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The Syntax of Crossing Coreference Sentences

By

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Approved:

[Signatures]

Committee in Charge

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INTRODUCTION

The primary aim of this thesis is to support the claim that definite, personal pronouns (like she, he, it) are, in some of their occurrences, full NP's in semantic representation. This is not to say that these pronouns always correspond to full NP's. There are at least three possible theories as to the correct representation for pronouns. In one, all pronouns are represented as full NP's. Arguments against this theory are fairly well established; these are reviewed in Section 3. A second possibility is that these pronouns never correspond to full NP's. This theory has been proposed by, among others, McCawley (1970) and, within a different framework, by Jackendoff (1972). A third approach has been taken by Geach (1962) and Partee (1972), who argue that in some occurrences these pronouns are related to full NP's, while in others they are not. This is the theory that I will try to support; I will refer to this as the Pronominalization theory.

My arguments are based primarily on a consideration of the syntactic behavior of a class of sentences generally known as Bach-Peters, or, Crossing Coreference sentences. These sentences contain at least two NP's, where in each NP there is a pronoun coreferential to the other NP:

1. a. The woman, who wrote to him, saw the man, who loves her.
   b. The woman, who wrote to him, saw her husband.

Crossing Coreference sentences have played a central role in much of the discussion on Pronominalization. Bach (1970) shows that they pose a serious problem for a theory which relates all pronouns to full NP's; McCawley (1970) takes this as evidence for a theory in
which no pronouns correspond to full NP's. However, Karttunen (1971) points out several drawbacks with McCawley's analysis, and tries to show that a theory which relates all pronouns to full NP's can accommodate Crossing Coreference sentences. My analysis essentially takes Karttunen's as its point of departure, although I will claim that these sentences actually provide evidence for the Pronominalization theory, in which pronouns are treated in two different ways.

Most of the discussion about Crossing Coreference sentences since Karttunen's paper has focussed on the problem of providing representations which correctly account for the meaning of these sentences. Unfortunately, there has been little agreement about the meaning of a sentence like (1), and so arguments based solely on semantic considerations are bound to remain inconclusive. The approach taken here then is to concentrate largely on the syntactic behavior of these sentences, although semantic evidence is also considered.

Thus I began this study by asking the following question: What are the syntactic configurations in which crossing coreference is possible? This phenomenon is not entirely free; there are, in fact, severe limitations on its occurrence. So, for example, crossing coreference is not permitted in the following sentences:

2. *The woman, he wrote to saw her husband
3. *Her childhood friend saw his wife
4. a. *The house that belongs to the woman who wrote to him pleased her husband
   b. *Her husband likes the house that belongs to the woman who wrote to him

Moreover, while a sentence like (5) is ambiguous between a variable (or "sloppy") reading and a constant (or "non-sloppy") reading:
5. Only the man\textsubscript{j} who loves Mary saw his\textsubscript{i} wife

a similar sentence with crossing coreference is not ambiguous:

6. Only the man\textsubscript{i} who loves her\textsubscript{j} saw his\textsubscript{i} wife\textsubscript{j}

Here only the variable reading is possible.

A more detailed investigation reveals that the two pronouns in a Crossing Coreference sentence behave differently. The first pronoun acts as though it were a full NP with respect to two constraints; the second pronoun does not. It further reveals an interesting interaction between crossing coreference and both relative clauses and only.

Part I, then, explores the question of what kind of theory can, and what kind of theory can't, account for these facts. I argue that the syntactic behavior of these sentences is unexplained in a theory in which no pronouns are related to full NP's, while the Pronominalization theory accounts for these facts in a very natural way. But there are, of course, some problems which remain for my analysis. These are discussed in Part II, and some tentative solutions are proposed. In Part II I also attempt to formalize some of the notions used in Part I.

There are several assumptions in this thesis which should be made explicit here. I am, first of all, assuming that there is such a thing as the semantic representation of a sentence, and that this representation is related to surface structure by a set of rules. The question of whether these rules are "syntactic" or "interpretive" is a separate issue; I will return to this below. I am also assuming that a semantic representation is interpreted by a set of rules which, at the least, assign a truth value to that representation in a given context.
One issue which deserves some discussion concerns the notion of coreference. It has generally been taken for granted that it makes sense to talk about a sentence like

7. John said that he left

as having one "reading" where John and he are understood as the same person, and a second in which they are not. In this second reading, he can be taken as any male individual in the context; the pronoun here functions much like a free variable. In view of the existence of the free variable reading, the assumption that (7) has two distinct readings has been seriously questioned (cf., Lasnik (1976)). A plausible alternative is that there is only one meaning for this sentence. He can be any male in the context, and one such person is obviously John.

Although this idea is an attractive one, it is clear that not all pronouns can be treated as free variables. In particular, a theory which claims that all pronouns are free variables breaks down in those cases which have led people to conclude that some pronouns function like bound variables. Consider, for example, a sentence like

8. Each man loves his mother

in a context with three men - Tom, Dick and Harry. This theory correctly predicts that (8) is true if all three men love Tom's mother; his can be taken as any of these men, and one possibility is Tom. But suppose that instead Tom loves only Tom's mother, Dick loves only Dick's mother, and Harry loves only Harry's mother. If a pronoun like his is simply taken as some individual in the context, then it is incorrectly predicted that (8) is false. There is no single individual here such that his mother is loved by each man. A solution to
this might be to break the sentence down, so that the truth of (8) is determined by considering the truth of the three separate sentences: Tom loves his mother, Dick loves his mother and Harry loves his mother. This solution fails, for it incorrectly predicts that (8) is true in a context where Tom and Dick both love only Tom's mother, while Harry loves only Harry's mother. If his in each of these sentences ranges freely over all men in the context, then all three sentences are true here.

Of course this does not conclusively show that the pronoun in (7) has a non-free variable interpretation. It could be maintained that certain NP's, such as the subject in (8), can be understood as coreferential with pronouns, while definite NP's like the subject in (7) cannot. I will argue against this position in more detail in Section 3. For now it will suffice to note that the fact that (8) has a non-free variable reading means that the assumption that (7) has this reading is as plausible as the assumption that it doesn't. In Sec. 3 I will also show that my arguments do not crucially depend on an appeal to the notion of a "coreferential reading". For example, it is noted in Sec. 1 that a sentence like (9) is ungrammatical with crossing coreference, while (10) is grammatical:

9. *The woman he wrote to saw the man who loves her

10. The man who loves her was seen by the woman he wrote to

To make such a claim assumes that it makes sense to talk about a reading in which the pronouns are understood as coreferential with the full NP's. Yet this assumption is not crucial. It will be shown that the notion "ungrammatical on the crossing coreference reading"
can be translated into "not true" in a given context. That is, it is possible to construct contexts in which (10') is true while (9') is not:

9'. The woman he wrote to saw the man who loves her

10'. The man who loves her was seen by the woman he wrote to

Although I will continue to assume that there is a reading of (7) in which John and he are coreferential, the use of the term coreference is not meant to imply that this notion is a primitive in grammar, but rather that it can be inferred from the semantic representation of some sentence. Similarly, the device of referential indices will be used in an atheoretical way. That is, in representing a sentence like (7) as:

11. John said that he left

I am not claiming that referential indices are part of grammatical theory, but only that this sentence is to be taken on the reading in which John and he are the same individual. Thus both referential indices and the term coreference are used simply to disambiguate surface structures. The use of the term antecedent is also not meant in a theoretical way. If a pronoun is coreferential to some full NP, I will, for convenience, call the latter the antecedent of the former.

I will only be discussing Crossing Coreference sentences in which the second NP is definite. My analysis predicts that sentences like (12) and (13) are ungrammatical; I believe they in fact are:

12. *The woman who wrote to him saw a man who loves her
13. *A woman who wrote to him saw a man who loves her

It is well known that a pronoun generally cannot precede an indefinite antecedent, and thus not surprising that these are bad. However, sentences like (13) often appear in the literature as grammatical. If
these are grammatical for some speakers, I have no explanation for this.

One limitation of the framework used here is that it essentially ignores functional and other pragmatic considerations. For example, in Sec. 6 I formulate a purely syntactic constraint to account for the ungrammaticality of a sentence like:

14. *The dragon that chased him attacked a green-hooded knight

It has been claimed that (14) does not violate a strictly grammatical constraint, but that the violation here follows from principles of conversation. For example, Kuno (1975) proposes the following constraint:

15. Do not pronominalize the lefthand noun phrase unless its referent is determinable (predictable) from the preceding context.

Such a constraint seems intuitively satisfying. Pronouns represent "old information", indefinite NP's are necessarily "new information", and so indefinite NP's must be introduced into the discourse before they can be referred to.

Nevertheless, I believe that there is justification for accounting for a sentence like (14) in purely grammatical terms. First of all, the existence of a principle like (15) does not preclude the possibility of a grammatical constraint. This kind of principle might, in part, explain why such a constraint exists; this does not mean that the constraint itself does not.

Moreover, a constraint like (15) does not cover a number of apparently related cases. For example, it has often been argued that the ungrammaticality of (16) is related to that of (14) (cf., Cole (1972), Wasow (1972)): 

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16. *Which knight did the dragon that chased him attack?*

The constraint proposed in Sec. 6 accounts for both (14) and (16); it is not clear that (15), or any similar principle, can. Here the phrase *which knight* is introduced into the discourse before the pronoun. Any explanation of the violation in these sentences which is based on the order in which items are communicated is necessarily dealing with surface structure. Therefore it is difficult to see how such an account can explain the contrast between (16) and (17):

17. Which knight attacked the dragon that chased him?

Perhaps a different functional principle could account for this. But a functional explanation of this contrast might have to take into account syntactic notions like derivational stages; other functional principles which have been proposed make use of grammatical notions like subject, by-agentives, etc. (cf., Kuno (1975)). Given this, it is not always clear just how a functional account differs from a syntactic account. Thus while functional considerations probably play a role in the facts I will consider, I suspect that the major conclusions reached in this thesis would be the same even if a more functionally oriented approach is adopted.

For convenience, I am also assuming that a sentence whose presuppositions fail has no truth value, and that definite NP's presuppose both the existence and the uniqueness of the thing described. As far as I can tell, neither of these assumptions is crucial in my analysis. However, the formulation of the conditions under which Pronominalization can occur does crucially assume that a sentence with a definite description is not true (i.e., either false or truth-valueless) in a context where more than one object fits that description. Horn (1972)
and Morgan (1975) both discuss problems with this; if this assumption is incorrect then the formulation of the conditions for Pronominalization would have to be modified and would probably have to include pragmatic considerations.

One other issue that should be mentioned here concerns the question of whether pronouns are to be handled syntactically or interpretively. This question is entirely separate from the question of the correct semantic representation of pronouns. I will be assuming a framework in which semantic representations are related to surface structures by a single set of rules, which we can call syntactic. I will not explore the possibility of translating the analysis into a theory which handles pronouns by interpretive rules; the question of whether or not this can be done depends, I believe, on the particular interpretive theory chosen. However, various arguments have been given against a theory which handles pronouns syntactically. These are discussed in Sec. 13, where I try to answer some of these arguments.
Part I - The Analysis
Section 1
Some Syntactic Facts

In this section I will discuss two cases where the first pronoun in a Crossing Coreference sentence acts like its full NP antecedent. But in both of these cases, the second pronoun does not have this property. This indicates that the first pronoun must be related to a fuller NP, and it further indicates that the two pronouns must be treated differently. I will also discuss a third situation in which there is an asymmetry between the two pronouns.

1.1. Postal's Constraint and Crossing Coreference Sentences

1.1.1. The Full NP Behavior of the First Pronoun

The first argument for the claim that some definite, personal pronouns are represented as fuller NP's is based on the contrast between Crossing Coreference sentences like those in (1) and those in (2):

1. a. The man_i who loves her_j kissed his_i wife_j
   b. The woman_i who wrote to him_j saw the man_j who
      loves her_i

2. a. *The man_i (who) she_j loves kissed his_i wife_j
   b. *The woman_i (who) he_j wrote to saw the man_j who
      loves her_i

The ungrammaticality of the (2)-sentences appears to be related to the ungrammaticality of the following:

3. a. *the man_i (who) his_i wife loves
   b. *the woman_i (who) the man who loves her_i wrote to

These NP's are identical to the subject NP's in (2), except that the pronoun has been replaced by the fuller NP antecedent. Notice
that the fuller relative clauses corresponding to the subject NP's in (1) are, like (1), grammatical:

4. a. the man who loves his wife
   b. the woman who wrote to the man who loves her

The constraint blocking (3) was originally formulated by Postal (1971) as part of the Crossover Constraint, and has since been re-analyzed in a number of ways (cf., Postal (1972), Cole (1972), Jacobson (1972) and Wasow (1972)). This constraint, which I will refer to here as Postal's constraint, will be discussed in much greater detail in Sec. 6; for now we need not be concerned with its exact formulation. Here I will argue that regardless of how it is formulated, it will not block (2) unless it holds for some structure in which the first NP in (2) is represented as (3). In other words, the pronoun she in (2a), for example, must at some stage be represented as the fuller NP his wife. It will then be shown that to try to block (2) by a different principle would require some constraint which duplicates all of the conditions of Postal's constraint.

There are two features of the NP's in (3) which are crucial in accounting for their ungrammaticality. First, (3) can be contrasted with grammatical NP's like:

5. a. the man who Jack's wife loves
   b. the woman who the man who loves Sally wrote to

The contrast between (3) and the versions of (5) containing pronouns is perhaps best brought out with more context. Thus, for example, compare:
6. Jack said that the man his wife loves visited Lapland last year

7. *Jack said that the man his wife loves visited Lapland last year

The constraint must therefore be formulated in such a way that it blocks NP's like (3) only if they contain a coreferential pronoun.

However, not all NP's containing coreferential pronouns are blocked; the constraint must crucially distinguish between the NP's in (3) and those in (4):

3. a. *the man who his wife loves

4. a. the man who loves his wife

In all of the formulations of this constraint that I know of, the constraint distinguishes (3) and (4) by virtue of the fact that, in (3), the relativized NP is, at the input to Relative Clause Formation, to the right of the pronoun:

8. the man [his wife loves relativized] NP

while in (4) the NP is relativized from the left of the pronoun:

9. the man [relativized loves his wife] NP

So for example, in Postal (1971) the constraint blocks the application of Relative Clause Formation if this rule would cause the relativized NP to "cross" a coreferential NP. From this it follows that relative clauses will be blocked only when the relativized NP is moved from the right of the pronoun. In Postal (1972) the constraint is reformulated to block derivations in which a "Wh-Movement rule" (such as Relative Clause Formation) has reversed the order of a wh-word and a coreferential pronoun. Some other formulations of the constraint are discussed in Sec. 6; these differ crucially from Postal's formulations...
in that the movement of the relativized NP is irrelevant.

Nevertheless, all of these constraints, including the reformulation proposed in Sec. 6, are similar in that they only block relative clauses which: (a) contain a pronoun which is coreferential to the relativized NP (or, to the entire NP), and in which (b) the relativized NP is, at the input to Relative Clause Formation, to the right of the pronoun.

The necessity for the first condition has been supported by the contrast between (3) and (5). It should be noted, though, that the second condition is not sufficiently justified by considering only the contrast between (3) and (4). Other criteria could be used to distinguish these. For example, the salient difference could be whether or not a subject is relativized. Evidence will be given later that the position of the relativized NP with respect to the pronoun is, in fact, the crucial feature. Here it will be assumed that this is correct, but the argument does not hinge on this.

The necessity for the first condition alone is sufficient to show that the constraint cannot block (2) directly. For the subject NP in (2) does not contain a coreferential pronoun; rather it contains a pronoun whose antecedent contains a pronoun coreferential to the subject. Regardless of the exact formulation of the constraint, it blocks (3) on the basis of properties internal to the NP his wife - i.e., the reference of his. As long as the reference of his is information crucial to the applicability of the constraint - and the contrast between (3) and (5) indicates that it is - then the constraint will not block (2) unless she is represented as his wife in a structure to which the constraint applies.

It could at this point be claimed that (2) is blocked not by

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Postal's constraint, but by a separate principle. But this is highly implausible, since this principle would have to essentially duplicate Postal's constraint. So, first of all, the principle will have to distinguish between the sentences in (1):

1. a. The man who loves her kissed his wife
and those in (2):

2. a. *The man (who) she loves kissed his wife
The difference between (1) and (2) is parallel to the difference between (3) and (4).

Furthermore, this principle must be formulated so as to block sentences like (2a) just in case the antecedent of *she contains a pronoun coreferential to the man (to put this differently, just in case there is crossing coreference). So, the principle must distinguish between sentences like (2) and sentences like:

10. a. ?The man (who) she loves kissed \{Mary, Sam's wife\}
   b. ?The woman (who) he wrote to saw \{Jack, the man who loves Sally, the man who loves her\}

The sentences in (10) are for some speakers a bit awkward; Lakoff (1967) has pointed out that backwards pronominalization from the subject of a relative clause is slightly worse than backwards pronominalization from the object. Thus, in contrast to (10) the sentences in (11) are fully grammatical:

11. a. The man who loves her kissed Mary
   b. The woman who wrote to him saw the man who loves Sally
Nevertheless, the contrast between (10) and (11) is much less than the contrast between (1) and (2). (10) may be slightly strange (though a number of speakers seem to find these completely grammatical), yet I believe that for most speakers (2) is uninterpretable.

Again the contrast between sentences like (2) and those in (10) which contain pronouns is easier to see in a context which contains the other possible antecedent for the pronoun. Thus compare:

12. a. Everyone who knows her_{k} told John_{j} that his_{j} mother_{k} is crazy
b. *Everyone she_{k} knows told John_{j} that his_{j} mother_{k} is crazy

13. a. The man_{i} who loves her_{k} told the press that his_{j} mother_{k} is crazy
b. *The man_{i} she_{k} loves told the press that his_{j} mother_{k} is crazy

Therefore the constraint that blocks (2) must distinguish between (2) and (10), and so it must take into account the reference of some pronoun contained within the antecedent of the first pronoun.

Given this, I see only one plausible alternative to the claim that (2) is blocked by Postal's constraint. This would be to suppose that there is a constraint blocking crossing coreference when a subject pronoun is used. But it is easy to show that this constraint is both too strong and too weak. First of all, it incorrectly blocks Crossing Coreference sentences like:

14. The man_{i} who thought she_{j} was rich killed his_{i} mother_{j}

Notice that the fuller NP version of the subject NP is good here:

15. the man_{i} who thought his_{i} mother was rich

That (15) does not violate Postal's constraint is predicted by the
assumption that relative clauses are blocked only when an NP is relativized from the right of a coreferential pronoun.

Second, this constraint fails to block Crossing Coreference sentences like:

16. *The man who I had introduced him to killed his enemy.

(16) can be contrasted with (17), in which there is no crossing coreference:

17. The man who I had introduced him to killed

\[
\text{Jack,}
\text{Jack's enemy,}
\text{his enemy.}
\]

(16) is bad even though no subject pronoun is used. The ungrammaticality of (16) is predicted in a theory which relates the pronoun him to its fuller NP antecedent, since the following is also blocked:

18. *the man who I had introduced his enemy to

We can further note that in contrast to (18) an NP like (19) is grammatical:

19. the man who I had introduced to his enemy

This is predictable, since here the NP is relativized from the left of the pronoun. Similarly, in contrast to (16), we have good Crossing Coreference sentences like:

20. The man who I had introduced to him killed his enemy

Thus to claim that an independent principle blocks (2) would be to miss the generalization that crossing coreference is blocked in just those cases where the fuller NP version is blocked. Yet the constraint that blocks the fuller NP's must refer to the fact that these contain a coreferential pronoun, and so it cannot block the (2)
sentences directly. It seems therefore that we must conclude that at some level the first pronoun in these sentences is represented as its fuller NP antecedent.

1.1.2. The Asymmetry

While the first pronoun in a Crossing Coreference sentence acts like its full NP antecedent with respect to this constraint, the second pronoun does not. So for example, in contrast to the ungrammatical (2b), where the first pronoun is in subject position within the relative clause, a sentence like (21), where the second pronoun is in subject position, is good:

2b. *The woman\(_i\) (who) he\(_j\) wrote to saw the man\(_j\) who loves her\(_i\)\n
21. The woman\(_i\) who wrote to him\(_j\) saw the man\(_j\) (who) she\(_i\) loves

Moreover, the Passive of (2b) is good, since here the pronoun he is the second pronoun:

22. The man\(_j\) who loves her\(_i\) was seen by the woman\(_i\) (who) he\(_j\) wrote to

Likewise, the Passive of (21), where she is the first pronoun, is bad:

23. *The man\(_j\) (who) she\(_i\) loves was seen by the woman\(_i\) who wrote to him\(_j\)

Thus sentences like (2b) indicate that some pronouns - in particular, the first pronoun in a Crossing Coreference sentence - must be related to their full NP antecedents. But the grammaticality of (21) and (22) provides evidence that some pronouns have a non-full NP source. For if the second pronoun in these sentences were derived from their full NP antecedents, then Postal's constraint would block (21) and (22) as well. Here the second NP would be derived from the
following NP's which violate the constraint:

24. (full NP version of object in (21)):
   *the man_i (who) the woman who wrote to him_j loves

3b. (full NP version of object in (22)):
   *the woman_i (who) the man who loves her_j wrote to

1.2. Langendoen's Constraint and Crossing Coreference Sentences

1.2.1. The Constraint

There is another case in which the first pronoun of a Crossing Coreference sentence behaves like a full NP. Langendoen (personal communication) has noted that there is some constraint which blocks NP's of the form NP's NP or NP of NP when these contain a coreferential pronoun. Thus the following are all ungrammatical:

25. a. *her_i childhood friend's wife_i
    b. *the wife_i of her_i childhood friend
    c. *the wife_i of the man she_j knew as a child

26. a. *his_i house's builder_i
    b. *the builder_i of his_i house
    c. *the builder_i of the house he_i owns

(25) and (26) can be contrasted with similar NP's which do not contain a coreferential pronoun:

Langendoen notes that NP's of this form do occur as predicate nouns, as in:

i. John_i is the builder of his_i house

Similarly, NP's which appear to violate Postal's constraint can occur as predicate nouns:

ii. John_i is the man who his_i wife loves

Postal (1971) points out that (ii) is not a counterexample to his constraint if it is formulated to block NP's like the object of (ii) only when there is "presupposed" rather than "asserted" coreference between the pronoun and the NP containing it. The grammaticality of (i) indicates that Langendoen's constraint is similar in this respect.
27. a. \( \{ \text{Mary's} \} \) childhood friend's wife
   b. the wife of \( \{ \text{Mary's} \} \) childhood friend
   c. the wife of the man \( \{ \text{Mary} \} \) knew as a child

28. a. \( \{ \text{Jack's} \} \) house's builder
   b. the builder of \( \{ \text{Jack's} \} \) house
   c. the builder of the house \( \{ \text{Jack} \} \) owns

It is also interesting to contrast the NP's in (25) and (26) to similar relative clauses which are grammatical:

29. the one who married \( \{ \text{her childhood friend} \} \)
30. the one who built \( \{ \text{his house} \} \)

The nature of the constraint blocking (25) and (26) - which I will refer to as Langendoen's constraint - will not be explored any further. It is sufficient for my argument to note that some constraint exists which has the effect of blocking the following:

31. a. \( \text{NP[...pro...]NP's NP} \)
   b. \( \text{NP of NP[...pro...]NP} \)

The only crucial assumption about the nature of this constraint is that it must take into account a property internal to the embedded NP. That is, in blocking (25) and (26) it must refer to the fact that these NP's contain a coreferential pronoun. In view of the contrast between (25) and (26) on the one hand, and (27) and (28) on the other, this assumption seems justified.
1.2.2. The First Pronoun

Now consider the following Crossing Coreference sentences:

32. a. *His\textsubscript{i} wife\textsubscript{j} saw the man\textsubscript{i} who loves her\textsubscript{j}

   b. *The wife\textsubscript{j} of his\textsubscript{i} best friend saw the man\textsubscript{i} who loves her\textsubscript{j}

   c. *The builder\textsubscript{i} of the house that pleased her\textsubscript{j} saw the woman\textsubscript{j} who wrote to him\textsubscript{i}

In contrast to (32) the following sentences, where there is no crossing coreference, are grammatical:

33. a. ?His\textsubscript{i} wife\textsubscript{j} saw \{Jack\textsubscript{i} \{the man\textsubscript{i} who loves Mary \}

   b. The wife\textsubscript{j} of his\textsubscript{i} best friend saw \{Jack\textsubscript{i} \{the man\textsubscript{i} who loves Mary \}

   c. The builder\textsubscript{i} of the house that pleased her\textsubscript{j} saw \{Mary\textsubscript{j} \{the woman\textsubscript{j} who wrote to Jack \}

Some speakers find backwards pronominalization in a configuration like (33a) somewhat awkward. Yet again, I believe that for at least most speakers there is a significant contrast between (33a) and (32a), where (33a) is at worst questionable, but (32a) is for most people impossible. Moreover, the awkwardness of backwards pronominalization in this configuration could not account for the ungrammaticality of (32c); here the parallel sentence (33c) is perfectly alright.

The contrast between (32) and (33) shows that there is some principle blocking crossing coreference just in case the first NP has the form \textit{NP's NP} or \textit{NP of NP}. To put this differently, an NP of this form
cannot contain a pronoun whose antecedent contains a pronoun coreferential to this NP.

But given the existence of Langendoen's constraint, this falls out from the claim that the first pronoun is derived from its full NP antecedent. The ungrammaticality of (32) is predicted because, at some level, these sentences contain NP's which violate the constraint. Thus the subjects in (32) would be derived from the ungrammatical NP's:

   34. a. *the man who loves her_i's wife_i 
       or a'. *the wife_i of the man who loves her_i 
   3 b. *the wife_i of the man who loves her_i's best friend 
       or b'. *the wife_i of the best friend of the man who loves her_i 
   c. *the builder_i of the house that pleased the woman 
       who wrote to him_i 

If, on the other hand, the first pronoun is not related to its full NP antecedent, then Langendoen's constraint will not block (32). For in blocking NP's like (34c), it must refer to a property internal to the embedded NP the woman who wrote to him. That is, it must take into account the reference of him. The subject of (32c) does not, on the surface, have the relevant property.

Here again the conclusion that the first pronoun is related to a full NP could be avoided by the claim that a separate principle blocks (32). Again this claim would be difficult to maintain in view of the fact that such a principle would have to distinguish between sentences like (32) and sentences like (33). The principle would essentially have to duplicate Langendoen's constraint.

The claim that it is Langendoen's constraint that blocks (32) is further supported by the fact that similar sentences involving relative clauses are, like the relative clauses in (29) and (30), grammatical:
35. a. The one \(_i\) who married him\(_j\) saw the man\(_j\) who loves her\(_i\)
    b. The one \(_i\) who married his\(_j\) best friend saw the man\(_j\) who loves her\(_i\)
    c. The one \(_i\) who built the house that pleased her\(_j\) saw the woman\(_j\) who wrote to him\(_i\)

1.2.3. The Second Pronoun

Langendoen's constraint also provides further evidence for the claim that the second pronoun of a Crossing Coreference sentence is not derived from its full NP antecedent. For in contrast to (32), sentences like (36) are grammatical:

36. a. The man\(_i\) who loves her\(_j\) saw his\(_i\) wife\(_j\)
    b. The man\(_i\) who loves her\(_j\) saw the wife\(_j\) of his\(_i\) best friend
    c. The woman\(_i\) who wrote to him\(_j\) saw the builder\(_j\) of the house that pleased her\(_i\)

Similarly, the Passives of (32) are good:

37. a. The man\(_i\) who loves her\(_j\) was seen by his\(_i\) wife\(_j\)
    b. The man\(_i\) who loves her\(_j\) was seen by the wife\(_j\) of his\(_i\) best friend
    c. The woman\(_i\) who wrote to him\(_j\) was seen by the builder\(_j\) of the house that pleased her\(_i\)

while the Passives of (36) are bad:

38. a. *His\(_i\) wife\(_j\) was seen by the man\(_i\) who loves her\(_j\)
    b. *The wife\(_j\) of his\(_i\) best friend was seen by the man\(_i\) who loves her\(_j\)
    c. *The builder\(_j\) of the house that pleased her\(_i\) was seen by the woman\(_i\) who wrote to him\(_j\)

The grammaticality of (36) and (37) indicate that the second pronoun is not derived from a full NP, for if it were, these sentences would violate the constraint. Here the object NP's would be derived from the
ungrammatical NP's in (34). Thus Crossing Coreference sentences behave the same way with respect to Langendoen's constraint as they do with respect to Postal's constraint.

The fact that not all pronouns behave syntactically like their full NP antecedents is hardly surprising. Bach (1970) shows that the very existence of Crossing Coreference sentences argues against the position that all pronouns are derived from full NP's identical to their antecedents. But while these sentences have often been taken to show that no pronoun is related to a fuller NP, their interaction with these constraints provides evidence that this position too is incorrect.

Rather, the asymmetry between the two pronouns indicates that not all pronouns can be treated in the same way, but that, as has been argued for by Geach (1962), Partee (1972) and others, there must be at least two different sources for pronouns. Moreover, it seems that the correct theory of pronominalization must allow the second pronoun to have a non-full NP source, while at the same time block a non-full NP source for the first pronoun. The question of how a theory can account for this asymmetry is one of the major questions that this thesis attempts to answer. In particular, I will try to show that given a more general formulation of Postal's constraint, combined with a theory that derives some pronouns from full NP's, this asymmetry falls out.

1.3. Crossing Coreference Sentences and Relative Clauses

There is at least one more configuration in which this asymmetry shows up. The first NP of a Crossing Coreference sentence cannot be in a relative clause, while the second NP can. By "first NP" I mean the NP which is the antecedent of the second pronoun; the second NP is the antecedent of the first pronoun.
So for instance take a Crossing Coreference sentence like:

39. The woman_ who wrote to him_ saw \{her_ husband_ \} \{the man_ who loves her_ \}

If the first NP - the woman who wrote to him - is embedded in a relative clause an ungrammatical sentence results:

40. *The house that pleased the woman_ who wrote to him_ annoyed \{her_ husband_ \} \{the man_ who loves her_ \}

This can be contrasted with the following sentence without crossing coreference:

41. The house that pleased the woman who wrote to him_ annoyed \{Sally_ \} \{the man_ who loves Sally_ \}

Yet here again there is an asymmetry, for the second NP can be in a relative clause:

42. The woman_ who wrote to him_ bought the house that pleased \{her_ husband_ \} \{the man_ who loves her_ \}

Here too we can contrast the Active-Passive pair (40) and (43):

40. *The house that pleased the woman_ who wrote to him_ annoyed the man_ who loves her_ vs. 43. The man_ who loves her_ was annoyed by the house that pleased the woman_ who wrote to him_

Or we can contrast (42) with its Passive:

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2This asymmetry appears to hold not only for relative clauses but for at least some other islands as well. So for example, the first NP of a Crossing Coreference sentence cannot be in a sentential subject, while the second NP can:

i. *My threatening the woman_ who wrote to him_ upset \{her_ husband_ \} \{the man_ who loves her_ \}

vs. ii. The woman_ who wrote to him_ thought that my threatening \{her_ husband_ \} \{the man_ who loves her_ \} was unnecessary

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42. The woman$_i$ who wrote to him$_j$ bought the house that pleased the man$_j$ who loves her$_i$

vs. 44. *The house that pleased the man$_j$ who loves her$_i$ was bought by the woman$_i$ who wrote to him$_j$

Thus the interaction of Crossing Coreference sentences and relative clauses provides further evidence that the two NP's must be treated differently.

