the antecedent is an object and the pronoun is in a PP (i.e., 'lower in accessibility'), yet coreference is permitted only in (13c).

Let us check now the situation with focus definite NP's. That tho

restriction stating that the antecedent must precede the pronoun is insufficient can be seen, again, from the fact that 'forward pronominalization' in similar cases is just as bad:[4]

14a) *Those who met the CANDIDATE said that he was crazy.

b) *The fact that ROSA has climbed this mountain before encouraged her to try agr in.

c) *In BILL's apartment, I saw him washing the dishes.

d) *Only after DAN moved in did Rosa start to flirt with him.

15 (from Akmajian & Jackendoff, 1970)

a) *That GEORGE would be Tom's thesis advisor never occured to him [him cannot be George]

b) *That George would be TOM's thesis advisor never occurred to him. [him cannot be Tom]

Akmajian and Jackendoff (1970), who noted that the restriction at issue is not limited to 'backward pronominalization,' suggested that there is a general restriction on coreference requiring that both antecedents and pronouns must have reduced stress. This, however, is too strong, since sentences like those in (16) are clearly possible, although the antecedent has focus stress.

16a) TOM said he wanted to do the dishes.

b) Tom told (even) ROSA that she was smart.

c) (Even) BILL smokes pot in his apartment.

If Akmajian and Jackendoff's restriction were right, it would mean that focus NP's can never be coreferential with any other NP in the sentence, which is obviously not the case. So we do need a special restriction stating the conditions under which a focus NP can be coreferential with other NP's. However, the restriction in (7), which blocks 'backward

pronominalization,' is not sufficient, since it does not block the sentences in (14).

Counter-examples to the restriction in (7) involving acceptable 'backward pronominalization' are harder to find. Evidence could have come from sentences like:

17a) ?Near <u>him</u>, <u>DAN</u> keeps a gun.

b) ?In <u>his</u> apartment, <u>DAN</u> washes the dishes.

c) ?Near the house, DAN keeps a gun.

However, as we saw in section 2.2, the subject in such sentences tends usually to be old information, hence these sentences are somewhat weird if the subject is interpreted as focus, as we see in (17c), which does not involve anaphora. Due to this tendency, I suspect that to the extent to which the sentences in (17) may look acceptable, their subjects are interpreted contractively, in which case, the sentences are not relevant to the discussion.

The restriction in (7) seems to work more successfully with traces. However, the main reason for this is that most of the sentences that serve as counterexamples to this restriction in the case of indefinite NP's have no parallel with traces. For example, in many of these counterexamples (in (9-11)), the indefinite antecedent is in an island. No parallel sentences with a trace are possible, since there is no <u>wh</u>-movement out of islands and, consequently, we will never find a trace there. The evidence against the restriction in terms of 'precede' in the case of traces is, therefore, of a somewhat marginal nature. Still, it is a fact that we can find sentences where the trace precedes the pronoun and coreference is, nevertheless, impossible, e.g.:

18a) ?Who did Rosa sit near t in his car?

b) ?The man who Rosa sat near t in his car is her husband.

19a) *Who [did Mary say [t would come] when you met her with him]?

b) ?The man who [Rosa said [t would come] when you met her with him] never showed up.

Compare also the pair in (20): although the trace precedes the anaphor in both (20a) and (20b), the b-sentences are much worse:

20a) i. Who t is appreciated in his (own) home town?

ii. The candidate who t is appreciated in his (own) home town will win the election.

b) i. *Who do people appreciate t in his (own) home town?

ii. ?The candidate who people appreciate t in his (own) home town will win the election.

(Several other counterexamples to (7) in the case of traces will be mentioned in section 3.3.2.)

Examples of appropriate 'backward pronominalization' with traces are even harder to find. The examples in the case of indefinite NP's (in (12) and (13) above) were of sentences with preposed PP's. Wh-movement is usually impossible in such cases (e.g., *Who, in the box, put the book?), so they cannot be used as counterexamples. However, we may look at the following cases cited by Wasow, in which the pronoun does precede the trace.

21) On December 23rd, the postman brought a large envelope which, when I opened it at breakfast, t shed a lot of silvery tinsel into my plate. [from Graham Greene]

22) He was the kind of man who, when he loses his collar stud, bellows the house down. [from Agatha Christie]

Two alternative solutions have been proposed concerning the problem of

coreference in sentences to which wh-movement has applied. Postal (1971, 1972) has faced the problem with a derivational constraint. His constraint, summarized roughly, blocks sentences in which a wh-word has been fronted over (crossed over) a coreferential pronoun. As was pointed out in Wasow (1972), trace theory provides a way to capture whatever information is captured by derivational constraints (at least in the case of movement rules which leave traces). The predictions made by Postal's cross-over constraint are thus identical to those made by the restriction blocking anaphoric relations when the pronoun precedes the trace. Consequently, it would also fail in exactly the same environments. It cannot block the sentences in (18), (19), (20b), where the wh-word has not crossed over the pronoun, and it incorrectly blocks the sentences in (21) and (22), in which the relativized NP has crossed over the pronoun. (This latter case is, however, a rather weak counterexample, as it could be argued that the when-clauses are niched into their surface position after wh-movement has applied, in which case, in the derivational history of the sentence the relativized NP has not crossed over the pronoun.)

The other solution is the one suggested briefly in Keenan & Comrie (1972) for relative clauses (which can, perhaps, be extended to wh-movement in general). Within the framework of trace theory, their 'preferred reference condition' can be stated to require that the trace must be higher on the accessibility hierarchy[5] than the pronoun, or that an anaphoric relation between a trace and a pronoun is impossible if the trace is not higher in the hierarchy. As Keenan & Comrie note, when dealing with simple sentences of SVO languages, like England, their 'preferred reference condition' yields very similar results to Postal's cross-over constraint, since

in such languages, if a constituent B is to the right of a constituent A, B is usually also lower in the accessibility hierarchy than A. Thus, their constraint, just like Postal's, blocks coreference in sentences like The men that he met t, since the trace (or the NP relativized) is lower in the hierarchy than the pronoun. However, as we saw in section 3.1 (in the discussion of the examples in (4)), within trace theory, there is no need for a special constraint to block such sentences, since they violate the general restriction on anaphora prohibiting coreference in case a non-pronoun (here the trace) is in the domain of a pronoun. When it comes to more complicated cases, like the ones discussed in this chapter, the constraint of Keenan and Comrie is not sufficient to block impossible coreference. Thus, in the examples discussed in section 3.1 (e.g., (3b) *The guy who those who met him said t was dangerous was arrested yesterday), the pronoun is in a relative clause. Although Keenan and Comrie discuss only simple (basic) sentences, it would be plausible to assume that an NP in a complex NP island would be lower in the accessibility hierarchy than any NP in the matrix sentence. The pronoun in such examples is, thus, lower in the hierarchy than the trace (or the relativized NP) but coreference is still blocked.

3.3 The restriction in terms of c-command domains

3.3.1 We can now see that in fact the anaphora restriction on indefinite NP's, traces, and focus NP's operates on precisely the same syntactic domain as the restriction on definite NP's coreference. The difference is only that NP's of the first type are more limited in their anaphora options than definite NP's, which means that they obey a stricter restriction.

The restriction suggested in Chapter 1 for definite NP's is repeated in (23).

23) Two NP's cannot be coreferential if one is in the syntactic domain of the other and is not a pronoun (where the domain is defined by the c-command relation as in (38) of Chapter 1).

The restriction in (23) does not specifically mention definite NP's, nor does it need to, since in fact (23) is a general restriction on anaphora for all NP's. It states that coreference is never possible if a non-pronoun is in the domain of a pronoun or another non-pronoun (regardless of whether the non-pronoun is a definite NP, an indefinite NP, a trace, etc.). Thus, the same restriction blocks equally the a-sentences below, with definite NP's, and the b- and c-sentences, since in all of these sentences a non-pronoun is in the domain of a pronoun.

24a) *He expects Bill to win.

b) *He expects someone to win.

c) *Who does he expect t to win.

25a) *Him, Bill hopes we will accept.

b) *Him, BILL hopes we will accept.

c) *Him, a candidate hopes we will accept.

In the case of definite NP's, the general restriction in (23) is the only one which applies. This means that there are no restrictions on two definite NP's when one is not in the domain of the other, or that coreference of definite NP's is free, except for the general restriction on anaphora in (23). In the case of indefinite NP's, traces, and focus NP's, this general restriction is not sufficient. In addition, they obey a further, stricter restriction, given in (26).

26) Non-definite NP's (i.e., indefinite NP's, traces, and focus NP's) can have anaphoric relations only with NP's in their syntactic domain (where the domain is defined by c-command relations as in (38) of Chapter 1).[6]

This means that unlike definite NP's, non-definite NP's cannot have any anaphoric relations outside their domain. In case one such NP is in the domain of another, an anaphoric relation is possible as long as the general restriction on anaphora in (23) is met—namely, the NP in the domain of the other is a pronoun.

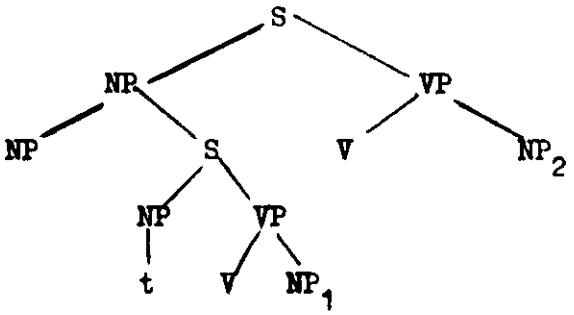
One of the consequences of the strict coreference restriction (26), which applies to non-definite NP's, is that there can be no anaphoric relations between two such NP's when both of them are non-pronouns. In Chapter 1, we saw that definite NP's can be coreferential with non-pronouns outside their domain, as in the a-sentences of (27) and (28). In the non-definite cases of the b- and c-sentences below, no such coreference is possible.

27a) People who knew Nixon hated Nixon.

b) *People who knew NIXON hated Nixon.

c) *People who knew a politician hated a politician.

d)

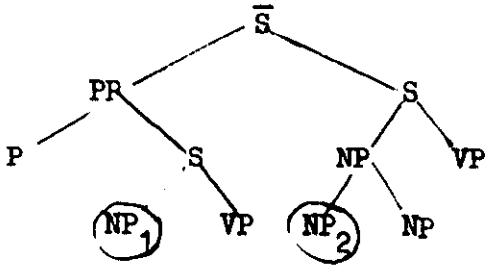


28a) Although Ben has failed all the exams, Ben's mother is still convinced she has a new Einstein at home.

b) *Although Ben has failed all the exams, BEN's mother is still convinced she has a new Einstein at home.

c) *Although someone has failed all the exams, someone's mother is still convinced she has a new Einstein at home.

d)



In the sentences of (27-28), neither of the relevant circled NP's—NP_1 or NP_2—is in the domain of the other (since neither c-commands the other). For this reason, the general restriction on anaphora does not apply to these NP's and if they are (non-focus) definite NP's, as in the a-sentences, nothing blocks their coreference. However, the strict restriction on anaphora of non-definite NP's does not permit two NP's to be coreferential if neither of them is in the domain of the other, regardless of whether one of them is a pronoun or not. Therefore, coreference in the b- and c-sentences is impossible. (For the same reason, coreference will be just as impossible if one of these NP's is a pronoun.)

In case one of the two non-definite NP's involved is in the domain of the other, coreference is possible in principle, but it will still be blocked if both the NP's are non-pronouns, this time by the general restriction on anaphora in (23). Thus (23) blocks coreference between the non-definite NP's in (29b,c) just as it does in the case of the definite NP's of (29a), since in these cases the embedded NP is in the domain of the subject NP and is not a pronoun.

29a) *Rosa is wearing the dress that Rosa bought yesterday.

b) *ROSA is wearing the dress that Rosa bought yesterday.

c) *Somebody is wearing the dress that somebody bought yesterday.

If the restriction in (26) is correct, it provides, therefore, an account of the fact that two full (non-pronominal) NP's of the non-definite type cannot be coreferential. The restriction on non-definite coreference does not, in itself, mention pronouns. However, it blocks coreference in cases where the general restriction on anaphora would have permitted two full NP's (non-pronouns) to be coreferential.

I will proceed to show that the restriction (26), rather than the restriction in terms of 'precede' (in (7) above) is the one relevant to non-definite coreference.

3.3.2 As was the case with the alternative restrictions on coreference discussed in Chapter 1, the alternative formulations of the restriction on non-definite coreference in (7) and (26) intersect in their predictions in a large number of cases (though not as large as in the previous case).[7] The restriction (7) blocks coreference in all the cases where a pronoun precedes a non-definite NP. In most structures of a right-branching language, when NP_2 is to the right of NP_1, NP_2 does not c-command NP_1 (i.e., NP_1 is not in the domain of NP_2). Hence, in such structures, when a pronoun, NP_1, precedes a non-definite NP, NP_2, the restriction (26) blocks coreference, since NP_1 is not in the domain of NP_2. To facilitate the presentation, I will concentrate here on the relation between non-definite NP's and pronouns. Although the restriction in (26) makes no special mention of pronouns, the requirement that non-definite NP's cannot have anaphoric relations with any NP outside their domain entails that no such relation is possible between a non-definite NP and a pronoun outside its domain. This entailed restriction is all we need for the present discussion.

The way the two rules intersect in the case of 'backward pronominali-

zation' can be illustrated with the sentences in (30) and (31), which have the structure (32).

30a) *Those who know <u>him</u> are kissing <u>someone</u> in Rosa's film.

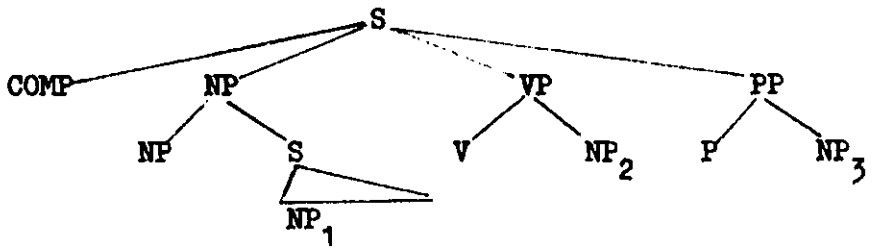
b) *Those who know <u>him</u> are drinking champagne in <u>someone</u>'s film.

c) *Those who are lucky are kissing <u>him</u> in <u>someone</u>'s film.

31a) *Who do those who know <u>him</u> kiss <u>t</u> in Rosa's film.

b) *Those who know <u>her</u> are drinking champagne in <u>ROSA</u>'s film.

32)



In these sentences, NP_1 precedes NP_2 and NP_3, and NP_2 precedes NP_3. Hence the coreference restriction in (7) seems to give the right predictions, blocking the sentences in (30) and (31), in which the preceding NP is a pronoun. However, if we look at the domain relations of the NP's involved, rather than their linear order, we see that in (32) an NP to the left is not in the domain of an NP to the right: NP_1 is not in the domain of NP_2, since NP_2 is dominated by the VP which does not dominate NP_1. The restriction in (26), then, blocks coreference between NP_1 and NP_2 in (30a) and (31a), because the pronoun is not in the domain of the non-definite NP and not because the pronoun precedes it. The same is true for NP_1 and NP_3. NP_3 in the PP in (32) does not c-command NP_1 (the domain of an NP in a PP is only the PP). Hence, coreference is blocked, as in (30b). For the same reason, NP_2 is not in the domain of NP_3 and the restriction in (26) blocks coreference in (30c) and (31b).

To illustrate the same point, consider the sentences in (33-34).

33) His mother spoils Bill.

34a) *His mother spoils someone.

b) *His mother spoils BILL.

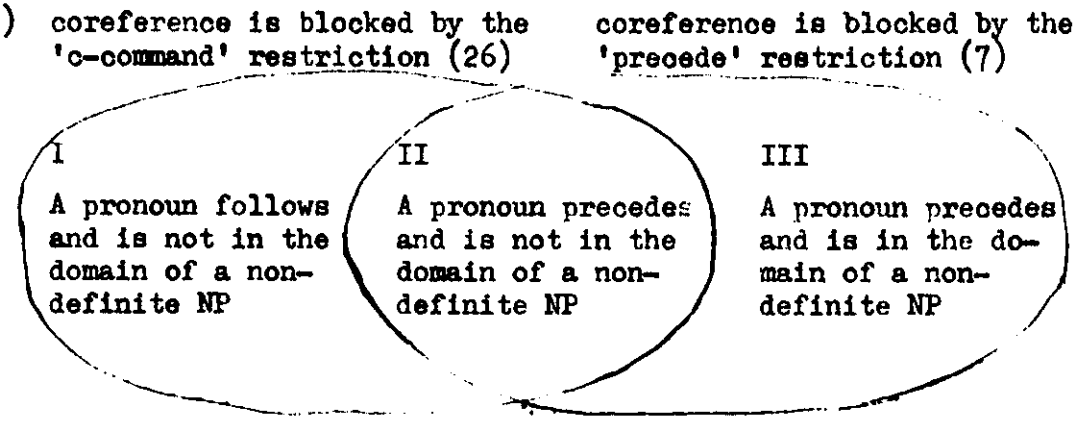
c) *Who does his mother spoil t?