1.4. **Worse Sentences**

Some of the ungrammatical sentences discussed in the preceding sections are, I believe, at least marginal for some speakers. For example, I imagine that some speakers might allow sentences like:

32a. *His$_i$ wife$_j$ saw the man$_i$ who loves her$_j$

though I suspect that this requires heavy stress on the object NP in order to be acceptable.

This indicates that, for some speakers, the first pronoun need not be derived from a full NP. But the claim that some pronouns must be derived from full NP's is not weakened by this fact. For while (32a) may be acceptable, I believe that no speakers allow sentences like:

45. *His$_i$ wife$_j$ killed \{her$_j$ childhood friend$_i$  \\
                              \{the man$_i$ who loves her$_j$ best friend\}  \\

46. *The builder$_i$ of her$_j$ house saw his$_i$ wife$_j$

The ungrammaticality of (45) and (46) follows from the claim that one of the two pronouns in a Crossing Coreference sentence is derived from a full NP (though for speakers who accept (32a) it need not be the first pronoun). If one of the pronouns must have a full NP source then either the first pronoun in (45) does, in which case the subject NP violates Langendoen's constraint:

47. *her$_j$ childhood friend's wife$_j$
or the second pronoun has this source, in which case the object NP violates the constraint:

48. *his\textsubscript{i} wife's childhood friend\textsubscript{i}

If neither pronoun were related to a full NP, then a separate principle would be necessary to account for (45) and (46). But notice that similar sentences without crossing coreference are not blocked:

49. a. ?His\textsubscript{i} wife killed Sally's childhood friend\textsubscript{i}
   b. Jack's wife\textsubscript{j} killed her\textsubscript{j} childhood friend

50. a. The builder of her\textsubscript{j} house saw Jack's wife\textsubscript{j}
   b. The builder of Mary's house saw his\textsubscript{i} wife

Thus the principle blocking (45) and (46) must take into account the reference of a pronoun contained within the antecedent of each pronoun. It is difficult to imagine how such a principle could be formulated without duplicating Langendoen's constraint.

As will be discussed later, a theory can be formulated which requires that one or the other of the pronouns be derived from a full NP, while the other must have a non-full NP source. There is further a constraint - of which Postal's constraint is a special case - which has the effect of blocking the derivation in which the second pronoun comes from a full NP and the first pronoun does not. However, this constraint is not as strong as, for example, Langendoen's constraint; other cases will be discussed later in which some speakers allow violations of this constraint. I have no idea why the constraint permits some degree of violation, but this accounts for the fact that speakers may find (32a) somewhat better than (45).

Similarly, while (40) may be marginal for some speakers, sentences
like (51) and (52) are much worse:

40. *The house that pleased the woman who wrote to him annoyed the man who loves her

51. *The house that pleased the woman who wrote to him annoyed her husband

52. *The storm that frightened the man who loves her destroyed the house that belongs to the woman who wrote to him

It will be argued later that there is a constraint that predicts that a pronoun whose antecedent is in a relative clause must have a full NP source; we can call this the relative clause constraint. This means that her in (40) must be derived from a full NP. Given a theory requiring one of the pronouns to have a non-full NP source, it follows that the pronoun within the relative clause (him in (40)) must have this source. (40) is therefore ungrammatical since it violates the constraint that predicts that the first pronoun must have the full NP source.

The fact that some speakers can violate this constraint means that (40) will be acceptable or marginal for these speakers. But the relative clause constraint and Langendoen's constraint are much stronger; these two predict that (51) and (52) are impossible. If a pronoun whose antecedent is in a relative clause has a full NP source, then the pronoun her in (51) is derived from a full NP. Given this, the object NP violates Langendoen's constraint. In (52) both antecedents are in relative clauses. In a theory which derives one and only one of the pronouns in a Crossing Coreference sentence from a full NP, there is no way to derive (52). The principle that a pronoun whose antecedent is in a relative clause corresponds to a full NP predicts that both pronouns in (52) have the full NP source.
Section 2

Some Semantic Claims

Before turning to the question of what kind of theory can account for the syntactic behavior of Crossing Coreference sentences, we will, in this section, consider their meaning. Beginning with Karttunen's seminal paper on this question (Karttunen, 1971) there has been a good deal of discussion about this. Most of the arguments as to the correct representation for these sentences have been based on claims about their meaning. The problem with basing a theory on the semantic evidence alone is that there has been little agreement as to what these sentences actually do mean.

Yet although the syntactic evidence is much clearer, there is some evidence which can be brought to bear on the question of the meaning of these sentences. Thus in this section I will first enumerate the various claims that have been made, and will then present some evidence in support of one of these. Later it will be shown that this claim is consistent with the syntactic evidence. However, in light of the disagreement about the meaning of these sentences, I should stress that I consider the semantic evidence to be less compelling than the syntactic evidence considered in the previous section.

First some terminology should be clarified. I will, following Karttunen, speak of a sentence as being interpretable in a given context if its presuppositions are met in that context; otherwise the sentence is uninterpretable in the context. So a sentence containing a definite description will be called uninterpretable if no object or if more than one object meets the description. These terms and the term presuppo-
sition will be used somewhat loosely in that I will speak of the pre-
suppositions and interpretability of NP's (as well as of S's). Roughly
speaking, the notion of the presuppositions of some NP can be taken to
mean the presuppositions of some S containing that NP; this definition
is somewhat loose, but will suffice here.

2.1. Related Sentences

We can first consider sentences like (1) and (2) in a context
like (3):

1. The woman谁 wrote to the man谁 loves her saw him

2. The man who loves the woman who wrote to him was seen by her

3. Women wrote to Men loves Women

<table>
<thead>
<tr>
<th>Women</th>
<th>wrote to</th>
<th>Men</th>
<th>loves</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sally</td>
<td>→ Ted</td>
<td>Sally</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jane</td>
<td>→ Dick</td>
<td>Jane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mary</td>
<td>→ John</td>
<td>Mary</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In this context, both sentences are true if and only if Sally saw Ted,
since Sally and Ted are the only man-woman pair such that the woman
wrote to the man and the man loves the woman.

However, Karttunen has shown that these two sentences are not
synonymous, for they involve different presuppositions. Take a phrase
like:

4. the woman who wrote to the man who sneezed

Two things are presupposed by (4); that one and only one man sneezed,
and that one and only one woman wrote to that man. If this is compared
to the subject NP in (1):
1'. the woman who wrote to the man who loves her;

a crucial difference emerges. Like (4), (1') presupposes two things: that one and only one man loves the relevant woman, and that one and only one woman wrote to the man who loves her. But (4) is uninterpretable in a context where two women wrote to the relevant man, while this is not necessarily the case for (1'). Given the relevant man, several women may have written to him; if he loves only one of them, then he is describable as the man who loves her with respect to only one woman. Thus the presupposition that there is only one woman who wrote to the man who loves her is not violated in this context.

Given this, (1):¹

1. The woman who wrote to the man who loves her saw him requires a context in which only one man loves the relevant woman, but several women may have written to that man. On the other hand, (2):

2. The man who loves the woman who wrote to him was seen by her

requires that one and only one woman wrote to the relevant man, but several men might love the relevant woman. To clarify this difference, Karttunen considers these sentences in a context similar to Crime and Punishment (with a slight modification):²

5. Women wrote to Men loves Women
   Sonia Raskolnikov Sonia
   Dunia Razumikhin Dunia

¹I will from here on in omit referential indices when the intended reading is clear.

²This context and the following one are modelled after those constructed by Wasow (1972); the contexts that Karttunen actually considers involve an additional, unnecessary complication.
Here (1) is interpretable, and means that Dunia saw Razumikhin. Since Razumikhin is the only man that loves Dunia (we are excluding brotherly love), the phrase the man who loves her refers, with respect to Dunia, to Razumikhin. Since Dunia did indeed write to him, she can be described as a woman who wrote to the man who loves her. Sonia, on the other hand, cannot be so described since she did not write to the man who loves her (Raskolnikov). Hence the phrase the woman who wrote to the man who loves her is interpretable in (5); the presupposition that there is one and only one woman who wrote to the man who loves her is met, and this woman is Dunia.

(2) on the other hand is not interpretable in this context. Although Razumikhin loves Dunia and Dunia wrote to Razumikhin, the phrase the woman who wrote to him makes no sense with respect to Razumikhin, for there is no unique woman who wrote to him. Therefore Razumikhin is not describable as a man who loves the woman who wrote to him. Raskolnikov, on the other hand, can be characterized in terms of the woman who wrote to him, since Dunia is the only one who wrote to Raskolnikov. But since he doesn't love Dunia, he can't be described as the man who loves the woman who wrote to him. Thus this phrase is uninterpretable in this context.

The situation is reversed in (6) (adapted with slight changes from The Insulted and Injured):

6. Women wrote to Men loves Women
   Natasha → Alyosha → Natasha
   Katya → Vanya → Katya

Here (2) is interpretable and true if Natasha saw Alyosha, while (1) is

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Karttunen also considers contexts in which both sentences should be interpretable, but where the two refer to different pairs. Such a context is (7) (taken from *The Brothers Karamazov*):

7. **Women** wrote to **Men** loves **Women**

   - Grushenka to Dmitri loves Grushenka
   - Katerina to Ivan loves Katerina
   - Lisa to Alyosha loves Lisa

(1) is true if Lisa saw Alyosha. Since one and only one man loves Lisa (i.e., Alyosha) she is characterizable in terms of the man who loves her. She did write to Alyosha, and so can be described as a woman who wrote to the man who loves her. In order for the presuppositions of (1) to be met, there must be no other woman who can be so described. Grushenka cannot; although the phrase the man who loves her makes sense with respect to Grushenka (and refers to Dmitri) she did not write to Dmitri.

The complication in this context involves Katerina and Dmitri. Katerina did write to Dmitri, and Dmitri loves Katerina. Yet the phrase the man who loves her cannot be used with respect to Katerina, since two men love her. Given this, Katerina cannot be described as a woman who wrote to the man who loves her. Thus Lisa is the only woman describable this way; the sentence is thus interpretable and the subject refers to Lisa. By the same reasoning, (2) is interpretable and true if Katerina saw Dmitri.

In other words, this context involves the added complication that there are two men-women pairs such that the woman wrote to the man and the man loves the woman. But each sentence should be interpretable here, because in each case only one pair meets the uniqueness presupposition.

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of the most deeply embedded NP. While Karttunen's point should, in theory, be correct, it seems that most speakers' intuitions collapse in the face of this added complication. We will therefore restrict the discussion whenever possible to the simpler contexts (5) and (6).

2.2. Crossing Coreference Sentences

We can now consider the following sentences, with crossing coreference:

8. The woman who wrote to him saw the man who loves her
9. The man who loves her was seen by the woman who wrote to him

While there is general agreement about the meaning of (1) and (2), there are, unfortunately, at least seven different claims in the literature as to the meaning of (8) and (9). I will first enumerate these claims, and will then try to support one of them.

2.2.1. The Claims

a.) Dik (1973) claims that (8) and (9) are synonymous, and that both are interpretable only in a context where there is one and only one x-y pair such that x is the only woman who wrote to y and y is the only man who loves x. According to this, then, these sentences are not interpretable in any of the Dostoyevsky contexts considered above, but only in the Ted and Sally context (3).

b.) Another possibility is that the sentences require a unique

3This, at least, appears to be what he claims. At one point he says that a sentence like (8) "can refer to a pair" such that only one woman wrote to the man and only one man loves the woman; this would seem to suggest that there need not be only one such pair. (This reading is discussed in (c) below.) However, he later says that sentences like (8) and (9) require "data bases containing just one configuration" of this type (i.e., only one such pair).
pair, but that the individuals need not be unique. This is the meaning assigned by Keenan's representation of these sentences (Keenan, 1971). In other words, the sentences are interpretable only in a context where there is one and only one x-y pair such that x is a woman who wrote to y (but not necessarily the only woman who wrote to y) and y is a man who loves x (again, not necessarily the only man who does). This predicts that (8) and (9) are both interpretable in *Crime and Punishment* (5) and in *The Insulted and Injured* (6), as well as in *Ted and Sally* (3), but not in *The Brothers Karamazov* (7). On the other hand, they would also be interpretable in a context like:

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10. Women wrote to Men loves Women
    Melissa    Jack    Melissa
    Carol   Sam    Carol
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and would be true if Carol saw Sam.

c.) This suggests another possibility which, to my knowledge, has never been claimed as the only meaning of these sentences. This is that the sentences require a context where there is at least one (but not necessarily only one) x-y pair such that x is the only woman who wrote to y and y is the only man who loves x, and that further the sentences are true if, for one such pair, x saw y.\(^4\) Of the contexts considered so far, only *Ted and Sally* meets this requirement; but this claims that the sentences are also interpretable in a context like:

\(^4\)Dave Davis and Stanley Peters have both pointed out to me that this is actually the meaning assigned by the system outlined in Hintikka and Saarinen (1975). However, Hintikka and Saarinen argue for a different meaning for these sentences, which is discussed in (d). (They also claim that the meaning in (d) is predicted by their system.)
Given this meaning, (8) and (9) would be true here either if Rosa saw Paul or if Maude saw Harold.

d.) According to Hintikka and Saarinen (1975), (8) and (9) are interpretable in (11), but not on the reading discussed above. Rather, they claim that these sentences are true only if Rosa saw Paul and Maude saw Harold. In other words, the sentences would be true if for all x-y pairs such that x is the only woman who wrote to y and y is the only man who loves x, then x saw y. The interpretation discussed in (c) above is that the sentences are true if there exists an x-y pair such that x is the unique woman who wrote to y and y is the unique man who loves x and x saw y.

e.) Karttunen claims that (8) and (9) are both ambiguous; both have the reading of (1) and the reading of (2). Thus, the sentences require either: (i) a unique x-y pair such that x is a woman who wrote to y and y is the only man who loves x, or (ii) a unique x-y pair such that x is the only woman who wrote to y and y is a man who loves x. According to this, both sentences are interpretable in *Ted and Sally* (3), *Crime and Punishment* (5), and *The Insulted and Injured* (6). They are also both interpretable in *The Brothers Karamazov* (7), and are true if either Lisa saw Alyosha or Katerina saw Dmitri. They are uninterpretable in (10) and (11).
f.) Kuroda (1971) claims that these sentences are actually three-ways ambiguous. According to him, they not only have the two Karttunen readings, but they additionally have the reading discussed in (c) above. That is, these sentences require either (i) or (ii) above or: (iii) a context in which there is an x-y pair (not necessarily only one such pair) such that x is the only woman who wrote to y and y is the only man who loves x. Thus in addition to contexts like Ted and Sally, Crime and Punishment, The Insulted and Injured and The Brothers Karamazov, Kuroda claims that the sentences are also interpretable in a context like the following:

12. Women wrote to Men loves Women
Alice ----> Abe ^ Alice
Barbara --- Bill ^ Barbara
Claudia  ---> Chuck ^ Claudia
Diane    ---> Dave ^ Diane

Given only the two Karttunen readings, the sentences are not interpretable in (12), since the presuppositions are not met for either reading. There is no unique x-y pair such that x uniquely wrote to y and y loves x; two pairs meet this specification (Alice and Abe, and Diane and Dave). Nor is there a unique x-y pair such that x is a woman who wrote to y and y is the unique man who loves x. Again two pairs fit this description (Claudia and Chuck, and Diane and Dave). But if the sentences have the third reading in addition to the other two, they will be interpretable in (12) for there is an x-y pair such that x uniquely wrote to y and y uniquely loves x. This pair is Diane and Dave. Kuroda's claim therefore predicts that (8) and (9) are interpretable in (12), and
true if Diane saw Dave.

Kuroda's position and Karttunen's also make different predictions in simpler contexts, like (11). According to Kuroda's claim, the sentences are interpretable here, and true if Rosa saw Paul or Maude saw Harold. Karttunen's claim predicts that the sentences are uninterpretable here; there is neither a unique pair where the woman is unique, nor a unique pair where the man is unique.

g.) Fauconnier (1971) points out that the claim that (8) and (9) are interpretable in (12) is consistent not only with the position that they have a reading which requires a non-unique pair with unique members, but also with the position that they have instead a reading which requires a unique pair with unique members. (This is the reading which Dik claims these sentences have.) Thus Fauconnier claims that the sentences are three-ways ambiguous, but not in the same way as Kuroda does. According to Fauconnier, these sentences have the two Karttunen readings and the Dik reading. That is, they require that one of the following exists: (i) a unique x-y pair such that x is a woman who wrote to y and y is the only man who loves x, (ii) a unique x-y pair such that x is the only woman who wrote to y and y is a man who loves x, or (iii) a unique x-y pair such that x is the only woman who wrote to y and y is the only man who loves x.

If one more pair is added to (12) then the difference between Kuroda's position and Fauconnier's is clarified:
According to Fauconnier (and Dik) these sentences are not interpretable in (13), while Kuroda's position predicts that they are. Of course Fauconnier's and Kuroda's claims are also differentiated by a simpler context like (11), where the latter, but not the former, predicts that (8) and (9) are interpretable in (11).

It is, incidentally, interesting to note that it is impossible to construct a context in which all three of the readings which Fauconnier attributes to these sentences are possible, and where all three pick out different pairs. In fact, there can be no context where the third reading and one of the Karttunen readings are both true, but pick out different pairs. Any pair which satisfies the two-way uniqueness requirement of Dik's reading will satisfy the one-way uniqueness requirement for either of Karttunen's readings. Thus if Dik's reading is met by some pair, then the other reading will either not be possible, or it will be met by the same pair.

h.) Wasow (1972) has claimed that (8) and (9) are both unambiguous and not synonymous.\(^5\) He claims that (8) is synonymous with (1) and (9) with (2):

\(^5\)Though in Wasow (1973) he agrees with Kuroda.
8. The woman who wrote to him saw the man who loves her
1. The woman who wrote to the man who loves her saw him
9. The man who loves her was seen by the woman who wrote to him
2. The man who loves the woman who wrote to him was seen by her

In other words, the claim here is that (8), like (1), requires a unique x-y pair such that x is a woman who wrote to y and y is the only man who loves x; while (9), like (2), requires a unique x-y pair such that x is the only woman who wrote to y and y is a man who loves x. Thus this claims that (8) is interpretable in Crime and Punishment (5) but not in The Insulted and Injured (6), while the reverse is true for (9). It also means that the two sentences will be true in The Brothers Karamazov under different circumstances; (8) is true if Lisa saw Alyosha, and (9) is true if Katerina saw Dmitri.

2.2.2. The Evidence

I will agree with Wasow's claim, and will give some evidence here to support this claim. Given the proliferation of disagreement in the literature, it is obviously not enough to support this claim by looking only at the interpretability of these sentences in various contexts. Nevertheless, I think the discussion in the literature has been obscured by the consideration of overly complicated contexts.

Thus we can look again at the simplest context which tests the validity of Wasow's position. This position is distinguished from the others by simply considering Crime and Punishment:

5. Women wrote to Men loves Women
Sonia Raskolnikov Sonia
Dunia Razumikhin Dunia

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Wasow's position differs from that of Dik (a) and the position discussed in (c) in that these predict that neither of the Crossing Coreference sentences are interpretable here, while Wasow's predicts that (8) is. As evidence for this, consider (8) in the following discourse:

14. Q. Which woman saw the man who loves her?
   A. (=8) The woman who wrote to him saw the man who loves her

This seems to be a perfectly plausible discourse in the context of Crime and Punishment; the answer would be true if Dunia saw Razumikhin.

On the other hand, Wasow's position differs from the remaining positions in that it claims that (9), like (2), is not interpretable in Crime and Punishment:

9. The man who loves her was seen by the woman who wrote to him

2. The man who loves the woman who wrote to him was seen by her

Here I know of no way to show this by consideration of the context alone.

However, two other types of evidence can be given. First, by considering these sentences in discourse situations, some support emerges for the validity of Wasow's position. Second, I will present some very scanty evidence based on informants' intuitions. This evidence, while weak, supports this position.

According to all of the other claims discussed above, (8) and (9) are not synonymous. This means that, all other things being equal, (8) and (9) should be able to occur in all of the same discourses. Thus Wasow's position would be supported if there is some discourse in which (8) is appropriate and not (9), or vice-versa.

A consideration of the questions that these sentences can answer
reveals that they are not appropriate in the same situations. Thus (8) but not (9) can be an answer to the question in (15); the reverse holds true in (16):  

15. Q. Which woman saw the man who loves her?
   A. (8) The woman who wrote to him saw the man who loves her
   (9) *The man who loves her was seen by the woman who wrote to him

16. Q. Which man was seen by the woman who wrote to him?
   A. (8) *The woman who wrote to him saw the man who loves her
   (9) The man who loves her was seen by the woman who wrote to him

An obvious objection to this test is that (9) answers the Active question (15) with a Passive sentence, and so this question-answer pair should be bad on independent grounds. Similarly (8) answers the Passive (16) with an Active. But such question-answer pairs are, in general, possible:

17. Q. Which woman saw John?
   A. ?John was seen by Mary

18. Q. Which man was seen by Mary?
   A. ?Mary saw John

(9) seems to be far worse as an answer to (15), and (8) to (16), than a simple changing of active and passive seems to warrant.

Notice that we cannot rephrase (15) as a Passive to match (8), nor can (16) be rephrased as an Active. These questions are, in themselves, bad for most speakers:

---

6I would expect that some speakers can marginally get (9) as an answer for (15) and (8) for (16). But I believe that most speakers find this impossible.
19. (Passive of (15)):
   *Which woman$_1$ was the man who loves her$_1$ seen by?

20. (Active of (16)):
   *Which man$_1$ did the woman who wrote to him$_1$ see?

Later it will be argued that the constraint blocking these questions is
the same as the constraint which blocks the ambiguity with Crossing Co-
reference sentences. In other words, (20) is ungrammatical for the same
reason that (8) couldn't be an answer to (20) (or to its corresponding
grammatical question (16)).

There is a second discourse situation which provides evidence for
Wasow's position. To show this, we will consider not (8) and the Passive
(9), but rather (8) and (21):

8. The woman who wrote to him saw the man who loves her
21. The man who loves her saw the woman who wrote to him

Of course (8) and (21) are not synonymous, but, according to the other
positions, the only difference between these sentences lies in their
assertions; they should be interpretable in the same contexts. The same
is true of a pair like:

22. Mary saw John
23. John saw Mary

Thus in any situation where pairs like (22) and (23) are both appropriate,
we would expect (8) and (21) to both be appropriate if these other claims
are correct.

Yet this is not the case. Both (22) and (23) can be followed by
sentences in which John is pronominalized:

24. Mary saw John yesterday.
   Did that bother him?

25. John saw Mary yesterday.
   Did that bother him?
Note too that both the subject and the object can be pronominalized with sentences like the following (though (a) is perhaps a bit strange in (26)):

26. The woman who wrote to him saw John yesterday
   a. Did that bother her?
   b. Did that bother him?

27. John saw the woman who wrote to him yesterday
   a. Did that bother her?
   b. Did that bother him?

However, both possibilities do not exist with Crossing Coreference sentences. Thus we have contrasts like the following:

28. The woman who wrote to him saw the man who loves her yesterday
   *Did that bother him?

29. The man who loves her saw the woman who wrote to him yesterday
   Did that bother him?

The feeling is that (28) is bad because him simply has no referrent.

   To put the difference between (8) and (21) in intuitive terms, (8) is a statement about the woman, and cannot be taken as a statement about the man. Therefore it cannot be continued by a sentence about the man; nor can it answer a question like (16), which is about the man. Yet a simple sentence like

22. Mary saw John

   can be a statement about either Mary or John.

   However, Karttunen's claim that (8) and (9) are synonymous and both ambiguous appears to receive strong support from informants' intuitions. Karttunen reports that he consulted a number of speakers and asked them to interpret (8) and (9) in contexts like Crime and Punishment (5) and The Insulted and Injured (6) (his contexts are actually slightly more
complicated). The results were that all speakers found both sentences interpretable in both contexts. In addition, he asked these speakers to interpret (8) and (9) in a context similar to \textit{The Brothers Karamazov} (7) (again his context is more complicated). All of the speakers agreed that both sentences refer to two different pairs.

In trying to duplicate Karttunen's experiment, I got similar results. Of 15 speakers, 12 said that (8) and (9) were both interpretable in \textit{Crime and Punishment} and in \textit{The Insulted and Injured}. Of 10 speakers, 9 said that both sentences would be true in \textit{The Brothers Karamazov} if Lisa saw Alyosha or Katerina saw Dmitri.

Given this, it would appear that the claim that Crossing Coreference sentences are unambiguous is untenable. But I also asked these speakers to interpret (1) and (2) in these contexts:

1. The woman who wrote to the man who loves her saw him
2. The man who loves the woman who wrote to him was seen by her

All twelve who said that the Crossing Coreference sentences were interpretable in both \textit{Crime and Punishment} and \textit{The Insulted and Injured} also said that both (1) and (2) were interpretable in both contexts. Likewise, all nine who found that (8) and (9) could refer to two different pairs in \textit{The Brothers Karamazov} found the same to be true of (1) and (2).

Karttunen does not say whether he asked speakers to interpret the "control" sentences (1) and (2) in these contexts. In view of my results, I suspect that he didn't. Given these results, we must either conclude that this kind of method is not reliable, or that (1) and (2) are actually ambiguous. The latter conclusion seems dubious; more likely we would conclude that this is a poor way to test speakers' intuitions.
These sentences are quite complex, and I think that most speakers simply looked for any pair such that the woman wrote to the man and the man loves the woman.

But a striking result was that three speakers did say that (1) was uninterpretable in *The Insulted and Injured* and that (2) was uninterpretable in *Crime and Punishment*; all three also said that (8) was uninterpretable in *The Insulted and Injured* and (9) in *Crime and Punishment*. Thus no one found (8) interpretable in contexts in which (1) is not. Although this evidence is extremely scanty, Wasow's position does appear to receive some support.7

Actually, I believe that there are some speakers who can get the second reading for these sentences, though this is probably not the preferred reading, and probably requires heavy stress on the object NP. As mentioned in the previous section, there is a constraint which blocks one possible source for Crossing Coreference sentences; this source has the second meaning. However, this constraint does seem to allow some violation. Nevertheless, I think that for most speakers these sentences are unambiguous.

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7Interestingly, Karttunen seems to indicate that his own original intuitions were that the Crossing Coreference sentences are unambiguous. Thus with respect to the question of whether or not a sentence like (8) is interpretable in a context like *The Insulted and Injured* he says in a footnote that "there was initially some doubt about this" (though he does not indicate any doubt about its interpretability in a context like *Crime and Punishment*).
Section 3

Outlining the Theories

The main purpose of this section is to outline two different theories of pronominalization which have been proposed within a framework using bound variables. The first, which I will call the No Pronominalization theory, maintains that all pronouns are merely variables bound by the same phrase as their antecedents. The second, which I will call the Pronominalization theory, allows some pronouns to be derived from full NP's, as well as deriving some from variables. There are other possible theories as to the representation of pronouns. For example, it could be maintained that all pronouns are simply free variables. I will briefly argue against this theory here; the rest of this thesis deals primarily only with the Pronominalization and the No Pronominalization theories.

3.1. Background

Since one of the main motivations for adopting a framework using bound variables is its ability to handle certain facts about pronouns and coreference, it will be useful to first review this evidence. To begin, we can consider a theory maintaining the following two premises: (a) all pronouns are represented as full NP's in semantic representation; (b) there is no primitive notion coreference in semantic representation. I will call this the Full NP theory. Although I know of no work which explicitly puts forth these two premises, the seem consistent with the early treatments of pronominalization within a transformational framework, Arguments against this theory along the lines of those discussed here are found in a number of works; most notably in Bach (1968), Dougherty (1969) and McCawley (1970).
such as that of Lees and Klima (1963). (It would, however, be incorrect
to equate this theory with that of Lees and Klima, since the latter made
no real claims about the nature of semantic representation, but rather
about deep structure.)

In this theory, a sentence like

1. The mockingbirddestroyed a nest that he built

would have as its representation something roughly like:

2. \( /_{NP_1}[\text{the mockingbird}] \) destroyed a nest that \( /_{NP_2}[\text{the mockingbird}] \) built/

(I am enclosing semantic representations in slashes so as to distinguish
them from surface sentences.) Here the lack of an explicit notion of co-
reference presents no problem. The two NP's in (2) are not specified as
coreferential, but, assuming that there is some mechanism by which a def-
inite NP like the mockingbird picks out some individual only in contexts
where there is one and only one mockingbird, coreference between \( NP_1 \) and
\( NP_2 \) can be inferred. In any given context they will either pick out the
same individual, or else both will fail to refer. I will call the rela-
tionship between these two NP's referential identity. Thus in speaking
of two NP's as referentially identical I am not assuming a theory which
includes this notion as a primitive. A tentative definition of referen-
tial identity will be given in Sec. 10.

To derive the surface sentence (1) from (2), this theory needs a
rule by which \( NP_2 \) is pronominalized under some kind of identity with \( NP_1 \).
One possibility is that formal identity is required, and that the two NP's
must be identical in their entirety. Another possibility is that some
kind of partial formal identity is required. Or we could assume that
the condition for Pronominalization is not formal identity - or perhaps
not formal identity alone - but referential identity.

Regardless of which identity condition is chosen, this theory breaks down for pronouns whose antecedents are not definite. For example, this theory provides no representation for:

3. a. A mockingbird\textsubscript{i} destroyed a nest that he\textsubscript{i} built
   b. Every mockingbird\textsubscript{i} destroyed a nest that he\textsubscript{i} built

If Pronominalization requires complete formal identity, then the representation for (3) must be roughly:\textsuperscript{2}

4. a. /\textsubscript{NP\textsubscript{1}}[a mockingbird] destroyed a nest that
    \textsubscript{NP\textsubscript{2}}[a mockingbird] built/
   b. /\textsubscript{NP\textsubscript{1}}[every mockingbird] destroyed a nest that
    \textsubscript{NP\textsubscript{2}}[every mockingbird] built/

Without going into a detailed account of the semantics of this theory, it is safe to assume that any reasonable semantic theory would assign meanings to (4) which are not correct for (3). This assumption has generally been made on the grounds that the surface sentences corresponding to (4) - which presumably have (4) as their semantic representations - are not synonymous with (3).

An alternative hypothesis is that Pronominalization requires only partial formal identity. This allows structures like (5) to underlie (3):

5. a. /\textsubscript{NP\textsubscript{1}}[a mockingbird] destroyed a nest that
    \textsubscript{NP\textsubscript{2}}[the mockingbird] built/
   b. /\textsubscript{NP\textsubscript{1}}[every mockingbird] destroyed a nest that
    \textsubscript{NP\textsubscript{2}}[the mockingbird] built/

Interestingly, the claim that (5) is the representation for (3) does pre-

\textsuperscript{2}It should be noted that representations like (4) ignore the problem of indicating the relative scopes of the quantifiers. Although scope phenomena also argue for treating NP's as variables bound by quantifiers, I will discuss only the arguments based on coreference.
dict that \( N_P_1 \) and \( N_P_2 \) are, in some sense, coreferential, though not in the same way as the two NP's in (2). A structure like (5) is interpretable only in a context in which there is one and only one mockingbird.\(^3\) Thus in any context where it is interpretable, there must be only one individual which satisfies the phrase a mockingbird, and this will of course have to be the same as the individual described as the mockingbird.

Nevertheless, it is clear that this theory is inadequate, since (5) has the wrong meaning for (3). For (3) is interpretable in contexts in which there is more than one mockingbird (and (3b) is in fact quite odd in a context where there is only one mockingbird).