Coreference in (33) is permitted for one dialect (the other dialect, which blocks it, will be discussed in Chapter 4). But no dialect permits coreference in the parallel case (34) involving a non-definite NP. For the 'precede' restriction (7), this is due to the fact that in (34), the pronoun precedes the antecedent; for the c-command restriction (26), this is due to the fact that objects do not c-command the subject, hence the pronouns in (34) are not in the domain of the non-definite NP's and no coreference is possible.

The fact that 'backwards pronominalization' is usually not permitted with non-definite NP's is, thus, a consequence of the requirement that the pronoun (or any NP) be in the domain of the non-definite NP for coreference to be possible. This consequence holds, however, only for the cases in which the NP to the left is not in the domain of the NP to the right. Although this is the common case in right-branching languages, there are several structures in which NP_1 is to the left of NP_2, but NP_1 is still in the domain of NP_2. In these constructions, the restrictions (7) and (26) will differ in their predictions. The other, and more substantial difference in the predictions of the two restrictions shows up when the non-definite NP precedes the pronoun. The 'precede' restriction (7) permits coreference in all such cases, while the c-command restriction (26) permits it only when the pronoun is, furthermore, within the domain of the

non-definite NP. Thus, the two types of cases that should be examined in evaluating the alternative restrictions are I and III of (35):

35)



The cases of type I are the crucial tests for the evaluation of the two restrictions, since, unlike cases of type III, they are very common in a right-branching language. Thus, whenever an NP in an embedded sentence precedes a pronoun of the matrix sentence we have an instance of type I. We have already seen in section 3.2 that in such cases, coreference is indeed impossible, contrary to the predictions of the restriction (7), and I shall only repeat a few examples here:

36a) *Those who know <u>a guy</u> say that <u>he</u> is dangerous.

b) *I told the nurse who expected <u>one more patient</u> that <u>he</u> will be late.

c) *Since <u>ROSA</u> never wakes up before 5:00 we never see <u>her</u>.

d) *The dog I gave to <u>ROSA</u> bit <u>her</u>.

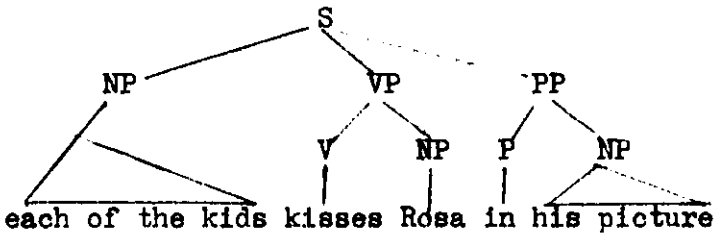
However, in all these cases, the preceding non-definite NP also does not command the pronoun, so they can still be captured by a modified version of the precede restriction which requires that the non-definite NP must both precede and command the pronoun for coreference to be possible. (Cf. footnote 7.) We should now check structures that show that it is the c-command domain, rather than the relation of 'precede-and-command,' which

determines the coreference options of non-definite NP's.

One test for the linguistic relevance of the c-command domain (and the non-relevance of the precede-and-command domain) which has been mentioned in previous chapters is the asymmetry between the relations of subjects and objects to constituents dominated by S (i.e., the S which dominates the subject). While subjects have the whole sentence in their domain, the domain of objects consists only of the VP. The same type of evidence supports the 'c-command' restriction (26): this restriction predicts that a non-definite object NP cannot have anaphoric relations with NP's outside the VP, while non-definite subjects can. Let us check this first in cases with PP's:

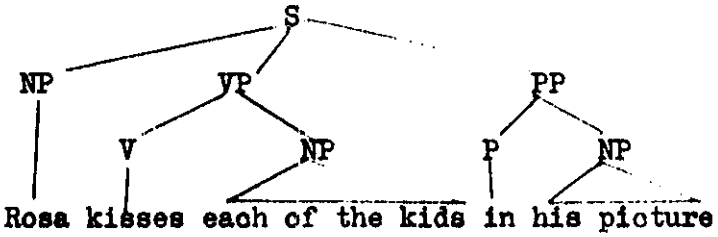
37a) Each of the kids kisses Rosa in his picture.

b)



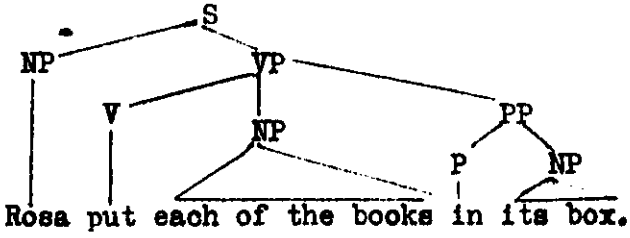
38a) *Rosa kisses each of the kids in his picture.

b)



39a) Rosa put each of the books in its box.

b)



As we saw in Chapter 2, the PP in (37) and (38) is sentential, which means that it is in the domain of the subject, but not in that of the object. Consequently, in (37), where the non-definite NP each of the kids is in the VP, it does not c-command the pronoun, or the pronoun is not in its domain, and coreference is correctly blocked by the restriction in (26). In (39), the non-definite NP is also an object, but in this case the PP is verb-phrasal, hence it is in the domain of the object and an anaphoric relation between the non-definite object NP and the pronoun in the PP is permitted by the restriction in (26). The asymmetry of subjects and objects shows up as well in (40) and (41).

40a) Anybody over 60 had to resign in order to receive his insurance.

b) *We had to fire anybody over 60 in order to pay his insurance.

c) We had to send anybody over 60 home to live on his pension.

41a) Anybody remotely connected with the assassination will be arrested in spite of his alibi.

b) *The police will arrest anybody remotely connected with the assassination in spite of his alibi.

As was mentioned in Chapter 2, in order to-clauses are always sentential. Hence, anaphoric relations are permitted only when the non-definite NP is the subject as in (40a). In (40b), coreference is blocked, since the pronoun in the in order to-clause is not in the domain of the non-definite object NP. The to-phrase in (40c), on the other hand, is verb-phrasal (arguments can be found in Williams (1974) and Faraci (1974)) hence it is in the domain of the non-definite object NP and coreference is permitted. Similarly, the in spite of phrase in (41) is sentential, hence an NP in it can be coreferential with a non-definite subject, as in (41a), but not with a

non-definite object, as in (41b).

The examples in (42) illustrate the same domain asymmetry between subjects and objects in cases involving traces and focus NP's (and see also (28) above).[8]

42a) The actress who t kissed Brando in her latest film will win the Oscar.

b) *The actress who Brando kissed t in her latest film will win the Oscar.

c) *What actress did Brando kiss t in her latest film.

43a) Who t was arrested in spite of his alibi?

b) *Who did the police arrest t in spite of his alibi?

c) *The guy who the police arrested t in spite of his alibi has filed a complaint.

44a) ROSA is kissing Ben in Max's picture of her.

b) *Ben is kissing ROSA in Max's picture of her.
/44b is intended to mean: there is some woman being kissed by Ben in Max's picture of her and that woman is Rosa./

45a) THE DOPE-DEALER was arrested in spite of his alibi

b) *The police arrested THE DOPE-DEALER in spite of his alibi.

In the (b) and (c) cases above, a trace, or a focus NP, precedes and commands the pronoun, but coreference is nevertheless blocked, since the pronoun is not in its c-command domain.

Another test for the relevance of c-command domains is provided by sentences which have undergone extraposition. We saw in Chapter 1 (section 1.6) that the coreference options of the matrix object in such sentences depend upon whether the extraposed S is attached to the VP or to the matrix S. In cases like (46a) the extraposed sentence is attached to the VP, while, in the case of resultative-clause extraposition as in (46b) or

extraposition from NP as in (46c), the extraposed sentence S_2 is attached to the matrix S.

46a) *$[_{S_1}$ It $[_{VP}$amused <u>him</u> $[_{S_2}$ that so many people wrote to <u>Brando</u>$]$$]$$]$

b) $[_{S_1}$ So many reporters $[_{VP}$called <u>him</u>$]$$]$$[_{S_2}$ that <u>Brando</u> couldn't answer them all$]$$]$

c) $[_{S_2}$ Many people $[_{VP}$hate <u>him</u>$]$$]$$[_{S_2}$ who had the chance to work with <u>Brando</u> on a film$]$$]$

Consequently, in the case of definite NP's, the general restriction on anaphora blocks coreference in (46a), where the NP in S_2 is in the domain of the object and thus must be a pronoun in order to be coreferential with the object. But it permits coreference in (46b) and (46c), since the extraposed S_2 is not in the domain of the object (being outside the VP), and thus, there are no restrictions on coreference options of the object and NP's in S_2.

In the case of non-definite NP's, the situation is reversed---'forward pronominalization' is permitted only in the structure where 'backward pronominalization' of non-focus definite NP's is blocked:

47a) $[_{S_1}$ It $[_{VP}$amused <u>BRANDO</u> $[_{S_2}$ that so many people wrote to <u>him</u>$]$$]$$]$

b) *$[_{S_1}$ So many reporters $[_{VP}$called <u>BRANDO</u>$]$$]$$[_{S_2}$ that <u>he</u> couldn't answer them all$]$$]$

c) *$[_{S_1}$ Many people $[_{VP}$hate <u>BRANDO</u>$]$$]$$[_{S_2}$ who have had a chance to work with <u>him</u> on a film$]$$]$

The domain relations of the objects and the NP's in S_2 in (47) are, of course, identical to those in (46). The restriction on non-definite

(including focus) NP's applies, thus, to precisely the same domains. However, since this restriction permits an anaphoric relation only in case the pronoun is in the domain of the non-definite NP, it blocks coreference as in (47b,c) when the object does not c-command the pronoun. In (47a), on the other hand, the pronoun is properly in the domain of the focus NP, and coreference is possible. ('Backward pronominalization' parallel to that of (46b,c) is blocked in the case of non-definite NP's, since a non-definite NP in S_2 does not c-command anything outside S_2, and hence it cannot have anaphoric relations with a pronoun outside this S.)

The same differences in coreference options depending upon the position of the extraposed sentence appear with the other cases of non-definite NP's, as illustrated in (48) and (49).

48a) It surprised <u>each candidate</u> that <u>he</u> was not elected.

b) *So many people interviewed <u>each candidate</u> that <u>he</u> couldn't remember them all.

c) *Many people interviewed <u>each candidate</u> who knew nothing whatsoever about <u>his</u> background.

49a) It surprised <u>nobody</u> that <u>he</u> wasn't elected.

b) *Many people interviewed <u>nobody</u> who had nothing to offer <u>him</u>.

50a) Who did it bother <u>t</u> most that <u>he</u> wasn't elected?

b) *The actor who so many reporters called <u>t</u> that <u>he</u> couldn't see them all is now in Paris.

c) *Which book do people recommend <u>t</u> most who know anything about <u>it</u>?

The asymmetry of subjects and objects shows up again in sentences of this type. The c-command restriction predicts that pronouns in extraposed sentences of types (b) and (c) in the sentences above (i.e., cases where

the extraposed S is attached to the matrix S) can be anaphoric to non-definite subjects of the matrix sentence, since the subject, unlike the object, does c-command the extraposed S. That this is indeed the case is illustrated in (51).

51a) Each of the candidates was interviewed by so many people that he couldn't remember them all.

b) Nobody was interviewed who didn't bring his c.v and proofs of his loyalty.

c) The actor who t received so many phone calls that he couldn't answer them all is now in Paris.

Needless to say, this asymmetry between subjects and objects cannot be accounted for in terms of the relation of precede-and-command, since by definition, anything which is commanded by the subject is also commanded by the object of the same sentence.

Sentences with preposed PP's, such as (12) and (13), repeated below in (52) and (53), provide another counterexample to the precede (and command) restrictions: in these sentences, the non-definite NP precedes (and commands) the pronoun, but no anaphoric interpretation is possible.

52a) Near Ben, you will see his gun.

b) *Near somebody in the crowd, you will see his gun.

53a) For Ben's car, I'm willing to give him two grand.

b) *For BEN's car, I'm willing to give him two grand.

The general restriction on anaphora permits anaphora in these cases, since the pronoun (being non-subject) does not c-command the full NP. However, the strict restriction on non-definite anaphora blocks coreference in the (b) cases, since the NP in the PP does not c-command the pronoun.

We have seen that there is considerable evidence supporting the

c-command restriction on non-definite anaphora in cases of type I of (35)—namely, cases where the precede (or precede-and-command) restriction permits anaphoric relations, while the c-command relation blocks them. In summary, a non-definite NP in a preposed PP cannot have anaphoric relations with any NP outside the PP, a non-definite object cannot have anaphoric relations with any NP outside the VP, while a non-definite subject can have anaphoric relations with any NP dominated by the same S that dominates the subject. These differences in coreference options follow directly from the domains defined for subjects and objects by the c-command definition of domain, and the restriction prohibiting non-definite NP's from having anaphoric relations outside their domains. We should check now the other type of non-intersecting prediction of the alternative restrictions, namely III of (35), where the c-command restriction permits 'backward anaphora,' which is prohibited by the precede (and command) restriction.

The evidence here is not as clear. The major source for a structure in which the pronoun precedes but the non-definite NP c-commands it consists of sentences in which the pronoun is in a preposed PP and the non-definite NP is the subject. However, such sentences are hard to get regardless of anaphoric relations, since, as we saw in Chapter 2, section 2.2.3, the subjects in such sentences tend to function as old information, and hence cannot easily be indefinite or focus NP's. Nevertheless, there are some cases which indicate that if such considerations can be ignored, the c-command restriction yields the right result. Consider first the sentence in (54) quoted in Carden (1976).

54) As <u>it</u> grows older, <u>each feminist group</u> is likely to become somewhat more like a traditional bureaucracy.
/Draft report to the Ford Foundation, Dec. 1975/

In (54), the pronoun is in the domain of the subject, although it precedes the subject, hence the c-command restriction permits coreference. A crucial prediction of this restriction is that if the non-definite NP were not the subject, no anaphoric relation would be possible. This is supported by examples like (55).

55a) *As it grows older, the members of each feminist group become somewhat more like traditional bureaucrats.

b) *As it grows older, we expect each feminist group to become somewhat more like a traditional bureaucracy.

In (55a), each feminist group is immediately dominated by an NP which does not dominate the as-clause; hence the pronoun is not in its domain. In (55b), it is dominated by a VP, and again the pronoun is not in its domain. Similarly, in (56a), where the pronoun is in the domain of the antecedent, an anaphoric relation is possible, but in (56b), where the pronoun is not in the domain of the potential antecedent, it is not possible.

56a) In his (own) apartment, nobody would ever put cigarettes out on the floor.

b) In his (own) apartment, you would meet nobody after 9 AM.
you would see nobody ever putting cigarettes out on the floor.

To see the same thing with focus NP's requires ranking the 'degree of badness' of inappropriate sentences: suppose we could assign the right (non-contrastive) reading to sentence (57a)—which does not involve anaphora (it should mean, then, something like: there is somebody who does the gardening on the summer estate, and it is Marcello). On this reading, anaphora is possible in (57b), but not in (57c).

57a) ?On the country estate, MARCELLO does the gardening.

b) ?On his estate, MARCELLO does the gardening.

c) *On his estate, you'll find MARCELLO doing the gardening.
I taught MARCELLO how to do the gardening.

As was mentioned in section 3.2, parallel examples with trades do not exist, since wh-movement can't apply to sentences whose COMP is filled with a preposed PP.

Although they do not provide any impressive evidence for the 'c-command' restriction (26), cases with prepositional phrases seem at least consistent with the claim that the linear order of the non-definite NP and the pronoun is not what determines their coreference options, but rather, as in the case of 'forward pronominalization,' the crucial question is whether the pronoun is in the domain of the non-definite NP. However, I should mention that there is another type of structure in which an NP to the left is c-commanded by an NP to the right, and in which the c-command restriction does not fare so well: in coordinate NP's, as in (60) and (61), the non-definite NP c-commands the pronoun in both the (a) and the (b) sentences, but anaphoric relation is nevertheless impossible in the (b) cases, where the pronoun precedes.

60a) Each of the employees and his wife will be invited to the party.

b) *His wife and each of the employees will be invited to the party.

c) ?His wife and Ben will be invited to the party.

61a) Tonight we will interview a famous actor and his producer.

b) *Tonight we will interview his producer and a famous actor.

c) ??Tonight we will interview his producer and Marlon Brando.

d) ??Tonight we will interview the man who discovered him and Marlon Brando.

There may be some special discourse constraint on coordinate constructions, which is indicated by the fact that coreference with definite NP's in (60c) and (61c,d) is also hard to get. (In (61d) the pronoun does not command the antecedent, which shows that this is not a specific problem for the c-command restriction on anaphora.) But it still seems that the (b) sentences are worse than the (c) sentences. All I can say at the moment is that coordinate constructions provide, in general, one of the rare examples where the linear order matters in natural language. (It is well-known that while the order of conjuncts in a logical formula is arbitrary, different orderings in natural language can result in a change of meaning.) It seems, therefore, not unreasonable to treat them with a special constraint.[9]

FOOTNOTES

1. On the other hand, there would obviously be also cases where anaphoric relations of the type under consideration will be blocked on semantic grounds. Thus, if the pronoun is not in the scope of the quantifier binding the variable which corresponds, in the logical form, to the non-definite NP, this pronoun cannot be interpreted as the same variable (i.e., anaphoric relation would not be possible). For this reason several of the examples which I will discuss in the following sections have also an independent semantic account. However, the restriction I will suggest is needed independently to capture the many cases which do not follow from semantic considerations.

2. In a few other cases where the examples do have parallel structures, there is disagreement on the judgment. Thus, Postal (1971) cites the following pair, judging (ib) acceptable.

i a) *The fact that <u>he</u> lost disturbed <u>a jockey</u>.

b) The fact that <u>a jockey</u> lost disturbed <u>him</u>.

Several speakers whom I consulted disagree with this judgment. A reasonable account for the difference in judgment can hardly be 'dialectical,' but has, probably, to do with the interpretation given to 'a jockey.' As was mentioned above, specific indefinites pattern with definite NP's. Those who accept coreference in (ib) can, perhaps, interpret the NP here as specific. Of course, this does not explain why there should be a difference between (ia) and (ib). I find it hard to believe that those who see a difference here interpret the NP 'a jockey' in the same way in both sentences (though I could not check this doubt, not having found such speakers).

Alternatively, there may be some reason why the NP in (1b) is more easily interpreted as specific for these speakers.

3. It is possible that for some speakers (who can distinguish degrees of badness of bad sentences) the (a) sentences are somewhat worse than the (b) sentences. This is due to the fact that the (a) sentences violate, in addition to the grammatical constraints, discourse, or pragmatic, constraints as well. If it is true that, as argued in Kuno (1972), 'backward pronominalization' is more acceptable when the pronoun refers to the 'predictable topic' (or 'old information') of the discourse, discourse conditions for 'backward pronominalization' are not met by indefinite NP's, since they cannot serve as old information, or predictable topics.

4. In judging sentences like (14) and the examples with focus to follow, it should be remembered that emphatic stress may be due to processes other than focusing. As was pointed out in Wasow (1972), coreference is possible even in the cases of (6) above, if the context indicates that the stress is contrastive, which means, that it is used to correct or contradict a previous sentence in the speech situation, rather than just to indicate new information. Whatever coreference restriction is at issue, it applies only to focus-NP's.

5. The Accessibility Hierarchy suggested by Keenan and Comrie is given in (i):

i) Subj DO IO Object of Preposition Possessive NP Object of Comparatives

NP's higher in the hierarchy can more easily be relativized or extracted.

6. In section 3.2, I mentioned that if it is established that all

linguistic rules can operate on two given nodes only in case one is in the domain of the other, the coreference rule applying to definite NP's must assign non-coreference rather than coreference. Note that the situation is reversed with the strict coreference restriction on non-definite NP's. If this restriction assigns non-coreference, it must apply to NP's not inside the domain (since it is in this case that coreference of indefinite NP's, etc., is impossible). In order to obey this general constraint on rule application, the strict coreference restriction must, therefore, assign coreference rather than non-coreference. This difference between the coreference restrictions on definite and non-definite NP's can, perhaps, gain some further justification from the difference of semantic properties involved.

7. We saw in section 3.2 that if the restriction on non-definite anaphora has to mention precede, then a more adequate formulation seems to be that of Ross (1972), which requires that the antecedent must both precede and command the pronoun, and which can be reformulated as in (ii):

ii) A non-definite NP can have anaphoric relations only NP's to its right which are commanded by it.

The restriction in (ii) has a much larger intersection with the c-command restriction in (26) than does the restriction in (7), since it blocks more cases blocked also by (26). (If the non-definite NP does not command the pronoun, it also does not c-command it--hence both (ii) and (26) will block coreference.) Nevertheless, several non-interesting predictions of (ii) and (26) support (26) over (ii), and they will be mentioned below.

8. As is often the case with bad anaphora in wh-sentences, it is much improved if the sentences are interpreted as 'quiz-show' or 'echo'

questions. Thus (42c) might be possible as a title in a Hollywood gossip column. However, the (b) and (c) cases of (42) and (43) are unacceptable as a genuine request for information. It should also be mentioned, again, that the stressed NP in (44) and (45) is not to be read contrastively.

9. Another problem for the c-command restriction arises in 'double-object' and dative constructions. Such constructions are problematic for the c-command definition of domain in general (which means that they post problems not only in the case of non-definite NP's) and they will be treated separately in Chapter 4.

Chapter 4. PROBLEMS AND MODIFICATIONS

So far, I have assumed the somewhat simplified definition of the syntactic domain of a given node, in terms of the purely formal relation of c-command, repeated in (1).

1) Node A c(onstituent)-commands node B if neither A nor B dominates the other and the first branching node which dominates A dominates B.

However, if what we are looking for is the specification of domains which have a broad linguistic relevance (which would mean that they play a role in the processing of sentences and that several, if not all, linguistic rules are restricted to apply only to nodes within the same domain), it should be obvious that English (or any human language), cannot be as simple as to operate so neatly on such purely formal domains, as defined by the relation (1). In fact, this simplified definition is not even sufficient for a full account of the syntactic restrictions on anaphora.

The definition of domain has to be modified in several ways. The first, and rather trivial, is a formal modification: the relation of c-command would be redefined in section 4.1 to be compatible with a more realistic picture of syntactic structures than that assumed so far.

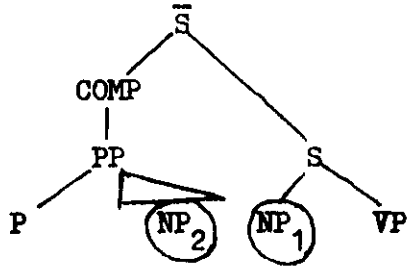
Next, we'll have to look into the domain relations inside constituents like the NP and the VP. In the preceding discussion, I have concentrated on clear-cut domains: the domain of the subject (the whole sentence), the domain of objects (the VP) and the domain of NP's in a Prepositional Phrase (the PP). However, when it comes to the internal structure of constituents, like VP's and NP's, the domain relations are not that clear-cut. In the case of possessive NP's, which will be discussed in section

4.2, a line for a systematic account of dialectal differences seems possible. A more substantial problem, however, is the analysis of domain relations of constituents inside the highest VP ($\overline{V}$), which will be discussed in section 4.3. Here we will see that a purely formal solution seems impossible at the moment, especially in view of the variety of speaker's judgments. Finally, in section 4.4, we will see how islands, or the subjacency condition, interact with the definition of domain.

4.1 A modification of 'c-command'

In the preceding discussion I have assumed simplified syntactic trees that made it possible for the definition of c-command in (1) to apply. This was the case with the internal analysis of the VP, and with the position of COMP. In fact, the relation of c-command should be defined so as to apply to trees like (2a) and (3a) (still ignoring irrelevant details).

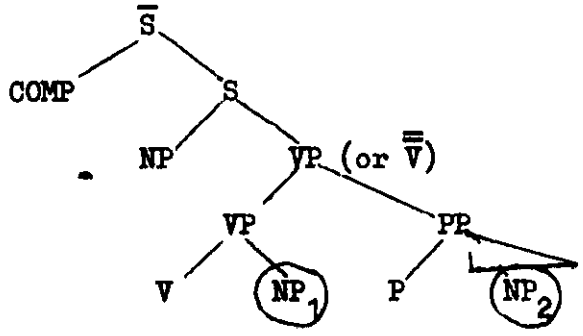
2a)



b) *In Ben's picture of Rosa, she found a scratch.

c) In Ben's picture of her, Rosa found a scratch

3a)



b) *I met <u>him</u> in <u>Ben's</u> office

c) I met <u>Ben</u> in <u>his</u> office

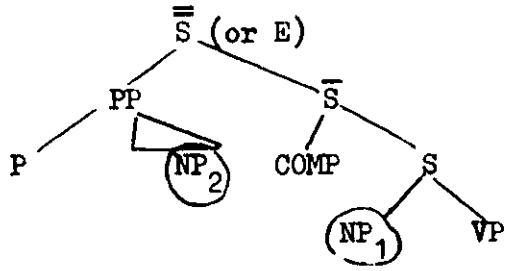
I have argued in the previous chapters that coreference in (2c) and (3c) is blocked since the pronoun c-commands the antecedent (i.e., the full NP is in the domain of the pronoun). However, this description has ignored the details of the exact position of <u>COMP</u> and of a v-phrasal PP. If we consider the more detailed trees in (2a) and (3a), by the definition in (1), NP_1 c-commands NP_2 in neither tree. The definition of c-command should, therefore, be modified so that in the situation of the type of α over α, the higher α node should be considered as determining c-command relation. The modified definition of c-command is given in (4):

4) Node A c(onstituent)-commands node B iff the first branching node α_1 dominating A either dominates B or is immediately dominated by a node α_2 which dominates B, and α_2 is of the same category type as α_1.

(<u>Category type</u> stands for the categorial content of a node (e.g., S,V) abstracted from its indexing by a bar. This assures that (4) will apply to S and $\bar{S}$; $\bar{V}$ and $\bar{\bar{V}}$, etc.) Thus, in tree (2a) the first branching node which dominates NP_1, namely S, does not dominate NP_2, however S is dominated by $\bar{S}$ which is of the same category type as S, and $\bar{S}$ does dominate NP_2, hence, by definition (4), NP_1 c-commands NP_2. The same holds for NP_1 and NP_2 in tree (3a).

In Chapter 2 we noted the difference in the position of preposed v-phrasal PP's, as in (2a), and preposed sentential PP's, which is reflected in their different coreference options. The actual tree of preposed sentential PP's is the one in (5) (in which the PP is attached to a position higher than COMP.

5a)



b) In Ben's picture of her, Rosa is riding a horse.

c) In Ben's picture of Rosa, she is riding a horse.

I have assumed that NP_2 in (5a), unlike NP_2 in (2a) is not in the domain of NP_1 (i.e., it is not c-commanded by NP_1), hence there is no restriction on the coreference options of NP_1 and NP_2 in (5a), and we can get both (5b) and (5c).

Note that the modified definition (4) captures this difference between (2a) and (5a). This definition mentions only one node (α_2 in (4)) above the first branching node dominating a given node (A). In tree (5a) the node $\overline{S}$ immediately dominating the first branching node (S) which dominates NP_1 does not dominate NP_2. The c-command domain of NP_1, therefore, includes the COMP but not the PP.[1]

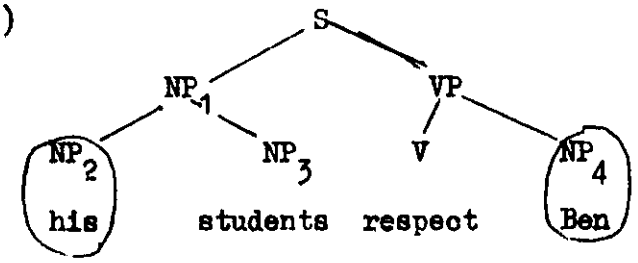
The modified definition (4), thus, enables the anaphora restrictions discussed above to apply to actual trees, rather than the simplified trees we have assumed so far.

4.2 Dialect differences in the case of NP over NP.

Coreference judgments on sentences like (6a) are known to vary with dialects (see, e.g., Lakoff (1968)).

6a) His students respect Ben.

b)

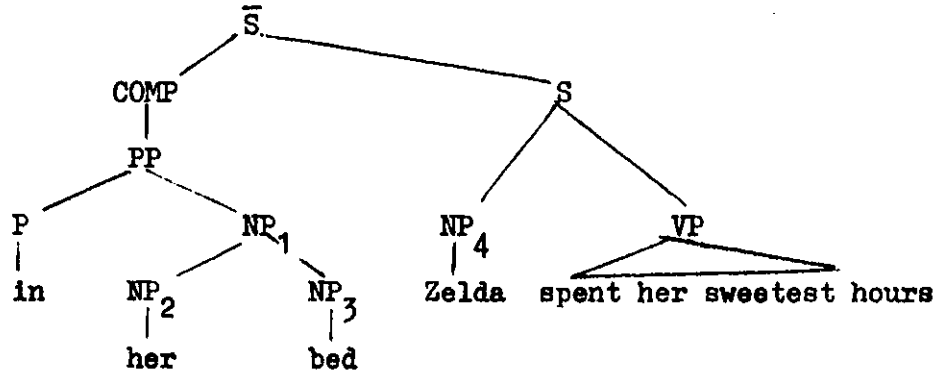


Ignoring details of the analysis of possessive NP's, the structure of (6a) is something like (6b). By any of the definitions of 'c-command' (in (1) or in (4)), the pronoun <u>his</u> does not c-command <u>Ben</u>.[2] Hence, by what has been said so far, coreference in (6a) should be permitted (since the antecedent is not in the domain of the pronoun). However, for many speakers, coreference is impossible in such structures. There seems to be a difference in the degree of independence that speakers assign to NP's inside a possessive NP, or, more generally, in the assignment of domains to such NP's. The dialect which permits coreference in (6a) considers the domain of NP_2 (in (6b)) to be only the nodes in NP_1 (namely NP_3), while the dialect which blocks coreference ignores the NP immediately dominating NP_2 and considers the domain of NP_2 to be the whole sentence (just like the domain of NP_1).

As with the other coreference facts discussed in the previous chapter, the linear order of the pronoun and the antecedent is not what accounts for this difference in dialects. That the difference at issue has to do with different assignment of domains and not with different attitudes to 'backwards pronominalization' is indicated by facts like the following: First, there is no dialect difference concerning sentences like (7a).

7a) In <u>her</u> bed, <u>Zelda</u> spent <u>her</u> sweetest hours.

b)



No dialect blocks coreference in (7a), although just as in (6a), a pronoun in a possessive NP precedes its antecedent. The reason is that the two dialects differ in the analysis of the possessive NP itself—the dialect which blocks (6a) assigns NP_2 in (6b) the same domain as the one assigned to NP_1. In (7b), the internal analysis of the possessive NP does not matter, since the domain of NP_1 is, in any case, only the PP. For one dialect, thus, the domain of NP_2 in (7b) would consist only of nodes in NP_1, while for the other, it would consist of the whole PP. NP_4 (Zelda) is not in the domain of the pronoun, under either analysis.

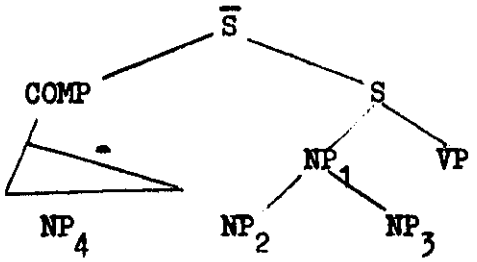
Next, the same dialect which blocks coreference in (6) blocks coreference in sentences like those in (8), where the antecedent precedes the pronoun.

8a) Ben, his students respect.

b) In Zelda's kitchen, her husband spent his sweetest hours.

c) With Zelda, her husband always felt secure.

d)



Given the modified definition of c-command in (4), the possessive NP—NP_1 in (8d)—c-commands NP_4 in the preposed constituent, but the pronoun, NP_2, does not. Hence, for the dialect that follows the formal definition (the one that permits coreference in (6)), coreference is permitted in the sentences of (8) as well. However, for the dialect which extends the domain of NP_2 to that of NP_1 (thus blocking coreference in (6)), NP_4 in (8) is in the domain of NP_2, and coreference is blocked in the same way that similar sentences with non-possessive subjects are blocked (e.g., *In Zelda's kitchen, she spent her sweetest hours).[3]

If the account suggested above is correct, and the different assignment of domains to NP's in possessive NP's is what determines dialectal differences, we should expect to find parallel differences in judgments of coreference options of non-definite NP's in possessive NP's. It will be recalled that the restriction on non-definite NP's, discussed in Chapter 3, permits them to have anaphoric relations only with pronouns in their domain. Given this restriction, it is obvious that the difference in dialect will not show up in sentences precisely parallel to (6) such as (9).

9) *His teachers respect nobody.

As we saw in Chapter 3, no dialect can permit this sentence, since the non-definite object (nobody) does not c-command the pronoun under any analysis (and hence the pronoun is not in its domain). The situation to check is the one where the non-definite NP occurs in the position of NP_2 in tree (6), as in the sentences of (10). Although judgments vary somewhat, there is a general tendency for speakers who permit coreference in (6) to block coreference in (10), while speakers who block coreference in (6) permit it in (10).

10a) Nobody's students should respect him.

b) Whose students respect him?

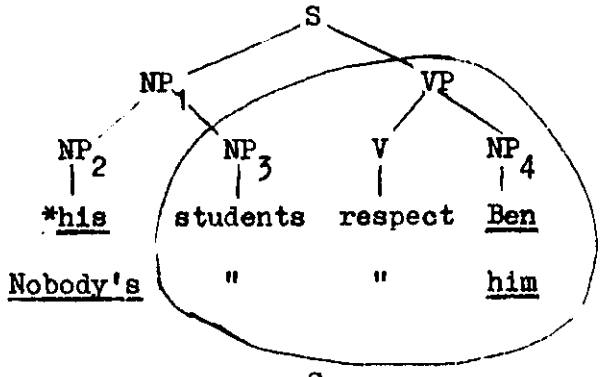
c) BEN's students respect him.

d) Anybody's friends might gossip about him.