A third hypothesis is that the correct representation for, e.g., (3a) is actually:

\[
6. \quad \text{[\( \text{NP}_1 \) [a mockingbird] destroyed a nest that \text{NP}_2 [mockingbird] built]}
\]

But this does not predict that \( N_P_1 \) and \( N_P_2 \) are coreferential. Thus this theory incorrectly provides only one representation for:

\[
7. \quad \text{A ladybug}_i \text{ told [another] ladybug}_j \text{ that each} \{\text{her}_i\} \text{house was on fire} /
\]

Both readings of this sentence would have to be represented as:

\[
8. \quad \text{[a ladybug told [another] ladybug that ladybug's house each on fire]}
\]

\(^3\)This claim could be objected to on the grounds that no rules have been given to interpret structures like (5). I am assuming, though, that this would follow in any system which can predict that:

i. A crow destroyed a nest that the mockingbird built requires a context with one and only one mockingbird. The representation for (i) would be roughly:

ii. /a crow destroyed a nest that the mockingbird built/

The crucial assumption, then, is that a system which requires such a context for (ii) would require it for (5) as well.
Similar problems for the Full NP theory are presented by both 
Crossing Coreference sentences like

9. The woman$_i$ who wrote to him$_j$ saw the man$_j$ who loves her$_i$
and simpler sentences like:

10. The woman$_i$ who wrote to the man who loves her$_i$ picked mushrooms

Perhaps the best known argument against a theory in which all pronouns are represented as full NP's, and in which Pronominalization requires complete identity between the two NP's, is that these assumptions lead to the Bach-Peters paradox. Thus Bach (1970) shows that for a sentence like (9) it is impossible to construct a finite representation in which the pronouns are represented as NP's which themselves contain no pronouns. The representation for him would have to be /the man who loves her/, but this contains the pronoun her. This pronoun would have to be depronominalized; this yields as the representation for him: /the man who loves the woman who wrote to him/. Yet here again we have a pronoun.

The same argument can be made for a sentence like (10). Here too it is impossible to depronominalize her into an NP which is identical to its antecedent without a structure of infinite depth resulting:

11. /the woman who wrote to the man who loved the woman who wrote to the man who loved the woman who...

Again an alternative hypothesis is that only partial identity is required for Pronominalization. This allows (10), for example, to be represented as:

12. /the woman who wrote to the man who loves the woman picked mushrooms/

But this fails in the same way that this solution failed for (3). (12) is interpretable only in contexts in which there is one and only one
woman, which is not the case for (1)) (again, (10) is at best strange in such a context; the presence of a restrictive relative clause makes no sense in this situation.)

The same kind of solution could be proposed for Crossing Coreference sentences, and it will have the same problem. Thus (9) could be represented as:

13. /the woman who wrote to the man saw the man who loves the woman/

But (13) requires a context in which there is only one woman. The problem can be half alleviated by representing (9) as either (14) or (15):

14. /the woman who wrote to the man who loves the woman saw the man who loves the woman/

15. /the woman who wrote to the man saw the man who loves the woman/

(14) and (15) are in fact similar to the representations proposed by Karttunen (1971) for these sentences. However, his representations are presumably not intended as semantic representations. These could not be the semantic representations for (9), since (14) should require a context with only one woman, and (15) a context with only one man. While there is disagreement as to the contexts in which (9) can be interpreted, it is clear that it is interpretable in contexts containing more than one woman and more than one man.4

Again this problem could be solved by positing as the representation for (10), for example, the following:

4Wasow (1973) does propose that (13), (14) and (15) are the semantic representations for (9). He does not, however, show that it is possible to construct a system which allows these structures to be true in contexts containing more than one woman and more than one man.
16. /the woman who wrote to the man who loves woman
picked mushrooms/

But again this structure does not assign coreference to the two NP's.
Thus this would provide only (18) as a representation for (17):

17. The woman, who wrote to the woman, who said that \{she
would win picked mushrooms

18. /the woman who wrote to the woman who said that woman
would win picked mushrooms/

There are then at least two different approaches which have been
taken for specifying coreference. The most explicit is to represent NP's
as bound variables; coreference in this system is ensured by the con­
straint that all variables bound by the same phrase must stand for the
same object.\(^5\) A second approach is to allow pronouns in semantic repre­
sentation, and to incorporate some device to indicate coreference. One
such device is the use of referential indices; another is Jackendoff's
"Table of Coreference" (Jackendoff (1972)), whereby every pair of NP's
is marked, in semantic representation, as being either coreferential or
non-coreferential. I will not discuss these theories in any detail,
since it is not clear to me just how they differ from a theory incorpo­
rating bound variables. We can, however, note that since Jackendoff's
theory has no level at which pronouns are represented as full NP's, it
will not account for the syntactic facts discussed in Sec. 1.

\(^5\)This is not meant to imply that the only pairs of NP's which can
be coreferential are those which correspond to the same variable. A
bound variable theory, like the Full NP theory, will predict that two
identical definite NP's are in some sense coreferential, since both re­
quire a context in which only one object fits the description. Here,
however, coreference is not specified in the semantic representation;
rather it can be inferred from the interpretation of the representation.
3.2. NP's as Bound Variables

3.2.1. Assumptions and Notation

Before discussing some theories of pronominalization within a framework incorporating variables, I will first outline the basic assumptions and notation that I will be using. First, I will assume a system containing what McCawley (1972) has called restricted quantification (though my notation will differ somewhat from his). That is, instead of treating

19. A mockingbird flew

as a conjunction:

20. \exists x( (x is a mockingbird) \& (x flew) )

this will be represented as:

21. \[ QP \\
    S_1 \\
    \exists x \\
    S_2 \\
    \text{x is a mockingbird} \\
    x \text{ flew} \]

(where QP stands for Quantifier Phrase). Structures like (21) will be linearized as:

22. \exists x: x \text{ is a mockingbird} (x \text{ flew})

Similarly,

23. Every mockingbird flew

will be represented as:

24. \forall x: S_2 [x \text{ is a mockingbird}] (x \text{ flew})

rather than:

25. \forall x( (x \text{ is a mockingbird}) \supset (x \text{ flew}) )
At least two sorts of arguments can be given against the more traditional representations (20) and (25). First, McCawley (1972) has argued that (23) presupposes the existence of a mockingbird; this is not captured in (25) if $O$ is given the normal interpretation. But this can be built into the rules to interpret a structure like (24) (this is done explicitely in Soames (1976)). Thus we will assume that (24) is assigned a truth value only if there is some object whose substitution for all occurrences of $x$ in $S_2$ yields a true sentence.

A second argument for the incorporation of restricted quantification is that structures like (21) and (24) correspond more closely to the surface sentences. Hence the syntax is simplified; no rule is needed here to delete the connectives $\&$ and $\supset$.

Given the notation outlined above a problem remains, for there is no satisfactory way to represent sentences with more complex NP's like:

26. Every mockingbird that flew sang in the plaza

This will have to be represented as:

27. $\forall x (x$ is a mockingbird $\& x$ flew $\supset x$ sang in the plaza)

The syntax needed to derive (26) from (27) remains complicated and unnatural. Some process must delete the $\&$, and embed one of the clauses within the other. But since this problem is not relevant to anything that follows, I will continue to use representations like (27)\textsuperscript{6}, though

\textsuperscript{6} These representations can be seen as abbreviations for more complex structures; Keenan (1971), for example, constructs a system in which the clauses are given hierarchically.
these will generally be abbreviated as:

28.  

\[ S \]

\[ \forall x \quad (\text{mockingbird}) \]

\[ \text{x flew} \]

\[ S \]

\[ \text{x sang in the plaza} \]

Given a theory with variables, the notion of coreference is explicit. Thus sentences like (3):

3. a. A mockingbird destroyed a nest that he built  
   b. Every mockingbird destroyed a nest that he built

which posed problems for the Full NP theory are no problem here. (3b), for example, can be represented as:

29.  

\[ S_1 \]

\[ \forall x \quad (\text{x is a mockingbird}) \]

\[ S_2 \]

\[ \exists y \quad (\text{nest}) \]

\[ S_3 \]

\[ \text{x built y} \]

\[ S_4 \]

\[ \text{x destroyed y} \]

Similarly, there is no problem in representing pronouns which are contained within their antecedents. So

30. A woman who wrote to a man who loves her picked mushrooms

can be represented as:

31. \[ \exists x : x \text{ is a woman} \quad (\exists y : (y \text{ is a man}) \& (x \text{ wrote to } y) \quad (x \text{ picked mushrooms}) ) \]

The derivation of the surface sentences from these structures must involve a rule that substitutes the Quantifier Phrase for one of the variables that it binds; I will refer to this as Quantifier Substitution (Q Sub). (I will be assuming that Q Sub is cyclic, but anything which
crucially hinges on this assumption will be pointed out.) Thus in the
derivation of (3) from (29), the \( y \)-QP is substituted for \( y \) in \( S_5 \), and the
\( x \)-QP is substituted for the occurrence of \( x \) in \( S_5 \). In addition, there
must be some process by which unsubstituted variables are realized as
surface pronouns. Assuming that \( Q \text{ Sub} \) is cyclic, this process (which is
basically lexical) must occur post-cyclically.

3.2.2. Some Theories of Pronouns with Definite Antecedents

3.2.2.1. Definite NP's as Terms

The arguments against the Full NP theory all indicate that some
non-full NP source (and hence, some device for capturing coreference) is
needed to handle pronouns with indefinite antecedents and pronouns con­tained within their antecedents. But they do not directly argue that the
pronoun in (1) must have a non-full NP source:

1. The mockingbird destroyed a nest that he built

As discussed before, this is just the case that the Full NP theory can
handle; no explicit notion of coreference is needed if the pronoun in (1)
is derived from the full NP the mockingbird.

A viable theory, then, would be one in which the pronouns in (3)
were derived from unsubstituted variables, while the pronoun in (1) must
be derived from a full NP. This would be compatible with a theory which
used the \( \xi \)-operator for definite NP's, treating them as terms rather
than as variables bound by quantifiers. Thus (1) could be represented as:

32. \( \xi x( x \text{ is a mockingbird) destroyed a nest that } \)
\( \xi y(y \text{ is a mockingbird) built } \)

(where (32) is shown after the substitution of the nest-QP).

It would in fact appear that a theory which treated definite NP's
this way is forced to conclude that the pronoun in (1) is derived from a full NP. Since a phrase like $\exists x(x \text{ is a mockingbird})$ is not a QP, it cannot bind both the pronoun and the antecedent; the pronoun therefore cannot correspond to an unsubstituted variable. This theory could, however, allow both to be bound by a single QP (and thus derive the pronoun from a variable) by allowing phrases like $\exists x: x \text{ is } x \text{ is a mockingbird}$ to underlie the surface NP the mockingbird. But this requires the introduction of some elaborate syntactic rules to derive the surface NP.

I will refer to the theory sketched above, where (1) must be represented as (32), as the Definite Full NP theory. This theory has two ways to derive pronouns, but any given pronoun has only one source. All pronouns with indefinite antecedents and all pronouns within their antecedent correspond to unsubstituted variables. All other pronouns with definite antecedents must be derived from full NP's.

A second possible theory which is compatible with the use of the $\exists$-operator is one which claims that the pronoun in (1'):

$$1'. \text{ The mockingbird destroyed a nest that he built}$$

is only a free variable and has no reading in which it is coreferential with the subject NP; I will call this the Free Variable theory. It was noted in the Introduction that it cannot be maintained that all pronouns are only free variables; the pronoun in a sentence like (3b'):

$$3b'. \text{ Every mockingbird destroyed a nest that he built}$$

clearly has a bound variable interpretation. But the reading of (1') in which he is a free variable subsumes the "reading" in which he is coreferential with the mockingbird, and so it could be claimed that the latter

---

*I would like to thank Scott Soames for pointing this out to me.*
is not a distinct reading.

Thus both the Definite Full NP theory and the Free Variable theory maintain that the is not a quantifier and therefore cannot bind a pronoun which is not contained within the definite NP. The Definite Full NP theory allows pronouns to be derived from full NP's on the basis of formal and/or referential identity with another NP, and so provides a full NP source for the pronoun in (1'). The Free Variable theory does not include a rule of Pronominalization, and so the pronoun in (1') must be a free variable. I will return to these theories very briefly in 3.3, and will give some arguments against them.

3.2.2.2. The as a Quantifier

A more common assumption is that pronouns with definite antecedents can be derived from unsubstituted variables. This requires a framework in which both the antecedent and the pronoun can be bound by the same QP. I will assume that the is a quantifier (which I will represent as T)\(^8\), and will represent a sentence like (1) as:

\[
\begin{array}{c}
33. \\
\end{array}
\]

\[
\begin{array}{c}
\text{QP} \\
\text{S} \\
\text{S} \\
\text{QP} \\
\text{S} \\
\text{S} \\
\end{array}
\]

\[
\begin{array}{c}
x \text{ is a } \\
\text{mockingbird} \\
\text{x built y} \\
\text{x destroyed y} \\
\end{array}
\]

Here the pronoun in (1) is derived in a fashion parallel to the pronoun

---

\(^8\)The treatment of the as an unanalyzed quantifier is not crucial here; the assumption that the pronoun in (1) can correspond to an unsubstituted variable is also compatible with a Russellian analysis of the. As discussed above, the use of the \(\tau\)-operator to represent definite NP's can also allow a variable source for this pronoun. But since this requires the adoption of complicated syntactic rules, I can see no advantage in this system.

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in (3). The $x$-QP is substituted onto the circled $x$, and the remaining variable is realized as a surface pronoun.\(^9\)

There are, however, two theories of pronominalization compatible with the treatment of definite NP's as bound variables. The first, which I will call the No Pronominalization theory, maintains that all pronouns are simply unsubstituted variables. In this theory (33) is the only representation for (1). This theory has been proposed by McCawley (1970) and Keenan (1971).

But another possible theory is one in which the pronoun in (1) can also be derived from a full NP. Any framework which includes representations like (33) will also include the following representations:

34.  

\[
\begin{array}{c}
\text{S} \\
\text{QP} \\
\text{Tx} \\
\text{x is a mockingbird (nest)} \\
\text{S} \\
\text{QP} \\
\exists y \\
\text{S} \\
\text{S} \\
\text{z built} \\
\text{mockingbird} \\
\text{S} \\
\text{x destroyed y} \\
\text{S} \\
\end{array}
\]

This structure presumably underlies the surface sentence:

35. A nest that the mockingbird built was destroyed by the mockingbird

Since structures like (33) and (34) will have truth value (or, be true) only if there is one and only one mockingbird, the two are logically equivalent.

The theory that I will try to support - which I will call the

\[^9\]I will assume that proper names are treated in essentially the same way as definite descriptions, so that the representation for a phrase like John is, very roughly: $\text{Tx: x is John}$.

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Pronominalization theory - allows both (33) and (34) as representations for (1). No representations exist in this theory which do not exist in the No Pronominalization theory; the difference between the two theories lies only in the relationship between semantic representation and surface structures. In the Pronominalization theory, some pronouns can be derived either from unsubstituted variables or from full NP's.\footnote{Both theories would also allow pronouns to have a free variable representation; presumably these would be realized as surface pronouns by the same process that unsubstituted bound variables are.} If (1) is derived from (34), where the pronoun has the full NP source, then it follows that the pronoun and the antecedent are coreferential. Here, as in the Full NP and the Definite Full NP theories, this is a consequence of the fact that both the $x$-phrase and the $z$-phrase will refer only if there is a unique mockingbird; therefore they must refer to the same mockingbird. A theory which allows two such representations for pronouns has been argued for by Geach (1962), who refers to pronouns derived from full NP's as "pronouns of laziness."\footnote{Actually Geach's theory is somewhat different in that he seems to assume that every surface pronoun has only one representation.} Partee (1972, 1975) also argues for this theory, and it seems implicit in Morgan (1970).

There are a number of possible hypotheses as to the formulation of the Pronominalization rule. One is that Pronominalization requires only formal identity between the two NP's. While this allows (1) to be derived from (34) - since the $z$-phrase is identical to the $x$-phrase - it simply reopens all of the problems of the Full NP theory. With this condition, there is no reason that (3a):

$$3a. \text{A mockingbird}_i \text{ destroyed a nest that he}_i \text{ built}$$

could not be derived from the structure underlying:
36. A mockingbird destroyed a nest that a mockingbird built. This theory could be patched up by a constraint that only definite NP's can pronominalize, but such a constraint seems ad hoc.

Rather, I will assume that a necessary condition for Pronominalization is referential identity (this is suggested in Geach (1972) and Partee (1975)). Defining this notion presents several problems; some of these are discussed in Sec. 10. For now it will suffice to continue with an intuitive characterization of this notion - two NP's are referentially identical if, in any given context, they pick out the same object. It should be noted that a more thorough characterization of referential identity should take into account problems connected with opacity phenomena. There are a number of ways in which opacity interacts with pronominalization; this is an area which I will completely ignore. The hypothesis that Pronominalization requires referential identity does not preclude the possibility that formal identity is also required. I will, in fact, assume that it is, though it is difficult to show that a theory in which formal identity is not required makes incorrect predictions.12

Notice that the hypothesis that Pronominalization requires referential identity leads to the somewhat strange result that (33) and (34)

12Partee (1975) points out that one problem with the claim that Pronominalization requires referential identity is that this does not account for the kind of sentence discussed in Karttunen (1969):

i. The man who gave his paycheck to his wife was wiser than the man who gave it to his mistress
where it has a "sloppy" reading (and refers to the paycheck of the less wise man). Yet such examples are unusual; personal pronouns cannot in general have this reading. Thus in contrast to (i), (ii) does not have a sloppy reading:

ii. The man who loves the woman who wrote to him spoke to the man who hates her
This problem is also discussed in Partee (1972).
share a surface realization precisely because they are logically equivalent. Thus we have a situation where a single surface structure has two semantic representations, but only one meaning. An objection which could be raised to this formulation of the conditions for Pronominalization is that the application of a syntactic rule depends on the interpretation of the semantic representation. Moreover, it is not only the interpretation of that representation in a given context which is relevant, but its interpretation in all possible contexts.

This problem could be avoided by an alternative hypothesis that coreference between certain NP's is explicitly marked (rather than being inferred from the interpretation of the semantic representation); and that one phrase can pronominalize another if the two are marked as coreferential. Given this theory, the $x$-phrase and the $z$-phrase in (34) would be marked as coreferential, and so the former could pronominalize the latter. In other words, coreference in this system is a primitive; this is similar to a theory incorporating referential indices or a Table of Coreference and which allows NP's which do not correspond to the same variable to be marked as coreferential as well as NP's which do. While this theory appears not to require a definition of referential identity, it fails to explain why two NP's quantified by a or every cannot be marked as coreferential, while two NP's quantified by the can be. Thus some additional constraint is needed to predict which pairs of NP's can be marked as coreferential.

I will, therefore, be assuming that the former theory is correct, but nothing in my analysis hinges on this assumption. The only crucial assumption for the analysis is that there is some mechanism which permits a full NP representation for the pronoun in (1), while the pronouns in...
(3) do not have this representation. More specifically, it is necessary to assume that there is some mechanism which can characterize the difference in the relationship between two identical definite NP's, like those in (37), and two identical indefinite NP's, like those in (38):

37. The nest that the mockingbird built was destroyed by the mockingbird

38. The nest that a mockingbird built was destroyed by a mockingbird

It seems that some such mechanism is necessary in any theory; thus any theory must account for the fact that the two NP's in (37) are understood as the same mockingbird while those in (38) are not. Moreover, there are other grammatical processes (such as stress reduction) which appear to be sensitive to this difference.

3.3. The Definite Full NP and Free Variable theories

As discussed above, there are at least two possible theories of the correct treatment of the pronoun in (1') in a framework which does not treat the as a quantifier:

1'. The mockingbird destroyed a nest that he built

In one, the Definite Full NP theory, there is a reading of the pronoun in which it is understood to be the same individual as the subject NP; in this reading the pronoun he is represented as the Full NP the mockingbird and has no other representation. In the Free Variable theory, the pronoun in (1') has only a free variable interpretation. Since I will be focussing primarily on the Pronominalization and the No Pronominalization theories in the rest of this thesis, I will briefly discuss these two theories here.

One argument against both of these theories concerns the representation of reflexive pronouns and pronouns with own, as in:
39. a. The mockingbird killed himself  
b. The mockingbird destroyed his own nest

Neither of the above theories permits a definite NP to bind a pronoun which is not contained within it. Thus the Definite Full NP theory is forced to conclude that the pronouns in (39), like he in (1'), are represented as Full NP's. (39a), for example, must be represented as:

40. $\exists x (x \text{ is a mockingbird}) \text{ killed } \exists y (y \text{ is a mockingbird})$

But Partee (1975) argues that a reflexive pronoun must correspond to the same variable as its antecedent; her arguments can also be extended to the pronoun in (39b). If this is correct, then this theory cannot account for these pronouns.

The Free Variable theory, on the other hand, is forced to conclude that himself in (39a) and his in (39b) are free variables. This conclusion is obviously incorrect; these pronouns do not have a free variable reading but must be understood as coreferential with the subject NP. Thus this theory must permit representations for the sentences in (39) in which a phrase binds both the subject NP and the pronouns; this means that the $\exists$-operator cannot be used to represent the subject. Thus while it cannot be shown directly that the pronoun in (1') has a non-free variable interpretation, it is not clear what kind of theory could allow such an interpretation for the pronouns in (39) but not for the pronoun in (1').

Moreover, an examination of Crossing Coreference sentences shows that there are other pronouns similar to that in (1') which must have a non-free variable interpretation. Thus consider a sentence like:

41. The woman who wrote to him saw her husband

in a context like:
42. Women wrote to Men Women is the husband of
Gretel Hansel Gretel
Snow White Grumpy Snow White
Cinderella Prince Charming Cinderella

where Gretel saw only Hansel, and no other woman saw any man. According to the Free Variable theory, (41) is false here. If him has only a free variable interpretation then the phrase the woman who wrote to him refers to some woman who wrote to a man that no one else wrote to. This phrase, then, could not refer to Gretel, but must refer to Snow White. Snow White did not see anyone, and so regardless of who the phrase her husband refers to, (38) would be false. But if, as claimed in Sec. 2, (38) can refer to a unique woman-man pair such that she wrote to him and he is her only husband, then (38) is true in this context.

Thus if the semantic evidence is correct, him in (38) has a non-free variable interpretation. However, this is not meant to imply that this pronoun has a bound variable interpretation. I will in fact argue that this pronoun must be derived from a full NP rather than from an unsubstituted variable.

Notice that, given the kind of method used above, the arguments in this thesis concerning Crossing Coreference sentences can be made without reference to the "reading" of some sentence. For example, it was claimed in Sec. 1 that while a sentence like (41) is grammatical with Crossing Coreference, a sentence like (43) is not:

41. The woman who wrote to him saw her husband
43. The woman (who) he wrote to saw her husband

However, rather than contrasting the grammaticality of these sentences on
a particular reading, we can translate this into a difference in the set of contexts in which these sentences are true. Thus while (41) is true in the context (42), consider (43) in the parallel context:

44. Women wrote to Women
    Gretel  <--- Gretel
    Snow White  <--- Snow White
    Cinderella  <--- Cinderella

where Gretel saw only Hansel and no other woman saw any man. Here (43) is not true. The phrase the woman (who) he wrote to must refer to some woman such that there is a man who wrote only to her; it cannot refer to a woman who was written to by a man who wrote to several women, but where she is the only one who he is the husband of. This means, then, that it must refer to Snow White, and so (43) is false.

3.4. Two Possible Arguments Against the Pronominalization Theory

3.4.1. The Precede and Command Constraint

Before turning to the arguments for the Pronominalization theory, there are two potential objections to this theory which I will consider here. The first concerns the nature of the constraint discussed in Ross (1966) and Langacker (1966) to the effect that, roughly, a pronoun cannot precede and command its antecedent. Ross and Langacker assumed that all pronouns were derived from full NP's, and therefore formulated this as a constraint on Pronominalization. McCawley (1970) suggests that given the No Pronominalization theory, this constraint can instead be built into the rule of Q Sub. Thus the ungrammaticality of a sentence like:

44. *He spoke to the woman who knew the master of ceremonies

can be accounted for by a constraint that no QP can be substituted for some variable \( x \) if that variable is preceded and commanded by another oc-
currence of \( x \). Since in the No Pronominalization theory the pronoun in (44) must be a variable bound by the same phrase as its antecedent, the substitution of the phrase the master of ceremonies has violated the constraint. A similar proposal is made in Harman (1976). His formulation of the constraint is somewhat different; but in his analysis the ungrammaticality of (44) also follows from a constraint on Q Sub.

In the Pronominalization theory, such a constraint is insufficient to predict the ungrammaticality of (44). The derivation of this sentence in which he corresponds to an unsubstituted variable is blocked; but there is another possible derivation in which he corresponds to a full NP. Nor can the constraint be simply on the application of Pronominalization; this formulation would block the full NP source of he, but not the variable source. It would appear then that the Pronominalization theory needs two constraints - one on Q Sub and one on Pronominalization.

There is, however, independent evidence that, regardless of the theory, the constraint cannot be either a constraint on Q Sub nor a constraint on Pronominalization, but must be something else entirely. Thus consider the following sentence:  

46. *The woman who wrote to the master of ceremonies\( _1 \) told him\( _1 \) to feed the dog that bit the master of ceremonies\( _1 \).*

Here him precedes and commands the coreferential full NP the master of ceremonies, and so (46) is blocked. Yet its ungrammaticality could not be accounted for by a constraint on the application of Pronominalization, since him could be pronominalized by the first master-phrase rather than by the second. The relationship between the first phrase and the pronoun does not violate any constraint:

\[\text{The argument given here is a modification of one in Lasnik (1976): a similar case is also discussed in Wasow (1972).}\]
47. The woman who wrote to the master of ceremonies told him to feed the dog that bit Jack

Nor is the violation attributable to the relationship between the two full NP's:

48. The woman who wrote to the master of ceremonies told Jack to feed the dog that bit the master of ceremonies

A constraint on Q Sub, such as that proposed by McCawley, also fails to account for the ungrammaticality of (46). Here the two master-NP's would correspond to different variables (since both have been substituted by a QP). There are, then, roughly the following two representations for (46) (where both are shown after the substitution of the QP's):

49. a. the woman who wrote to Tx(master of ceremonies) told y to feed the dog that bit Ty (master of ceremonies)

b. the woman who wrote to Tx(master of ceremonies) told x to feed the dog that bit Ty (master of ceremonies)

The (49a)-derivation is blocked by McCawley's constraint since the y-phrase has been substituted for an occurrence of y which is preceded and commanded by another occurrence of y. But the (49b)-derivation is not blocked by this constraint.

Lasnik (1976) also claims that no full NP can precede and command a coreferential full NP:

50. *The master of ceremonies fed the dog that bit the master of ceremonies

If Lasnik is correct in claiming that the ungrammaticality of (50) is related to that of (51):

51. *He fed the dog that bit the master of ceremonies

then this provides further evidence that constraint cannot, in any theory,
be built into the rule of Pronominalization or into the rule of Q Sub. McCawley's constraint will not block (50) since the two phrases the master of ceremonies would correspond to different variables. Nor can a constraint on Pronominalization block (50), since no Pronominalization has occurred.

The exact nature of this constraint is somewhat problematic; Lasnik formulates a constraint which, roughly, specifies that if an NP₁ precedes and commands a full NP₂, the two must be noncoreferential. I will

\[14\] I am a bit uncomfortable with this claim since (51) seems far worse than (50). Moreover, a sentence with two full NP's in this configuration can sometimes be improved with more distance between the NP's:

i. a. *Sally spoke to Sally's mother  
   b. ??Sally spoke to Ruth, to Jack, to Sam, and to Sally's mother

while there is no improvement in the parallel sentence involving a pronoun and a full NP:

ii. a. *She₁ spoke to Sally's₁ mother  
   b. *She₁ spoke to Ruth, to Jack, to Sam, and to Sally's mother

\[15\] Actually Lasnik revises his formulation to specify that the two NP's must be "disjoint in reference". His evidence for this formulation is based on the contrast between (i) and (ii):

i. The soldiers think that the officers are competent  
ii. The man who spoke to the soldiers praised the officers where the soldiers can be taken to include the officers in (ii), but not in (i). However, (i) and (ii) are not a minimal pair; I find the relevant reading also impossible in:

iii. That the officers are competent is believed by the soldiers whereas this reading is perfectly alright in:

iv. The officers were praised by the man who spoke to the soldiers

This interpretation is a bit more difficult in:

v. The soldiers were praised by the man who spoke to the officers

but again it is equally difficult in:

vi. The man who spoke to the officers praised the soldiers

The fact that the relevant interpretation is possible in (iii) indicates that Lasnik's revised formulation of the constraint is incorrect.
assume that something along these lines is correct, although it is not clear just how "noncoreferential" should be defined. At any rate, the fact that this constraint cannot, in the Pronominalization theory, be accounted for by a constraint only on Q Sub or by a constraint only on Pronominalization does not argue against this theory. The ungrammaticality of of (46) indicates that no theory can account for this constraint in this way.

3.4.2. The Missing Clausemate

One other potential problem for the Pronominalization theory concerns the distribution of reflexive and non-reflexive pronouns. As mentioned above, there is evidence that a reflexive must correspond to the same variable as its antecedent (this is argued in Partee (1975)). Thus while the Pronominalization theory allows two sources for the pronoun in

52. The mockingbird destroyed his nest

the reflexive in (53) must be derived from an unsubstituted variable:

53. The mockingbird killed himself

Both the Pronominalization and the No Pronominalization theory allow roughly the following representation:

54. Tx (mockingbird) killed Ty (mockingbird)

If Lasnik is correct in claiming that a full NP cannot precede and command a coreferential full NP, then this constraint will, in both theories, block (55) as a surface realization of (54):

55. *The mockingbird killed the mockingbird

But the Pronominalization theory has no apparent way to block (56) as

16If, as suggested in fn. 14, the ungrammaticality of (50) is not related to that of (51), then the constraint must be applicable only when NP1 is a pronoun.
a realization of (54):

56. *The mockingbird$_i$ killed him$_i$

where the $y$-phrase is pronominalized on the basis of formal and referential identity with the $x$-phrase. (56) is not blocked by the Precede and Command constraint. Nor is the hypothesis that Reflexive is obligatory of any help here. If a reflexive must correspond to the same variable as its antecedent, then (54) does not meet the structural description for Reflexive. Thus the Pronominalization theory needs some additional constraint to block (56).

While I have no real solution to this problem, it seems quite plausible that (56) is actually a special case of what Postal (1974) calls the Inclusion Constraint, which blocks sentences like:

57. a. *They$_{i,j}$ criticized him$_i$
    b. *He$_i$ criticized them$_{i,j}$

Postal argues that no NP can "overlap in stipulated coreference" with a clausalmate NP. Notice that this constraint must be formulated in such a way as to not block (53).

There are two ways in which (53) differs from (57), and either of these could be the salient difference. The first is that the subject and object in (53) are identical in reference; thus the constraint might prohibit overlapping but non-identical reference. But it is equally plausible that the constraint is not applicable to reflexive pronouns (or, perhaps, that two NP's which correspond to the same variable are not within the domain of the constraint). If this is correct, then we can take overlapping in its more general sense, to include the case where the two NP's are identical in reference. This constraint, then, would block (56).