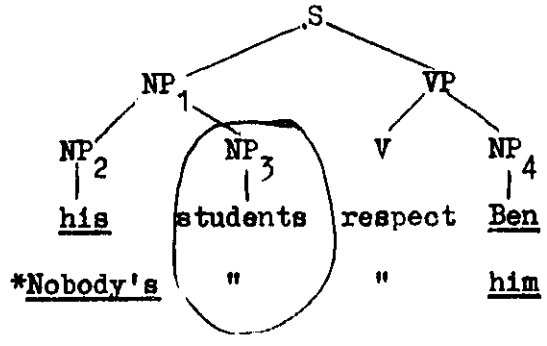
e) Someone's mother should complain about his teacher.

The restriction on non-definite NP's permits NP_4 (the pronoun in the sentences of (10)) to have anaphoric relations with a non-definite NP_2 (the non-definite NP in the sentences of (10)) only if NP_4—the pronoun—is in the domain of NP_2. NP_4 is in the domain of NP_2 for the dialect which blocks sentence (6) but not for the dialect which permits it. To make this clearer, the nodes in the domains picked by the two dialects (D_1 and D_2) for NP_2 are circled in (11):

11a) D_1:



D_2:



In D_2, NP_4 is not in the domain of NP_2, nor is NP_2 in the domain of NP_4. For this reason, there is no restriction on their coreference options if they are definite NP's. (In this dialect we can get also coreference in

Ben's students respect Ben.) On the other hand, if either of them is a non-definite NP, it cannot have anaphoric relations with the other. In D_2, the situation is reversed; since NP_4 is in the domain of NP_2, the general restriction on anaphora is violated when NP_4 is not a pronoun (for the same reason coreference in Ben's students respect Ben will be blocked in this dialect). On the other hand, the conditions for coreference of non-definite NP's are met.

Two more examples for dialectal differences in sentences that I checked (see fn. 3) are given in (12) and (13); a ± sign indicates acceptance of coreference in the given dialect and a − sign its rejection.

12) D_1 D_2

a) − + We'll send his application to Dan's boss.

b) + − We'll send nobody's application to his boss.

c) + − (We haven't done any work in so long) we should mail someone's order to him.

d) + ? We'll send BEN's application back to him.

13a) − + I told his mother about Dan's problems.

b) + − I'll tell anybody's mother about his problems

c) + − We'll tell nobody's mother about his failures

d) + ? I told BEN's mother about his problems.

The judgments marked in (12) and (13) show general tendencies. Individual "inconsistent" variations show up, especially in the judgment of coreference of non-definite NP's.[4] A full account of dialectal differences requires, of course, a much more elaborate study than I can offer. However, it does seem that, in the case of possessive NP's, a difference in the interpretation of domain relations is the major factor affecting

different judgment of coreference options, although other factors may interfere as well.

4.3 Domain relations inside the VP

Problems for the c-command restriction on anaphora arise when we consider anaphora options of NP's inside the VP. First, if indirect objects are dominated by a PP, the c-command definition of domain assigns different domains to direct and indirect objects, since, in this case, the domain of indirect objects consists of the PP alone. However, the following examples show that there is no difference in anaphora options of direct and indirect objects:

14a) *It didn't surprise her that Rosa has failed the exam.

b) *It didn't occur to her that Rosa has failed the exam.

15a) *I met him in Ben's office.

b) *I spoke to him in Ben's office.

16a) *Someone should tell her that Rosa's driving is dangerous.

b) *Someone should point out to her that Rosa's driving is dangerous.

Coreference in the (a) sentences above is blocked since the pronoun c-commands the antecedent. But coreference in the (b) sentences is just as impossible although, by the formal definition, the indirect-object pronoun does not c-command the antecedent. Note, further, that the similarity between anaphora options of direct and indirect objects is preserved when they are preposed (topicalized). Thus, coreference is equally blocked in the (a) and (b) sentences of (17) and (18).

17a) *Him, I met in Ben's office.

b) *To him, I spoke in Ben's office.

18a) *Him, Max's mother gave a book.

b) *To him, Max's mother gave a book.

19a) *Him, Don's mother found a gun near.

b) Near him, Don's mother found a gun.

The c-command restriction has no problems in blocking the (ε) sentences, where the pronoun c-commands the antecedent. It also, correctly, permits coreference in (19b), since the pronoun is dominated by a (locative) PP, and, therefore, it does not c-command the antecedent. The problem is, however, the (b) sentences in (17) and (18): If the indirect object in these sentences is dominated by a PP, the c-command restriction predicts that they should behave like the PP in (19b), and coreference should be permitted.

Facing this problem, it may be argued that indirect objects should be distinguished, syntactically, from such PP's (as locative and instrumentals), e.g., they could be dominated by an NP with a case marker, in which case, their domain relations would be identical to those of indirect objects.[5] It should be noted, however, that the problem does not arise only with NP's which are marked by the dative to as indirect objects. Consider, for example, the paradigm in (20):

20a) *We told her (the truth) about Rosa's son.

b) *We talked to her about Rosa's son.

c) ??We talked with her about Rosa's son.

d) ?We talked about her with Rosa's son.

There is some disagreement in the judgments of (20c) and (20d). For many speakers, coreference in these sentences is just as impossible as in (20a) and (20b); while some find them better than (20a) and (20b), especially if they are embedded in an appropriate context (e.g., After we talked about her with Rosa's son, we realized that {we'd better call the doctor / she should be hospitalized}). In any case, a full description of the restrictions on anaphora should account for the many speakers who block coreference in (20c) and (20d), although the NP's involved are not normally considered indirect objects (so the proposed structural solution does not hold).

If indirect objects are analyzed as governed by NP and not by PP, their anaphora options should be identical when they precede or follow the antecedent. But here, again, the situation is not so clear. In some of the sentences below 'forward pronominalization' seems indeed weird, in others (as in (21d)), it seems possible.[6]

21a) ??We talked about Rosa's son $\begin{matrix}\text{to}\\ \text{with}\end{matrix}$ her.

b) ??I spoke, in Ben's office, to him.

c) ?I referred Dr. Levin's students to him.

d) We sent Rosa's grades to her.

I will not attempt here a full survey of anaphora options inside the VP. It seems clear, however, that a fully formal account in terms of branching nodes is not sufficient to determine domain relations in this case. The generalization which is suggested is that the domain of all NP's in the VP, except those inside locative, instrumental or mannar PP's, is the whole VP. However, in many cases (which were exemplified in (20)), there would be variations in speakers' assignment of domain relations of NP's in the VP. Some will include, for example, about NP's in the class of

independent PP's (as locatives, instrumentals, etc.) while for others these would pattern with direct and indirect objects with respect to domain relations. I will leave open for further study the question whether inside the VP, linear order may play (exceptionally) a role in determining anaphora option.

In Chapter 5 I will suggest that c-command domains are the basic units of processing of sentences, and thus, they have a broad linguistic role. If this is true, it should be obvious that the formal definition of domains in terms of branching nodes is just a first approximation. It is sufficient to define clear-cut domains, like that of the subject, and that of the object, but several further specifications of which branching nodes are relevant in determining domain relations are needed to yield the full range of domain relations in the tree.

4.4 'Island' restrictions on the application of anaphora rules

In studies of anaphora, or pronominalization, it has been assumed that anaphora rules do not obey island constraints (see, e.g., Ross (1967)). This assumption is a necessary consequence of the picture of anaphora which underlies these studies. If the question at issue is when two NP's can be coreferential (or when can a transformation of pronominalization apply), it is obvious that coreference is possible across island boundaries (e.g., the books Rosa writes upset the man she lives with). However, within the framework outlined in Chapter 1, coreference is assumed to be free, except for the cases where one NP is in the domain of the other. If this is the case, the anaphora restriction applies, requiring that the one in the domain is a pronoun. This allows us to restate the question of islands. Suppose NP_2

is in the domain of NP_1, but NP_2 is in an island, does the anaphora restriction still apply to require that NP_2 be a pronoun? If it does, this means that the anaphora restriction does not, indeed, obey island constraints. However, we will see now that (except for cases where NP_1 is the subject and NP_2 is in the VP) coreference in such cases is free, which means that the restriction on anaphora does not apply to such structures, or that it obeys, at least partially, island constraints.

I will consider here only cases of complex NP islands (the situation is less clear with the other types). Within the framework of Chomsky (1973) this type of island constraint is captured by the subjacency condition which states, roughly, that linguistic rules cannot operate on two given nodes if there is more than one cyclic node which dominates the one but not the other. And the relevant NP nodes in these cases are considered cyclic nodes.

Consider first sentences with preposed constituents: The subjects in 21 and 22 c-command the NP in the preposed constituent. Still coreference is blocked only in the (a) sentences, but not in the (b) sentences, where the NP in the preposed constituent is in an island (is not subjacent to the subject).

22a) *In Zelda's bed, she spent her sweetest hours.

b) In the bed which Zelda stole from the Salvation Army, she spent her sweetest hours.

23a) *Sonya's cookies, she sent to the contest.

b) The cookies which Sonya baked, she sent to the contest.

In section 2.2.4 we have seen that coreference options of sentences like (22a) are often improved when the PP is lengthened, since in these

cases it can be more easily interpreted as a sentential PP. However, as we have seen there, when the PP must be interpreted as verb-phrasal, as in the sentences of (24) and (25), lengthening does not change coreference options, and coreference is still impossible in (24b) and (25b).

24a) *With Zelda's feather, she tickled Dr. Levin.

b) *With Zelda's most magnificent peacock feather, she tickled Dr. Levin.

c) With the feather that Zelda inherited from her late peacock, she tickled Dr. Levin.

25a) *In Ben's box, he put his cigars.

b) *In Ben's most precious Chinese box, he put his cigars.

c) In the ivory box that Ben brought from China, he put his cigars.

In (24c) and (25c), on the other hand, where the antecedent is in a complex NP island, the restriction on anaphora does not apply, and coreference is permitted. These examples indicate that the phenomenon at issue is of different order than the one discussed in section 2.2.4. It does not have to do with the length of the PP or its interpretation, but explicitly with the fact that islands (or the subjacency condition) are involved.

As with the other cases which were discussed in the previous chapters, the linear order of the antecedent and the pronoun plays no role in determining coreference options of NP's in complex NP islands. In the (b) cases below the pronoun precedes the antecedent, but, since the antecedent is not subjacent to the pronoun, the restriction on anaphora, which blocks coreference in the (a) cases, does not block it in the (b) cases.

26a) *After days of search, they finally found him in Dr. Levin's hotel room.

b) After days of search, they finally found him in a sleazy

hotel room that Dr. Levin had rented under a false name.

28a) *Zelda sent him back all Dr. Levin's flowers.

b) Zelda sent him back all the flowers which Dr. Levin had bought for her.

29a) *Society has always granted her Zelda's wishes.

b) Society has always granted her everything Zelda ever wanted.

As we have seen in section 1.4, non-obligatory backwards pronominalization is not always natural and it may depend on the context of the utterance. One way to check whether a given 'pronominalization' arrangement is impossible or is just discourse dependent, is to embed it in a context like that in (30) and (31). We see that the (b) sentences, but not the (a) sentences of (28) and (29) are improved in such contexts:

30) Since Zelda has been sending him back
a) *all Dr. Levin's flowers
b) all the flowers Dr. Levin buys for her
I can't understand why he keeps sending her new flowers.

31) Since society has always granted her
a) *Zelda's wishes
b) everything Zelda ever wanted
no wonder she's spoiled.

The following examples illustrate the same island phenomenon with subjects and sentential PP's in final position.

32) She finally had to give up the bed, since
a) *Zelda's apartment
b) the apartment Zelda moved to
was too small.

33) He was considered divine in
a) *the Maharaj Ji's home town.
b) all the towns the Maharaj Ji visited.

34) He finally divorced Sonya, since
a) *Hirschel's favorite dish
b) the dish Hirschel liked most of all
was the only one she didn't know how to cook.

Let us consider now another type of cases where the c-command restriction on anaphora does not apply. The examples in (35)-(36) seem to have identical domain relations, but coreference, which is blocked in the (a) sentences, is permitted in the (b) sentences.

35a) *With Zelda's feather she tickled Dr. Levin.

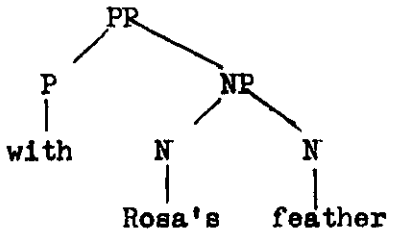
b) With which (one) of Zelda's feathers did she tickle Dr. Levin?

36a) *Sonya's recipes, she sent to the contest.

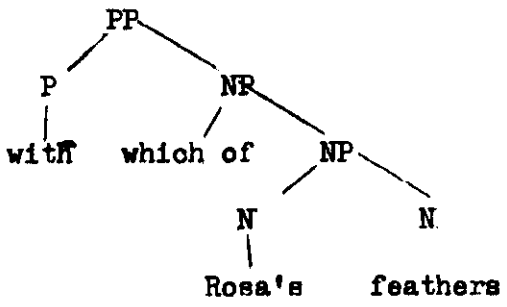
b) Which of Sonya's recipes did she send to the contest?

However, the preposed constituents in these sentences differ internally: while in the (a) sentences they consist of only one cyclic NP, as in (37), partitive NP's (e.g. Which of Rosa's feathers, many of the boys, three of his children) are analyzed as in (some equivalent of) (38), which consists of two cyclic NP's (for a review of this analysis see Selkirk (1976)). I ignore here many important details in the trees.

37) The preposed PP in (35a):



38) The preposed PP in (35b):



This means that while in the (a) sentences of (35) and (36) the NP in the preposed constituent is subjacent to the subject, in the (b) sentences it is not (since it is dominated by two cyclic NP nodes which do not dominate the subject). The fact that coreference is permitted in the (b) sentences indicates, therefore, that the anaphora rule obeys the subjacency condition (i.e. it does not apply to non-subjacent nodes).[7]

There is, however, one type of structure where the anaphora rule does not obey the subjacency condition (namely it applies into complex NP islands): If NP_1 is the subject and NP_2 is in the VP, NP_2 must be a pronoun for coreference to hold, even if it is in an island. While a pronoun subject can be coreferential with a non-subjacent full NP in a sentential PP, as in (32)-(34), it cannot be coreferential with non-subjacent NP's inside the VP, as illustrated in (39)-(41).

39) *After days of search, he was finally found in a sleazy hotel room that Dr. Levin had rented under a false name.

40) *She spent her sweetest hours
in Zelda's bed.
in the bed Zelda stole from the Salvation Army.

41) *He denied that the flowers which Dr. Levin sent had been returned.

At the moment I do not know what accounts for this difference between the relation of the subject and the VP and other domain relations in the sentence. We may hope, however, that fuller understanding of the role that both the c-command domain and the subjacency condition play in the processing of sentences would explain also this particular type of their interaction in the case of the restrictions on anaphora.

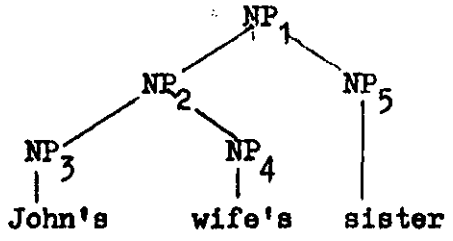
FOOTNOTES

1. This is a somewhat mechanical solution. A more intuitive way to describe the limits of the expansion of the relation of c-command could be to state that the c-command domain of a node dominated by S cannot expand beyond the comp of this S. As we saw in Chapter 2, it is possible that the PP in (5a) is dominated by E, rather than $\overline{S}$, in which case, since E is not of the same category type, the problem does not arise. In any case, whatever the intuitive account for the difference in the c-command relation in (2a) and (5a) may be, the definition in (4) captures all the cases, since there is no case where the c-command domain of a node expands more than one node above the first branching node dominating it.

2. The modification of the c-command relation in (4) does not apply to the structure in (6b), since the first branching node dominating NP_2 is dominated by a node of a different category (namely S). The modification in (4) permits, for example, NP_3 in (ib) to c-command NP_5 (while by the definition in (1) NP_3 c-commands only NP_4),

ia) John's wife's sister

b)



but it does not permit NP_2 (his) of (6b) to c-command the VP.

3. The facts in this section are drawn from a survey of about 30 sentences with possessive NP's with 7 (linguist) speakers. Two of them had the dialect which permits coreference in (6). Among the five who blocked

such coreference there was some variation in the judgement of sentences with topicalization as in (8a), but the tendency was to block them.

4. The largest variation of judgements shows up in the case of focus NP's. A reason for this may be the fact that it is hard to distinguish between the intonation that takes the whole NP_1 (e.g. Ben's students) as a focus from that which takes only NP_2 (Ben) as a focus. In other words, a sentence like (ii) with focus intonation on Ben can be interpreted either as in (iiia) or as in (iiib). Only in the reading (iiia) are dialect differences to be expected.

ii) BEN's student respects him.

iiia) The person x such that x's student respects x is Ben.

b) The person x such that x respects Ben is Ben's student.

5. A possible argument for this proposal is the fact that the indirect object marker to cannot have an independent stress while locative prepositions can. Thus, in (i) the normal intonation would put the stress on near, while this is impossible in (ii).

i) Near him, Rosa found a book.

ii) #To him, Rosa gave a book.