If, as suggested in fn. 14, the Precede and Command Constraint is

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actually restricted to cases where a pronoun precedes and commands a full NP, then some such constraint is needed anyway to block (55). Moreover, the fact that (55) is significantly worse than (50):

\begin{enumerate}
\item 50. *The master of ceremonies fed the dog that belonged to the master of ceremonies
\end{enumerate}

suggests that (55) violates an additional constraint. Other than this, I know of no evidence for the claim that coreference is simply a special case of overlapping reference, but I know of no problem with this hypothesis either.
Section 4
The Failure of the No Pronominalization Theory

We can now consider the predictions made by the No Pronominalization theory with respect to Crossing Coreference sentences. I will argue that this theory can account for the semantic evidence discussed in Sec. 2 only if it includes some complicated syntax. But given the disagreement about the meaning of these sentences, an argument based solely on this evidence is somewhat inconclusive. More serious, then, is the fact that the syntactic behavior of these sentences is not accounted for.

4.1. The Semantic Predictions

4.1.1. Double Binding: Keenan's Representations

Given a framework incorporating restricted quantification, the No Pronominalization theory - in which all pronouns are unsubstituted variables - appears to provide no way to construct a representation for (1) in which both variables are bound:

1. The woman who wrote to him saw the man who loves her

In order for the pronoun her within the object NP to be bound the QP binding the subject NP must have wide scope. In other words, the phrase the woman who wrote to him must bind both variables in the open sentence: x saw the man who loves x. But this is impossible, for then the variable corresponding to him is not bound. If on the other hand the phrase the man who loves her has wide scope, then the pronoun corresponding to her is not bound.

In answer to this apparent paradox, Keenan (1971) introduces a
device that he calls "double binding", which allows two variables to be bound by a single phrase. The two variables then are interpreted as constituting a "set of pairs of objects", where each object is defined in terms of the other. Presumably this device need not be limited to sets containing only two objects. It would, in fact, have to allow for sets with three members in order to account for triple Crossing Coreference sentences like:

2. The woman$_i$ who wrote it$_j$ gave the book$_j$ that pleased him$_k$ to the man$_k$ who loves her$_i$

Though Keenan's formalism is somewhat different from the system used here, we can capture the predictions of his proposal by allowing for a structure roughly like (3) to underlie (1):

3. 

A structure like this will be assigned a truth value only if there is a unique pair of objects such that both $S_1$ and $S_2$ are true when all occurrences of $x$ in both $S$'s are replaced by one of the objects and all occurrences of $y$ by the other. Therefore (3) requires a unique $x$-$y$ pair such that $x$ wrote to $y$ and $y$ loves $x$. In other words, the quantifies not the members of the pair, but the pair itself.

While the device of double binding provides representations for Crossing Coreference sentences, there are several problems with Keenan's system. First, the arguments adduced by Karttunen (1971) against McCawley's analysis (McCawley, 1970) argue against Keenan's analysis as well. Thus, McCawley proposed that a Crossing Coreference sentence like
(1) can be represented as:

```
S
/  \
NP:x NP:y Prop
  /       \
the woman who wrote to y the man who loves x x saw y
```

Although McCawley is not explicit about the semantics of (4), Karttunen shows that this system is inadequate by considering the meanings of the surface sentences which are to be derived from (4).

Thus McCawley's system allows only one structure - (4) - to underlie both (1) and (5):

1. The woman who wrote to him saw the man who loves her
5. The man who loves her was seen by the woman who wrote to him

Karttunen's actual argument against this analysis is based on the claim that (1) and (5) are both ambiguous, and should therefore each have two representations. This claim has been challenged in Sec. 2. There it was argued that (1) and (5) are both unambiguous, and not synonymous. But if this is correct, then McCawley's analysis still fails, since (1) and (5) should have different underlying structures. Karttunen further argues against this analysis on the grounds that (4) must be the representation for both (6) and (7):

6. The woman who wrote to the man who loves her saw him
7. The man who loves the woman who wrote to him was seen by her

---

Karttunen (1969b) assumes that (4) translates into:

1. \( \exists x \exists y \left( (x \text{ saw } y) \& (x \text{ is tw (w wrote to } y)) \& (y \text{ is tz (z loves } x)) \right) \)

This gives the reading discussed in (c) in Sec. 2.2.1; it requires a non-unique x-y pair such that x is the only woman who wrote to y and y is the only man who loves x.
As discussed earlier, it is clear that these two sentences are not synonymous.

These same two problems arise in Keenan's theory. Thus both (1) and (5) must be represented as (3). Not only does this predict that the two sentences are synonymous, but, according to the evidence in Sec. 2, the semantics of (3) is correct for neither. (3) requires a unique x-y pair such that x is a (not necessarily unique) woman who wrote to y and y is a (not necessarily unique) man who loves x. Thus this predicts that (1) and (5) are both interpretable in a context like:

8. **Women** wrote to **Men** loves **Women**

Melissa → Jack loves Melissa
Carol → Sam loves Carol

while neither should be interpretable in *Crime and Punishment*:

9. **Women** wrote to **Men** loves **Women**

Sonia → Raskolnikov loves Sonia
Dunia → Razumikhin loves Dunia

This theory must also represent both (6) and (7) by the same structure. At first glance, it would appear that these sentences should be represented as (10a) and (10b) respectively:

10. a.

```
          S
         /\    /
        SQ  QP
       /\  /\  /
      T y  T y  T x
      |   |   |   |
     /   /   /   /
   S   S   S   S
   /   /   /   /
  x   x   x   x
  saw saw saw saw
  y   y   y   y
```

10. b.

```
          S
         /\    /
        SQ  QP
       /\  /\  /
      T y  T y  T x
      |   |   |   |
     /   /   /   /
   S   S   S   S
   /   /   /   /
  x   x   x   x
  saw saw saw saw
  y   y   y   y
```

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But in each of these structures, the circled variable is not bound by the embedded QP.\textsuperscript{2} Thus only the double binding structure (3) is provided as a representation for these sentences. (6) and (7) would be derived by the substitution of one of the variables in the QP rather than the variable within the main S.

But in this case it is quite clear that the semantic predictions are wrong. (6) and (7) are not synonymous, and again neither has the meaning of (3). (3) requires a unique x-y pair such that x is a woman who wrote to y and y is the only man who loves x; while (7) requires a unique pair where x is the only woman who wrote to y and y loves x.

There are at least two other problems with this theory. First, in order to derive the Crossing Coreference S's in (1) and (5), the QP must be broken up; this process seems rather unnatural. A second and more serious problem is the fact that both variables are bound simultaneously by a single quantifier the, yet in all four sentences there are two occurrences of the on the surface. The theory would therefore have to include a rule by which the quantifier is copied onto both of the NP's. But this provides no way to represent similar sentences where each NP has a different quantifier, such as:

11. a. Every woman who wrote to the man who loves her saw him
b. A woman who wrote to the man who loves her saw him

4.1.2. A More Elaborate System

Some of these problems are solved by the hypothesis that more elaborate representations can underlie sentences like (1), (5), (6) and (7).

\textsuperscript{2}This assumes that the rules interpreting sentences containing QP's operate on structures like: $S_1[Qx: S_2(S_3)]$. Hence no variable which is not within $S_1$ can be bound by the quantifier in $S_1$. 

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For example, a structure like (12) gives the correct meaning for (1) and (2):³

(12), like (1) and (6), requires a unique x-y pair such that x is a woman who wrote to y and y is the only man who loves x.

Here no rule is needed to make a copy of the quantifier; (12) has the same number of quantifiers as the surface structures. If there is no such rule, then these sentences cannot be derived from (3). This analysis has the additional advantage of providing representations for the sentences in (11); (11a) can be represented by:

(13), like (11a), says that for all x-y pairs such that x wrote to y and y is the only man who loves x, x saw y.

³Ayres (1972) develops a No Pronominalization analysis of Crossing Coreference sentences within a framework which does not use restricted quantification (and which uses a Russellian analysis of the). His representations are equivalent to the representations discussed in this section, and the problems discussed here will carry over to his analysis.
However, this analysis requires some complicated rules and constraints. (12) bears little resemblance to surface structures like (1) and (6); some rule is needed to delete the clause $z = y$. Notice too that to derive (1) this analysis still must include some process which breaks up the QP, substituting part of it onto each of the variables within the main S.

Moreover, while (12) has the right meaning for (1) and (6), this framework appears to allow other representations for these sentences which have the wrong meaning. Some constraints are therefore necessary to insure that these sentences can be derived only from (12).

First, the device of double binding must somehow be constrained. Keenan places a restriction on this to the effect that each member of the set must be described in terms of the other. In other words, both sentences in a QP like:

$$T\{x, y\} \quad S \quad S$$

must contain an occurrence of both variables. This condition excludes structures like (15), which we might expect as a possible representation for (16):

$$T\{x, y\} \quad (\text{woman, man}) \quad x \text{ laughed} \quad y \text{ walked}$$

16. The woman who laughed saw the man who walked

There might appear to be no reason to block this, since (15) requires a context with one and only one set consisting of a woman who laughed and...
a man who walked. It is therefore logically equivalent to both (17a) and (17b):

17. a. \( T_x : x \text{ laughed} ( \; T_y : y \text{ walked} (x \text{ saw} y) \) 
   \( \text{(woman)} \quad \text{(man)} \)

   b. \( T_y : y \text{ walked} ( \; T_x : x \text{ laughed} (x \text{ saw} y) \) 
   \( \text{(man)} \quad \text{(woman)} \)

Nevertheless, something like Keenan's restriction is necessary in order to account for the meaning of a sentence like:

18. The woman who wrote to the man who loves her bought the house that belonged to him

This framework provides the following as one representation for (18):

19.

\[
\begin{array}{c}
T \{x, y\} \\
\text{(woman, man)}
\end{array}
\xrightarrow{\text{OP}}
\begin{array}{c}
x \text{ wrote} \\
to \ y
\end{array}
\xrightarrow{\text{S}}
\begin{array}{c}
T_z \\
\text{(man)}
\end{array}
\xrightarrow{\text{OP}}
\begin{array}{c}
z = y \\
z \text{ loves} x
\end{array}
\xrightarrow{\text{S}}
\begin{array}{c}
T_v \\
\text{house}
\end{array}
\xrightarrow{\text{OP}}
\begin{array}{c}
v \text{ belongs} \\
to \ y
\end{array}
\xrightarrow{\text{S}}
\begin{array}{c}
x \text{ bought} v
\end{array}
\]

(19) has the right meaning for (18); it requires a unique x-y pair such that x is a woman who wrote to y and y is the only man who loves x. It further requires a unique house which belongs to y.

But as mentioned earlier, the device of double binding must be extended to allow for sets consisting of three or more members. If there are no restrictions on a multiple QP, another possible representation for (18) would be:
The derivation of (18) is sketched above; the man-S is substituted for the y within the woman-S; the woman-S is substituted onto the subject variable in the main S, and the house-S is substituted for the object.

But (20) does not have the right meaning for (18). It requires a unique x-y-v set such that x is a woman who wrote to y, y is the only man who loves x, and v is the only house belonging to y. Consider then a context like:

(18) is not interpretable in (21) since there are two x-y pairs such that y is the only man who loves x and x wrote to y. But since two houses belong to Henry, there is only one house-man-woman set meeting the requirements of (20); this set is The Elms, Ward, and Isabella. Thus if (20) can underlie (18) it is incorrectly predicted that (18) is interpretable
in (21).

Since there appears to be nothing wrong with the above derivation, some constraint must rule out (20) as a possible structure. Notice that this structure would be blocked by a constraint that the sentence within the scope of the multiple QP must contain an occurrence of each of the variables. In (20), there is no occurrence of the man variable (y) in this sentence. Yet the same problem arises with:

22. The woman who wrote to the man who loved her bought from him the house that belonged to him

The above constraint will not exclude a representation for (22) in which the same QP binds the sentence: x bought v from y. But (22) is also uninterpretable in (21).

Thus something like Keenan's constraint is necessary to exclude (20). His constraint is formulated so as to cover only cases of double QP's. It could then be reformulated to require that, in a multiple QP, each variable is described in terms of all other members of the set. (Thus each S must contain an occurrence of each variable.) While this formulation blocks (20), it also permits no representation for a sentence like (2):

2. The woman who wrote it gave the book that pleased him to the man who loves her

Here the woman-sentence would contain an occurrence of the book-variable but not the man-variable; each of the three sentences contains only one of the other variables.

The problem then is to formulate a constraint which blocks (20) (and the similar representation for (22)) but allows a representation for (2). The only possibility that I can see is that there is a constraint on multiple binding to the effect that each variable must occur in at
least two of the sentences. Such a constraint seems extremely ad hoc.

Second, while this framework allows (6) to be derived from (12):

6. The woman who wrote to the man who loves her saw him

12.

\[
T\{x,y\} \quad (\text{woman, man}) \\
S \quad x \text{ wrote to } y \\
S \quad x \text{ saw } y \\
S \quad z \text{ loves } x \\
S \quad z = y
\]

it must block the derivation of this sentence from:

23.

\[
T\{x,y\} \quad (\text{woman, man}) \\
S \quad x \text{ saw } y \\
S \quad y \text{ loves } x \\
S \quad w = x \\
S \quad w \text{ wrote to } y \\
S \quad w \text{ is } x
\]

(23) requires a unique pair such that the woman is the only woman who wrote to y, while the man need not be the only man who loves x. It must therefore be the representation for (7), but not for (6):

7. The man who loves the woman who wrote to him was seen by her

The constraint needed to block a derivation of (6) from (23) (and (7) from (12)) seems quite straightforward. These derivations would require the substitution of part of \( QP_1 \) for some variable in a \( QP \) (\( QP_2 \)) which is contained within \( QP_1 \). It is not unreasonable to assume that some general principle exists which blocks this. In fact a simpler con-
that no QP can be substituted into any other QP (or, into a relative clause) - would also block these derivations. There is independent evidence that such a constraint exists; this will be discussed in Sec. 6 and Sec. 8.4

Given the evidence in Sec. 2, this theory must also block the derivation of (1) from (23), and (5) from (12):

1. The woman who wrote to him saw the man who loves her
5. The man who loves her was seen by the woman who wrote to him

But here there is no obvious principle which blocks these derivations. Thus, for example, the derivation of (1) from (12) is roughly:

24.

If Passive occurs in S₂ then this derivation must be blocked, for it yields (5). In other words, some principle must ensure that the NP with the more complex representation occurs second.

Thus to account for the meaning of these sentences, the No Pronominalization theory must incorporate the device of double binding, and must include rules to derive a sentence like (1) from a structure like

4However, the No Pronominalization theory is forced to conclude that there are counterexamples to this constraint; this is discussed later.
(20). And, some constraint must exist to block the derivation of (5) from (12).

Still, this is not conclusive evidence against this theory. In the first place, the necessary rules and constraints, though complicated, could be formulated. Second, the semantic evidence with respect to Crossing Coreference sentences is weak. It could therefore be claimed that these sentences simply are ambiguous, as Karttunen argued, and so no constraint is needed to block the derivation of (5) from (12). Therefore we will now consider the syntactic predictions made by the No Pronominalization theory, in order to show that this theory does not account for the syntactic behavior of these sentences.

4.2. The Syntactic Evidence

4.2.1. The Full NP Behavior of the First Pronoun

The sentences considered in Sec. 1 show that the first pronoun of a Crossing Coreference sentence acts like a full NP with respect to both Postal's constraint and Langendoen's constraint. This fact is unexplained in the No Pronominalization theory, since all pronouns are simply unsubstituted variables. Whether the correct representations for these sentences are those proposed by Keenan, or the more complex structures, there is no stage of the derivation at which this pronoun is a fuller NP.

Thus for example consider:

25. *The woman (who) he wrote to saw the man who loves her

It was claimed earlier that the ungrammaticality of this sentence is predicted by the constraint which blocks:

26. *the woman, (who) the man who loves her, wrote to

However, it was argued that this constraint blocks (26) only by virtue
of the fact that this NP contains a coreferential pronoun. Translating this into the framework here, we can say that a relative clause is blocked when the relativized variable is preceded by another occurrence of the same variable.⁵

Therefore, in the No Pronominalization theory, this constraint will not block (25). Given the analysis in 4.1.2, the representation for (25) is:

\[ T\{x, y\} \]
\[ \text{(woman, man)} \]
\[ y \text{ wrote to } (x) \]
\[ z \text{ loves } x \]
\[ x \text{ saw } y \]

Here the circled \( x \) is the relativized variable in what corresponds to the surface NP: the woman who he wrote to. It is not preceded by another occurrence of \( x \), but only by the variable \( y \) which corresponds to the surface pronoun he. The same problem arises given the simpler structure proposed by Keenan.

We could not suppose that Postal's constraint is formulated in such a way as to block (25) by virtue of the fact that the relativized \( x \) is preceded by a variable \( y \) which is bound by a phrase that contains another occurrence of \( x \). Not only would such a formulation be extremely

---

⁵As discussed earlier, it has not really been established that it is the position of the relativized variable with respect to the other variable that is crucial. For example, the constraint could block relative clauses in which a non-subject is relativized, and the clause contains another occurrence of the same variable. However, this does not affect the argument; the only crucial assumption is that the constraint must refer to the presence of a variable identical to the relativized one.
complex, but it would incorrectly block NP's like:

28. the woman (who) wrote to the man (who) she (who) loves

The representation for (28) is:

29.

Here the relativized \( y \) is preceded by an \( x \) which is bound by a phrase containing another occurrence of \( y \). Yet (28) is grammatical. There is therefore no explanation for the fact that the first pronoun acts like its full NP antecedent.

4.2.2. The Relative Clause Asymmetry

As will be discussed in Sec. 8, there is evidence that a QP cannot be substituted into a relative clause. Given this constraint, the ungrammaticality of a sentence like (30) - where the first NP is within a relative clause - is predicted in the No Pronominalization theory:

30. *The house that belongs to the woman who wrote to him pleased the man who loves her

Here we have the sentence \( x \) pleased \( y \) where \( x \) is bound by the house-phrase and \( y \) is bound by the man-phrase. Further, since there is crossing coreference, the man-phrase and the woman-phrase must constitute a single double binding QP.

Given this, either the house-QP, which binds the subject, has wide scope, or the man-woman QP, which binds the object, has wide scope. But the former is impossible, since the house phrase contains some variable which corresponds to the surface NP the woman who wrote to him, and must
therefore be bound by the man-woman phrase. If the house has wide scope then this variable, which is circled below, is unbound:  

31.

The woman-variable within the house-phrase would be bound if the man-woman QP were within the house-QP, but then the object variable in the main S is not bound:

32.

The house-phrase must therefore be within the scope of the man-woman phrase. This means that the representation for (30) must be:

---

6 Again for consistency I am using representations of the sort outlined in 4.1.2 here; it makes no difference whether these or Keenan's are used.
In order to derive (30) from this structure, the \( x \)-phrase must be substituted for the occurrence of \( x \) within the house phrase. If there is a constraint that nothing can be substituted into a relative clause, then this derivation is blocked, since the \( x \)-phrase is substituted into the phrase the house that belongs to \( x \).

Yet if there is such a constraint then this theory has no way to derive a sentence like (34), where the second NP is in a relative clause:

34. The woman who wrote to him bought the house that belonged to the man who loves her

As in (30), this sentence must have as its representation a structure in which the man-woman phrase has wide scope. If this phrase originated within the house phrase, then the subject variable of the main \( S \) would not be bound. Moreover, the house phrase must be within the scope of the woman-man phrase, since the former contains a variable bound by the latter. Thus the representation for (34) must be:

35. \[ T \{x,y\} : S ( T_y : v \text{ belongs to } y (y \text{ bought } v) ) \]

But the derivation of (34) from (35) involves the substitution of the man-phrase into the relative clause in the house phrase.

Thus in order to derive (34), the No Pronominalization theory cannot maintain that a QP cannot be substituted into a relative clause.
Yet without such a constraint, the ungrammaticality of (30) is unexplained; nothing blocks the derivation of this sentence from (33). This theory then does not account for the asymmetry of these sentences with respect to relative clauses.

As mentioned in Sec. 1, some speakers might marginally allow sentences like (30) where the first NP is in a relative clause. The same argument, however, can be made with a more complex sentence like (36), where both NP's are in relative clauses:

36. *The storm that frightened the man who loves her destroyed the house that belongs to the woman who wrote to him.

This sentence is, I believe, ungrammatical for all speakers.

In order to account for the grammaticality of (34), the No Pronominalization theory must permit the substitution of a QP into a relative clause. However, it then has no way to block (36); this sentence should be derivable from:

37.

Thus the No Pronominalization theory is inadequate, even for speakers who accept (30).
Section 5

The Apparent Failure of the Pronominalization Theory

This section will consider how these sentences are handled in the Pronominalization theory. This theory provides a source for a Crossing Coreference sentence which has the correct meaning. No new device such as double binding is needed; nor are any new syntactic rules required except, of course, the rule of Pronominalization. If this structure is the only possible representation for such a sentence, then the syntactic facts are accounted for as well.

Nevertheless, a serious problem arises in this theory, for there appears to be another source as well. Given this second source, the Pronominalization theory predicts that the sentences are ambiguous in the way that Karttunen claimed. Moreover, the syntactic facts are not explained. While one derivation of the ungrammatical sentences discussed in Sec. 1 is blocked, there is another good derivation of these sentences from the second source. In view of this, it would appear that the Pronominalization theory is no more adequate than the No Pronominalization theory. In Secs. 6 and 7 I argue that there is a constraint which provides the solution to this problem.

5.1. A Representation for the Sentences

As discussed before, it would seem that the subject NP of a sentence like:

1. The woman who wrote to the man who loves her saw him
   should, like the subject of:

2. The woman who wrote to the man who loves her danced on
   the ceiling

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be bound by the phrase:

3. 

```
  QP
     S
     /\        x wrote to y
    /  \                   \
  Tx   QP (man) S    Ty       S
   (woman)             y loves x
```

In the No Pronominalization theory, (3) cannot be the representation for the subject in (1), since this would leave the variable corresponding to the surface pronoun him unbound. This theory must therefore introduce double binding to provide a structure for (1).

This problem does not exist in the Pronominalization theory. Here the subject of (1) can be bound by (3), since the object pronoun him can be derived from a full NP rather than from an unsubstituted variable. Thus (1) is derivable from:

4. 

```
  QP
     S
     /\    x wrote to y
    /  \       \
  Tx   QP (man) S    Tz       S
   (woman)             z loves x
```

(4) has the correct meaning for (1); it requires a context in which there is one and only one woman who is such that there is one and only one man who loves her and she wrote to him. Notice that the scopes of the two QP's cannot be reversed in (4); the phrase binding the subject NP must have wide scope in order to bind the pronoun within the object NP.

Substituting all of the QP's onto the appropriate variables and

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pronominalizing the unsubstituted variables will yield the sentence:

5. The woman who wrote to the man who loves her saw the man who loves her

which is synonymous with (1). In (4), the $y$-phrase (the man who loves $x$) and the $z$-phrase (the man who loves $x$) are referentially identical. In any given context, they will either pick out the same individual or else both will fail to refer, since they require a context in which there is one and only one man who loves $x$. Therefore the $y$-phrase can pronominalize the $z$-phrase; this yields (1). So the first pronoun in (1) (her) is derived from an unsubstituted variable; while the second pronoun (him) is derived from a full NP.

(4) is similar to the structure that Karttunen (1971) proposed for (1), although he was not using a framework with variables in the syntax. Thus he represented (1) as:

6. The woman who wrote to the man who loved the woman saw the man who loved the woman

It is interesting to note that Karttunen's system also provides two different kinds of sources for pronouns. The first pronoun in (1) (her) is derived from a simple NP (the woman); it can be pronominalized on the basis of identity with the head noun. The second pronoun (him) is derived from the complex NP the man who loved the woman. Thus wherever Karttunen's analysis derives a pronoun from a simple NP, the framework here derives that pronoun from an unsubstituted variable.

The Pronominalization theory must, of course, not allow (1) to be derived from:

---

As discussed earlier, one problem with representations like (6) is that this structure predicts that (1) should be interpretable only in a context with only one woman.
since (7) requires a pair where only one woman wrote to the man. A derivation of (1) from this structure would involve first the substitution of the w-phrase into $S_3$, yielding roughly:

8. $T_y: S_2 \triangleleft S_3 (the \ woman \ who \ wrote \ to \ y \ saw \ y)$

If the y-phrase were then substituted onto the first occurrence of y (the variable within the subject NP), and the x-phrase were Pronominalized, the result would be (1). But the hypothesis that a QP cannot be substituted into another QP (or into a relative clause) will block this derivation; the y-phrase could not be substituted for the variable in the phrase: the woman who wrote to y.

Thus (1) can be derived only from (4), while (7) is the representation for:

9. The man who loves the woman who wrote to him was seen by her

Here Passive has applied in the lowest S; the w-phrase is substituted for the underlying subject, the y-phrase for the derived subject, and the w-phrase is pronominalized by the x-phrase. If Passive does not apply here then the derivation is blocked, since the Precede and Command Constraint is violated:
10. *She saw the man who loves the woman who wrote to him

The Pronominalization theory also has no trouble providing a representation for a Crossing Coreference sentence like:

11. The woman who wrote to him saw the man who loves her

Looking again at (4) (shown here after all the QP's have been substituted):

4. \( \text{Tx} [x \text{ wrote to Ty } [y \text{ loves } x]] \text{ saw Tz } [z \text{ loves } x] \)

\( \text{(woman) (man) (man) } \)

we see that just as the \( y \)-phrase can pronominalize the \( z \)-phrase to give (1), the \( z \)-phrase could instead pronominalize the \( y \)-phrase. The output of this derivation is (11).

5.2. Accounting for the Syntactic Facts

Let us assume for now that (4) is the only structure which can underlie (11) in this theory. This means that a Crossing Coreference sentence must be derived from a source in which the subject NP has wide scope, and in which the first pronoun is derived from a full NP which is Pronominalized by the second NP. Since the second NP has narrow scope, the pronoun within this NP corresponds to an unsubstituted variable; it is bound by the first NP.

If this assumption is correct, then the semantic predictions of this theory accord with the claim in Sec. 2. There it was argued that a sentence like (11) is unambiguous and is synonymous with (1):

11. The woman who wrote to him saw the man who loves her

1. The woman who wrote to theman who loves her saw him

Both sentences require a unique woman-man pair such that the woman wrote to the man, and the man is the only man who loves the woman.

\(^2\)I will use the notation \( \text{Tx}[S] \) to indicate a QP which has been substituted into a clause (where \( \text{Tx:S} \) indicates a QP which has not been substituted.

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In the previous section it was shown that the No Pronominalization theory can also represent these sentences by structures which have the right meaning, though this requires some complicated syntax. But the major problem in this theory is that these representations do not account for the syntactic behavior of Crossing Coreference sentences. It can now be shown that if (4) is the only source for (11), then not only does the Pronominalization theory make the correct semantic predictions, but the syntactic facts are also explained.3

We have seen that the first pronoun of a Crossing Coreference sentence acts like its full NP antecedent with respect to both Postal's constraint and Langendoen's constraint. Consider now the derivation of (11) from (4). Here the first pronoun is derived from the full NP: the man who loves x. The second pronoun, on the other hand, is simply an unsubstituted variable. This accounts for the fact that the second pronoun does not act like a full NP with respect to these constraints.

To look at this in more detail, we will consider the derivation of an ungrammatical sentence like:

12. *The woman (who) he wrote to saw the man who loves her

It was argued earlier that (12) must be blocked by Postal's constraint, which also blocks:

13. *the woman (who) the man who loves her wrote to

This constraint blocks NP's like (13) by virtue of the fact that the relativized variable (which corresponds to who) is, at the input to Relative Clause Formation, preceded by another occurrence of the same variable (which corresponds to her).  

3The interaction of crossing coreference and relative clauses will not be considered here; this is discussed in Sec. 9.
If Crossing Coreference sentences are derived from structures like (4) - in which the subject NP has wide scope - then the structure underlying (12) must be:

14.

After the \( y \)-phrase is substituted into \( S_4 \), the \( x \)-phrase is roughly:

15. \( Tx \left[ \text{the man who loves x wrote to X} \right] \)

Here the circled variable is relativized; this variable is preceded by another occurrence of the same variable. Postal's constraint will therefore block the derivation of (12) from (14). Put more simply, the subject NP in (12) is derived from the same source as (13) since the pronoun he is derived from the full NP the man who loves her. The constraint blocking (13) will therefore block (12) as well.

It should be noted that there are two crucial assumptions in this analysis. One is that the \( y \)-phrase (the man who loves x) is not pronominalized until after the stage of the derivation at which Postal's constraint holds. While I know of no independent motivation for this assumption I see no problem with it either. This ordering would, for example, follow from the hypothesis that Pronominalization is post-cyclic, and that the constraint holds cyclically. It would also be predicted if both are cyclic, and QP's are a cyclic domain; the domain relevant for the application of Pronominalization is \( S_1 \), while the domain of the constraint is \( QP_1 \).
Second, if it is correct that the constraint blocks NP's like (13) by virtue of the fact that the relativized variable is preceded by another occurrence of the same variable, then the substitution of $QP_2$ in a structure like (16) must occur before the stage in the derivation at which the constraint holds:

![Diagram]

Although in (16) the relativized variable is preceded by another occurrence of $x$ prior to the substitution of $QP_2$, this is simply a consequence of the arbitrary convention of drawing the QP to the left of the sentence. Given the contrast between (13) and (17):

13. *the woman who the man who loves her wrote to

17. the woman who wrote to the man who loves her

it is clear that it is the position of the variable after Q Sub as applied which is relevant. Prior to Q Sub, the relativized $x$ in (17) is also preceded by another occurrence of $x$:

18. $Tx : Ty$ : $y$ loves $x$ ($\times$ wrote to $y$)

Again, I see no problem with the assumption that the substitution of $QP_2$ occurs prior to the stage of the derivation at which the constraint holds. This would in fact be predicted if Q Sub is cyclic. Notice, though, that the necessity for some principle to ensure this ordering is not unique to the Pronominalization theory. The No Pronominalization theory

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must also block the derivation of (13) from (16).

The Pronominalization theory accounts for the interaction of Crossing Coreference sentences and Langendoen's constraint in much the same way. Thus it was argued in Sec. 1 that:

19. *His wife saw the man who loves her

is blocked by the constraint which blocks:

20. a. *the man who loves his wife_i
    b. *the wife_i of the man who loves her_i

This constraint blocks NP's like (20) only if they contain a coreferential pronoun:

21. the wife_i of the man who loves her_j

and thus it cannot block (19) directly.

But if Crossing Coreference sentences are derived from a source in which the subject NP has wide scope and the first pronoun is derived from a full NP, then the structure for (19) is, very roughly, (22) ((22) is shown after all of the QP's have been substituted, and is rather cryptic since I have no idea of what is the correct representation for NP's like wife):

22. Tx (wife) of Ty [y loves x] saw Tz [z loves x]
    (man) (man)

Since the subject NP here contains a coreferential pronoun (or, variable), the constraint blocking (20) will block (19) as well.4

Thus the hypothesis that Crossing Coreference sentences are derived from structures like (4) predicts that the first pronoun is derived from - and therefore acts like - a full NP. Since the subject has wide scope, 

4Here too it is crucial that Langendoen's constraint holds before the y-phrase is pronominalized; again there seems to be no reason not to make this assumption.
the first pronoun cannot be bound by the object NP. Therefore it cannot be an un/substituted variable, but must be derived by Pronominalization. On the other hand, the second pronoun does not act like a full NP. This too is explained. Since the object is within the scope of the subject, this pronoun corresponds to an un/substituted variable bound by the subject.