On the other hand, if this solution is adopted, a substantial problem to be solved is the fact that, in English, unlike in the languages with clearer case marking, the to marker can be left behind while the indirect object is preposed, as in (iiib).

iiia) To Bill, Rosa gave a book.

b) Bill, Rosa gave a book to.

6. I should mention here that in Hebrew, where the pronoun is

morphologically incorporated into the preposition (or the case marker), the linear order plays indeed no role in these cases. Even in sentences like (20d) which seem acceptable in English, forward pronominalization, as in (i), and backward pronominalization, as in (ii), are equally bad in Hebrew:

i) *šalaxnu la et haciunim šel Rosa.
We sent to her acc the grades of Rosa.

ii) *šalaxnu et haciunim šel Rosa la.
We sent acc the grades of Rosa to her.

7. Selkirk's (1976) analysis of the internal structure of NP's opens the way to account for another coreference mystery. Compare (35a) and (36a), repeated in the (a) sentences below, to the (b) sentences.

ia) With which of Zelda's feathers did she tickle Dr. Levin?

b) *With which feather of Zelda did she tickle Dr. Levin?

iia) Which of Sonya's recipes did she send to the contest?

b) *Which recipes of Sonya did she send to the contest?

Selkirk argues that NP's of the type of the (a) sentences differ structurally from those in the (b) sentences. The second, which she calls simple NP, contains only one cyclic node (the one dominating which). If her analysis is correct, the antecedent in the (b) sentences is still subjacent to the pronoun, so the anaphora rule applies to block coreference.

Chapter 5. THE LINGUISTIC SIGNIFICANCE OF THE C-COMMAND DOMAIN

In the previous chapters I argued that the basic restrictions on anaphora are statable in terms of purely structural domain-relations (although discourse, or pragmatic, considerations may impose further restrictions and select the grammatical option which is most appropriate to a given speech-situation). In section 5.1 we will see, further, that these restrictions must (and not only can) be stated in structural terms, and despite the large correlation between semantic relations and anaphora options, anaphora restrictions cannot apply directly to semantic representations.

The questions which remain to be answered are, then, first why do anaphora rules obey this structural restriction, or why do they operate within c-command domains? and, next, if anaphora restrictions must apply directly to syntactic trees, what accounts for the correlations we observed between anaphora options and semantic relations? In sections 5.2 and 5.3 I will suggest that anaphora restrictions operate within c-command domains since these domains are the basic units of the processing of sentences and, thus, they are the domains for the operation of major syntactic and semantic rules. This means that correspondence-rules which determine relative scope, function-argument relations and theme-rheme relations apply to the same domains as the rules of anaphora, and, furthermore, they assign 'prominence' to heads of these domains. Consequently, although each of these rules applies independently to syntactic representations, there would be large intersections in their application.

5.1 Semantically based accounts of coreference.

There are certain alternative approaches to coreference which I have

ignored so far. For these approaches, the failure of the precede-and-command restriction on anaphora (as well as independent beliefs about the nature of language) indicate that coreference should be determined on the basis of semantic (or discourse) properties of sentences and not on the basis of their syntactic structures.

We have noted earlier (primarily in Chapter 2) that there are indeed some striking correlations between coreference options and other semantic properties of sentences. Therefore, before we proceed to ask why coreference restrictions operate within c-command domains, it is reasonable to ask whether it is possible that, in fact, they do not, and the applicability of the c-command restriction is either accidental or is due to other correlations between syntactic domains and semantic representations.

I will discuss here two possible semantic approaches to coreference and show that they cannot hold, and that despite the correlation between semantic properties and coreference facts the coreference restriction must, nevertheless, apply to syntactic trees.

5.1.1 Functional (theme-rheme) approaches. Hinds (1973) suggests that the principle in (1) governs generally the acceptability of pronominalization:

1) (Hinds (1973), (33))

> A function of pronominalization is to indicate that the referent of the pronoun is marked as thematic material.

Combined with the assumption that "all grammatical devices used in a single sentence must be compatible in terms of these functions..." (ibid. (40)), the generalization in (1) predicts, for example, that if a certain transformation results in marking a given NP as the Rheme, this NP cannot be a pronoun. The awkwardness of "forward pronominalization" in sentences like (2b) (which Kuno

(1972) has attributed to a conflict in point of view) is due, according to Hinds, to the fact that the Passive transformation marks the matrix Ben as Rheme, but the pronominalization marks it as theme.

2a) That he would be a candidate was announced by McIntosh yesterday

b) That McIntosh would be a candidate was announced by him yesterday

Although the generalization in (1) may seem commonsensical (since pronouns tend to be introduced in the discourse when the referent is already known) it is nevertheless incorrect when intra-sentential coreference options are considered. The most acknowledged thematic element in the sentence—the subject—can never be a pronoun coreferential with any other non-pronoun in the sentence. Thus, basic facts like those in (3) violate Hinds principle in two ways: In the grammatical sentence (3a) the pronoun is part of the rheme, and not the theme of the sentence. Furthermore, if the function of pronominalization is to mark the theme, the matrix subject should be a pronoun, as in (3b).

3a) Ben said that Rosa likes him

b) *He said that Rosa likes Ben

Hinds does not suggest that the principle in (1) alone determines coreference options and he also assumes the rules of precede-and-command, but it is still unreasonable to adopt as a general rule, a principle which would be systematically violated in the most common cases (due to the operation of other linguistic rules). While it is often true for a discourse that a pronoun would be introduced only when the referent is somehow known, if there is any potential functional explanation for intra-sentential coreference restrictions, it goes in the opposite direction from Hinds' principle: A major function of

'pronominalization' within a sentence is to indicate that the pronoun is not the topic (theme) of the sentence. (More precisely, that it is not in topic position, since, obviously, if the pronoun is coreferential with the topic, its referent is the topic of the statement expressed by the sentence.)[1]

Although no existing functional treatment of coreference has stated this last principle precisely in this way, two proposals, that of Bickerton (1975) and Kuno (1973, 1975) follow it essentially.

Bickerton's principle states that pronominalization flows from presupposed NP's to NP's in the asserted part of the sentence (but not conversely), and it can go either way when the two NP's are presupposed. This means that coreference is impossible when the topic (or, the presupposed NP in Bickerton's framework) is the pronoun and the non-pronoun is (part of) the rheme (which, in Bickerton's framework, is the asserted NP). But otherwise coreference is free. Kuno's relevant restriction is that the predictable topic (i.e., a sentence topic which is also a discourse topic) can not be pronominalized intra-sententially.

Both writers are aware that these restrictions alone cannot account for all coreference facts. Kuno assumes in addition, the syntactic restrictions of precede-and-command (along with several other discourse restrictions). Bickerton, on the other hand, claims that syntax plays no role in determining coreference options, and he adds further conditions stated in terms of assertion and presupposition.[2]

I will show first that, in the light of several facts that were observed in the previous chapters, Kuno and Bickerton's restrictions capture even more than these authors assumed. Then I will argue that the coreference restriction must, nevertheless, refer directly to syntactic structure and cannot be

stated in semantic (theme-rheme) terms.

The restriction that seems most properly stated is the one given by Kuno (eliminating his distinction between predictable and unpredictable themes). Let us assume (unlike Kuno) that coreference is free except for cases where a noun in topic position has been pronominalized intra-sententially. The way the restriction works is illustrated in (4).

4a) *She wears the dress that Rosa's mother bought

b) Her mother wears the dress that Rosa bought

c) The dress she bought is too big for Rosa

d) With her new dress on, Rosa did the dishes

In the acceptable sentences (b)-(d), the pronoun is not the topic (although it may be a part of the topic NP). But in (4a), where the pronoun is the topic, coreference is correctly blocked. The restriction on topic pronominalization can, furthermore, account for the problematic cases in (5) and (6).

5a) In Ben's picture of her, Rosa found a scratch

b) *In Ben's picture of Rosa, she found a scratch

6a) In Ben's picture of her, Rosa is riding a horse

b) In Ben's picture of Rosa, she is riding a horse

We saw in Chapter 2 that the sentences in (5) and (6) differ in their theme-rheme relations. (I will not repeat the arguments here; see section 2.2.3.) The subject in sentences with proposed verb-phrasal PP's, as in (5), is still the topic. The restriction on topic pronominalization therefore, blocks the subject from being a pronoun, as in (5b). (The whole NP in the PP is also a topic. However, her in (5a) is only part of the topic, and not a topic in itself. Hence the restriction permits it to be a pronoun.) In

the case of preposed sentential PP's, on the other hand, the subject is not a topic for the whole S, hence the restriction on topics does not apply to it, and both (6a) and (6b) are possible.

However, it is easy to see that the restriction, as stated, has very little to say about NP's which are not subjects, since these NP's are normally not the topics of their sentences. What blocks, then, coreference in (7)?

7a) *Rosa locked <u>him</u> in <u>Ben</u>'s room

b) *I told <u>him</u> that <u>Dan</u> is crazy

An answer will have to examine the relative information status of the two NP's. Thus, although the objects in (7) are not strictly the topics of their sentences, the information they represent is still older, relative to that represented in the PP, or in the embedded <u>that</u> clause.[3] Here we are already reaching an area that is not fully formalizable. However, we could think of an intuitive notion of 'topic of a phrase' (rather than 'topic of the sentence') which would stand for the NP which represents old information in its phrase (i.e., old relative to the phrase). Given this notion, we can formulate the restriction on topic pronominalization as in (8).

8) The topic (theme) of a given phrase cannot be 'pronominalized' within the phrase (or: coreference is impossible between the topic of a given phrase and non-pronouns within the same phrase).

The principle in (9) correctly blocks coreference in the sentences of (7) (where the topic of the VP is 'pronominalized' within the VP). Furthermore it captures the difference between (7a) and (9).

9) Rosa is kissing <u>him</u> passionately in <u>Ben</u>'s picture

Regardless of whether the object <u>him</u> in (9) is considered 'topic of the VP,' the full NP <u>Ben</u> is not within the same phrase (namely the VP) since it is in

a sentential PP, so coreference is not blocked by (8).

It takes little effort to see that (the parenthesized version of) the principle in (8) is simply a translation of the c-command restriction on anaphora into functional (theme-rheme) terms. What it basically states is that the head NP of a domain cannot be coreferential with non-pronouns in its domain, assuming further that the head of the domain is the topic of this domain. The point, however, is that if such a translation is possible, it may be argued that the coreference restriction does not apply at all to syntactic structures--rather, all we have to know for given pairs of NP's, is which of them represent relatively 'older' information, and then we block coreference in case the 'older' one is 'pronominalized' by the other. This, in fact, is precisely Bickerton's view on coreference (although the details of my formulation and his differ).

However, despite the correlation between functional relations and domain relations the coreference restriction cannot apply directly to semantic structures (which include theme-rheme information). The major reason for this is that the correlation between functional (theme-rheme) and grammatical relations is only a matter of tendency, while some basic coreference facts are clear-cut, and do not vary with discourses. The functional relations in the sentence may change radically with intonation. So, although subjects are usually topics, with proper intonation, they can easily be foci. For example, the stressed Rosa in (10) is the focus, and not the topic, as indicated by the appropriate question-answer sequence, in (11).

10) ROSA suggested that we invite her brother

11a) Did ROSA suggest that we invite her brother?

b) No, MAX did.

12) *SHE suggested that we invite Rosa's brother

Since the subject in (10) is not the topic the restriction in (8) does not apply and the pronominalization order of (12) should be possible here, which of course it is not.[4] Similarly, no intonation would permit coreference in sentences like those in (7) (*Rosa locked him in Ben's room, *I told him that Dan is crazy) although the pronouns in these sentences can easily function as foci (rather than as topics of their phrases).

I should add that even among cases of normal intonation, where there is usually a correlation between the thematic function and the position in the syntactic tree, we can find certain sentence structures that indicate that the coreference restriction applies to the syntactic tree and not directly to the semantic representation. The prediction made by (8) is that if there are two topics in a given phrase, no coreference is possible in any order of 'pronominalization.' This prediction is supported by sentences like (13), which, as we saw in Chapter 2, involve two topics.

13a) *Her, Zelda says that Zalman would give his life for

b) *Zelda, she says that Zalman would give his life for

14a) *For Zelda, she says that Zalman would give his life

b) For her, Zelda says that Zalman would give his life

15) Near him, Dan keeps his gun

However, precisely the same topichood relations hold also in (14) and (15) (i.e., the NP in the preposed PP as well as the subject are topics). Nevertheless, coreference in (14b) and in (16) is possible in violation of the principle in (8). In terms of c-command domains this difference between (13) and (14)-(15) is due to the fact that although the NP in the PP is a topic, its syntactic domain still does not extend beyond the PP since it does

not c-command anything else in the sentence. (The subjects in (14) and (15) on the other hand, do c-command the PP, which means that the PP is in their domain, hence coreference in (14a) is still blocked.)

In summary, then, the large correlation between the predictions of the syntactic restriction on anaphora and those of functional restrictions like (8) is due to the fact that usually there is a correlation between domain relations and functional (theme-rheme) relations. However, the fact that when there is a discrepancy between domain relations and functional relations, coreference options follow the syntactic requirements indicates that coreference restrictions apply directly to syntactic trees.

5.1.2 Logically based accounts.

A different approach to a semantically based analysis of coreference was offered in Keenan (1974). He suggested an outline for a theory in which coreference options of NP's (as well as quantifier-scope of NP's) are determined on the basis of the logical (i.e., function-argument) structures of their sentences. The major part of the general principle he suggests is given in (16). (The use of the term 'functional' here is different from the one mentioned in the previous section. It means simply that the principle applies to function-argument expressions.)

16) The Functional Principle

i) The reference of the argument expression (in a function-argument expression) must be determinable independently of the meaning or reference of the function symbol. (Keenan (1974), §1)

From (the full formulation of) the Functional Principle it follows that if there are any dependency relations between expressions in argument position and expressions in the function position the latter may depend upon the

former, but not conversely. Two examples of dependency relations are 'pronominalization' and relative scope: Pronouns may be viewed as dependent upon their antecedents for determining their reference, and somewhat similarly, when a quantified NP, α, is in the scope of a quantified NP, β, α depends on β but not conversely. (The concept of dependency here will be clearer in the discussion of sentence (21).) Hence, the restrictions on pronominalization and on relative scope, which are stated in (17) and (18) respectively, follow from the Functional Principle in (16).

17) NP's in function symbols cannot control the pronominalization of their arguments (Keenan (1974; §3.1)).

18) Quantified NP's in argument position generally have wider logical scope than NP's in the function symbol (ibid., §3.2).

(Within a non-transformation approach to coreference, a rule equivalent to (17) will block coreference in semantic representations where the pronoun is in an argument position and the full NP is in the function expression.)

Since the restrictions in (17) and (18) operate on semantic (logical) representation their application depends crucially upon the precise assignment of function-argument analyses to sentences of natural language. Keenan argues that in basic (simplex) sentences like Ben hit Rosa the subject occupies the argument position and the VP (hit Rosa) is the function symbol. Given this analysis the restriction on coreference in (17) will block coreference in (19b) (where the argument is a pronoun) but not in (19a).

19a) (Ben)(hit himself)

b) *(He/himself)(hit Ben)

This analysis can be extended to more complex sentences as in (20), where the that clause, which is in the VP, is part of the function expression.

Hence (20b), in which the argument is a pronoun, violates the requirement in (17).

20a) (Rosa)(denied that she hit Ben)

b) *(She)(denied that Rosa hit Ben)

When scope assignment applied to semantic representations of this type the principle in (18) will assign sentence (21a) the quantified structure in (21b)--namely it would give wider scope to the universal quantifier.

21a) (Every girl)(kissed some boy)

b) $(\forall x)(\exists y)$(kissed (x,y))

(The interpretation of 'wider scope' means that in the interpretation of (21a) the choice of a girl is independent of the choice of a boy, while the choice of a boy may depend on the choice of girl.)

Another example of the constructions which Keenan discusses is that of possessive NP's. He suggests that in many types of such constructions the 'possessor' NP (e.g., John in (22a) is the argument expression and the other NP (e.g., analysis of himself) represents a function (from NP's to NP's syntactically speaking). Consequently the principle in (17) permits coreference in (22a) but blocks it in (22b), where the argument expression is a pronoun.

22a) (John's)(analysis of himself)

b) *(his)(analysis of John)

Examples like Every country's president attended the meeting illustrate that the scope rule in (18) applies correctly to these structures assigning wider scope to every (rather than the reading in which there is a president such that he is the president of every country and he attended).

Accepting Keenan's proposals concerning the logical analysis of sentences[5] it may seem that independently motivated semantic considerations determine coreference options, and that the coreference rule may apply directly to logical representations (function-argument expressions) and need not refer to syntactic relations at all. Keenan himself does not make this strong claim. He argues only that coreference facts in natural languages would not violate the Functional Principle (16), though independent syntactic constraints are needed to yield the full range of coreference facts. However, since the strong claim that coreference is determined on the basis of logical structure could have, in principle, been made (imposing additional semantic conditions to account for residual facts), I will show first that this claim cannot be correct. Next, we will see that even the weaker claim does not always hold.

First, precisely the same argument directed toward the theme-rheme approach to coreference can be directed against a logically based account. Since intonation may change the presupposition structure of a sentence it does (at least within certain theories of presupposition) change its logical structure. Thus, if the subject of a sentence like Ben hit Rosa receives Focus intonation, its logical structure is more like that of The one who hit Rosa is Ben, in which Ben is part of the predicate (i.e., the function expression) rather than the argument. Consequently the Functional Principle cannot block coreference in sentences like HE hit Ben or HE hit Ben's father.