So for example, consider the contrast between (12) and (23):

12. *The woman (who) he wrote to saw the man who loves her
23. The woman who wrote to him saw the man (who) she loves

(23) does not violate Postal's constraint despite the fact that the fuller NP version of the object NP does:

24. *the man (who) the woman who wrote to him saw

This is predicted, since the second pronoun (she in (23)) is not derived from a full NP; it is simply an un/substituted variable:

24.

or:  \[ T_x \ [ x \text{ wrote to } T_y \ [ x \text{ loves } T_z \ [ x \text{ loves } \underline{z}\ ] \text{ saw } T_z \ [ x \text{ loves } \underline{z}\ ] \text{ him } \downarrow \text{ she} \]

Here the relativized variable in the object NP (the circled \( z \)) is not preceded by another occurrence of \( z \), but only by the variable \( x \).

Similarly, the contrast between (19) and (25) is accounted for:

19. *His wife saw the man who loves her
25. The man who loves her saw his wife
(25) is not blocked by Langendoen's constraint since the second pronoun (his) is not derived from a full NP, but is an unsubstituted variable. The structure for (25) is, very roughly:

\[
Tz \quad z \text{ loves } \underbrace{Tx (\text{wife}) \text{ of } z}_\text{her} \text{ saw } Tw (\text{wife}) \text{ of } z \quad \text{him}
\]

The object NP (the \textit{w}-phrase) does not contain a coreferential NP, but only the variable \(z\), which is bound by the subject phrase.

In other words, the claim here is that a Crossing Coreference sentence is synonymous with the parallel sentence in which the first pronoun is a full NP, and that the two have the same source. The contrast between (12) and (23) is therefore accounted for in the same way as the contrast between (27) and (28):

12. *The woman (who) he wrote to saw the man who loves her
27. *The woman (who) the man who loves her wrote to saw the man who loves her
23. The woman who wrote to him saw the man (who) she loves
28. The woman who wrote to the man (who) she loves saw the man (who) she loves

The same parallelism exists with respect to Langendoen's constraint:

19. *His wife saw the man who loves her
29. *The wife of the man who loves her saw the man who loves her
25. The man who loves her saw his wife
30. The man who loves his wife saw his wife

5.3. The Problem

5.3.1. The Second Source

The analysis above assumes that a Crossing Coreference sentence like (11):

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11. The woman who wrote to him saw the man who loves her can be derived only from a structure like (4):

\[ (\text{woman}) \quad z \quad \text{loves} \quad x \quad \text{wrote} \quad k \quad \text{to} \quad y \quad (\text{man}) \]

(4) is analogous to one of the structures which underlies (11) in Karttunen's analysis; this structure is (6):\(^6\)

6. The woman who wrote to the man who loves the woman saw the man who loves the woman

Karttunen, however, claimed that (11) is ambiguous; that it shares a reading not only with (1) but also with (9):

1. The woman who wrote to the man who loves her saw him

9. The man who loves the woman who wrote to him was seen by her

His analysis therefore provides a second source for (11):

31. The woman who wrote to the man saw the man who loves the woman who wrote to the man

which, in the framework here, is analogous to (7):

\[ (\text{woman}) \quad z \quad \text{loves} \quad x \quad \text{wrote} \quad k \quad \text{to} \quad y \quad (\text{man}) \]

\[^5\text{If (6) were the only representation for (11) in Karttunen's analysis, then this analysis also accounts for the syntactic facts. Here the first pronoun is derived from the complex NP the man who loves the woman, while the second pronoun is derived from the simple NP the woman. The fact that the second pronoun does not behave like the full complex NP is therefore predicted.}\]
or: \( Tw \) [\( w \) wrote to \( y \)] saw \( Ty \) [\( y \) loves \( Tx \) [\( x \) wrote to \( y \)] ]

(7), like (9), requires a unique x-y pair such that \( x \) is the only woman who wrote to \( y \) and \( y \) is a man who loves \( x \).

If the claim in Sec. 2 is correct, then (11) is not ambiguous; it does not have the meaning of (9). Given this, the assumption that it cannot be derived from (7) is valid. Nevertheless, a serious problem for the Pronominalization theory emerges here, for there is no apparent way to block the derivation of (11) from (7).

In (7), the x-phrase (the woman who wrote to y) and the w-phrase (the woman who wrote to y) are referentially identical. The former can therefore pronominalize the latter, and, if Passive has applied on the main S, this derivation yields (9). If Passive does not apply, the derivation in which the w-phrase is pronominalized is blocked by the Precede and Command Constraint:

10. *She saw the man who loves the woman who wrote to him

The w-phrase can also pronominalize the x-phrase. Here, if Passive applies, the result is (32):

32. The man who loves her was seen by the woman who wrote to him

which, according to the evidence in Sec. 2, is synonymous with (9). How-
ever, if Passive does not apply and the x-phrase is pronominalized the result is (11):

33. Tw who wrote to y saw Ty who loves Tx who wrote to y
   ↓ (woman) (man) (woman)
   him her

Thus the Pronominalization theory does not make the correct semantic prediction unless there is some constraint which blocks the derivation of (11) from (7). One hypothesis is that there is a constraint on Pronominalization to the effect that the pronominalized NP must precede the controlling NP. In other words, (32) can be derived from (9) since the pronominalized x-phrase (which corresponds to the surface pronoun her) precedes the controlling w-phrase (the woman who wrote to him). In (11) these are reversed, and so the constraint would block this derivation. (Such a constraint predicts that any pronoun which follows its antecedent must correspond to an unsubstituted variable; it cannot have a full NP source.) But this constraint is clearly incorrect, for it also blocks the derivation of (9) from (7) (and the derivation of (1) from (4)):

9. The man who loves the woman who wrote to him was seen by her

Here the w-phrase is Pronominalized by the controlling x-phrase; the x-phrase precedes the w-phrase.

Therefore it seems that the Pronominalization theory does not predict that Crossing Coreference sentences are unambiguous, unless some ad hoc constraint is adopted. In view of the tentative nature of the semantic evidence, we might then simply accept Karttunen's claim that (11) has both readings.

But if Crossing Coreference sentences do have this second source,
then the syntactic facts are not accounted for. The claim that these sentences are ambiguous means that they have one source in which the first pronoun corresponds to a full NP and the second pronoun corresponds to a variable, and another source in which the second pronoun is derived from a full NP and the first is an unsubstituted variable.

Given this, the ungrammaticality of a sentence like

12. *The woman who he wrote to saw the man who loves her

is not explained. One derivation of this sentence is blocked (therefore it should be unambiguous); it cannot be derived from (14) where the subject has wide scope and the first pronoun corresponds to a full NP. But it has a second source parallel to (7), where the object has wide scope. Here her is derived by Pronominalization, while the first pronoun he is an unsubstituted variable:

34.

```
S
  QP
  Ty (man)
  QP
  Tx (woman)
  S
  y wrote to x
  QP
  S
  y loves x
  S
  y wrote to w
  y saw w
```

or: Tw [y wrote to ] saw Ty [y loves Tx [y wrote to x] ]

The derivation of (12) from (34) does not violate Postal's constraint. The relativized variable (the circled w) is not preceded by another occurrence of the same variable. It is preceded only by the variable y, which corresponds to the surface pronoun he. Thus just as the Passive of

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(12), which is derived from (34), is grammatical:

35. The man who loves her was seen by the woman he wrote to 
(12) should also be grammatical if it has this source.

Likewise, this theory does not seem to account for the ungrammaticality of:

36. *His wife saw the man who loves her 
since there should be a structure for this sentence in which his does not 
correspond to the full NP the man who loves her, but rather to an unsub-
stituted variable:

   37. Tx of y saw Ty who loves Tw of y  
      (wife)  ↓   (man)  ↓   (wife)  
           his         her

In sum, the Pronominalization theory seems to predict that a sen-
tence like (11) is ambiguous:

11. The woman who wrote to him saw the man who loves her 
and that sentences like (12) and (36) are grammatical though unambiguous:

12. *The woman he wrote to saw the man who loves her

35. The man who loves her was seen by the woman he wrote to

Neither can be derived from the structure in which the first pronoun cor-
responds to a full NP, since this derivation violates Postal's constraint. 
But both should be derivable from the structure in which her corresponds 
to a variable, and the pronoun he is derived from the full NP. This 
structure also underlies the grammatical sentence:

36. The man who loves the woman he wrote to was seen by her

Therefore the Pronominalization theory appears to be no more ade-
quate than the No Pronominalization theory. It does not in fact account 
for the asymmetry between the two pronouns, unless some constraint blocks
the derivation in which the second pronoun is derived by Pronominalization. Yet there seems to be no non ad hoc way to constrain the Pronominalization rule to block its application here.

To establish the solution to this problem, the next section will consider Postal's constraint in more detail. It will be argued that the cases that Postal considered are instances of a more general phenomenon, and a reformulation of his constraint will be proposed. In Sec. 7 it will be shown that this constraint blocks the derivation of a Crossing Coreference sentence from the second source.

5.3.2. More Extra Structures

Before turning to this constraint, two other potential problems should be noted. Karttunen points out that, in addition to the two structures discussed above, his system provides a third representation for Crossing Coreference sentences:

38. The woman who wrote to the man saw the man who loves the woman

If an analogous representation is provided in the framework here, then another problem exists for the Pronominalization theory.

As mentioned earlier, wherever Karttunen's analysis derives a pronoun from a simple NP, a framework with variables derives that pronoun from an unsubstituted variable. In the derivation of (11) from (38), the first pronoun corresponds to the simple NP the man; therefore in the corresponding structure this pronoun would be derived from an unsubstituted

*Karttunen considered this to be a problem, though Kuroda (1971) claimed that the existence of this third structure actually supports Karttunen's analysis. According to Kuroda, a Crossing Coreference sentence has three readings; the third reading requires a non-unique pair with unique members. Since a structure like (38) is not a semantic representation, I see no way to determine whether this would actually be its meaning, or whether it would require a unique pair with non-unique members (Keenan's reading), or a unique pair with unique members (Dik's reading).
variable. This means that the Pronominalization theory would provide yet another good derivation for an ungrammatical sentence like (12). Since the first pronoun is not derived from a full NP, Postal's constraint is not violated.

There is, though, no reason to suppose that there is a representation which corresponds to (38). If this structure exists, then both pronouns can be derived from unsubstituted variables. But we have seen that, given a framework with restricted quantification, the only way to construct a representation in which both pronouns are unsubstituted variables is to introduce the device of double binding. There is no independent motivation for this device; it was proposed by Keenan simply to allow the No Pronominalization theory to provide representations for Crossing Coreference sentences. If double binding does not exist, then there is no third structure analogous to (38).

A related problem has been noted by Fauconnier (1971), Ayres (1972) and Wasow (1972). They all point out that Karttunen's analysis actually allows an infinite number of structures to underlie a Crossing Coreference sentence. The question then arises as to whether the Pronominalization theory also provides an infinite number of other structures for a sentence like (11); this problem is discussed in Sec. 12. For now we will assume that the only representations provided by the Pronominalization theory are those discussed above.
Section 6

Postal's Constraint as the Leftmost Constraint: Another Problem for the No Pronominalization Theory

This section will reexamine Postal's constraint, to try to establish that the cases considered by Postal are examples of a more general phenomenon. The principle needed to account for these in itself provides a serious problem for the No Pronominalization theory. This principle has the effect of constraining the application of Q Sub, but the No Pronominalization theory is forced to conclude that Q Sub violates this constraint just in case a definite NP is substituted.

There are two ways to avoid this problem. One is to conclude that definite NP's are not derived by Q Sub, as in the Definite Full NP theory. But the Pronominalization theory also provides a solution to the problem, allowing the substitution of definite NP's to obey the constraint. In the next section we will return to Crossing Coreference sentences, to show that these provide evidence that definite NP's are in fact constrained in the same way as other NP's.

6.1. Formulating the Constraint

Postal (1971) and (1972) noted the following contrasts (for most speakers) in relative clauses and questions:

1. a. *the man who your punching him annoyed
   b. *the knight who the dragon that chased him killed

   vs. 2. a. the man who was annoyed by your punching him
   b. the knight who killed the dragon that chased him

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3. a. *Who\textsubscript{i} did your punching him\textsubscript{i} annoy?
   b. *Who\textsubscript{i} did the dragon that chased him\textsubscript{i} kill?

vs.

4. a. Who\textsubscript{i} was annoyed by your punching him\textsubscript{i}?
   b. Who\textsubscript{i} killed the dragon that chased him\textsubscript{i}?

There are two approaches which have been taken to account for these contrasts. Postal (1971 and 1972) suggests that (1) and (3) are blocked by what is essentially a constraint on the application of certain movement rules. The second hypothesis is that these violate a constraint on the relationship between pronouns and indefinite antecedents. I will argue here that neither of these constraints are adequate. Both constraints are descriptively correct, but they follow from a more general principle which is developed in 6.1.4.

6.1.1. Postal’s Wh Constraint

6.1.1.1. The Constraint

In Postal’s formulations of the constraint, the salient difference between (1) and (3) on the one hand and (2) and (4) on the other is that in the former the relativized or questioned NP originates to the right of a coreferential pronoun; in the grammatical cases it originates to the left. As mentioned earlier, these contrasts are not sufficient to demonstrate that this is the crucial distinction. Two other generalizations are consistent with the above examples:

i. An NP cannot be relativized or questioned if the clause contains a pronoun coreferential to that NP, and the pronoun is part of the subject of that clause.

ii. An NP cannot be relativized or questioned if it is not the subject of the clause and the clause contains a pronoun coreferential to that NP.

Although my argument does not hinge upon this (since the proposed...
constraint could be reformulated to be compatible with (i) or with (ii)), it is worth establishing that Postal's generalization is the correct one. (i) is insufficiently general and (ii) is too strong. Thus (i) will not block (5), where the pronoun is not part of the subject:

5. a. *Who did you introduce his enemy to?  
   b. the man who I introduced his enemy to

(5) can be contrasted with:

6. a. Who did you introduce Jack's enemy to?  
   b. the man who I introduced Jack's enemy to

Postal's generalization does predict that (5) is ungrammatical, since the NP is questioned or relativized from the right of the pronoun.¹ (ii), on the other hand, is too strong, and will incorrectly block:

7. a. Who did you introduce to his enemy?  
   b. the man who I introduced to his enemy

Postal (1971) originally accounted for these facts by the hypothesis that some rules (including Relative Clause Formation and Wh-Fronting) cannot reverse the order of any two coreferential NP's. The class of rules constrained in this way must be limited; Passive, for example, is not so constrained:

8. a. The dragon that chased him killed the knight.  
   b. The knight was killed by the dragon that chased him

In Crossover Phenomena Postal attributed this difference to the fact that

¹This is not to say that left-right order is essential here; the generalization could be stated in terms of grammatical relations. Given a theory of relational grammar such as that of Perlmutter and Postal, in which NP's are ranked as follows:

Subj. > Dir. Obj. > Ind. Obj. > Others

the crucial generalization can be that no NP can be relativized or questioned if the clause contains a coreferential pronoun, where that pronoun is part of some NP such that NP outranks the relativized or questioned NP.

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Passive is upward bounded, while Wh-Fronting and Relative Clause Formation are unbounded. That this distinction is not the salient one is demonstrated by the fact that Tough-Movement, which can in some cases move NP's unboundedly, is not so constrained:

9. a. It's hard to imagine their owner taming those lions
   b. Those lions are hard to imagine their owner taming

10. a. It's hard to imagine John convincing their owner to try to tame those lions
    b. Those lions are hard to imagine John convincing their owner to try to tame

In a revised formulation, Postal (1972) proposed roughly the following constraint:

11. The Wh-Constraint:
    A derivation is ill-formed if:
    at the input to a Wh-rule there are two constituents A and B such that:
    A is a pronoun
    B is a wh-word
    A is to the left of B
    and at the output B is to the left of A
    and A and B are presupposed coreferents.

It seems unlikely that such a constraint could exist in grammar; it does nothing more than describe the situation. Nor does this formulation solve the problem of predicting which rules will be constrained in this way. It refers to the class of "Wh-rules"; without further definition this amounts to a list of the relevant rules. But more seriously, there are a number of cases not accounted for by the constraint, but which appear to be related to the violations in (1) and (3).

Before considering these cases, it should be noted that the Wh-Constraint as stated in (11) assumes that surface wh-words and pronouns are marked as such at the input to Wh-Fronting and Relative Clause Forma-
tion. This is not crucial; the constraint could be rephrased to say that constituent A corresponds to a surface pronoun and B to a surface wh-word. It also assumes a notion of "presupposed coreference." In the framework here, we could take this to mean that the two constituents correspond to identical variables in semantic representation.

6.1.1.2. The Inadequacy of the Wh-Constraint

One seemingly trivial problem with this constraint is that it blocks (1) and (3) by virtue of the fact that a "wh-word" has moved. This is a surface morphological notion; the constraint as stated therefore holds only for English. Yet the same constraint exists in French:

12. a. *l'homme que sa mère a tué
   "the man who his mother killed"
   
   b. l'homme qui a tué sa mère
   "the man who killed his mother"

13. a. *Qui est-ce que sa mère a tué?
   "Who did his mother kill?"
   
   b. Qui a tué sa mère?
   "Who killed his mother?"

The fact that French has this constraint is not in itself serious. It could be hypothesized that relative and interrogative pronouns universally constitute a unified class, and that the constraint refers to this class.

But there are languages with different sets of relative and interrogative pronouns. And, in at least some such languages, the rules front-

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2I would like to thank the following people for supplying me with the non-English data: Martine Mazadon - French; Annie Zaenen and Ingrid Stasse - Dutch; Masayoshi Shibitani - Japanese; Guray Chaglar and Ayhan Aksu - Turkish; and Sun Chang - Korean. Karl Zimmer also helped with the Turkish examples, and Annie Zaenen helped me work out the analysis of the Dutch examples. For the most part my data was not collected in a very systematic way; it should, therefore, be seen as somewhat tentative.
ing both of these are constrained in the same way. So, for example, consider first the following relative clauses in Dutch:

14. a. *de \textit{man} \_ \textit{die } de \textit{hond} \_ \textit{hem} \_ \textit{beet haatte}
   the \textit{man} rel. the \textit{dog} rel. \textit{him} bit hate
   pro. pro.
   "*the \textit{man} who \_ \textit{the dog that bit him} \_ hates"

   b. de \textit{man} \_ \textit{die } ___ de \textit{hond} \_ \textit{hem} \_ \textit{beet haatte}
   the \textit{man} rel. the \textit{dog} rel. \textit{him} bit hate
   pro. pro.
   "the \textit{man} who \_ hates the dog that bit him"

As indicated above, the relativized NP has moved from the right of the co-referential pronoun in (14a), and from the left in (14b). (The schematization above assumes that the order of elements within the clause at the input to relativization is SOV. However, this assumption is not crucial; the only relevant assumption is that the subject precedes the object at the input to relativization.) Although questions use a different set of pronouns, the rule fronting these pronouns is constrained in the same way:

15. a. *Wie \_ haatte de \textit{hond} \_ \textit{hem} \_ \textit{beet}?
   who hate the \textit{dog} rel. \textit{him} bit
   pro.
   "*Who \_ does the dog that bit him \_ hate?"

---

3 Of the two informants asked, one found the relative clause in (15a) better than the corresponding question in (16a); the other found both bad. However, I do not take this as evidence that the situation in Dutch is different from the situation in English, since many English speakers also find the relative clauses better. This is discussed more thoroughly in 6.1.2.2.

4 Despite the fact that the subject in (15a) occurs in final position, I am again assuming that it precedes the object at the input to the fronting rule. This assumption seems justified since the occurrence of the subject in final position is a consequence of the fact that the object has preposed, combined with the fact that Dutch, like German, requires the matrix verb to be in second position. Notice that if the constraint is formulated in terms of grammatical relations along the lines discussed in fn. 1, then the order of the elements at the input to the fronting rule is irrelevant.
b. Wie hy haatte de hond die hem hit bet?
   who hate the dog rel. him bit pro.

"Who, hates the dog that bit him,?"

The Dutch data indicates that a morphological characterization of
the moved NP's is inadequate. Some semantic and/or syntactic characteri­
zation of the class of NP's moved by Relative Clause Formation and Wh
Fronting is necessary for the statement of the constraint.

A much more serious flaw is that the Wh-Constraint does not account
for similar violations in languages which do not move the questioned and
relativized NP's. Thus Cole (1972) points out that languages without
question movement have a parallel constraint. Three examples are Korean,
Japanese and Turkish:

Korean

16. a. *k i - iy tounsel - in nugu i - 1 i1 miwaha - ninya?
   he -poss brother -subj who obj hate  Q
   marker marker particle

"*Who, does his, brother hate?"

b. Nugu i - ka k i - iy tounsel - 1 i1 miwaha - ninya?
   who subj he -poss brother - obj hate  Q
   marker marker particle

"Who, hates his, brother?"

Japanese

17. *Kar e i no waihu wa dare i ga suki ka
   he poss wife topic who obj love Q
   marker marker particle

"*Who, does his, wife love?"

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Turkish

18. *Karφ- si i kim i - i seviyor?
   wife-his who -acc love
   "*Who i does his i wife love?"

Similarly, parallel violations occur in relative clauses in languages where the relativized NP is deleted rather than moved:

Korean

19. a. *ki i - iy togsæng - i miwaha - nin salam i - i
   he -poss brother -subj hate -rela- man subj
   marker tivizer marker
cu - at - ta
came-past-sentence
particle
   "*The man i who his i brother hates came"

b. ki i - iy togsæng - il miwaha - nin salam i - i
   he -poss brother -obj hate -rela- man -subj
   marker tivizer marker
cu - at - ta
came-past-sentence
particle
   "The man i who hates his i brother came"

Japanese

20. *kare i no waihu ga suki na otoko i
   he poss wife subj love rela- man
   marker tivizer
   "*the man i who i his i wife loves"

Turkish

21. *karφ - sin i - in sev - diğ i - i adam i
   wife - his - gen. love-nomina-poss man
   lizer
   "*the man i who i his i wife loves"

A related potential problem concerns English that-relatives. These
are constrained in the same way that *wh*-relatives are:

22. a. *the man that your punching him annoyed
   b. *the knight that the dragon that chased him killed

There are at least three possible analyses of the derivation of *that*-relatives: (a) that is a relative pronoun, and the construction involves movement of this pronoun; (b) that is a complementizer and a *wh*-relative pronoun is moved and then deleted; (c) that is a complementizer and no movement occurs - the relativized NP is simply deleted.

The Wh-Constraint blocks (22) only if a movement analysis of *that*-relatives is correct; either (a) or (b) is compatible with the constraint. However, arguments have been given against both of these positions (cf., Morgan, 1973). I will not review these arguments here, but will simply note that the Wh-Constraint relies crucially on an analysis which is at best controversial.

6.1.2. The Backwards Pronominalization Constraint

6.1.2.1. The Constraint

The arguments above indicate that the Wh-Constraint is inadequate because it blocks relative clauses and questions only when they involve movement. The correct generalization seems to be that a relativized or questioned NP cannot be preceded by a coreferential pronoun at the point in the derivation at which questioning or relativization occurs. This constraint holds regardless of the particular syntactic process used in these constructions.

Yet even this generalization seems to be too narrow, for there are similar cases which do not involve either questions or relative clauses. A frequently noted problem with the Wh-Constraint (cf., Jackendoff (cited
in Postal, 1971), Cole (1972), Wasow (1972)) is that it does not account for the ungrammaticality of (23), which appears to be related to that of (3):

23. a. *Your punching him_i annoyed someone_i
    b. *The dragon that chased him_i killed a knight_i

3. a. *Who_i did your punching him_i annoy?
    b. *Who_i did the dragon that chased him_i kill?

(23) can be contrasted with:

24. a. Someone_i was annoyed by your punching him_i
    b. A knight_i killed the dragon that chased him_i

The ungrammaticality of (23) cannot be attributed to a general constraint against backwards pronominalization since, if the antecedent is definite, backwards pronominalization is possible:

25. a. Your punching him_i annoyed the man_i with the Stetson hat
    b. The dragon that chased him_i killed the green-hooded knight_i

On the other hand, it is not only existentially quantified antecedents which are constrained in this way. Postal (1970) points out that universally quantified NP's behave the same way:

26. a. *Your punching him_i annoyed each man_i
    b. *The dragon that chased him_i killed every knight_i

vs. 27. a. Each man_i was annoyed by your punching him_i
    b. Every knight_i killed the dragon that chased him_i

It has generally been assumed that (23) and (26) are blocked by roughly the following constraint:

28. The Backwards Pronominalization Constraint:
    No pronoun can precede an indefinite antecedent

Given this constraint, Cole (1972) and Wasow (1972) both argue that the
Wh-Constraint is unnecessary. (Wasow's formulation differs somewhat from
the formulation in (28), but in ways which are irrelevant here.) Cole
makes the fairly standard assumption that a questioned wh-word is "indef-
inite".\textsuperscript{5} If, then, the structure for (3) at the input to Wh-Fronting is
roughly:

\begin{align*}
29. \text{a. your punching him}_i \text{ annoyed who}_i \\
\text{b. the dragon that chased him}_i \text{ killed who}_i
\end{align*}

and if (28) holds for this input structure, then (28) will block (3).

Postal considers this objection to the Wh-Constraint, and argues
that the ungrammaticality of (23) is unrelated to that of (3). His strong-
est argument is that there are speakers who accept (3) while rejecting (23).
Since I will claim that these are related, I will return to this problem
later.

Postal's other two arguments are predicated on the assumption that
the Backwards Pronominalization Constraint is indeed the correct way to
account for the ungrammaticality of (23). He argues that this constraint
cannot in fact account for the wh-cases. Given this, he concludes that
the ungrammaticality of (23) is not related to that of (1) and (3). The
details of these arguments will be considered below; the crucial point
here is that Postal's conclusion is unwarranted. Rather, the inability
of the Backwards Pronominalization Constraint to account for the wh-cases
indicates that it, like the Wh-Constraint, is too narrow, and that both
follow from some more general principle.

\textsuperscript{5}In Sec. 13 I will argue that it is at best difficult to charac-
terize the class of NP's which are indefinite; every process which has
been proposed as a test for definiteness defines a different class. In
view of this, the assumption that this notion plays a role in grammar
is questionable.
6.1.2.2. The Inadequacy of the Backwards Pronominalization Constraint

The Backwards Pronominalization Constraint will block a Wh-question like (3) only if it is applicable at the input to Wh-Fronting; at the output the wh-word precedes the pronoun. Postal (1971) claims that the constraint cannot hold for this level. His argument, however, is inconclusive. It is based on the assumption that all pronominalization constraints are applicable at the same level, combined with the claim that the Precede-Command Constraint cannot hold for the input to Wh-Fronting. But there is no reason to make the first assumption; if the two constraints are independent they could apply at different stages of the derivation. Nevertheless, this points to two questions which arise in a theory incorporating the Backwards Pronominalization Constraint. First, just what is the level at which the constraint is relevant? Second, why does it hold for this level? An answer to the second should fall out from a more explanatory account.

Postal's other argument reveals a much more serious inadequacy in the Backwards Pronominalization Constraint. He points out that although this constraint could perhaps account for the ungrammaticality of the Wh-questions in (3), it cannot account for the ungrammaticality of the corresponding relative clauses:

1. a. *the man_i who_i your punching him_i annoyed
   b. *the knight_i who_i the dragon that chased him_i killed

Every process which has been claimed to be sensitive to the definiteness of an NP characterizes the wh-word in a relative clause as definite (argu-

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6Wasow (1972) does treat the two as a single constraint which holds after the application of Wh-Fronting. In his analysis, the constraint need not hold for the input to this rule since the NP moved by Wh-Fronting leaves a trace in the position from which it is moved.
ments to this effect are given in Morgan (1973) and Cole (1974). Thus
the Backwards Pronominalization Constraint will not block (1) even if it
holds for the input structure to Relative Clause Formation.

Cole has replied to this argument, claiming that (1) is blocked
by analogy with the corresponding wh-questions in (3). This analogical
principle holds by virtue of the fact that relative clauses in English are
structurally and morphologically identical to wh-questions. Thus Cole
claims that in languages where the two constructions are not similar, the
relative clauses are not blocked. This includes: (a) languages in which
both relative pronouns and question pronouns are fronted, but where the
two sets of pronouns are different; (b) languages in which a relative pro-
noun is not fronted, and where this pronoun doesn't resemble a question
pronoun; (c) languages where the relativized NP is deleted.

Cole presents data from six languages to support this claim. Data
to the contrary has been presented above from Dutch (type a) and Japanese,
Korean and Turkish (type c). In view of the difference between my results
and Cole's, I would like to stress that I consider my results somewhat
tentative. Other factors could be at work in the languages I have con-
sidered. Moreover, of the two Turkish informants, one found the relative
clause (21) slightly better than the corresponding question in (18); the
same situation held in Dutch with two informants.

There are, however, several reasons why I feel that Cole's data
is unconvincing. For three out of the six languages that he cites
(Mandarin, South Min and Korean) he uses a cleft-like construction. For
example, he cites the following grammatical Mandarin sentence:
30. Zhe jiushi ta_i taitai bu xu ta_i he jiu de
   this is he wife not allow he drink wine relativizer
   neige ren_i
   that man

which is translated as "This is the man, who his wife didn't allow to
drink wine". Notice that this sentence has a grammatical reading in Eng­
lish as well as in Mandarin. Here his can be read as a presupposed coref­
erent of this (which functions as a deictic pronoun). This kind of appar­
ent counterexample to the constraint has been discussed by Postal (1971)
and Lakoff (1968); similar constructions will be discussed further in
6.1.3.

The crucial sentence that Cole cites from German is quite compli­
cated:

31. Hier ist die Dame_i, die_i der Gedanke dass sie_i gestern
   here is the lady who the thought that she yesterday
   geheiratet hätte, überraschte
   married had surprised

"?*Here is the lady, who the thought that she had gotten
married yesterday surprised"

Here too I think that the violation in the English gloss is not as glaring
as the violation in the cases discussed earlier - this is probably due to
the complexity of the sentence. The situation in German should therefore
be tested with a simpler sentence.

I have no explanation for Cole's other two cases (Hebrew and Yoruba).
But a crucial point is that even in English the relative clauses are
better than the corresponding questions. Thus the significance of Cole's
data depends upon how many informants were consulted. It would not be
surprising to find one informant who accepts the relative clause and re-
jects the question; I have found English informants who will do the same. (As mentioned above, of the two Dutch speakers that I asked, one found the relative clause better, the same was true in Turkish. The Japanese and Korean data were each checked with only one informant.)

In order to settle this completely, the data should be checked with a number of informants. From the small amount of checking that I have done, the situation in the relevant languages does not seem to be any different from the situation in English. Cole's theory predicts that the Dutch, Turkish, Korean and Japanese relative clauses should be fully grammatical, which apparently they are not. On the other hand, the fact that the relative clauses are, in general, better than the corresponding questions remains to be accounted for. Unfortunately, I have no explanation for this, and leave it as a problem with my analysis.

There is another serious problem with the analogical principle as an explanation for the ungrammaticality of English relative clauses. As discussed above, that-relatives are constrained in the same way that wh-relatives are. Since these are not morphologically identical to the corresponding questions, the analogical principle fails to block relative clauses like:

22. a. *the man\text{\_i} that your punching him\text{\_i} annoyed
   b. *the knight\text{\_i} that the dragon that chased him\text{\_i} killed

Moreover, NP's with no surface relativizer show the same violation:

32. a. *the man\text{\_i} your punching him\text{\_i} annoyed
   b. *the knight\text{\_i} the dragon that chased him\text{\_i} killed

The analogical principle also does not account for the ungrammaticality of (32).
6.1.3. An Additional Case

6.1.3.1. Only Facts

The above arguments indicate that both the Wh-Constraint and the Backwards Pronominalization Constraint are insufficiently general. The former concerns cases involving movement only; it therefore fails to block relative clauses and questions in languages which do not front a relativized or questioned NP. Nor does it block the English indefinite case. The latter constraint is relevant only when the antecedent is indefinite, and so it does not block the ungrammatical relative clauses.

We can now consider an additional case which neither constraint accounts for.

First, consider a sentence like (33) (the symbol @ will be used to designate an ambiguous sentence):

33. @ The green-hooded knight is the one who attacked the dragon that chased him

This sentence is ambiguous between what has been called the "variable" or "sloppy" reading (which I will refer to as the a-reading) and the "non-variable" reading (the b-reading). A different presupposition is associated with each reading; the a-reading presupposes (34a), the b-reading (34b):

34. a. There is one and only one x such that x attacked the dragon that chased x

b. There is one and only one x such that x attacked the dragon that chased the green-hooded knight

This ambiguity is brought out by a consideration of (33) in the following two contexts, where in both contexts Gollum (a dragon) chased the green-hooded knight, and Sal (a dragon) chased the black-hooded knight:
Context A: The green-hooded knight attacked Gollum
The black-hooded knight attacked Gollum
The black-hooded knight didn't attack Sal

Context B: The green-hooded knight attacked Gollum
The black-hooded knight didn't attack Gollum
The black-hooded knight attacked Sal

In Context A, the a-reading is true. The b-reading is not, since there is no unique knight who attacked the dragon that chased the green-hooded knight. The situation is reversed in Context B.

The ambiguity of (33) is accounted for by the fact that this sentence can be represented as, roughly, either (35a) or (35b):

35. a. Ty [y is a green-hooded knight] is
   Tx [x attacked the dragon that chased x]

b. Ty [y is a green-hooded knight] is
   Tx [x attacked the dragon that chased y]

The Pronominalization theory actually allows a third representation for this sentence which is logically equivalent to (35b):

35. d. Ty [y is a green-hooded knight] is
   Tx [x attacked the dragon that chased Tz[z is a green-hooded knight]]

Here the z-phrase is Pronominalized by the y-phrase. This structure, like (35b), gives the b-reading. Notice that there can be no additional representation for the a-reading. The pronoun him cannot be derived by Pronominalization on the basis of identity with the x-phrase, since this pronoun is contained within the x-phrase.

In contrast to (33), (36) is for most speakers unambiguous (where @@ designates an unambiguous sentence):

33. @The green-hooded knight is the one who attacked the dragon that chased him

36. -@The green-hooded knight is the one who the dragon that chased him attacked

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Here the a-reading is blocked; (36) can presuppose (37b) but not (37a):

37. a. There is one and only one x such that the dragon that chased x attacked x

b. There is one and only one x such that the dragon that chased the green-hooded knight attacked x

In support of this, consider the following contexts (where again Gollum chased the green-hooded knight and Sal chased the black-hooded knight):

**Context A':** Gollum attacked the green-hooded knight
Gollum attacked the black-hooded knight
Sal didn't attack the black-hooded knight

**Context B':** Gollum attacked the green-hooded knight
Gollum didn't attack the black-hooded knight
Sal attacked the black-hooded knight

(36) is true in Context B', but it is not true in Context A'.

The Wh-Constraint predicts the contrast between (33) and (36).

Parallel to (35a) and (35b), there should be two structures which can underlie (36):

38. a. Ty [y is a green-hooded knight] is
   Tx [the dragon that chased x attacked x]

   \[\text{him} \quad \text{who}\]

b. Ty [y is a green-hooded knight] is
   Tx [the dragon that chased y attacked x]

   \[\text{him} \quad \text{who}\]

(Again the Pronominalization theory provides a third structure which is logically equivalent to (38b)). However, the derivation of (36) from (38a) violates the Wh-Constraint. Here the fronting of the relativized variable causes an order reversal of two identical variables (or, in Postal's terms, of two constituents which are presupposed coreferents).
The derivation in (38b) does not violate the constraint since the wh-word and the pronoun correspond to different variables. (The fact that the existence of this derivation is not a counterexample to the constraint is discussed in Lakoff (1968) and Postal (1971)).

The contrast between (33) and (36) is accounted for by the Wh-Constraint because Relative Clause Formation applies in the derivations of these sentences. But there are other cases which exhibit the same pattern of ambiguity, where no reordering is involved. Thus (39) is ambiguous:

39. Only the green-hooded knight attacked the dragon that chased him

This sentence entails either (40a) or (40b):

40. a. There is no x besides the green-hooded knight such that x attacked the dragon that chased x.
   b. There is no x besides the green-hooded knight such that x attacked the dragon that chased the green-hooded knight.

The a-reading is true in Context A above; it is false in Context B. The reverse holds for the b-reading. But, like (36), (41) is unambiguous:

41. The dragon that chased him attacked only the green-hooded knight

This sentence entails (42b) but not (42a):

42. a. There is no x besides the green-hooded knight such that the dragon that chased x attacked x.
   b. There is no x besides the green-hooded knight such that the dragon that chased the green-hooded knight attacked x.

Therefore (42) is false in Context A'.

The same pattern occurs in sentences with even, and in sentences with contrastive stress:

43. a. Even the green-hooded knight attacked the dragon that chased him
   b. The dragon that chased him attacked even the green-hooded knight

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44. a. @The green-hooded knight attacked the dragon that chased him

b. -@The dragon that chased him attacked the green-hooded knight

These examples appear to completely doom a reordering constraint like the Wh-Constraint. While it could perhaps be claimed that the cases involving indefinite antecedents are not related to the wh-cases, it would be difficult to maintain that the ambiguity pattern of (33) and (36) is unrelated to that of (39) and (41). Yet a reordering constraint, which successfully blocks the a-reading of (36), will not block this reading in (41). The Backwards Pronominalization Constraint as stated in (28) also fails to account for the only facts.

6.1.3.2. A Discussion of Only

Before continuing, some discussion of only will be useful. Partee (1975) suggests that a sentence like

45. Only the green-hooded knight died

is represented as the open sentence \( x \text{ died} \) where \( x \) is bound by a QP which is roughly: only the green-hooded knight.\(^7\) Given this, she argues that the ambiguity of a sentence like (39):

39. @Only the green-hooded knight attacked the dragon that chased him

provides evidence against the No Pronominalization theory. The representation for the a-reading of this sentence is, roughly:

46. \( \text{QP[only the green-hooded knight, } x \text{]} \) (\( x \text{ attacked the dragon that chased } x \))

In the b-reading, the pronoun him cannot correspond to the variable \( x \).

\(^7\)Partee's example actually uses the phrase only John, but I am assuming that proper names are represented in a fashion parallel to definite descriptions.
It must therefore be derived from the full NP the green-hooded knight; thus the representation for the b-reading must be roughly:

47. QP[only the green-hooded knight, x] (x attacked the dragon that chased the green-hooded knight)

However, this argument seems to be based on the assumption that the phrase only the green-hooded knight is a single QP. The No Pronominalization theory could counter this by the claim that there are two separate QP's here — the only QP and the the QP. In other words, the b-reading of (39) can be represented by something roughly like:

48.

If (48) (or some other representation where the only-QP contains an occurrence of both x and y) underlies the b-reading, then there are two possible representations for the a-reading. Here the only-QP can be within the scope of the the-QP (as in (48)), or the the-QP can be contained within the only-QP:

49. a. 

Notice that no representation parallel to (49b) can be constructed for the
b-reading. Since in this reading the main S contains an occurrence of \( y \), this S must be within the scope of the the-QP which binds \( y \).

Evidence for the claim that there are actually two QP's in (39) comes from the fact that only can quantify a simple pronoun, as in

50. Someone said that only he left

In (50) he cannot be derived from a full NP, since its antecedent is not definite. This means that the representation for the embedded sentence in (50) must be something roughly like:

51. Only x: x is y (x left)

and the representation for the full S:

52. \( \exists y \) (y said that (Only x: x is y (x left)))

Despite the fact that a representation can be constructed in the No Pronominalization theory which gives the b-reading of (39), an interesting problem arises here. If (48) underlies this sentence, then the No Pronominalization theory must permit a derivation where one QP is substituted into another QP:

53. Ty: y is a green- (Only x: x is \( y_1 \) (x killed the dragon that chased x))

As discussed in Sec. 4, the No Pronominalization theory must also allow this in order to provide a derivation for a sentence like:

54. The woman who wrote to him bought the house that belonged to the man who loves her

There are, however, other cases which indicate that the substitution of one QP into another is blocked. Thus Partee points out that while a sentence like (39) is ambiguous, a sentence like (55) is not - here the b-reading is blocked:
39. @Only the green-hooded knight killed the dragon that chased him

55. -@Only a green-hooded knight killed the dragon that chased him

If (39) can be derived from (48), then (55) should be derivable from (56), which gives the b-reading:

Thus the No Pronominalization theory has no apparent way to block the b-reading in (55) but allow this reading for (39).

This problem does not arise in the Pronominalization theory. Here the hypothesis that a QP cannot be substituted into another QP blocks the derivation of (55) from (56), and the derivation of (39) from both (48) and (49a). This means that the a-reading is derivable only from (49b), where the the-QP is within the only-QP. Since the only-QP cannot be within the scope of the the-QP and bind the variable within the main S, the b-reading must be derived by Pronominalization, as Partee claimed. In other words, the structure for this reading must be roughly:

57.
6.1.4. The Leftmost Constraint

6.1.4.1. The Constraint

We can now formulate a principle which accounts for all four of the cases discussed above - the relative clauses in (1), the Wh-questions in (3), the sentences in (23) and (26) where a pronoun follows an indefinite antecedent, and the only case. To keep the discussion neutral between the No Pronominalization theory and the Pronominalization theory, we will consider sentences in which only quantifies a pronoun rather than a full NP. Thus, note that (58) is ambiguous in the same way that (39) is:

58. @Someone thinks that only he_i attacked the dragon 
    that chased him_i

This ambiguity is again clarified by a consideration of this sentence in the following two contexts (where Gollum chased the green-hooded knight and Sal chased the black-hooded knight):

**Context A:**

The green-hooded knight thinks that:
- The green-hooded knight attacked Gollum
- the black-hooded knight attacked Gollum
- the black-hooded knight didn't attack Sal
- The black-hooded knight doesn't think anything

**Context B:**

The green-hooded knight thinks that:
- The green-hooded knight attacked Gollum
- The black-hooded knight didn't attack Gollum
- The black-hooded knight attacked Sal
- The black-hooded knight doesn't think anything

The a-reading is true in Context A only; the b-reading in B. Similarly, (59), which is parallel to (41), is unambiguous:

59. -@Someone thinks that the dragon that chased him_i 
    attacked only him_i

(59) is true in Context B', but it is false in A':

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Context A':
The green-hooded knight thinks that:
  Gollum attacked the green-hooded knight
  Gollum attacked the black-hooded knight
  Sal didn't attack the black-hooded knight
  The black-hooded knight doesn't think anything

Context B':
The green-hooded knight thinks that:
  Gollum attacked the green-hooded knight
  Gollum didn't attack the black-hooded knight
  Sal attacked the black-hooded knight
  The black-hooded knight doesn't think anything

This means, then, that (58) can be derived from, roughly, either (60a) or
(60b) (where these are shown after the substitution of the dragon-QP):

60. a. \(\exists y (y \text{ thinks (only } x: x \text{ is } y (x \text{ attacked the dragon that } x \text{ chased } x)) )\)

b. \(\exists y (y \text{ thinks (only } x: x \text{ is } y (x \text{ attacked the dragon that } x \text{ chased } y)) )\)

However, the corresponding a-derivation of (59) is blocked:

61. a. \(\exists y (y \text{ thinks (only } x: x \text{ is } y (\text{the dragon that chased } x \text{ attacked } x)) )\)

b. \(\exists y (y \text{ thinks (only } x: x \text{ is } y (\text{the dragon that chased } y \text{ attacked } x)) )\)

The only difference between the derivation in (60b) and the derivation in
(61b) is that in the latter, the \(x\) onto which the only-QP is substituted
is preceded by another occurrence of \(x\). Thus some principle prevents the
substitution of a QP for some variable which is preceded by another in-
stance of that variable.

The constraint that a pronoun cannot precede an indefinite antecedent is another example of this same principle. While (24b) can be derived from (62):

24b. A knight \(_i\) attacked the dragon that chased him \(_i\)

62. \(\exists x: x \text{ is a knight} \rightarrow (x \text{ attacked the dragon that chased } x)\)

the derivation of (23b) from (63) is blocked:

23b. *The dragon that chased him \(_i\) attacked a knight \(_i\)

63. \(\exists x: x \text{ is a knight} \rightarrow (\text{the dragon that chased } x \text{ attacked } x)\)

The relative clauses and Wh-questions are similar. The data in 6.1.1 shows that a variable cannot be relativized if it is preceded by another occurrence of the same variable. Thus the circled variable in (64) cannot be fronted by Relative Clause Formation since it is preceded by another \(x\); this accounts for the ungrammaticality of (1b):

64. \(\forall x \rightarrow (\text{knight} \rightarrow \text{the dragon that chased } x \text{ attacked } x)\)

1b. *the knight \(_i\) who the dragon that chased him \(_i\) attacked

However, the relativization of this variable is blocked regardless of the exact syntactic process used. In languages which delete the relativized NP (and, perhaps in English that-relatives), this variable cannot be deleted.

Likewise, the ungrammaticality of (3b) indicates that the circled \(x\) in (65), which is preceded by another \(x\), cannot be questioned (I am using the symbol \(?\) to indicate a quantifier which binds a questioned NP):
3b. *Which knight\textsubscript{i} did the dragon that chased him\textsubscript{i} attack?

On the basis of these facts, I proposed in Jacobson (1972) that there is a constraint to the effect that any rule which acts on a bound variable can affect only the leftmost occurrence of that variable; I will refer to this as the Leftmost Constraint. Thus this constraint must ensure that for any rule whose structural description contains a bound variable \(x\), only the leftmost \(x\) in some structure can be analyzed as meeting the structural description of the rule. The definition of "bound variable" must include variables within relative clauses, which, in the framework used here, are contained within the QP.

A similar constraint is proposed in Harman (1972, cited in Harman (1976)). He suggests that a QP can only be substituted onto the leftmost occurrence of the variable that it binds.\(^8\) (In his analysis, however, the constraint has quite a different effect. It is not designed to account for the facts discussed above; rather it is designed to account for the fact that a pronoun cannot precede and command its antecedent. In Sec. 3 it was argued that the Precede and Command Constraint cannot be explained by a constraint on the application of Q Sub.) The Leftmost Constraint is somewhat more general than Harman's constraint; it is not clear whether the above cases can all be reduced to a constraint on Q Sub. One problem with this hypothesis concerns relative clauses. In the framework here nothing is substituted onto a relativized NP. However, a more detailed analysis of relative clauses may reveal that there is a substitution pro-

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\(^8\)Barbara Partee has informed me that a similar constraint is built into the grammar developed by Montague in *The Proper Treatment of Quantification in Ordinary English.*
cess involved in their derivation.

As discussed earlier, Postal's formulations of the constraint require some limitation to be placed on the class of rules which cannot reorder identical variables. No such problem arises here; rules like Tough Movement and Passive are not constrained in this way since they don't crucially affect bound variables. The Backwards Pronominalization Constraint, on the other hand, is faced with the problem of explaining why the constraint holds for the input to Wh-Fronting. Again the Leftmost Constraint avoids this problem. The constraint requires that an NP affected by the process forming questions is the leftmost variable bound by the question quantifier. It follows from this that the constraint holds for the input to this process.

It should be noted that the analysis above assumes that a QP with narrow scope is substituted before a QP with wide scope (this would, of course, be predicted if Q Sub is cyclic). Thus, for example, take the contrast between:

24. A knight\textsubscript{i} attacked the dragon that chased him\textsubscript{i}
23. *The dragon that chased him\textsubscript{i} attacked a knight\textsubscript{i}

The ungrammaticality of (23) is accounted for by the fact that the knight-QP is substituted onto the object variable, and this variable is preceded by another occurrence of the same variable (which corresponds to him). In (24), the other variable follows. This difference between (23) and (24) occurs only after the substitution of the dragon-phrase, which is within the scope of the knight-phrase.

6.1.4.2. Some Remaining Problems

There are some problems with this analysis of the constraint. First, Postal's argument against collapsing the violation in (23) with
that in (3) remains to be answered:

3. *Who did the dragon that chased him attack?

Postal points out that there are speakers who accept (3) but reject (23). I suspect that the greater acceptability of (3) lies, in part, in a principle of surface amnesty. Thus in (3) the questioned variable is the leftmost one on the surface.

The constraint does, however, seem subject to a lot of idiolect variation (see Cole (1974) for some discussion), and violations in some configurations are better than in others. For example, it was mentioned earlier that the relative clauses which violate the constraint are slightly better than the corresponding questions; I have no principle to account for this. Moreover, some speakers seem to permit the a-reading in sentences like (41) and (59):

41. The dragon that chased him attacked only the green-hooded knight.

59. Someone thinks that the dragon that chased him attacked only him.

And, Wasow (1972) notes that there are speakers who accept sentences like (23) (on a specific reading of a knight):

23. *The dragon that chased him attacked a knight.

I have no explanation for this variation among speakers with respect to the constraint.

One other potential argument against this analysis concerns a class of questions in English in which a wh-word is not fronted. The Leftmost Constraint predicts that a variable cannot be questioned if it is preceded by another occurrence of the same variable; this holds regardless of whether or not the questioned variable is fronted. The evidence from
Korean, Japanese and Turkish bears out this prediction. Here questions corresponding to (3) are ungrammatical despite the fact that the questioned NP is not moved. There are also constructions in English in which a questioned NP is not fronted. The constraint predicts that in these cases a wh-question word cannot be preceded by a coreferential pronoun. But Postal (1972) has claimed that there is evidence against just this prediction.

Postal considers three types of questions which do not involve fronting. The first is Echo questions, as in:

66. The dragon attacked who?

In this construction, the questioned NP can be preceded by a coreferential pronoun:

67. The dragon that chased him attacked who?

While I have no proposal as to the correct representation of Echo questions, I do not think that (67) constitutes a genuine counterexample to the above analysis. It is unlikely that this construction involves a question quantifier which binds both him and who. The non-questioned part (his father saw) functions much like a direct quote.

The second construction that Postal discusses is Quiz Show questions, as in:

68. For $64,000, the first run in All-Star competition was driven in by who?

This construction also permits a coreferential pronoun to precede a wh-word:

69. For $64,000, his father had what famous ruler exiled to Transylvania?

Again these seem to differ from true Wh-questions. Wasow (1972) and Cole (1974) both point out that these, unlike normal questions, assume
that the speaker knows the answer. In the absence of a more detailed analysis of this construction, it is unclear whether or not they constitute a counterexample to the Leftmost Constraint.

The third type of question considered by Postal is a multiple Wh-question, where the appropriate answer is a list of pairs:

70. Which man owns which dog?

This can be answered:

71. Jim owns Otto and Larry owns Ite

Unlike the two constructions discussed above, a multiple Wh-question seems to be a true question asking for information. Here there is no reason to believe that the question NP's are bound in a significantly different way from the NP's in normal questions. The Leftmost Constraint therefore predicts that the following questions, in which a coreferential pronoun precedes the second wh-word, are ungrammatical (the symbol 0 indicates that no grammaticality assignment is being given):

72. a. °Who told the news of his victory to which candidate?
b. °Which woman talked to his mother about which man?

Postal considers examples like these, and claims that they are grammatical. I think that Postal's judgments here are incorrect.9 Notice that these can be read as double Echo questions:

73. Which woman talked to his mother about which man?

But they cannot be true multiple Wh-questions, where a list of pairs is requested.

Actually, it would be difficult to construct a theory that predicts that these are grammatical. If the ungrammaticality of questions like

9Wasow (1972) and Cole (1974) also disagree with Postal's judgments on these.
(3), in which the questioned NP is moved, is attributed to a constraint on movement:

3. *Who did the dragon that chased him kill?

then something like the Backwards Pronominalization Constraint is needed to account for the ungrammaticality of:

23. *The dragon that chased him killed a knight

But this constraint will also predict that (74) is ungrammatical.

6.2. The Consequences of the Leftmost Constraint for the No Pronominalization Theory

The Leftmost Constraint predicts that a QP can only be substituted onto the leftmost variable bound by the QP. This accounts for the ungrammaticality of sentences like (23) and (26):

23. *The dragon that chased him killed a knight

26. *The dragon that chased him killed each knight

and the non-ambiguity of a sentence like:

59.-@Someone thinks that the dragon that chased him killed only him

Yet the No Pronominalization theory is forced to conclude that there is one counterexample to this principle. This theory claims that all pronouns, including those with definite antecedents, are unsubstituted variables. Therefore, a pronoun with a definite antecedent must correspond to the same variable as its antecedent. This, combined with the Leftmost Constraint, predicts that a pronoun cannot precede a definite antecedent, just as it cannot precede the antecedents in (23) and (26). But this prediction is of course false:

74. The dragon that chased him attacked the green-hooded knight

The derivation of (74) violates the constraint since it is not
the leftmost occurrence of the variable bound by the knight-QP which is substituted:

75. $\text{Tx: } x \text{ is a green-hooded knight}(\text{the dragon that chased } x \text{ killed } x)$

Here the knight-phrase is substituted onto the second occurrence of $x$. The No Pronominalization theory must therefore conclude that Q Sub violates the constraint just in case an NP quantified by the is substituted.

This problem is independent of the exact formulation of the constraint. The essential generalization which emerges from the facts considered above is that given a structure in which a pronoun precedes a quantified NP, the NP and the pronoun cannot correspond to the same variable. However, this generalization does not hold in the No Pronominalization theory when the NP is quantified by the.

It appears then that pronouns with definite antecedents must be treated differently from other pronouns, since they can occur in a configuration in which other pronouns cannot. One theory which accounts for this difference is the Definite Full NP theory; here definite NP's are treated in a radically different way from other NP's. Since Q Sub does not apply in the derivation of (76), the Leftmost Constraint is not violated. The pronoun him is not an unsubstituted variable, but is derived by Pronominalization:

76. $\text{the dragon that chased } \exists x (x \text{ is a green-hooded knight}) \text{ attacked } \exists y (y \text{ is a green-hooded knight}) \downarrow \text{ him}$

In other words, the fact that a pronoun can precede a definite antecedent is not a counterexample to the generalization noted above. In this theory, a pronoun whose antecedent is definite never corresponds to the
same variable as that antecedent.

But a theory which derives definite NP's from variables bound by a QP need not be abandoned. The Pronominalization theory also provides a solution to this problem, since this theory permits one derivation of (74), similar to that in (76), in which the constraint is not violated. Thus, there are two possible derivations of a sentence like:

77. The green-hooded knight$^i$ attacked the dragon that chased him$^i$

In one derivation, him is an unsubstituted variable bound by the same QP as the antecedent:

78. $^{IX: x \text{ is a green-hooded knight}}(x \text{ attacked the dragon that chased x)} \downarrow \text{him}$

In the other, him is derived from a full NP.

Similarly, two sources are provided for (74). The derivation of (74) in which him corresponds to an unsubstituted variable is blocked by the Leftmost Constraint; this derivation is (75). (74) can, however be derived from a structure in which him corresponds to a full NP. Here the substitution of the x-phrase onto the object variable does not violate the constraint, since this variable is not preceded by another occurrence of x:

79. (shown after the substitution of the dragon-phrase)$^{10}$

$Ix: x \text{ is a green-hooded knight} (\text{the dragon that chased}$

$(Iz: z \text{ is a green-hooded knight} \text{ attacked x)} \downarrow \text{him}$

---

In the derivation here, the knight-phrase has wide scope. This sentence can also be derived from a similar structure in which the dragon-phrase has wide scope; this derivation does not violate the constraint either.
To summarize, the Leftmost Constraint predicts that no pronoun can precede its antecedent if the two correspond to the same variable. Given this, the Pronominalization theory predicts that any pronoun which precedes its antecedent is derived from a full NP, rather than from an unsubstituted variable. Since only pronouns with definite antecedents can be derived from full NP's, it follows that these are the only pronouns which can precede their antecedents.

There is then a rather interesting generalization which is captured in the Pronominalization theory. It is predicted that a pronoun can precede and be understood as coreferential to some full NP just in case there is a corresponding sentence in which that pronoun is replaced by the full NP, and where the two NP's are understood as coreferential. Thus the following paradigm is accounted for:

74. The dragon that chased him attacked the green-hooded knight

= 80. The dragon that chased the green-hooded knight attacked the green-hooded knight

41. b-reading only:
The dragon that chased him attacked only the green-hooded knight

= 82. The dragon that chased the green-hooded knight attacked only the green-hooded knight

23. *The dragon that chased him attacked a knight

≠ 83. The dragon that chased a knight attacked a knight

26. *The dragon that chased him attacked each knight

≠ 84. The dragon that chased each knight attacked each knight
6.3. The Leftmost Constraint and Deletion - A Sloppy Argument

There is an interesting interaction between the Leftmost Constraint and deletion processes which, at first glance, appears to provide evidence for the claim that the substitution of a definite QP obeys the constraint. However, a closer look reveals that this interaction has nothing to do with Q Sub but is instead a property of the deletion processes themselves.

Thus consider a sentence like (85), which is ambiguous between a sloppy and a non-sloppy reading:

85. @The green-hooded knight, spoke to his, mother, but the black-hooded knight didn't

Here the second conjunct has either the interpretation in (86a) or (86b):

86. a. the black-hooded knight didn't speak to his mother
   b. the black-hooded knight didn't speak to his mother

It has often been noted (cf., Morgan, 1970) that sloppy identity is possible only when the two conjuncts correspond to identical propositional functions. In other words, the representation for (85) under the sloppy reading (the reading in (86a)) would be roughly:

87. Tx: x is a green-hooded knight (x spoke to x's mother) but
   Ty: y is a black-hooded knight (y didn't speak to y's mother)

In contrast to (85), (88) is unambiguous:

88. @His mother spoke to the green-hooded knight, but not to the black-hooded knight

(88) does not have the sloppy reading (89a), only the non-sloppy reading (89b):

89. a. ...but his mother didn't speak to the black-hooded knight
   b. ...but his mother didn't speak to the black-hooded knight

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An argument based on the contrast between (85) and (88) could be objected to on the grounds that two different deletion processes are involved here; moreover, (88) could perhaps be analyzed as not involving a deletion rule. For simplicity, I will continue to assume that (88) is derived by some rule which deletes all but the knight-phrase in the second conjunct. But the same argument could be made with a case involving VP Deletion in both sentences. Thus for example (90) is ambiguous; the second conjunct could be understood as either (91a) or (91b):

90. The green-hooded knight$_{i}$ gets upset when Sally water$_{i}$ his$_{i}$ plants, but the black-hooded knight$_{j}$ gets upset when she doesn't

91. a. ...but the black-hooded knight$_{j}$ gets upset when she doesn't water his$_{j}$ plants
   b. ...but the black-hooded knight$_{j}$ gets upset when she doesn't water his$_{i}$ plants

In contrast, (92) is unambiguous; the second conjunct has only the non-sloppy interpretation:

92. When Sally water$_{i}$ his$_{i}$ plants, the green-hooded knight$_{i}$ gets upset, but when she doesn't, the black-hooded knight$_{j}$ gets upset

These contrasts could be taken as evidence that the substitution of a definite QP - like that of all other QP's - obeys the Leftmost Constraint. Thus (88) cannot be derived from:

93. Tx: x is a green-hooded knight (x's mother spoke to x) but not
   Ty: y is a black-hooded knight (y's mother spoke to y)

Here we could suppose that the reason that (88) cannot be derived from (93) has nothing to do with the deletion process itself. Rather, in the derivation of (88) from (93) the green-hooded knight-phrase has been substituted onto what is not the leftmost variable bound by that QP.
In other words, if we assume that a pronoun which precedes its antecedent can never correspond to an unsubstituted variable, the fact that (88) has no sloppy reading is explained. This reading is possible only when the pronoun in the first conjunct is an unsubstituted variable.

However, a further look reveals that these contrasts are independent of the application of Q Sub, and so cannot be used to argue that the substitution of a definite QP obeys the Leftmost Constraint. For the same contrast holds in cases involving only pronouns, where Q Sub has not necessarily applied. Thus, for example, compare (94), which is ambiguous, with (95), which has no sloppy reading:

94. @The green-hooded knight

i

said that he

i

spoke to his

i

mother, but the black-hooded knight

j

said that he

j
didn't

95. -@The green-hooded knight

i

said that his

i

mother spoke to him

j
, but the black-hooded knight

j

didn't speak to him

j

Again, I believe that the same contrast holds in cases involving VP-Deletion in both conjuncts:

96. @The green-hooded knight

i

said that he

i

gets upset when Sally waters his

i

plants, but the black-hooded knight

j

said that he

j

gets upset when she doesn't

97. -@The green-hooded knight

i

said that when Sally waters his

i

plants he

i

gets upset, but the black-hooded knight

j

said that when she doesn't he

j
gets upset

Thus (95) can be derived from a representation in which the two relevant sentences are:

98. ...x spoke to x's mother but ...y didn't speak to y's mother

while (95) cannot be derived from the corresponding structure:

99. ...x's mother spoke to x but ...y's mother didn't speak to y
The fact that (95) cannot be derived from (99) cannot be accounted for by a violation in the application of Q Sub; no QP is substituted onto the relevant variable. (The Pronominalization theory does of course allow a derivation of the first conjunct in (95) where a QP is substituted onto the pronoun him and this NP is then pronominalized. But there is no apparent reason to conclude that this pronoun must be derived by Pronominalization.)

Rather, this must be accounted for by some violation in the deletion process itself. Roughly speaking, it appears that the non-deleted variable must be the leftmost occurrence of that variable.¹⁰ This principle will account for the contrast between (85) and (88), and so we cannot conclude that the application of Q Sub is blocked in the derivation of (88) from (93). It seems clear that this principle is an instance of the Leftmost Constraint, but just how to explicitly account for this would depend on how deletion rules are formulated. At any rate, these contrasts do not provide an argument for the claim that the substitution of definite QP's obeys the Leftmost Constraint, and thus they do not provide a direct argument against the No Pronominalization theory. We will now return to Crossing Coreference sentences, to show that these do provide direct evidence for the claim that definite QP's behave in the same way as other QP's.

¹⁰This assumes that the domain of the deletion rule in (95) is the two speak-sentences. Notice that if the domain includes the two say-sentences then the non-ambiguity of (95) is unexplained, since the leftmost occurrence of the relevant variable (i.e., the subject of say) is not deleted.
Section 7

The Leftmost Constraint and Crossing Coreference Sentences:

The Solution for the Pronominalization Theory

7.1. The Semantic Predictions

The previous section argued for the Leftmost Constraint, which blocks the substitution of a QP onto a variable which is preceded by another occurrence of that variable. It is therefore predicted that no pronoun which corresponds to an unsubstituted variable can precede its antecedents. Since any pronoun with a universally or existentially quantified antecedent must be an unsubstituted variable, the ungrammaticality of a sentence like:

1. *The woman who wrote to him saw each man who collected butterflies

is accounted for. A pronoun can, however, precede a definite antecedent:

2. The woman who wrote to him saw the man who collected butterflies

Assuming that definite NP's are variables bound by quantifiers, one of two conclusions can be drawn from the grammaticality of (2). The first is that Q Sub violates the Leftmost Constraint just in case a definite NP is substituted; the No Pronominalization theory must draw this conclusion. The Pronominalization theory, on the other hand, can maintain that the substitution of a definite NP is constrained in the same way as the substitution of other NP's. From this it must be concluded that a pronoun which precedes a definite antecedent can be derived only from a full NP, and not from an unsubstituted variable.