Here again, the fact that when there is a discrepancy between the logical form and the syntactic structure coreference follows the syntactic restriction indicates that, in principle, coreference restrictions cannot

apply directly to logical representation.

The next argument is more specific: We will see that coreference facts and relative scope facts cannot both be captured by the Functional Principle on the basis of logical structures. The stronger extention of Keenan's analysis predicts that there should be a one-to-one correlation between coreference facts and relative scope since both are determined by (derivative of) the more general Functional Principle. Consequently, if a given sentence structure permits scope ambiguity, which must mean within this framework that either it is ambiguous with respect to function-argument assignment, or that both quantified NP's are in argument positions in the logical structure so that their scope assignment may be free, this sentence-structure should permit also two pronominalization arrangements. The following examples indicate that this correlation does not hold as a rule.[6] Sentence (23a) is ambiguous with respect to scope. However, the corresponding sentence with non-quantified NP's permits only one 'pronominalization' arrangement, namely the one in (23b).

23a) Everyone's letters/gifts to some senator are kept in the bank-safe

b) Ben's letters/gifts to himself are kept in the bank-safe

c) *his letters/gifts to Ben are kept in the bank-safe

In Chapter 2 we saw other examples of scope ambiguities. Thus, quantified NP's in sentential PP's can have either wider or narrower scope over quantified subjects, as in (24):

24) Someone looks unhappy in everyone's picture

Whatever logical analysis would capture this ambiguity, if Keenan's Functional Principle is the one which determines coreference options it

predicts (assuming the stronger claim) that coreference too could go both ways (since within this framework, for the scope ambiguity to be possible, there must be at least one logical analysis for sentences like (24) in which the subject is not the argument expression of a function expression which contains the NP in the PP). This, however, is not the case. Although a quantified subject can have narrow scope, it cannot be a pronoun (as in (25b) and the only 'pronominalization' arrangement possible is the one in (25a).

25a) Ben looks unhappy in his pictures

b) *He looks unhappy in Ben's pictures

Examples like those in (23)-(26) indicate that the rules of coreference and scope assignment cannot both apply directly to logical structures (or that Keenan's Functional Principle cannot yield both), which means that at least one of these rules must apply to syntactic structures, and the major advantage of having a unified explanation for 'dependency' relations is lost.

I+ should be noted, further, that even the weaker claim that coreference facts in natural language do not violate the Functional Principle (16) cannot be fully defended. As Keenan notes, the coreference principle in (17) applies clearly only when the NP in question is the full argument, and not when it is just a part of the argument. This should mean that (17) must be rephrased so that it explicitly applies only in those cases, permitting, thus, coreference in (26).

26) (The teacher he liked)(gave Dan an A)

Stated this way, the coreference principle (17) would never, indeed, be violated (and we may note further, that it applies, in this case, only

to heads of c-command domains). However, this modification itself violates the Functional Principle. As stated in (16), this principle requires that the reference of the argument must be determinable independently of the reference of nouns in the function expressions. This principle is violated by (26), since in this sentence the reference of the argument expression, the teacher he liked, cannot be determined fully independently of the reference of Dan in the function-expression.

This means, therefore, that the Functional Principle is observed only in the cases where it intersects with the independent restrictions on anaphora (Namely, when a given NP happens to be both the node corresponding to the argument in the logical form and a head of a c-command domain in the tree). As we will see in section 5.2.4, the existence of such intersections is not accidental, but is due to the fact that function-argument relations are determined, like anaphora options, on the basis of c-command domains. In any case, it is clear that anaphora options in a given sentence are independent of the logical (function-argument) interpretation given to this sentence, and cannot be derived from, or explained by logical principles.

5.2 The Minimal Domain Hypothesis (MDH)[7]

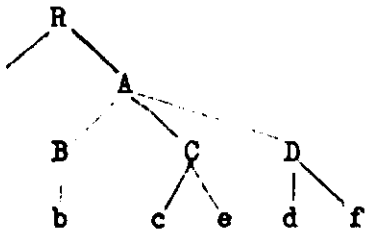
We saw that the restrictions on anaphora apply to two given NP's only in case one is in the domain of the other. If the domains defined by c-command have broad linguistic relevance (rather than being ad hoc restrictions on the operation of anaphora rules). This should mean, first, that the restrictions on anaphora reflect a more general restriction on linguistic rules, namely, that many other linguistic rules operate only within the

same domains, and second, that there should be some reason why this is the case. In this section I will outline some evidence that the first assumption may indeed be true. And in section 5.3 I will attempt an explanation as to why it is so.

5.2.1 The hypothesis

Let us first make more explicit what it means for a rule to operate within a c-command domain. It will be recalled that the domain of a node α was defined (in Chapter 1) as the subtree dominated by the first branching node dominating α (i.e., as α together with all the nodes c-commanded by it). Thus in tree (27) the domain of b is the subtree dominated by A; the domain of C is the same subtree, but the domain of c is only the subtree dominated by C, etc.

27)



In effect, as we have seen, the c-command definition determines the minimal branching constituent of a given node. In tree (27) the minimal branching constituent of which b is a member is the whole subtree dominated by A, while the minimal branching constituent of which c is a member is only the subtree dominated by C, etc. A related notion which was implicit throughout the earlier discussion, but was not formally introduced was that of two nodes 'being within a (same) minimal domain.' This relation is defined in (28).

28) Two nodes, α and β, are within a minimal domain iff either α is in the domain of β, or β is in the domain of α (or both).

Thus, in tree (27) the domain of node c is only C. However c and b are still within a minimal domain since c is in the domain of b. c and d, on the other hand, are not within a minimal domain, since neither of these nodes is in the domain of the other (i.e., neither c-commands the other).

Saying that a given linguistic rule is restricted to operate within a c-command domain is to say that the rule applies only to nodes which are within a minimal domain. E.g., such a rule cannot apply to c and d in tree (27). In the case of the anaphora rules we have discussed, if the two NP's are not within a minimal domain (i.e., neither is in the domain of the other) no coreference restrictions apply. The generalization of this restriction to all major linguistic rules is given below as the Minimal Domain Hypothesis.

29) THE MINIMAL DOMAIN HYPOTHESIS (MDH)

Major linguistic rules may operate on two nodes α and β only if α and β are within a minimal domain.

In the case of the coreference rule, the rule further gives prominence (or "primacy") to the head NP of the domain operated on, stating basically that all NP's within the domain of the head should be marked by pronouns as being dependent for their reference upon the head (and not conversely). The suggested generalization is that if a rule assigns some kind of prominence to any of the given nodes within a minimal domain it assigns it to a head of the domain, namely, to a node that c-commands the others. This generalization holds primarily for semantic rules.

Note that the MDH does not claim that two nodes not within a minimal domain cannot be possibly linked in any way. Various types of links

between words (e.g., semantic associations; sound linkages achieved by rhyme or alliteration patterns in poetry, etc.) are possible not only across minimal domains but also across sentences. The MDH only restricts operations that are strictly governed by sentence-level linguistic rules. The case of anaphora provides an example of the difference between rule-governed linkage and other possible types of relations between nodes. The general question of whether two nouns refer to the same object, like the question of which object a single noun refers to, is not, in the general case, determined by a linguistic rule. Thus as long as discourse and conditions in the world permit it, two nouns which are not within a minimal domain can obviously happen to refer to the same object, and this may mean that they are viewed as semantically linked. But marking their linkage is free, as far as linguistic rules are concerned. Nouns can also be linked by discourse conventions, as the tendency in discourse to mark first occurrences of a new referent with a full NP and subsequent occurrences with a pronoun. But this tendency is not governed by a linguistic rule in the narrow sense, in which I am using the term here, as is indicated by the fact that there are many contexts that ignore such considerations (e.g., a novel which introduces a character after two pages of referring to him with a pronoun).

On the other hand, there are cases where, regardless of the discourse or real-world situation, coreference options of two NP's are restricted by narrow linguistic considerations, which determine that one of these NP's must be a pronoun (in any discourse). These are the only cases which I consider governed by a linguistic rule in the strict sense—and this type of restriction on anaphora applies, as we have seen, only when the two

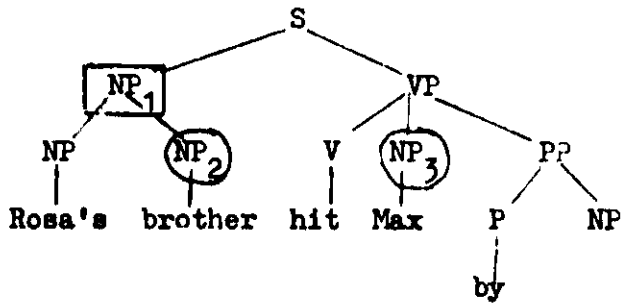
nouns are within the same minimal domain.

Needless to say, establishing the claim that all major linguistic rules operate, like the rules of coreference, in accordance with the MDH is too large a task to attempt here. However, in the next sections I will show, first, that the MDH holds for major syntactic rules, and I will proceed to suggest that the semantic relations which were discussed in Chapter 2 and in section 5.1--relative scope, function-argument, theme-rheme--are determined, in accordance with the MDH, on the basis of c-command domains, which accounts for the various correlations between these relations and anaphora options.

5.2.2 Syntactic rules[8]

First, examples of real syntactic trees may help make clearer the type of predictions made by the MDH (the Minimal Domain Hypothesis in (29)):

30a)



b) Max was hit by Rosa's brother.

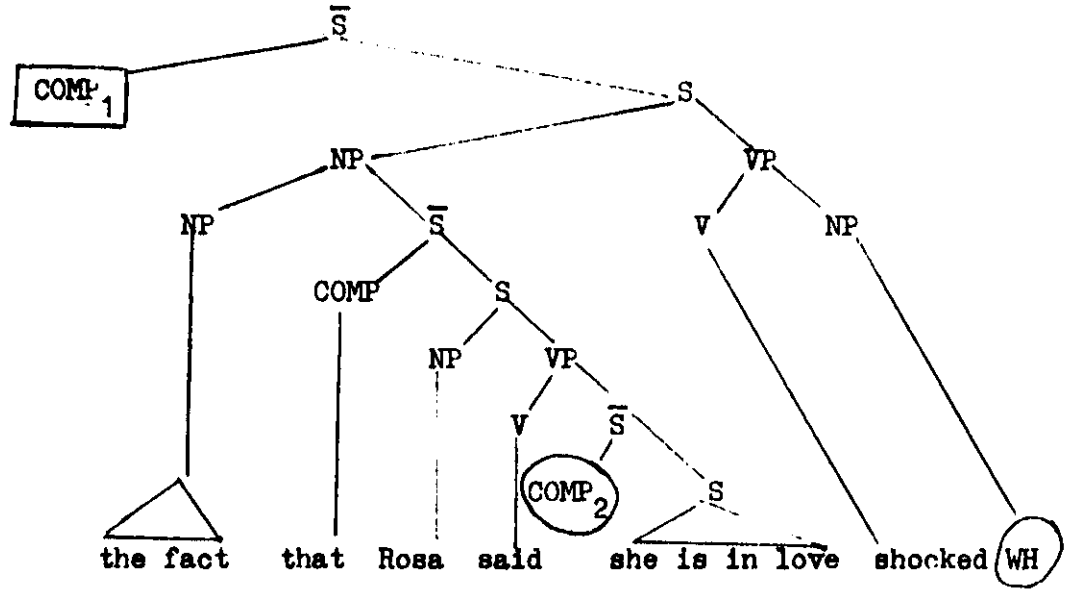
c) *Rosa's Max was hit by brother.

The circled nodes in (30a) have a domain relation similar to those of c and d in (27): They are not within a minimal domain since neither c-commands the other. If the MDH is correct then no linguistic rule may operate on them. And as (30c) illustrates, the rule of Passive cannot indeed operate on these two nodes. On the other hand, the MDH permits the rule to operate

on the node NP_3 and (the boxed) node NP_1 to give (30b), since NP_1 does c-command NP_3 and the two nodes are, thus, within a minimal domain.

Next, consider the tree in (31a).

31a)



b) COMP the fact that Rosa said COMP she is in love shocked WH.

c) Who did the fact that Rosa said she is in love shock.

d) *The fact that Rosa said who she is in love shocked.

Here again, the circled nodes are not within a minimal domain, and the MDH predicts that rules cannot operate on these two nodes. If we look at tree (31a) linearly (that is, at the sequence in (31b)), the first COMP available for the WH to move into is $COMP_2$. Nevertheless the WH cannot be moved into this position to yield (31d). The boxed comp ($COMP_1$), on the other hand, does c-command the WH, which means that it is within a minimal domain with the WH-word, and the MDH does not block operation on these two nodes, as in (31c).

These types of facts do not, in and of themselves, provide evidence for the MDH. The proper application of the rules exemplified above is assured by conditions like the A-over-A condition and Chomsky's subjacency

condition (the latter of which prohibits rules from operating on two nodes if there is more than one cyclic node which dominates the one, but not the other, as is the case with the circled nodes in (31a)). These conditions are needed independently and cannot be reduced to the MDH. Thus, in the example of Passive, the MDH does not block the rule from applying to John and Rosa in (32a) since they are within a minimal domain (because John c-commands Rosa).

32a) John hit Rosa and Max.

b) *Rosa was hit and Max by John.

Some version of the A-over-A principle is needed to block (32b), and this constraint, clearly, cannot be reduced to rule application within minimal domains. The same considerations hold for the subjacency condition.

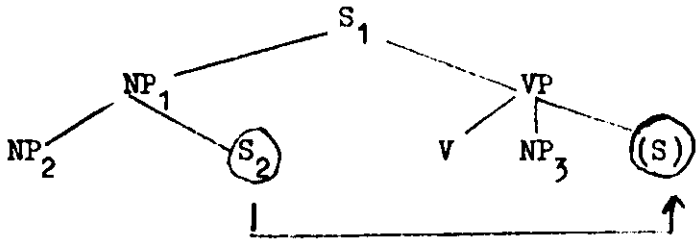
Nevertheless, it is still the case that the operations exemplified above apply in conformity with the MDH (although they do not require it). In general, this is true for all major syntactic rules. Any rule which moves material into or out of subject position within an S will satisfy the MDH since the subject NP c-commands all other material in the S. Similarly, any movement of constituents into COMP position operates within a minimal domain, since the COMP c-commands all other nodes in the S. And in general, any movement which attaches constituents to the S-node itself is consistent with the MDH since the position into which the moved constituent is attached will c-command its original position. The same is true for all types of 'Raising' rules since the node to which material is raised will c-command the position from which it was raised.[9]

Furthermore, there are some movement rules which conform to the MDH but for which independent constraints are lacking. We have seen in section

1.6 that there is substantial syntactic evidence that Extraposition-from-NP, unlike extraposition of sentential subjects, cannot attach the extraposed clause to the VP, but must attach it to S. There is no obvious motivation for this fact, except that that is how things are.

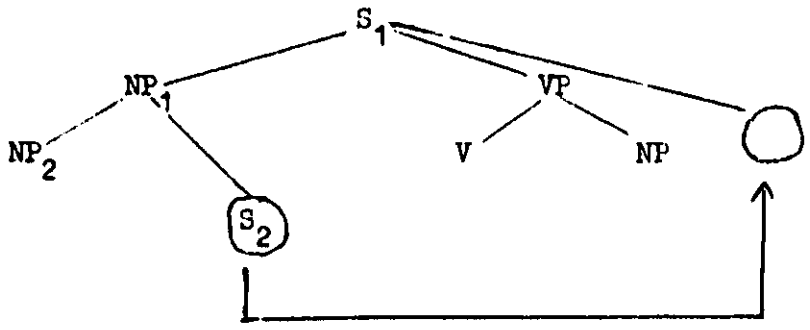
But now we may note that if the extraposed relative clause were to be attached to the VP, as in tree (33), the MDH would be violated, since neither of the nodes (or positions) affected in (33) c-commands the other.

33)



On the other hand, the rule which attaches the extraposed relative clause (S_2) to the S_1 node (or to a higher S position), as in tree (34), operates in accordance with the MDH, since the position into which S_2 is attached c-commands its original position and hence the two positions are within a minimal domain.

34)

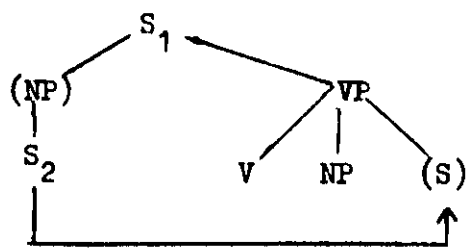


The same type of considerations apply to Result-Clause extraposition (see section 1.6).

Notice however that the MDH does not prohibit the clause moved by Sentential Subject Extraposition (which derives sentences like it bothered Max that Rosa was pregnant from ones like that Rosa was pregnant bothered Max).

The underlying source for such sentences I take to be that illustrated in tree (35):

35)



S_2 here, unlike S_2 in (33), c-commands its new position in the VP, so the rule does operate on nodes within a minimal domain. (Note that the MDH does not specify which of the nodes (or positions) affected by the transformation should be in the domain of the other).