There are actually a class of exceptions to this generalization; these are discussed in Sec. 8 and Sec. 11.
A consideration of the meaning of a sentence like (2) does not provide any evidence for the hypothesis that him must be derived from a full NP. Here the structure in which him corresponds to an unsubstituted variable is logically equivalent to the structure in which it corresponds to a full NP:

3. (shown after the substitution of the woman-phrase)
   a. Tx : x collects butterflies (the woman who wrote to x saw x)
      (man)    ↓
      him

   b. Tx : x collects butterflies (the woman who wrote to
      (man)    Ty [y collects butterflies] saw x
           ↓
           him

(3a) and (3b) both require a context in which there is one and only one man who collects butterflies, and where one and only one woman wrote to that man.

But the hypothesis that a pronoun which precedes its antecedent must be derived from a full NP can be tested by considering the meaning of a Crossing Coreference sentence like:

4. The woman who wrote to him saw the man who loves her

Here the structure in which him corresponds to a full NP is roughly:

5. (shown after the substitution of all of the QP's):
   Tx [x wrote to Ty [y loves x]] saw Tz [z loves x]
   (woman)    ↓
   (man)     ↓
   him her

(In (5), the subject NP must have wide scope.) (5) requires a context in

---

2In (3a) and (3b) the scope of the woman-phrase is within the scope of the man-phrase. There is a third possible structure identical to (3b) except that the woman-phrase has wide scope. This structure is logically equivalent to the two above.
which one and only one man loves the relevant woman, while several women may have written to him. This structure also underlies  

6. The woman who wrote to the man who loves her saw him  

If him can correspond instead to an unsubstituted variable, then (4) can also be derived from, roughly:  

7. (shown after the substitution of all of the QP's, where the y-phrase must have wide scope):  

\[
T_x [x \text{ wrote to } y] \quad \text{saw} \quad T_y [y \text{ loves } T_w [w \text{ wrote to } y]]  
\]

\[
(\text{woman}) \quad \downarrow \quad \text{him} \quad \quad \quad \quad (\text{man}) \quad \quad \quad (\text{woman}) \quad \downarrow \quad \text{her}  
\]

(7) underlies the sentence:  

8. The man who loves the woman who wrote to him was seen by her  

and requires a context in which one and only one woman wrote to the relevant man; other men may love her.  

In Sec. 2 it was argued that (4) is unambiguous; it is synonymous with (6) and not with (8). Thus, it requires a unique x-y pair such that x is a woman who wrote to y and y is the only man who loves x. This means that (4) cannot be derived from (7) - the source in which him corresponds to an unsubstituted variable. It can only be derived from (5), where him corresponds to a full NP. The Leftmost Constraint, then, appears to be completely general. The non-ambiguity of a Crossing Coreference sentence provides evidence that a pronoun which precedes its antecedent cannot be an unsubstituted variable, even when that antecedent is definite.  

This of course is the solution to the problem developed in Sec. 5. There it was shown that although the Pronominalization theory allows (4) to be derived from (5), it has no apparent way to block the derivation of (4) from (7). Therefore it appeared not to account for the non-ambiguity
of (4). But given the Leftmost Constraint, this problem is solved. The derivation of (4) from (7) violates this constraint; the man-phrase has been substituted onto a variable which is preceded by another occurrence of that variable:

9. (shown after the substitution of the woman-phrase, which is within the scope of the man-phrase):

\[
\begin{align*}
T_y &: y \text{ loves } Tw \ [w \text{ wrote to } y] \ (T_x \ [x \text{ wrote to } y] \text{ saw } y) \\
&\text{(man)} \quad \text{(woman)} \\
&\text{_________(woman)______________}
\end{align*}
\]

Thus the Leftmost Constraint provides a single explanation for the impossibility of all of the following:

1. *The woman who wrote to him saw each man who collected butterflies

10. *The woman who wrote to him saw a man who collected butterflies

11. (on the a-reading):
   *Someone said that the woman who wrote to him saw only him

12. *the man who the woman who wrote to him saw

13. *Which man did the woman who wrote to him see?

4. (on the reading requiring a unique x-y pair where x is the only woman who wrote to y and y loves x):
   *The woman who wrote to him saw the man who loves her

Notice too that this analysis accounts for the ungrammaticality of (13) by the same constraint which predicts that (4) could not be an answer to (13), or to the corresponding grammatical question:

14. Which man was seen by the woman who wrote to him?

That is, it was noted in Sec. 2 that (4) can only be a statement about the woman, and not about the man. It is therefore not appropriate as an answer to (14), but only to (15):

15. Which woman saw the man who loves her?
Both (13) and the relevant reading of (4) are blocked because him corresponds to an unsubstituted variable; both are derived from a structure containing the sentence:

16. the woman who wrote to y saw $\text{y}$

where $y$ is bound by the man-phrase. (13) violates the constraint since the questioned $y$, which is circled above, is not the leftmost occurrence of $y$. The derivation of (4) from this structure violates the constraint because the man-phrase is not substituted onto the leftmost $y$. The circled $y$ can be questioned only in the Passive of (16):

17. $\text{y}$ was seen by the woman who wrote to y

where questioning this variable yields (14). Similarly, (18) can be derived from a structure in which the man-phrase binds $y$ in (17):

18. The man who loves her was seen by the woman who wrote to him

since here the man-phrase is substituted onto the leftmost $y$. Thus the fact that the man-phrase cannot be questioned in (16) is an instance of the same principle which predicts that (4) cannot be an answer to a question about the man.

7.2. Accounting for the Syntactic Facts

We can now review the syntactic predictions of the Pronominalization theory to show that, given the Leftmost Constraint, this theory accounts for the full NP behavior of the first pronoun. Thus in Sec. 5 it was shown that the Pronominalization theory provides one source for a Crossing Coreference sentence in which the first pronoun is derived from a full NP, and the second from an unsubstituted variable. If this is the only source, then the fact that the first pronoun behaves like a full NP is accounted for. But this theory did not appear to account for the full
NP behavior of the first pronoun, since there appeared to be a second source in which the first pronoun is the unsubstituted variable and the second pronoun is the full NP. But this derivation is blocked by the Leftmost Constraint. The first pronoun cannot be an unsubstituted variable since an unsubstituted variable can never precede its antecedent. Thus it follows that the first pronoun acts like a full NP, while the second does not.

For example, consider again a sentence like:

19. *The woman who he wrote to saw the man who loves her

Two possible structures are provided for this sentence in the Pronominalization theory. In the first, the subject has wide scope and binds the variable within the object NP; the subject pronoun must therefore be derived from a full NP:

20.

```
  QP
   QP  S_1
     T_x (woman)
     QP  S_2
       T_y (man)
       S_3  [y loves x] wrote to x
       S_4
       z loves x
     QP
   S
     S z saw z
```

After the substitution of the y-QP into S_4, the x-QP is as follows:

21. T_x : T_y [y loves x] wrote to x
    (woman) (man)

Here, however, the relativization of the circled x violates the Leftmost Constraint, since this x is not the leftmost occurrence of x. Thus the derivation of (19) in which he is derived from a full NP is blocked in the same way that the derivation of (22) is blocked:

22. *the woman who the man who loves her, wrote to
There is, however, another possible source, in which the first pronoun is derived from a variable, and the second from a full NP:

23.

Here the relativization of the circled x within QP₂ does not violate the constraint, since this variable is not preceded by another occurrence of x, but only by the variable y. But the substitution of QP₁ for the object variable violates the constraint. After the substitution of QP₃ the structure is roughly:

24. Ty: (the woman who wrote to y saw (v))

The y-phrase cannot be substituted onto the circled y since this is preceded by another occurrence of y.

7.3. The Dialect Variation

As discussed in Sec. 6, some speakers seem to allow the Leftmost Constraint to be violated in some cases. Given this, it is predicted that a sentence like:

25. *His wife saw the man who loves her

might be acceptable or marginal for some speakers. It should, however, be unambiguous. I believe that Langendoen's constraint can never be vio-
lated, thus (25) cannot be derived from the structure in which the wife-phrase has wide scope, and in which his is derived from a full NP. This structure would require that only one man loves the relevant woman. Thus if any reading is possible for (25), it must be the one in which his corresponds to a variable and her to a full NP. This sentence would, then, be derived from the same source as:

26. The man who loves his wife was seen by \{his wife, her\} where (26) does not require a context in which only one man loves the woman.

While (25) may be acceptable, the Pronominalization theory predicts that a sentence like (27) is impossible:

27. *Her childhood friend saw his wife

Both of the possible sources for this sentence violate Langendoen's constraint. If wife has wide scope than the pronoun his must be derived from a full NP, and so the object violates the constraint:

28. *her childhood friend's wife

If, on the other hand, friend has wide scope than her must be derived from a full NP. Here the subject violates the constraint:

29. *his wife's childhood friend

Thus even if some speakers allow the Leftmost Constraint to be violated in the derivation of Crossing Coreference sentences, there is no way to derive (27) without violating Langendoen's constraint.
Section 8
Relative Clauses, Coordinate Structures and Quantifier Substitution

It has often been claimed that a QP cannot be substituted into a relative clause; this section will discuss some of the evidence for this claim. It will then be shown that this constraint on Q Sub - which I will refer to as the Relative Clause constraint[^1] - poses a problem for the No Pronominalization theory similar to that posed by the Leftmost Constraint. In order to account for the fact that there are pronouns whose antecedents are in relative clauses, this theory is forced to conclude that Q Sub can, in some cases, violate this constraint. No such problem arises in the Pronominalization theory, since here a pronoun whose antecedent is in a relative clause can be derived from a full NP.

However, the hypothesis that there is such a constraint on Q Sub combined with the hypothesis that only pronouns with definite antecedents can be derived by Pronominalization predicts that these are the only pronouns whose antecedents can be in relative clauses. Yet there are some well known counterexamples to this prediction. These will be discussed briefly here, to show that they do not constitute counterexamples to the claim that QP's cannot be substituted into relative clauses. Rather, the conditions under which Pronominalization can occur must be revised; this is discussed in more detail in Sec. 11. In Sec. 9 I will return to Crossing Coreference sentences to show that, given this constraint on

[^1] Lakoff (1970) has argued that a quantifier cannot be substituted into any island; in 8.3 I will discuss some evidence for the claim that a QP cannot be substituted into a coordinate structure. If Lakoff’s claim is correct then what I am calling the Relative Clause constraint is actually a case of the Complex NP Constraint. However, I will continue to refer to this as the Relative Clause constraint, where this term is meant simply as a description of some constraint.
Q Sub, the interaction of crossing coreference with relative clauses is explained.

The Relative Clause constraint can be seen as an instance of some more general principle; this is discussed in 8.3. Thus it was argued earlier that some constraint blocks the substitution of one QP into another; the Relative Clause constraint follows from this. Moreover, it has often been argued (cf., Lakoff, 1970) that Q Sub obeys all island constraints; some evidence will be discussed here for the claim that a QP cannot be substituted into a coordinate structure.

In 8.4 I consider the possibility of accounting for some of the facts discussed below by an extension of the Leftmost Constraint. If this extension is correct, then it is more difficult to motivate the Relative Clause constraint. However, this has no real bearing on my arguments; this extension presents the same kind of problem for the No Pronominalization theory. Moreover, this constraint would also account for the interaction of Crossing Coreference sentences with relative clauses.

8.1. Evidence for the Relative Clause Constraint

There are at least three kinds of arguments for the claim that a QP cannot be substituted into a relative clause. First, Rodman (1976) notes that a quantifier within a relative clause cannot have wider scope than the head noun of that clause. The second concerns the ability of a full NP within a relative clause to serve as the antecedent for a pronoun outside the clause. The third is based on a consideration of sentences with only.

8.1.1. Evidence from Relative Scopes

Rodman (1976) argues that a QP cannot be substituted into a rela-
tive clause by considering the scope possibilities of a quantifier within a relative clause. Thus he points out that in a sentence like:

1. A man who saw every lion left
the scope of a cannot be within the scope of every. In other words, (1) cannot be represented as:

2. \( \forall y \ ( \exists x : x \text{ saw } y (x \text{ left}) ) \)
   \( (\text{lion}) \ (\text{man}) \)

(1) is true only if there is some man who saw all of the lions, while (2) does not require this. Therefore the substitution of the lion-phrase into the relative clause within the man-phrase must be blocked, and the only possible representation for (1) is:

3. \( \exists x : \forall y : x \text{ saw } y (x \text{ left}) \)
   \( (\text{man}) \ (\text{lion}) \)

Similarly, a sentence like

4. The man who saw a lion left
is unambiguous. If the lion-phrase had wide scope here, then a possible representation for (4) would be:

5. \( \exists y \ ( T x : x \text{ saw } y (x \text{ left}) ) \)
   \( (\text{lion}) \ (\text{man}) \)

(5) requires a context in which there is some lion such that one and only one man saw him. However, (4) is interpretable only in contexts in which there is one and only one man who did any lion-seeing; it can therefore be derived only from:

6. \( T x : \exists y : x \text{ saw } y (x \text{ left}) \)
   \( (\text{man}) \ (\text{lion}) \)

8.1.2. Evidence from Pronominalization

The second kind of evidence for the claim that a QP cannot be sub-

\[ ^2 \text{Rodman's terminology is somewhat different since he is working within the framework of Montague grammar.} \]
stituted into a relative clause concerns the ability of a quantified NP within a relative clause to serve as the antecedent for some pronoun outside this clause. To begin, we can consider the situation with universally quantified NP's; such an NP within a relative clause cannot be co-referential to some pronoun outside the clause:

7. a. *The man who watered each plant spoke to it.
    vs. b. Each plant was spoken to by the man who watered it.

The ungrammaticality of (7a) follows from the hypothesis that a QP cannot be substituted into a relative clause. Here the pronoun and the antecedent are both bound by the each-phrase. This phrase must, therefore, have wider scope than the man-NP. (7a) is thus blocked since its derivation requires the plant-phrase to be substituted into the man-phrase. (7b) is grammatical since the QP is substituted for the variable which is not within the island.

Unfortunately, the situation with existentially quantified NP's is more complicated. Thus Geach (1962) discusses sentences like (8), where an existential NP within a relative clause is coreferential to a pronoun outside the clause:

8. a. The man who saw a lion shot it.
    b. Every man who saw a lion shot it.

(Similar examples are discussed in Karttunen (1969a) and Lakoff (1970)).

The grammaticality of (8) seems to indicate that a QP can be substituted into a relative clause. In both the No Pronominalization and the Pronominalization theory, an NP with an indefinite antecedent corresponds to an unsubstituted variable. Given this, the pronouns here must be bound by the lion-QP, and so the derivation of these sentences must involve the substitution of this phrase into the relative clause.
But a closer look at the meaning of (8) reveals that this sentence is not actually a counterexample to the hypothesis that Q Sub obeys the Relative Clause constraint. (8a), for example, like (4), requires a context in which there is one and only one man who saw a lion:

8a. The man who saw a lion shot it

4. The man who saw a lion left

Therefore, this sentence cannot be derived from a structure in which the man-phrase is within the scope of the lion-phrase and the lion-phrase is substituted into the relative clause:

9. $\exists y (Tx : x \text{saw} y (x \text{shot} y))$

(9), unlike (8a), requires only that there is some lion such that one and only one man saw it. Thus the subject NP in (8a) must be derived from (6), which also underlies the subject NP in (4):

6. $Tx : \exists y : x \text{saw} y$

Since the pronouns in (8) cannot be unsubstituted variables, there remains the question of what is their correct representation. A tempting solution to this problem, which is argued for in May (1977), is to claim that the pronouns here are actually free variables, and that there is no real reading in which these are coreferential with the lion-phrases. In the Introduction I argued that the pronoun in a sentence like:

10. Every man loves his mother

must have a non-free variable interpretation; the same technique can be used to argue against the claim that it in (8b) is only a free variable. Thus consider (8b') in the following context:
8b'. Every man who saw a lion shot it

<table>
<thead>
<tr>
<th>11. Men</th>
<th>Lions</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>saw</td>
<td>shot</td>
<td></td>
</tr>
<tr>
<td>Tom</td>
<td>Leo</td>
<td>Tom</td>
</tr>
<tr>
<td>Dick</td>
<td>Cleo</td>
<td>Dick</td>
</tr>
<tr>
<td>Harry</td>
<td>Rex</td>
<td>Harry</td>
</tr>
<tr>
<td>George</td>
<td>Tex</td>
<td>George</td>
</tr>
</tbody>
</table>

If it in (8b') has only a free variable interpretation, then (8b') would be false in (11), since there is no individual which was shot by every man who saw a lion. This prediction is obviously incorrect. Again, it could be supposed that the truth of (8b') is determined by considering the truth of the three separate sentences in (12), where it is a free variable in each of these sentences:

12. a. Tom shot it
   b. Dick shot it
   c. Harry shot it

This would predict that (8b') is true in (11), since each sentence in (12) is true here. But it also incorrectly predicts that (8b') is true in (13), since all three sentences in (12) are also true in (13):

<table>
<thead>
<tr>
<th>13. Men</th>
<th>Lions</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>saw</td>
<td>shot</td>
<td></td>
</tr>
<tr>
<td>Tom</td>
<td>Leo</td>
<td>Tom</td>
</tr>
<tr>
<td>Dick</td>
<td>Cleo</td>
<td>Dick</td>
</tr>
<tr>
<td>Harry</td>
<td>Rex</td>
<td>Harry</td>
</tr>
<tr>
<td>George</td>
<td>Tex</td>
<td>George</td>
</tr>
</tbody>
</table>

It seems then that the pronouns in (8) must correspond to full NP's.

Neither the No Pronominalization theory nor the Pronominalization theory as outlined in Sec. 3 accounts for this, since both theories permit only

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the variable source for a pronoun with an indefinite antecedent. This problem will be discussed more in Sec. 11, and it will be suggested that the conditions under which Pronominalization can occur must be revised so that in some cases a pronoun with an indefinite antecedent can be derived from a full NP. But for now we can note that the circumstances under which this can occur are quite restricted; not every indefinite NP within a relative clause can be the antecedent for a pronoun outside the clause. Thus in contrast to (8), (14)-(17) are all impossible:

14. *Only the man who saw a lion shot it
15. *The woman who wrote to the man who saw a lion shot it
16. *Every man who saw a lion left and then Fred shot it
17. *Every man who saw a lion shot it and then Fred stuffed it

8.1.3. Evidence from Only

A third piece of evidence for the claim that a QP cannot be substituted into a relative clause comes from a consideration of sentences with only. First, note that a sentence like (18) is ambiguous:

18. @Someone thinks that only he attacked the dragon that chased him

(18) can have either the a-reading (the variable reading) or the b-reading (the constant reading). Thus it can be represented by either, roughly, (19a) or (19b):

19. a. $\exists y (y \text{ thinks } (\text{only } x: x \text{ is } y \text{ (x attacked the dragon that chased } x)))$

19. b. $\exists y (y \text{ thinks } (\text{only } x: x \text{ is } y \text{ (x attacked the dragon that chased } y)))$

In contrast to (18), a sentence like (20) is unambiguous; here the a-reading is impossible:
20. -@Someone$_1$ thinks that the dragon that chased only him$_1$
   attacked him$_1$

This is accounted for by the hypothesis that the only-QP cannot be sub-
stituted into a relative clause. Since this phrase occurs within the
relative clause on the surface, it must originate within this clause,
and therefore cannot bind the pronoun. Thus (20) cannot be derived from
(21a), which corresponds to (19a) and gives the a-reading:

\[ 21. \text{a. } \exists y (y \text{ thinks } (\text{only } x: x \text{ is } y, (\text{the dragon that}
   \text{ chased } x \text{ attacked } x) )) \]

The derivation of (20) from (21b), which corresponds to (19b) and
gives the b-reading also violates the Relative Clause constraint:

\[ 21. \text{b. } \exists y (y \text{ thinks } (\text{only } x: x \text{ is } y, (\text{the dragon that}
   \text{ chased } x \text{ attacked } y) )) \]

But there is another source for this sentence which gives the b-reading.
This reading can be represented by a structure in which the only-phrase
originates within the dragon-phrase, since on this reading only does not
bind the object variable:

\[ 22. \exists y (y \text{ thinks } (\exists z : \text{only } x: x \text{ is } y, (z \text{ chased } x) (z \text{ attacked } y)) \]

This derivation does not require the only-QP to be substituted into a
relative clause. No parallel structure can be constructed to give the a-
reading; if the only-phrase originates within the dragon-phrase it can-
not bind the object.
8.2. The Consequences of the Relative Clause Constraint for the No Pronominalization Theory

The hypothesis that a QP cannot be substituted into a relative clause presents a problem for the No Pronominalization theory similar to that posed by the Leftmost Constraint. Since this theory derives the pronoun in (23) from an unsubstituted variable:

22. The dragon that chased the green-hooded knight, attacked him

the knight-QP must be substituted into the relative clause. The No Pronominalization theory must therefore conclude that a QP can be substituted into a relative clause just in case it is definite. Of course this theory also has no way to derive the sentences discussed earlier in which an indefinite antecedent is in a relative clause, but these sentences also present a problem for the Pronominalization theory.

The Pronominalization theory does, however, account for the grammaticality of (22) without having to conclude that a definite NP can be substituted into a relative clause. Since the antecedents in these sentences are definite, the pronouns can be derived by Pronominalization. This means that the knight-QP can originate with the relative clause. Thus the Pronominalization theory predicts that any pronoun whose antecedent is in a relative clause must be derived from a full NP, rather than from an unsubstituted variable. In Sec. 9 it will be shown that this prediction accounts for the interaction of crossing coreference and relative clauses.

8.3. More General Formulations of the Relative Clause Constraint

In Sec. 6 it was suggested that no QP can be substituted into another QP; evidence for this comes from the non-ambiguity of:
23. -@Only a green-hooded knight\textsubscript{i} attacked the dragon that chased him\textsubscript{i}.

Here only the a-reading is possible; (23) can be derived from (24a) but not from (24b) where the knight-phrase is substituted into the only-phrase:

24. a. Only x: \exists y: y is a green- (x is y) (x attacked the dragon that hooded knight chased x)

b. \exists y: y is a green- (Only x: x is y) (x attacked the dragon that hooded knight chased y)

If it is correct that the substitution of one QP into another is always blocked, then it is predicted that no QP can be substituted into a relative clause.

Moreover, Lakoff (1970) argues that Q Sub is subject to all island constraints - from this it would follow that no QP can be substituted into a relative clause. We can note that some of the arguments considered above with respect to relative clauses can be extended to coordinate structures.\textsuperscript{3}

Thus a universally quantified NP within one conjunct cannot be the antecedent for a pronoun in another conjunct:

25. a. *Each knight\textsubscript{i} slew a dragon and then he\textsubscript{i} feasted  
vs. b. Each knight\textsubscript{i} said that he\textsubscript{i} slew a dragon and that then he\textsubscript{i} feasted

The ungrammaticality of (25a) follows from the claim that a QP cannot be substituted into a coordinate structure; in order to bind the pronoun each must have wider scope than and. Again existentially quantified NP's pre-

\textsuperscript{3}Although, as will be discussed in 8.4, there is an alternative way to account for the evidence presented below.
sent a problem here, for these can occur in one conjunct and serve as the antecedent for a pronoun in another conjunct:

26. a. A lion\textsubscript{1} came in and he\textsubscript{1} ate up all the catfood
    b. Fred saw a lion\textsubscript{1} and then he shot it\textsubscript{1}

If it is correct that no QP can be substituted into a coordinate structure then these pronouns, like those in (8), must have a full NP source.

Similarly, there are sentences which indicate that only cannot be substituted into a coordinate structure. Thus (27) is unambiguous; the a-reading is impossible:

27. @Someone\textsubscript{1} thinks that only he\textsubscript{1} will slay and dragon and that he\textsubscript{1} will then feast

Here there is no reading which entails that the relevant man thinks that no one else will feast. Thus only the first occurrence of he, which is within the same conjunct, is within the scope of only. In other words, (27) cannot be derived from:

28. \[
\begin{array}{c}
\text{Someone} \ \\
\text{thinks} \ \\
\text{Only} \ \\
\text{he} \ \\
\text{will} \ \\
\text{slay} \ \\
\text{dragon} \ \\
\text{and} \ \\
\text{feast} \\
\end{array}
\]

Rather, only must be within the first conjunct; thus the second pronoun cannot correspond to x. Thus the only representation for (27) is:
Note that in contrast to (27), (30) is ambiguous:

30. Someone said that only he thinks that he will slay a dragon and that he will then feast

Here there is a reading in which the relevant man thinks no one else will feast.

If it is true that a QP cannot be substituted into a coordinate structure, then a sentence like

31. The green-hooded knight slew a dragon and then he feasted

provides the same kind of problem for the No Pronominalization theory as does (22). Since he must be derived from an unsubstituted variable, the knight-QP must bind this variable and must be substituted into the first conjunct. Thus the contrast between (25a) and (31) is not explained.

8.4. Islands or an Extension of the Leftmost Constraint?

The evidence considered in 8.1.2., 8.1.3 and 8.3 shows that any quantified NP in a relative clause or coordinate structure cannot correspond to the same variable as a pronoun outside these configurations. From this it was concluded that there is a constraint prohibiting the substitution of a QP into a relative clause or coordinate structure. This evi-
dence could, however, be construed in a different way. In all of these cases, the NP is within an embedded sentence and does not command the pronoun. In all but the coordinate structure case, the pronoun commands the NP.

Thus the ungrammaticality of a sentence like (7a), for example:

7a. *The man who watered each plant spoke to it^ could be interpreted as evidence that the Leftmost Constraint should be extended. This constraint could stipulate that any rule affecting a bound variable must affect the leftmost and "topmost" occurrence of that variable. (A constraint along these lines is suggested in Lasnik (1976)). (7a) violates this constraint in that the QP has been substituted for a variable \( x \) which is not the topmost \( x \).

Notice that topmost, unlike leftmost, can be defined in three different ways. The first is that \( x_1 \) is the topmost \( x \) if there is no \( x_2 \) such that \( x_2 \) commands \( x_1 \). However, it is clear that if the proposed extension of the constraint is correct this cannot be the definition of topmost. A variable which is commanded by another occurrence of the same variable can be affected by rules like Q Sub and Wh-Fronting if the two are clausemates:

32. a. Each vampire saw himself in the mirror
    b. Which vampire saw himself in the mirror?

A second possibility is that \( x_1 \) is the topmost \( x \) if there is no \( x_2 \) such that \( x_2 \) asymmetrically commands \( x_1 \) (i.e., \( x_2 \) commands and is not commanded by \( x_1 \)). A constraint which prohibits the application of Wh-Fronting and Q Sub which is not, in this sense, the topmost one will not block (32). Here the affected variable commands the other occurrence of that variable. This constraint will block (7a), since the other variable asymmetrically commands the substituted variable. The third possibility
is that $x_1$ is the topmost $x$ only if it commands all other occurrences of $x$. Under this definition, the suggested extension of the Leftmost Constraint will also block (7a) but permit (32). ⁴

The scope evidence considered in 8.1.1 indicates that the constraint that a QP cannot be substituted into a relative clause is independently motivated, and it is plausible that Q Sub is subject to other island constraints. The cases considered there did not involve another occurrence of the substituted variable. Still, this does not rule out the possibility that the extension of the Leftmost Constraint is not also correct. Both constraints might exist; the two converge in a case like (7a).

There are cases which would be ruled out by the extended Leftmost Constraint but not by island constraints, and so the question of whether or not this extension is necessary should be testable. Unfortunately, all of the sentences which I have been able to construct to test this are quite complex. The judgments are unclear, and other factors seem to interfere. It does, though, seem plausible to me that this is the correct formulation of the constraint. At any rate, nothing which follows hinges upon the question of whether (7a) violates the Leftmost Constraint as well as violating the Relative Clause constraint. In fact, even if the Relative Clause constraint is incorrect and only this extension of the Leftmost Constraint is relevant, the same basic arguments will hold.

⁴This is the only definition which will rule out sentences like (24a) in which the substituted variable is in a coordinate structure:

24a. *Each knight, slew a dragon and then he, feasted

Here the other variable does not command the affected variable, and so the substitution is not ruled out by the second definition. The third definition blocks this since the affected variable does not command the substituted variable.

However, this does not argue that the last definition is necessary, since (24a) could also be blocked by island constraints.
This section will show that, given the constraint that a QP cannot be substituted into a relative clause, the Pronominalization theory accounts for the behavior of Crossing Coreference sentences with respect to relative clauses.¹ There is also a class of related sentences which are affected by this constraint; these will be discussed in 9.3. Finally, I will show that this analysis accounts for an interesting constraint on only when it quantifies the first NP of a Crossing Coreference sentence.

9.1. The Relative Clause Asymmetry

The fact that only the second NP of a Crossing Coreference sentence can be in a relative clause can now be explained. Thus take the sentence:

1. *The house that belonged to the woman who wrote to him pleased the man who loves her

Given the constraint that no QP can be substituted into a relative clause, the woman-phrase must be within the house-phrase:

```
2. QP
   ____________
   |          |
   |          |
   |          |
   |   Tu     |
   |__________|
      (house)

QP
   _______
   |   S
   |___
      QP
         _______
         |   S
         |_______
            (woman)

S
   _______
   |   u belongs to x
   |________
```

¹As discussed in the last section, some of the relative clause evidence can instead be accounted for by an extension of the Leftmost Constraint. This is of no real consequence for this analysis; this constraint would also account for the sentences discussed below.
There are two possible representations for the phrase the woman who wrote to him. Either him is derived from the full NP the man who loves her and is Pronominalized by the object NP, or else it corresponds to an unsubstituted variable bound by the phrase binding the object.

If the first alternative is correct, then the pronoun her within the object NP is an unsubstituted variable, and is bound by the woman-phrase. In other words, if the woman NP is derived from:

3. $Tx \ [x \ wrote \ to \ the \ man \ who \ loves \ x]$
   \ (woman)

then the representation for the object must be the man who loves x, and this phrase must be within the scope of the woman-phrase. However, since the woman-phrase is within the house-phrase, it cannot bind the variable within the object (which is circled in (4)):

4. \[\]

The pronoun her in the object phrase can be bound by the woman-phrase only if the man-QP is also within the house-QP, and is within the scope of the woman-phrase. But if this is the case, it cannot bind the object variable in the main S. Therefore, the pronoun within the object - her - must be derived from a full NP.

Given this, the pronoun within the woman-phrase must be the un-
5. Ty \[y \text{ loves the woman who wrote to } y\]  
\[\text{(man)}\]

and the woman-phrase must be derived from the woman who wrote to y. Thus the object must have wide scope, and bind the pronoun him. But this derivation violates the Leftmost Constraint, which predicts that no pronoun which precedes its antecedent can correspond to an unsubstituted variable:

6. Ty : y loves Tw \[w \text{ wrote to } y\] (the house that belongs to  
\[\text{(man)}\] \[\text{(woman)}\]  
\[\text{her}\]  
\[\text{(woman)}\]  
\[\text{pleased } y\]  
\[\text{him}\]

To put this more simply, the fact that a QP cannot be substituted into a relative clause means that any pronoun whose antecedent is in a relative clause must be derived from a full NP. Therefore her must have the full NP source, while him must have the variable source. But the Leftmost Constraint has the opposite effect; it predicts that the first pronoun - him - must be the full NP. Thus one of these constraints must be violated in the derivation of (1).