We should acknowledge here that earlier versions of the Sentential Subject Extraposition transformation would appear to be counterexamples to the MDH. On those versions the underlying source would have a form identical to tree (33), with the NP_2 position being filled by <u>it</u>. Movement of S_2 into the VP then would relate nodes not within a minimal domain, since neither c-commands the other, and hence violate the MDH. Emonds (1976) argues convincingly, however, that this <u>it</u> (and the node which governs it) is not present in the underlying structure of such sentences and arises from a late morphological rule.

The fact that syntactic rules are organized in confirmity with the MDH, and some rules seem even to require it, makes it a possible candidate for a general condition on linguistic rules. If it turns out that c-command domains reflect some general restriction on human language (or the human mind) it would be highly significant that no matter how the major rules of a language are organized they always turn out to operate only within these domains.

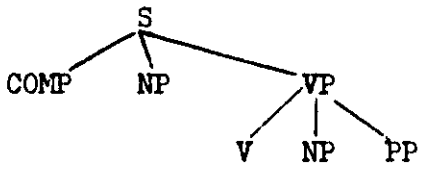
5.2.3 Relative scope

In Chapter 2 we observed a striking correlation between c-command domain relations and relative scope of quantifiers. I will suggest now that this correlation is due to the fact that the rule which determines relative scope obeys the MDH, namely it applies only within c-command domains and, since in this case, 'dependency' relations are involved, it gives 'prominence' (wider scope) to a head of the domain.

The correlation observed in Chapter 2 was illustrated by a paradigm like the one in (36)-(38), which consists of four syntactic structures, two of which (in (37)) have identical domain relations and differ only in the linear order of their parts. (I use here, again, simplified structures.[10])

36) Verb-phrasal PP's in final position

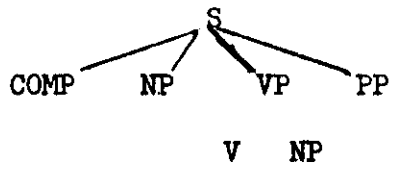
a)



b) Some reporters put taperecorders in every room
(—not ambiguous: $(\exists x)(\forall y)\ldots$ is the only interpretation)

37i) Sentential PP's in final position

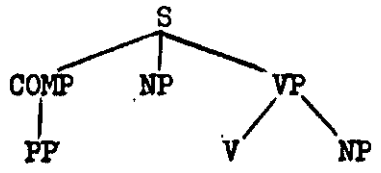
a)



b) Some reporters worship Kissinger in every town he visits
(—ambiguous)

ii) Preposed V-phrasal PP's

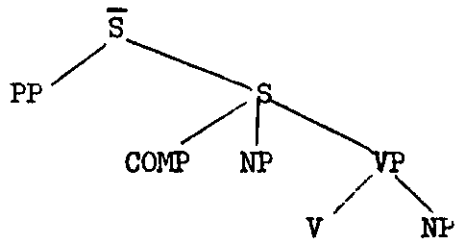
a)



b) In every room, some reporters have put taperecorders (—ambiguous)

38) Preposed sentential PP's

a)



b) In every town he visits, some reporters worship Kissinger (—not ambiguous. $(\forall x)(\exists y)\ldots$ is the only interpretation)

In the structures in (37) the quantified subject and the quantified PP c-command each other, and in these two cases we get scope ambiguity. (An intuitive, though not exact illustration of this is the fact that it could be either the same reporters, or different reporters that the quantified subject refers to.) In tree (36), the quantified PP is in the domain of the quantified subject but not conversely, and consequently, with normal intonation, the sentence is not ambiguous, and the quantified subject has wider scope. In tree (38) the situation is reversed—the subject is in the domain of the PP, but not conversely. Here again there is no ambiguity—the quantified PP has wider scope than the quantified subject.

The generalization which is suggested by these facts is given in (30):

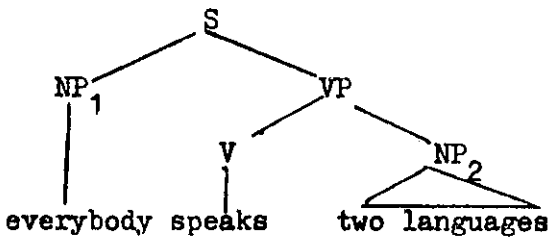
39) A logical structure in which a quantifier binding a variable x has wide scope over a quantifier binding a (distinct) variable y is a possible interpretation for a given sentence S just in case in the surface structure of S the quantified expression corresponding to y is in the (c-command) domain of the quantified expression corresponding to x.[11,12]

An obvious consequence of (39) is that the famous sentence in (40a) has only one logical interpretation, namely the one in (41), since in the syntactic tree (40b) of this sentence the quantified expression NP_2 (two

languages) is in the domain of the quantified expression NP_1 (everybody), but not conversely. (The disagreement among judgments here will be noted shortly.)

40a) Everybody speaks two languages

b)



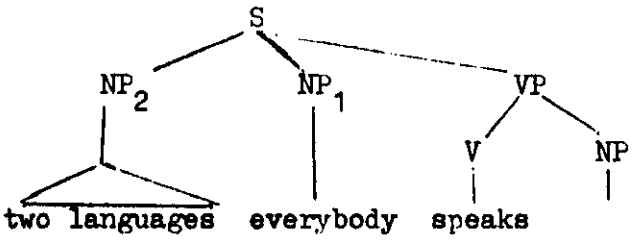
41) $(\forall x)(\exists$ two languages $y)(x$ speaks $y)$

42 $(\exists$ two languages $y)(\forall x)(x$ speaks $y)$

Given a sentence like (43a), on the other hand, the restriction (39) allows correctly both logical interpretations (41) and (42), since in the syntactic tree (43b) of this sentence the quantified expressions are in each other's domain. ((43b) again is a simplified tree--see footnote 10.)

43a) Two languages, everybody speaks[13]

b)



Note that (39) only restricts the set of possible logical interpretations for a given sentence. It does not require that all the possible logical interpretations it defines be acceptable in any given sentence. It has, e.g., been observed (Ioup, 1975) that lexical quantifiers differ inherently in their tendency to take wide scope. Consequently there will be cases where (39) permits in principle two scope arrangements, but, in fact,

only one of them would be acceptable. Thus, while (43a) is indeed ambiguous (perhaps with intonational differences) a sentence like some teachers, everybody likes, which has the same structure as that of (43a), will give a strong (if not exclusive) preference to the interpretation of some as having wider scope, since as Ioup argues, it is both the case that some tends to have wider scope than every (when possible), and that quantified expressions in topic position have stronger preference for a wide scope interpretation than subjects. In other cases an interpretation which is permitted by restriction (39) may be excluded on semantic grounds. Thus, in a sentence like the policeman found a bomb in every mailbox, the quantified expressions c-command each other (see footnote 11) and, therefore, (39) permits two interpretations, one of which is that there is some bomb such that the policeman found this bomb in every box. However, since this interpretation is semantically bizarre, the sentence will not, in practice, be judged ambiguous.

The crucial question concerning (39) is, therefore, not whether it provides a sufficiently strong restriction on the set of possible interpretations of a given sentence, but whether the restriction it provides is not too strong. Many linguists (particularly those working within a Montague oriented framework) have argued, for example, that sentences like (40a), Everybody speaks two languages, are, in fact, ambiguous, contrary to the claim I have made here. However, this is, I feel, a relatively minor problem.

In the first place, most putative examples of such ambiguities which are discussed in the literature are ones where one interpretation entails the other (e.g., the interpretation (42), in which there are two specific

languages that everybody speaks entails the interpretation (41)). So our intuitions distinguishing ambiguity and vagueness in these cases are less clear than in cases where the two interpretations are logically independent.

And in the second place, although there may be cases where speakers' disagreement cannot be reduced to the claim that the sentence in question is vague rather than ambiguous, and we will have to assume then that these speakers permit a violation of (39), it appears that the violation is highly restricted with respect to the NP pairs which tolerate it. Thus, Ioup (1975) has observed that 'scope ambiguity' may be possible between quantified subjects and quantified objects, but judgments of such ambiguity are much harder to obtain between quantified subjects and other NPs within the VP. This may be illustrated in (44): (44b) and (44c) are unlikely to be interpreted as ambiguous even by speakers who consider (41a) ambiguous.

44a) Some tourists visited all the museums

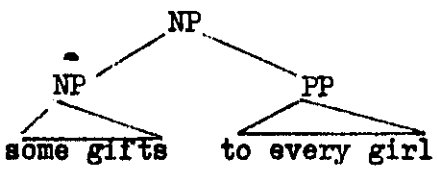
b) Some tourists spent an afternoon in all the museums

c) Some tourists were disgusted with all the museums

A more substantial problem for restriction (39) arises in the case of PP's within complex NP's, on which there is no disagreement in judgments. It has been observed (e.g., in Gabbay and Moravscic (1974)) that in complex NP's like those in (45) and (46) the quantified PP must have wider scope than the quantified head NP.

45a) Santa Claus brought some gifts to every girl

b)

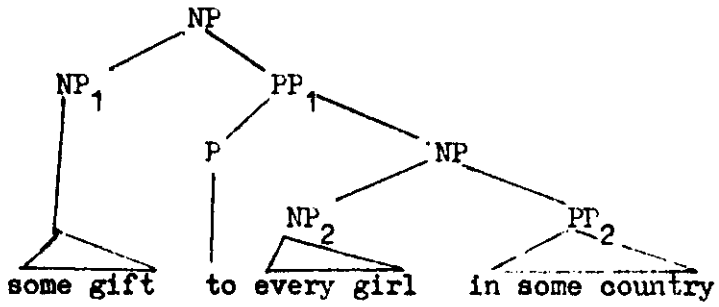


46) All the gifts to some girl were wrapped in red paper

Such examples do not yet pose a serious problem for (39). The quantified expressions in the underlying tree (roughly represented in (45b)) c-command each other, i.e., are in each other's domain. Restriction (39) therefore permits scope ambiguity. But as we have seen, this does not mean that other semantic considerations may not impose further restrictions on the set of interpretations permitted by (39). However, the more serious problem here is that the same order of quantifier scope holds when further PP's are embedded, e.g.,

47a) Santa Claus brought some gift to every girl in some country

b)



(47a) has only one correct scope interpretation—the one which assigns wide scope to some country (i.e., there is some country such that for every girl in that country, there is a gift such that...). But in the corresponding tree (47b) the quantified expression PP_2 (in some country) does not c-command the quantified NP_1 (some gift), so restriction (39) does not allow this scope arrangement.

It appears that this problem may be solved within our framework by restricting (39) as follows: In a complex NP of the form NP_1 + PP, the PP must have wider scope that NP_1. And if it happens that the PP itself contains such a complex NP, this same restriction tells us again (by transitivity) that the bottom quantified PP must have wider scope than the top

head.

To conclude, I should stress that determining quantifier scope in surface structures is known to pose many complicated problems. One simple constraint like (39) will not solve all of these problems. We may hope, however, that (39) does capture the basic restriction on the range of logical interpretations of quantified sentences, and that additional structure-specific constraints on this restriction (such as the one illustrated above for quantified PP's within complex NP's) can handle the many additional specific problems.

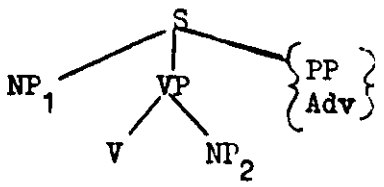
5.2.4 Function-argument representations

I will show now that it is possible to define in terms of the c-command relation (and hence within the MDH hypothesis) a semantic interpretation rule which assigns function-argument representations to syntactic structures. A rough approximation of such a rule (excluding special intonation cases) is given in (47)

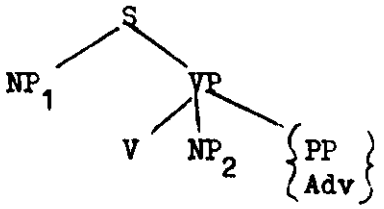
47) A function-argument formula $F(a_1,a_2,\ldots,a_n)$ is an appropriate logical translation of a phrase α iff there is a node F' in α which corresponds to F, and, for each argument expression a_i there is a corresponding node a_i' in α, and F' has in its domain all and only the nodes a_1', a_2',...,a_n'.

To illustrate the operation of (47) let us consider an example of the correlation between syntactic and logical structures which was discussed in section 2.1.2: Sentential adverbs or PP's, as in (48), are interpreted as functions from formulae to formulae, while V-phrasal adverbs or PP's, as in (49), are interpreted as restricting functions from functions to functions. This guarantees that entailments like the one in (49c) hold for sentences with V-phrasal PP's and V-phrasal adverbs but not for sentences with

sentential PP's or sentential adverbs.

48a) 

b) Rosa is riding a horse {in Ben's film / probably}

49a) 

b) Rosa rode a horse {in Ben's pasture / gracefully}

c) (b) ⟶ Rosa rode a horse

The correspondence rule from syntactic structures to function-argument representations must assure, therefore, that the PP or Adv in (49a) will not be interpreted as a function over the whole sentence (namely a function whose arguments are the translations of the subject NP_1 and the VP). This is precisely the type of restriction that is captured by the c-command domain relation. The restriction in (47) permits a function corresponding to the PP or Adv in (49) to take only arguments corresponding to V and the object NP_2, since it requires that all the nodes corresponding to argument expressions would be in the domain of the node corresponding to the function expression, and the only nodes which meet this requirement are the V and NP_2.

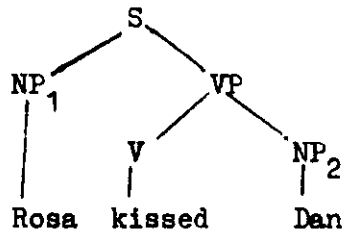
The correspondence rule must also assure that in translating the syntactic structure in (48a) the function corresponding to sentential adverbs will not take as an argument the translation of the VP alone (which would

allow sentence (48b) to have a logical structure identical to that of (49b)). This is guaranteed by the requirement that the node corresponding to the function expression have in its domain only nodes which correspond to argument expressions. If, in tree (48a) only the VP is picked as an argument, this would mean that the PP in this tree has in its domain more than just nodes corresponding to arguments, in violation of (47).[14]

It is easy to see that in many cases rule (47) puts stronger restrictions on the interpretation of sentences than required by purely logical considerations. Thus, a sentence like (50a) permits (among several others) the two interpretations in (51), which are logically equivalent.

50a) Rosa kissed Dan

b)



51a) kiss ⟨Rosa, Dan⟩

b) (kiss ⟨Dan⟩) ⟨Rosa⟩

But of these two representations only (51b) is permitted by rule (47): In the corresponding tree (50b) the node V corresponding to the function kissed has only the object NP_2 in its domain, hence the function kissed can take only the translation of NP_2 as an argument (but not the translation of NP_1, as in (51a)). The node VP, on the other hand, which corresponds to the function (kissed ⟨Dan⟩) has the subject NP_1 in its domain, hence given rule (47), (51b) is an appropriate representation for (50b).[15]

The possibility illustrated here is rather interesting: If the MDH can be shown to hold in general for linguistic rules, this would restrict

the set of possible logical interpretations of sentences of natural language, forcing a choice between logically equivalent interpretations. Some independent evidence that such a choice between the equivalent representations illustrated in (51) is required by natural language is suggested by Sag's (1976) study of VP deletion. He argues that a function corresponding to the VP is needed in the logical structure to account for the full range of deletion phenomena.

If the rule which assigns function-argument representations applies to c-command domains along the lines stated in (47), we have, now, an account for the types of correlation between logical structures, coreference and relative scope that were noted in Keenan (1974) and were discussed in section 5.1.2. It would be recalled that the logical structures assumed within the framework suggested by Keenan are basically those defined by rule (47). (E.g., the subject of a simple sentence will be the (unique) argument in its logical representation.) If all three rules which determine coreference options, relative scope of quantifiers and function-argument interpretation of sentences apply to the same syntactic domains, we should expect to find intersections in their operations (as well, of course, as cases where they do not intersect, like those discussed in section 5.1.2, or cases where scope ambiguity is possible although there is no ambiguity of function-argument interpretation).

5.2.5 Theme-rheme relations.

The correlations between theme-rheme and domain relations were discussed in detail in Chapter 2 (primarily in section 2.2.3) and in section 5.1.1. I will not repeat the arguments here, but only summarize the generalization observed there: In intonationally unmarked situations only a

head of a given domain can function as the theme or topic of this domain. Thus, the subject would normally be a topic, in its sentence, but the object would not, normally, be a topic of the whole sentence, though it may be the thematic element in the VP (i.e., represent older information relative to other constituents in the VP). Similarly sentential PP's tend to be interpreted as thematic elements but v-phrasal PP's cannot, in normal intonation, be interpreted this way.

At the moment a more rigorous account for the correlations between syntactic domains and theme-rheme relations is impossible, since the notions we are dealing with are not yet formally defined, or even fully understood intuitively. The point is, however, that these intuitive relations are determined on the basis of c-command domains. Or, in other words, that when a speaker intends a certain sentence to be a statement 'about' (the referent of) a certain NP, he would choose normally a syntactic form in which this NP is a head of the domain which corresponds to this statement. A possible reason for this type of choice will be outlined in the next section.

5.3 The psychological reality of c-command domains

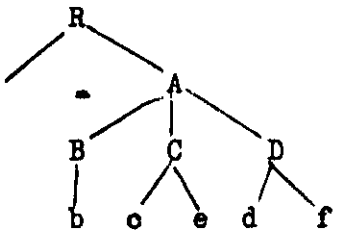
Finally, it is in place to ask, if it is established that the MDH (The Minimal Domain Hypothesis in (29)) is indeed true, what could be the reason for this? More specifically, why should unrelated rules of different levels (e.g., syntactic and semantic rules) operate within the same domains? An answer which is suggested is that c-command domains reflect the processing ability of the mind, which means that it is psychologically difficult to process nodes that are not within a minimal domain, or to retain in the

processing stage more than one domain at a time.[16] If c-command domains are processing units, the MDH follows for all levels of linguistic rules (in the narrow sense).

To illustrate what is meant by the claim that c-command domains reflect processing units let us consider one aspect of processing—speech perception, or the interpretation of acoustic signals. The basic assumption in speech-perception theories (which would be surveyed with more detail shortly) is that the processing of an acoustic input involves a mechanism of establishing 'closure' of units as soon as possible. The closed units are recoded, i.e., are assigned more abstract mental representations and cleared from short-term memory. Perceptual complexity of sentences may arise (among other cases) if the closure must be delayed, or if a closed unit must be reopened. (E.g., given a sentence like the boat floated on the water sank, the tendency to establish closure as soon as possible will dictate processing the boat floated on the water as a clause, but then, as sank is reached, the closed clause must be reopened and reanalyzed.)

If c-command domains reflect units of perception, this means that closure applies to these domains, namely to constituents. Given this hypothetical picture of processing, it is possible to see (though roughly and intuitively only) why, when 'dependency' relations are involved, the node which is assigned 'prominence' is the c-commanding node (or the head of the domain). Let us look again at tree (27), repeated in (52)

52)

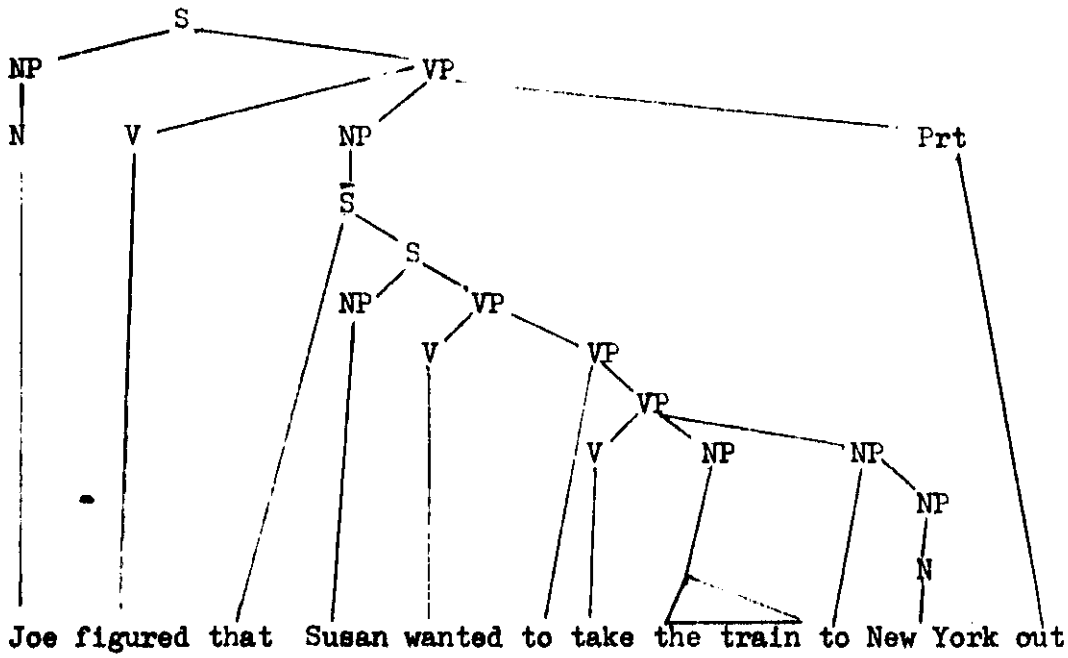


Once closure has applied to a given constituent, it is recoded, and in the next stage of processing its recoded representation, but not its individual nodes, is considered. Thus, in tree (52), when the constituent D is processed, the nodes c and e of the constituent C are no longer available, but the recoded representation of C can be considered. Now, since B is not a branching constituent, its recoded representation is determined solely by b, i.e., it is identical to b. Hence b is still available in the processing of the nodes in C and D and, consequently, b can 'influence' the interpretation of the individual nodes c...f. On the other hand, the individual nodes c...f are not available in the processing of b (i.e., they cannot 'influence' the interpretation of b), since when b is processed these nodes are either not processed yet, or are already recoded. If this picture is correct it would follow that languages will be organized so that nodes which play a more 'prominent' role (e.g., the topic of the sentence, a quantifier with wider scope, an NP which introduces a new referent, etc.) will be placed in head-positions of a c-command domain, which assures that these nodes are accessible in the processing of the whole domain.

Needless to say, at this stage, the picture of processing that I have outlined here is merely speculative. Furthermore, on the face of it, several studies in speech-perception appear not to support it. A common assumption in such studies (e.g., Fodor, Bever and Garett (1974), Bever (1975)) is that the minimal perception unit is the clause, rather than the full range of constituents as predicted by the MDH. If this is true, then the c-command domains play no role in this stage of the processing of a sentence, and a domain defined in terms of command seems more appropriate. However, Kimball (1973) provides evidence that clausal processing is not

sufficient and, at least in the syntactic parsing of acoustic signals, the perception unit is the phrase rather than the clause. In Kimball's description of the process of parsing, a phrase α is closed as soon as the rightmost daughter of α (i.e., the rightmost node immediately dominated by α) is reached. (This is roughly Kimball's principle five.) As soon as a phrase is closed it is "pushed down" for further processing and cleared from short term memory (Kimball's principle seven). This means that the mechanism of closure which sends parts of the acoustic signal for further processing applies to constituents rather than only to S nodes. A possible test for this hypothesis is checking cases of perceptual complexity: The phrase closure hypothesis predicts that the longer a phrase remains unclosed, the greater is the pressure on short term memory, and the harder it is to process the sentence. Several of Kimball's examples show that this is indeed the case for units smaller than sentences.[17] Thus consider the sentence in (53) which is rather difficult to process:

53) (Kimball (1973), (12))



The reason for the complexity is that the VP cannot be closed, since, by Kimball's definition of closure the VP can be closed only when its last daughter (namely, the particle out) is reached. That the problem with this sentence has to do with difficulties in the closure of the VP, and not just with its length, is further illustrated by the fact that there is no problem in processing the similar sentence in (54) which is otherwise just as "long."

54) Joe figured out that Susan wanted to take the train to New York

If the problem with (53) had to do with an inability to close the S clause rather than the VP, the sentence (54) should have been just as hard to process as the sentence (53) since the only difference between these two sentences is the internal structure of the VP.

Kimball also cites evidence from experiments with click-location reported in Chapin, Smith and Abrahamson (1972). Unlike other reports on click-location, this report states, according to Kimball, that clicks were attached to constituent boundaries: When a click was placed between a constituent boundary and a following clause boundary the tendency was to perceive the click near the constituent boundary, from which the authors conclude that there is a tendency for speakers to perform closure at the end of constituents.

If it can be established that the perception units are indeed constituents (and not just those constituents which are clauses), the MDH will turn out to have some perceptual support. This does not imply however that there is a complete correlation between the perception units defined, say, by Kimball and the c-command minimal domains. In fact, if we accept the specific details of Kimball's analysis, the restriction on what constitutes

a perception unit, or on what can be retained in short term memory is stricter than required by the MDH.[18] For this reason we may conclude that some existing studies about speech perception are consistent with the MDH but they do not, in and of themselves, prove it.

The fact that we cannot, at the moment, find direct experimental proof of the hypothesis that the MDH reflects limitations on processing ability does not mean, however, that this hypothesis cannot be defended in other ways. Strong support could come from the study of linguistic rules. If it turns out that unrelated linguistic rules of different levels (including, e.g., phonological and morphological rules, not only syntactic and semantic ones) only operate within c-command domains. This could only mean that the MDH reflects some inherent property of the mind. I have shown that the co-reference rule operates only within c-command domains, and exemplified the possibility that other rules do as well. Whether the MDH holds generally for all, or most, linguistic rules remains an open question.

FOOTNOTES

1. The source for the confusion which underlies Hinds principle (1) is the lack of a distinction between the reference of pronouns and their functional role in the sentence. The referent of a pronoun is often assumed to be known to the hearer (or to be in a way one of the discourse topics). However, this does not mean that the pronoun itself functions in its sentence as the topic (or as the thematic element). If the distinction between NP's and their referents is ignored, the distinction between theme and rheme is completely empty when applied to coreferential NP's.

2. Bickerton's further principle states that if both NP's are presupposed in the matrix sentence, we should further check whether anyone of them "was asserted" in its clause (including clauses in its 'derivational history'). If one "was asserted" and the other was not, pronominalization obeys again the general principle above, namely the one which was asserted must be a pronoun and not conversely. This is intended to account, for example, for the unacceptability of coreference in (i). Since both NP's in (i) are in presupposed positions, Bickerton's first principle should permit coreference. However, Bickerton assumes that (i) is derived from (ii):

i) *In John's apartment he smoked pot

ii) In the apartment that belongs to John, he smoked pot

Since, in its derivational history, John of (i) was asserted, it still cannot 'pronominalize' the presupposed subject in (i), and pronominalization should go the other way.

Regardless of the derivational details that Bickerton suggests, it is obvious that the restriction above cannot be true. Consider (iii):

iii) Those who know Bill believe every word he says

Both Bill and he are presupposed in the matrix sentence. However, if we check their functions in their clauses we see that Bill is asserted, while he is (being an embedded subject) presupposed, so Bickerton's second principle incorrectly blocks this sentence and requires that pronominalization is only permitted in the reverse order. We can, therefore, ignore this further principle in the discussion to follow (and we will also see that sentences like (i) can, anyway, be captured within a functional account with no further restrictions).

3. A famous test for this claim is possible question-answer sequences. Thus (iia) is a more appropriate answer to (i) (when asked with normal question intonation) than (iib).

i) A: Did Rosa lock Dan in the closet?

iia) B: No, in the toolshed.

b) B: No, Bill./ No, she locked Bill.

4. Note that there is no independent restriction preventing focus-NP's from being pronouns, as illustrated in (i).

i) Rosa's brother suggested that we invite HER.

5. As we will see in section 5.2 this assignment of logical structure is consistent with the notion of c-command domains and is possibly justifiable.

6. The scope facts in the examples below seem, in themselves, to violate Keenan's analysis. Thus (22) should have permitted only one scope assignment (namely wide scope for everyone). However, the exact logical form of such constructions is not yet well understood. (Some discussion of the

particular properties of quantified NP's in prepositional phrases is provided in Gabbay and Moravscic (1974).) It is possible to think of a justifiable logical analysis for such examples that will yield the right scope facts within Keenan's framework. The point is, however, that the same logical analysis would also yield the wrong coreference facts.

7. I am indebted to Ed Keenan for many suggestions and discussions of the problems discussed here.

8. When we consider movement rules, the statement of the domain requirement may appear somewhat unclear, since it mentions explicitly two nodes, while movement rules may be viewed as moving only one node. Within the structure-preserving hypothesis of Emonds (1976), structure preserving movement rules do operate explicitly on two nodes since an item can be moved only into an existing node. However, the MDH is unrelated to the structure-preserving hypothesis (and is not restricted to structure-preserving rules, as illustrated by the example of extraposition from NP to follow shortly). The term <u>node</u> in the MDH should therefore be more generally interpreted to cover also <u>positions</u> in the tree. This would mean that an item α can be attached to a given position in the tree only in case either α c-commands this new position or vice-versa.

9. I restrict the discussion only to the general version of the MDH (in (29)). This general requirement does not in and of itself assign 'prominence' to a given node in the domain. However within the trace theory of movement rules, as developed in Fiengo (1974) and Chomsky (1975a), there is a direct correlation between anaphora restrictions and restrictions on syntactic rules: Within this framework the relations between a moved NP and its trace are defined as bound anaphora relations. Hence

rules are restricted so as to block a situation in which the trace c-commands its 'antecedent' (i.e., the NP which has left this trace). Since there are, in my opinion, several problems still to be solved, within this theory, I will not elaborate here on this type of correlation between anaphora and syntactic rules.

10. The actual trees underlying the sentences below involve more S nodes, which are not relevant in determining domain relations. It will be recalled that the modification in section 4.1 of the relation of c-command applies correctly to the actual trees, but for ease of presentation I will continue to use simplified ones.

11. The definition in (39) mentions 'quantified expressions' rather than 'quantified NP' to allow it to apply to quantified PP's. This formulation avoids a minor problem which arises here: given a quantified PP like in all the rooms, if we consider strictly the node Q which dominates the quantifying word (all), its c-command domain under any syntactic analysis cannot extend beyond the PP (and under some syntactic analyses it consists only of the NP all the rooms). Similarly in a quantified possessive NP like everyone's father the c-command domain of everyone is only the possessive NP itself. Still, it is obvious that these quantifiers may have wide scope over quantifiers outside the PP or the possessive NP. This means that the relevant domains in determining relative scope options of such quantifiers are those of the PP's or the possessive NP's which contain them, and which I will refer to here as 'quantified expressions.'

12. Note that (39) only restricts the relative scope of two given quantifiers, i.e., their relative position in a logical structure. It does not state where they will go, nor does it restrict the position of a

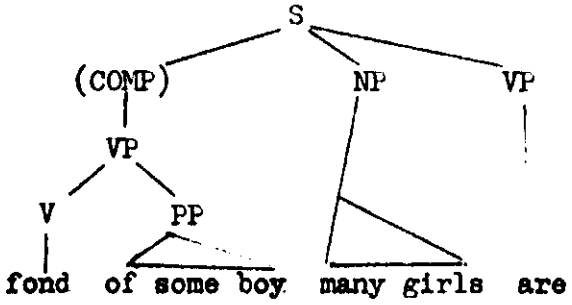
quantifier relative to anything which is not a quantified expression. To take a trivial example, given a sentence like Ben likes everybody, the position of the quantifier in the logical structure of this sentence is obviously not determined by (39), since this sentence involves only one quantified expression. Similarly (39) does not determine the position of the quantifier in sentences like Rosa likes the teacher that everybody hates. It has been argued (e.g., Chomsky (1975a)) that quantification in natural language is clause-bound (which means that the sentence above cannot be interpreted as for every x, Rosa likes the teacher that x hates). This restriction on quantification is independent of the one in (39).

13. Lakoff (1971) has argued that topicalization does not change the relative scope of quantifiers. However, his examples are mostly of the type illustrated in (i), where the whole VP is preposed.

ia) Many girls are fond of some boy.

b) Fond of some boy many girls are.

c)



While Lakoff is right that in this type of preposing the scope arrangement in (ib) is identical to that of (ia) (namely wide scope to many), the examples mentioned in the text indicate that this does not hold in general for all kinds of preposing (e.g., topicalization, PP preposing). Note, further, that the rule (39) captures this difference between VP preposing and topicalization (or PP preposing). In tree (ic), the quantified expression some

boy still does not have in its domain the subject many girls (since it does not c-command the subject). Hence (39) permits in this case only the reading predicted by Lakoff.

14. The actual function-argument representations that rule (47) will assign to the sentences in (2) and to the VP's in (3) are those in (ia) and (iia) respectively.

ia) {Probably / In Ben's picture} ⟨Rosa, Ride a horse⟩

b) {Probably / In Ben's picture} ⟨Ride a horse ⟨Rosa⟩⟩

iia) {Gracefully / In Ben's pasture} ⟨Ride, A horse⟩

b) {gracefully / in Ben's pasture} ⟨Ride ⟨a horse⟩⟩

These representations may look different from the ones we assumed earlier, since they involve functions of two arguments. However, they are logically equivalent to the more familiar representations in (ib) and (iib).

15. Note, on the other hand, that rule (1) does not determine which nodes in the tree would be translated as functions, and which as arguments. Thus in tree (4) it permits a logical representation in which the subject, NP_1, corresponds to the function and the VP to the argument. This choice of functions and arguments should be determined by independent correspondence rules.

16. The idea that an explanation for the linguistic role of the c-command domain should be sought in psychological terms was suggested to me by N. Chomsky. I am indebted to him for many intensive discussions of these problems, although the presentation given here is my sole responsibility.

17. Kimball does not attribute the difficulties of the following example to the principle of closure, but rather, to the principle he calls 'right association.' However, he notes that the latter can probably be reduced to the principle of closure. In general, my presentation is not fully loyal to Kimball's framework, since he does not fully develop his claim that the perception unit is the phrase. All the material I use, however, to argue for this claim is given in his paper.

18. It will also be recalled that I argued that the linear order of nodes plays no role in the application of the coreference restrictions, or in determining domain relations of nodes. In perception studies, on the other hand, it is believed that the linear order plays a crucial role and that acoustic signals are processed from left to right. However, it is worth mentioning that even within these studies some "look ahead" is granted, so it is in principle possible that it will be found that c-command domains and perception units do not differ much in this regard.

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