It is, however, predicted that the second NP can be in a relative clause, as in:

7. The woman who wrote to him bought the house that belonged to the man who loves her

Since the man-phrase is in a relative clause, the pronoun him must be derived from a full NP, while her corresponds to an unsubstituted variable. This is consistent with the Leftmost Constraint, since him is the first pronoun. Thus (7) can be derived from:
8. (shown after the substitution of all of the QP's):

\[
\begin{array}{c}
\text{Tx [x wrote to Ty [y loves x]] bought the house that belongs to} \\
\text{(woman) \downarrow \quad \text{him}} \\
\text{(man)} \\
\text{Tz [z loves x] \downarrow \text{her}} \\
\end{array}
\]

9.2. The Variation

Since the Leftmost Constraint seems to permit some degree of violation, at least for some speakers, this analysis predicts that some speakers may find (1) acceptable or marginal:

1. *The house that belongs to the woman who wrote to him pleased the man who loves her

However, it should be unambiguous for these speakers; it can be derived only from (9) in which the man-phrase has wide scope:

9. (9) also underlies:

10. The man who loves the woman who wrote to him was pleased by the house that belongs to her

and requires a unique woman-man pair such that she is the only woman who wrote to him and he loves her.

It should be impossible to interpret this sentence on the reading where the woman-phrase has wide scope and where a unique pair is required.
such that the man is the only man who wrote to the woman:

11. 

\[
\begin{array}{c}
S \\
\text{QP} \\
(Tx) \\
\text{(woman)} \\
\text{QP} \\
(Ty) \\
\text{(man)} \\
S \\
x \text{ wrote to } y \\
y \text{ loves } x \\
S \\
Tu \\
\text{(house)} \\
S \\
u \text{ belongs to } x \\
u \text{ pleased } z \\
S \\
Tz \\
\text{(man)} \\
z \text{ loves } x \\
S
\end{array}
\]

The derivation of (1) from (11) requires the substitution of the woman-phrase into the relative clause in the house-phrase. Since the substitution of a QP into a relative clause is, I believe, impossible for all speakers, it is predicted that if any reading is possible for (1) it will be the one represented by (9), where the derivation violates the Leftmost Constraint.

This analysis also predicts that sentences like (12) and (13) will be impossible for all speakers:

12. *The house that belonged to the woman who wrote to him pleased her husband

13. *The storm that pleased the woman who wrote to him destroyed the house that belonged to the man who loves her

In (11) the antecedent of her is within an island; this pronoun must therefore have the full NP source. However, the object NP would then violate Langendoen's constraint:

14. *The husband of the woman who wrote to him

(13) is blocked since both antecedents are in relative clauses. In order to derive this sentence either the woman-phrase or the man-phrase has to be substituted into a relative clause. If the pronoun him has the variable source then the man-phrase must have wide scope and be
substituted into the relative clause within the house-phrase. If her
has the variable source, then the woman-phrase must have wide scope, in
which case it is substituted into the storm-phrase.

9.3. Some Related Sentences

Consider the following contrast:

15. The house that belonged to him—pleased the woman who
wrote to Jack,

16. *The house that belonged to him—pleased the woman who
wrote to her husband,

The ungrammaticality of (16) is accounted for in essentially the same
way as the ungrammaticality of:

17. *The house that belonged to her husband—pleased the
woman who wrote to him,

Since in (16) the pronoun him precedes its antecedent, and since its
antecedent is in a relative clause, this pronoun must be derived from
a full NP. Thus the representation for the object must be:

18. T(x wrote to x's husband)
   (woman)

and the pronoun within the subject must be derived from x's husband.
This means that the object binds the variable x within the phrase under­
lying him. The Leftmost Constraint is therefore violated; the woman-
phrase is not substituted onto what is the leftmost occurrence of x.

Similarly, we have contrasts like:

19. The house that belonged to the man who loves Sally—pleased her,

20. *The house that belonged to the man who loves his wife—pleased her,

Here the ungrammaticality of (20) is parallel to that of:

21. *The house that belonged to the man who loves her—pleased his wife

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Since the antecedent of her in (20) is within a relative clause, this pronoun must be derived from the fuller NP his wife. This phrase must, therefore, be within the scope of the man-phrase. That is, the man-phrase has as its representation:

22. Ty [y loves y's wife]  
\[\text{(man)}\]

and this must bind the variable y within the phrase y's wife which underlies the surface pronoun her. But if the man-phrase originates within the house-phrase, it cannot bind a variable in the object NP. It must then have wider scope than the house-phrase, which means that the derivation of (20) requires the substitution of the man-phrase into the relative clause within the house-phrase.

9.4. Crossing Coreference and Only

A final case which this analysis accounts for concerns the interaction of crossing coreference and only. In contrast to an ambiguous sentence like:

23. @Only the green-hooded knight saw his wife  
which can have either the a-reading or the b-reading, a similar sentence with crossing coreference is unambiguous:

24. -@Only the man who loves her saw his wife  
This sentence has only the a-reading.

The non-ambiguity of (24) is explained in essentially the same way the non-ambiguity of (25), which was discussed in Sec. 6:

25. -@Only a green-hooded knight saw his wife  
In (25), his must correspond to an unsubstituted variable, since its antecedent is not definite. Given the hypothesis that a QP cannot be substituted into an only-phrase (or, into any other QP), his cannot
be bound by a green-hooded knight. It must be bound by only, and therefore (25) can have only the a-reading. In other words, this sentence is derivable from (26a), which yields the a-reading, but its derivation from (26b), which gives the b-reading, requires the substitution of the knight-phrase into the only-phrase:

26. a. Only x: ∃y: y is a green- (x is y) (x saw x's wife) hooded knight

b. ∃y: y is a green- (Only x: x is y (x saw y's wife) ) hooded knight

Since a quantifier within an only-phrase cannot bind material outside of this phrase, the ambiguity of (23) - in which the antecedent for the pronoun is definite - is a consequence of the fact that his can be derived by Pronominalization. The antecedent of his in the Crossing Coreference sentence (24) is also definite, but this pronoun cannot be derived from a full NP. If it were, the first pronoun - her - would be a variable bound by the wife-phrase; the Leftmost Constraint would thus be violated. Moreover, a structure in which his corresponds to a full NP violates Langendoen's constraint:

27. *the wife of the man who loves her

This means that his in (24), like the pronoun in (25), corresponds to an unsubstituted variable. Given this, it could be bound either by only, which gives the a-reading, or by the, which would give the b-reading. But the derivation of this sentence from the structure in which the binds the variable is blocked. In this structure the must have wider scope than the only-phrase, and the derivation requires its substitution into the only-phrase. Thus (24) is not derivable from

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(28b), which gives the b-reading, but it is not derivable from (28a), which gives the a-reading:

28. (shown after the substitution of the wife-phrases):

\[
\begin{align*}
\text{a.} & \quad \text{Only } x \text{ saw } x'\text{'s wife} \\
& \quad \text{Ty (man) } y \text{ loves } x'\text{'s wife} \\
& \quad x \text{ is } y \\
\text{b.} & \quad y \text{ loves } y'\text{'s wife} \quad \text{Only } x \text{ saw } y'\text{'s wife} \\
& \quad \text{Ty (man) } y' \text{ loves } y'\text{'s wife} \\
& \quad x \text{ is } y
\end{align*}
\]

Thus while pronouns with definite antecedents can generally be derived from full NP's, this analysis predicts that some of these pronouns cannot. In particular, the second pronoun in a Crossing Coreference sentence must correspond to an unsubstituted variable, since the Leftmost Constraint ensures that the first pronoun has the full NP source. (Langendoen's constraint also blocks the full NP source for his in (24).) Therefore, when only quantifies the first NP of a Crossing Coreference sentence, the b-reading is blocked just as it is in sentences where only quantifies an indefinite NP.
Part II - Some Problems and Discussion
Section 10

Defining Referential Identity

I have been assuming that Pronominalization requires not only formal identity between two NP's, but "referential identity" as well. A theory in which formal identity is a sufficient condition for Pronominalization cannot be maintained since such a theory incorrectly predicts that there is a reading of (2) which is synonymous with (1):

1. A dragon that chased a green-hooded knight killed a green-hooded knight

2. A dragon that chased him killed a green-hooded knight

In general, the only pronouns which can plausibly be derived from full NP's are those with definite antecedents. Thus while (1) and (2) are not synonymous, (4) shares a reading with (3):

3. A dragon that chased the green-hooded knight killed the green-hooded knight

4. A dragon that chased him killed the green-hooded knight

Thus it was claimed that (4) can be derived from (3) while (2) cannot be derived from (1) because the two knight-NP's in (1), but not in (3), must be satisfied by the same individual. This section, then attempts to formally characterize the difference in the relationship between the two knight-NP's in (1) and those in (3). In 10.1 a tentative definition of referential identity is developed, and 10.2 discusses some problems with this definition.

However, as discussed in Sec. 8, there is a class of pronouns with indefinite antecedents which cannot be derived from unsubstituted variables and must therefore be derived from full NP's. This includes the pronoun in (i) and in (ii) (from Geach, 1962):

i. A lion roared and the man with a gun shot it

ii. Every man who owns a donkey beats it

These are discussed in more detail in Sec. 11.
It should be noted that these problems are not avoided in a theory in which referential identity (or, coreference) is treated as a primitive rather than a defined notion. In other words, consider a theory in which any pair of NP's in semantic representation can be marked as coreferential. Any two occurrences of the same variable must be so marked; in addition two non-identical variables can be marked as coreferential. Thus there would be a representation for (3) in which the two knight-NP's are marked as coreferential; Pronominalization can apply to this representation to yield (4). Yet this theory must still explain why the two knight-NP's in the representation of (1) cannot be coreferential. In other words, this theory must also characterize the difference between the relationship of the two NP's in (1) and those in (3).

10.1. A Rough Definition of Referential Identity

Let us assume that every context consists of a set of object names \( (0_1, \ldots, 0_n) \) and an assignment of one and only one object name to each object in the context. We can further assume that a set of object names is assigned to each 1-place predicate; a set of ordered pairs of names to each 2-place predicate, etc. We can then speak of a metasentence as a sentence which contains an object name. Thus \( O_n \) runs is a metasentence in a context \( C \) if \( O_n \) is in the set of object names in \( C \); this sentence is true in \( C \) if \( O_n \) is assigned to run and false otherwise. Given some sentence (or metasentence) \( S_n \) which contains a variable \( x \), I will use the notation \( S_n(x=O_n) \) to refer to the metasentence derived by replacing all occurrences of \( x \) in \( S_n \) with \( O_n \).

I will also continue to assume that a sentence containing a definite NP requires both the existence and the uniqueness of that NP in
order to be true. That is, a sentence of the form: $Tx: S_2(S_3)$ is true in $C$ if and only if there is some $O_n$ such that: (1) $S_2(x=0_n)$ is true in $C$; (2) there is no $O_m$ (for $m \neq n$) such that $S_2(x=0_m)$ is true in $C$; and (3) $S_3(x=0_n)$ is true in $C$. The definition of coreference given below does not assume that a sentence in which (1) or (2) is not met has no truth value; whether such a sentence is false or truth-valueless is irrelevant.

We can now try to characterize the difference between the relationship of the two underlined NP's in (5) and those in (6):

5. a. A red-headed man sneezed
   b. A red-headed man tripped

6. a. The red-headed man sneezed
   b. The red-headed man tripped

If (6a) is true in some context then there is a true sentence of the form $O_n$ sneezed; if (6b) is true in this context then $O_n$ tripped must also be true. (5) does not have this property; one individual may have come in while a different one tripped. Yet the criterion for referential identity in (6) cannot be simply that in any context where both sentences are true there is some $O_n$ which can be substituted for both NP's to yield a true metasentence. By this criterion, the two underlined NP's in (7) would also be referentially identical:

7. a. Every red-headed man sneezed
   b. Every red-headed man tripped

The difference between (6) and (7) is intuitively clear; there are contexts in which the truth of (7a) requires the truth of a sentence

---

2I am assuming here that universally quantified NP's presuppose the existence of that NP; thus in contexts with no red-headed men (7a) and (7b) are not true.
like $O_n$ sneezed and the truth of (7b) requires the truth of $O_m$ tripped. The truth of (6a) and (6b) will, in no context, require the truth of sentences in which different object names are substituted for each of the NP's.

To formalize this, we can first define the notion of a replacement for some NP in a given context:

8. Given a sentence:

$$
\begin{align*}
Q_x & \quad S_1 \\
\quad \quad S_2 & \\
\quad \quad \quad \quad S_3
\end{align*}
$$

$O_n$ is a replacement for $x$ in $C$ iff:

- $S_2(x=O_n)$ is true in $C$
- and there is some context $C'$ in which:
  - $S_3(x=O_n)$ is true
  - $S_1$ is true
- and $C'$ is otherwise exactly like $C^3$

In other words, a replacement for some NP in $S_1$ above is an object name $O_n$ such that, when a sentence in which that object name is substituted for the NP is added to the context, then $S_1$ is true. $C'$ can, of course, be identical to $C$.

The condition in (8) that $S_2(x=O_n)$ is true is necessary to keep irrelevant objects from being replacements for $x$ in a context in which $S_1$ is true. In other words, consider a structure like:

9. $S_1[\text{Tx}: S_3[x \text{ is a man } (S_2[x \text{ came in }])] ]$

in a context with only one man, $O_n$, where $O_n$ came in. Here $S_1$ is true. Moreover, there is a $C'$ in which $S_1$ is true and where $O_m$ came in is true.

---

$^3$It is necessary to assume here that each object in $C$ has a counterpart in $C'$ and that the two are assigned the same object name in each context.
and where everything else is the same. (Here too, C' can be exactly the same as C.) Without the first condition in (8), $O_m$ is a replacement for $x$.

Referential identity can then be defined as follows:

10. Given two sentences:

\[
\begin{array}{c}
Qx \\
S_1 \\
\text{QP} \\
S_2 \\
\text{QP} \\
S_3
\end{array} \quad \text{and} \quad \begin{array}{c}
Qy \\
S_4 \\
\text{QP} \\
S_5 \\
\text{QP} \\
S_6
\end{array}
\]

\(x \text{ and } y \) are referentially identical if and only if for every context $C$:

1. $x$ has a replacement in $C$ if and only if $y$ has a replacement in $C$

and 2. there is no pair $O_n$, $O_m$ (for $n \neq m$) such that $O_n$ is a replacement for $x$ in $C$ and $O_m$ is a replacement for $y$ in $C$

Thus referential identity is defined not by considering only those contexts in which the two sentences are true, but by considering what it would take in any context to make each sentence true.

It is actually unclear whether the first condition in (10) is necessary. Without this condition the underlined NP's in (11) are referentially identical:

11. a. A man who came in sneezed
   b. The man who came in tripped

In any context where $O_n$ is a replacement for the NP in (11b) there is no $O_m$ such that $O_m$ is a replacement for the NP in (11a). Assuming that these two NP's are referentially identical, (12a) could, in the Pronominalization theory, serve as a source for (12b) if the condition
that the two NP's are formally identical does not include the quantifiers:

12. a. /a man who came in sneezed and the man who came in tripped/
   
b. A man who came in sneezed and he tripped

It might appear that (12b) should be derivable from (12a). If, as argued earlier, a QP cannot be substituted into a coordinate structure, then (12b) cannot be derived from a source in which he corresponds to an unsubstituted variable. Yet (12a) is not the correct source for (12b) either. (12a) requires a context in which one and only one man came in (since this is required by the second conjunct in (12a)); (12b) does not require this. Assuming, then, that (12b) cannot be derived from (12a), the Pronominalization theory must either include the first condition in (10) as part of the definition of referential identity, or it must require that the pronominalized NP and the antecedent be completely identical (including their quantifiers).

The second condition in (10) distinguishes pairs of identical existentially or universally quantified NP's from pairs of identical definite NP's. Thus the two NP's in (5) are not referentially identical:

5. a. A red-headed man sneezed
   
b. A red-headed man tripped

In a context with two red-headed men $O_n$ and $O_m$, $O_n$ is a replacement for the first NP and $O_m$ for the second NP. The two NP's in (7) are also not referentially identical by this definition:

7. a. Every red-headed man sneezed
   
b. Every red-headed man tripped

Consider (13), the structures underlying these sentences, in a context $C$ with two red-headed men $O_n$ and $O_m$ where both sneezed and both tripped:
Here \( O_n \) is a replacement for \( x \) since \( S_2(x=O_n) \) is true in \( C \), and there is a \( C' \) (where \( C' \) here is identical to \( C \)) in which \( S_3(x=O_n) \) is true and \( S_1 \) is true. Similarly, \( O_m \) is a replacement for \( y \) in \( C \) (where again, \( C' \) and \( C \) are identical). In other words, this captures the intuition that \( x \) and \( y \) are not referentially identical here because, in order for \( S_1 \) to be true in this context \( O_n \) sneezed must be true, while the truth of \( S_4 \) requires the truth of \( O_m \) tripped.

The definition of referential identity in (10), however, is incomplete. A variable \( x \) in some sentence \( S_1 \{Qx: S_2(S_3)\} \) has no replacement if \( S_1 \) is an open sentence, since \( x \) has a replacement only if there is some context in which \( S_1 \) is true. Given this, (10) defines any two variables which occur in open sentences as referentially identical. The definition of referential identity must therefore check not pairs of sentences, but pairs of metasentences. Moreover, if the two open sentences contain occurrences of the same variable, then this variable must be replaced by the same object name in the two metasentences. Thus we will let \( S_1' \) stand for any sentence in which all unbound variables in \( S_1 \) are replaced by an object name. (10) can then be revised as follows:

```
13. a. S_1
   \[ \forall x \quad S_2 \quad x \text{ sneezed} \]
   \( x \) is a red-headed man

b. S_4
   \[ \forall y \quad S_5 \quad y \text{ tripped} \]
   \( y \) is a red-headed man
```
14. Given two sentences:

\[
\begin{align*}
\text{a.} & \quad S_1 \\
& \quad \text{OP} \\
& \quad Qx \\
& \quad S_2 \\
\end{align*}
\]

\[
\begin{align*}
\text{and} & \quad S_3 \\
& \quad \text{OP} \\
& \quad Qy \\
& \quad S_4 \\
\end{align*}
\]

\[
\begin{align*}
\text{and} & \quad S_5 \\
& \quad \text{OP} \\
& \quad Tz \\
\end{align*}
\]

\[
\begin{align*}
\text{and} & \quad S_6 \\
\end{align*}
\]

\[
\begin{align*}
\text{and} & \quad S_7 \\
\end{align*}
\]

\[
\begin{align*}
x \text{ and } y \text{ are referentially identical if and only if:} \\
\quad \text{for every context } C \text{ and for every pair of sentences } \\
\quad S_1' \text{ and } S_4' \text{ (where all occurrences of the same} \\
\quad \text{variable in } S_1 \text{ and } S_4 \text{ are replaced by the same} \\
\quad \text{object name in } S_1' \text{ and } S_4'): \\
\quad (1) x \text{ in } S_1' \text{ has a replacement in } C \text{ if and only} \\
\quad \quad \quad \text{if } y \text{ in } S_4' \text{ has a replacement in } C \\
\quad \quad \text{and (2) there is no pair } o_n, o_m \text{ (for } n \neq m) \text{ such} \\
\quad \quad \quad \text{that } o_n \text{ is a replacement for } x \text{ in } S_1' \text{ in } C \\
\quad \quad \quad \text{and } o_m \text{ is a replacement for } y \text{ in } S_4' \text{ in } C \\
\end{align*}
\]

Given this definition, the \( x \)-phrase and the \( y \)-phrase in (15),
which is the structure underlying (16), are referentially identical:

15.

\[
\begin{align*}
\text{and} & \quad S_5 \\
& \quad \text{OP} \\
& \quad Tz \\
\end{align*}
\]

\[
\begin{align*}
\text{and} & \quad S_6 \\
\end{align*}
\]

\[
\begin{align*}
\text{and} & \quad S_7 \\
\end{align*}
\]

16. The woman, who wrote to the man who loves her, saw
the man who loves her.

Here for every context and for every pair of metasentences \( S_2' \) and \( S_5' \)

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In which \(x\) is replaced by the same object name, \(y\) and \(z\) have the same replacement. Thus it is predicted that Pronominalization can apply to yield (17a) or (17b):

17. a. The woman who wrote to him saw the man who loves her
   b. The woman who wrote to the man who loves her saw him

On the other hand, the \(y\)-phrase and the \(z\)-phrase in a structure like (18), which underlies (19), are not referentially identical:

```
18. S1
   |-----------S2
  |           |
  |           |
  QP         QP
  Tx         Tw
(woman) (woman)
```

```
19. The woman, who wrote to the man who loves her, spoke
to the woman who saw the man who loves her
```

The definition of referential identity in (14) stipulates that the \(y\) and the \(z\)-phrase here are referentially identical only if in all contexts and for every pair of metasentences \(S_2'\) and \(S_6'\), \(y\) and \(z\) have the same replacements, where \(x\) in \(S_2'\) and \(w\) in \(S_6'\) need not be replaced by the same object name. Thus consider a context in which \(O_n\) is the only man who loves \(O_a\) and \(O_m\) is the only man who loves \(O_b\). Here there is a pair of metasentences \(S_2(x=O_a)\) and \(S_6(w=O_b)\) where \(O_n\) is a replacement for \(y\) in the first metasentence, and \(O_m\) is a replacement for \(z\) in the second.

Thus the claim that Pronominalization requires referential iden-
tity, combined with the definition in (14), correctly predicts that (20) cannot be understood on the sloppy reading, which is synonymous with (19):

20. The woman who wrote to the man who loves her spoke to the woman who saw him

Unfortunately, though, there are sentences like (19) in which Pronominalization can occur; Karttunen (1969b) notes that a sentence like (21b) has a reading synonymous with (21a):

21. a. The man who gave his paycheck to his wife was wiser than the man who gave it to his mistress

b. The man who gave his paycheck to his wife was wiser than the man who gave it to his mistress

As mentioned earlier, the claim that Pronominalization requires referential identity does not account for the existence of (21b), while a theory in which Pronominalization requires only formal identity between the pronominalized NP and its antecedent does. On the other hand, a theory which requires only formal identity for Pronominalization incorrectly predicts that (20) has a sloppy reading.

10.2. Some Problems

There are some obvious problems with the definition of referential identity in (14) which seem inevitable given any definition based on truth. First, two identical existentially quantified NP's like those in (22) are referentially identical if we assume that there is no context in which either (22a) or (22b) is true:

22. a. A round square bounced

b. A round square fell into the soup

Thus consider a sentence like

23. The woman who followed a round square put a round square into the soup
The two square-NP's are formally identical; they are also referentially identical since there are no contexts in which either has replacements. It is then predicted that Pronominalization can apply in (23) to yield:

24. The woman who saw it put a round square into the soup

Despite the fact that (23) and (24) are both nonsensical, our intuitions are that they are not synonymous.

More seriously, the two underlined NP's in a sentence like (25) are referentially identical:

25. A man with a Stetson hat cooked the round square and 
   a man with a Stetson hat spoke to the married bachelor

Again neither man-NP has a replacement in any context. For any context, some object $O_n$ is a replacement for these NP's only if there is another context in which the sentences in (26) are true:

26. a. $O_n$ cooked the round square 
   b. $O_n$ spoke to the married bachelor

Since there is no context in which the sentences in (26) are true, the underlined NP's in (25) are referentially identical. Since these are also formally identical, the Pronominalization theory would predict that (27) can be derived from (25):

27. A man with a Stetson hat cooked the round square and 
   he spoke to the married bachelor

Again this prediction seems counterintuitive.

Similarly, it is predicted that two identical NP's are referentially identical if they each occur in a sentence which is contradictory. Thus the underlined NP's in (28) are referentially identical:

28. A man with a Stetson hat came and didn't come and 
   a man with a Stetson hat tripped and didn't trip

Since neither of these NP's have replacements in any context, and since

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they are formally identical, the Pronominalization theory would allow (29) to be derived from (28):

29. A man with a Stetson hat came and didn't come and he tripped

Of course none of these problems are unique to the Pronominalization theory; these reduce to problems with the definition of synonymy. If it is assumed that any two sentences are synonymous if in any context they have the same truth value, and if there is no context in which a sentence like (28) or (29) is true, then the prediction of the Pronominalization theory that (28) is synonymous with (29) is correct. If these two sentences are not synonymous, and if, in general all contradictory sentences are not synonymous with each other, then the notion of possible context must include contexts in which contradictory sentences are true.
Section II

Pronouns with Indefinite Antecedents

There remains a class of pronouns with indefinite antecedents which are not accounted for by the analysis here. These are pronouns such as those in (1) (from Geach, 1962) and (2) which, as argued in Sec. 8, cannot be derived from unsubstituted variables:

1. Every man who owns a donkey beats it
2. The man who saw a lion shot it

That these pronouns are not unsubstituted variables can be shown by a consideration of the scope of a with respect to every in (1) and the in (2). The existential quantifier does not have wide scope in these sentences, and so cannot bind the pronoun.

A related class of pronouns are those with indefinite antecedents in another conjunct, as in:

3. A lion came in and Fred shot it

Here it is more difficult to show that the pronoun cannot be a bound variable. However, the fact that other quantifiers (such as only and universal quantifiers) cannot bind a pronoun in a different conjunct provides some evidence for this. Moreover, as discussed in Karttunen (1969a), there are similar cases involving two sentences, where each sentence can be uttered by a different speaker:

4. A lion came in.
   Did Fred shoot it?

It is difficult to imagine an analysis which would permit the pronoun in (4) to be bound by the lion-phrase in the preceding sentence.

Pronouns of this type, particularly those in configurations like
(3) and (4) are dealt with extensively in Karttunen (1969a) and Partee (1972); the remarks below are based heavily on these discussions. I will argue, as has Partee, that these pronouns must be derived from full NP's. The problem with this claim is that it is difficult to characterize the type of identity which holds between the pronominalized and the controlling NP; these two are neither referentially nor formally identical.

In 11.1.2 I will try to give a rough characterization of the type of identity which holds here, and I will briefly discuss some of the problems that arise in formulating this precisely. Moreover, the best of all possible theories should probably include some more general notion of identity which subsumes both the kind that holds here and the kind that holds between identical definite NP's. I will not consider the question of how this can be done. In 11.2 I will show that there are a number of configurations in which an indefinite NP cannot serve as the antecedent of a pronoun, and will argue that these constraints can be accounted for by an analysis along the lines suggested here.

11.1. The Full NP Representation

11.1.1. Arguing for a Full NP Representation

As discussed earlier, both a sentence like (2) and a sentence like (5) require a context in which one and only one man saw any lions:

2. The man who saw a lion shot it.
5. The man who saw a lion shot a duck

There is, however, a difference in these two sentences. In (2) the relevant man may have seen several lions; in (1) he must have seen
only one lion. Thus it has often been noted that (2) is synonymous with:

6. The man who saw a lion shot the lion that he saw

This suggests that the pronoun in (2) should be represented as the full NP in (6). (This kind of proposal, with slightly different sentences, is made in Partee (1972)).

It could be objected here that (2) does not really require a context in which the man saw only one lion, but that the use of the pronoun assumes that there is one relevant lion which can be talked about. Hence if it is known that he saw several lions, the pronoun is used inappropriately, since it cannot pick out any individual. A more precise statement of this view would, I believe, be equivalent to the claim that the pronoun here is a free variable, and that there is a pragmatic restriction on the use of such a pronoun to the effect that the hearer can pick out one relevant object to replace that variable. While it is difficult to directly argue against the claim that the pronoun in (2) is a free variable, it was argued in Sec. 8 that the pronoun in a sentence like (1) cannot be treated this way:

1. Every man who owns a donkey beats it

Here it cannot be claimed that the pronoun simply picks out some relevant object in the discourse; this pronoun does not refer to any single object. Yet (1) also requires that the relevant men own only one donkey each; (1) is not interpretable in a context where some men own several donkeys. Thus (1) is synonymous with:

7. Every man who owns a donkey beats the donkey that he owns

However, the claim that the pronouns in (1) and (2) are derived from the fuller NP's in (6) and (7) gives rise to the problem of charac-
terizing the conditions under which these full NP's can pronominalize. These NP's are neither formally nor referentially identical with the indefinite NP's. Nevertheless, there is clearly some kind of identity here; in (6), the lion which the man shot must be the same as the lion which he saw. Moreover, it would seem that any theory must characterize the kind of identity which holds between these two NP's. Thus the object phrase must be destressed in (6); this is not the case for the object NP in (8):

6. The man who saw a lion shot the lion that he saw

8. The man who ate a lion shot the lion that he saw

Thus the condition needed to predict where Pronominalization can occur appears to be independently needed to predict where destressing occurs.

11.1.2. A Rough Formulation

Consider (9), which is the structure underlying (6):

9.

Here the z-phrase will have a replacement only if there is one and only one lion that x saw. From this it follows that S₂ must be true, and that the truth of S₂ depends on the truth of a sentence in which the replacement for the z-phrase replaces y in S₃. To put this a bit more formally, we can say that, given two sentences:
\( y \) can pronominalize if, for every context \( C \) and for every set of meta-sentences \( S_1', S_2', S_3' \) and \( S_4' \), if \( Q_n \) is a replacement for \( y \) in \( S_4' \) then \( S_1' \) is true, \( S_3'(x=0_n) \) is true, and there is no \( O_m \) (for \( m \neq n \)) such that there is a context \( C' \) which is exactly like \( C \) except that \( S_3'(x=0_m) \) is false and \( S_1 \) is false. This third condition means that while \( S_3'(x=0_m) \) could be true in \( C \), it is not necessary for the truth of \( S_2 \). In other words, take (9) in a context where \( x \) saw only one lion \( 0_n \). Here \( Q_n \) is a replacement for \( z \) in \( S_4 \), \( S_2 \) is true and \( S_3'(y=0_n) \) is also true. However, \( x \) might have also seen a duck \( 0_m \). In this context, \( S_3'(y=0_m) \) is therefore true, but the truth of \( S_2 \) does not depend on this. Thus, there is no \( C' \) which is exactly like \( C \) except that \( S_3'(y=0_m) \) is false and \( S_2 \) is false. If \( S_2 \) is false in \( C' \), then so is \( S_3'(y=0_n) \).

This characterization is meant to be simply a rough description of the condition under which this kind of pronominalization can occur; hopefully this would follow from some simpler principle. Moreover, as it stands, this characterization does not account for a class of sentences (discussed in Karttunen (1969a), Lakoff (1970) and Partee (1972)) like:

11. The man who hoped that there was a lion in the garden
shot the lion that was in the garden

Pronominalization cannot apply here (nor is the second NP obligatorily destressed); (12) is not synonymous with (11):
12. The man who hoped that there was a lion in the garden shot it.

Yet consider (13), the structure which underlies (12):

According the the condition for Pronominalization outlined above, the \( z \)-phrase can pronominalize here. In any context where \( 0_n \) is a replacement for \( z \), \( S_3 \) is true, \( S_4(y=0_n) \) is true, and there is no \( 0_m \) such that the truth of \( S_3 \) depends on the truth of \( S_4(y=0_m) \). The problem, then, is that the relevant sentence to be considered here is not \( S_3 \) but \( S_2 \). Although \( S_3 \) is true in any context in which \( 0_n \) is a replacement for \( z \), \( S_2 \) is not. Moreover, the truth of \( S_2 \) does not depend on the truth of \( S_4(y=0_n) \). Thus the fact that \( 0_n \) is in the garden does not mean that \( x \) hopes that the sentence \( 0_n \) is in the garden is true. In other words, the domain relevant for the Pronominalization condition is not the first sentence containing the antecedent (\( S_3 \) above), but rather the highest sentence containing a world creating predicate.

In Sec. 13 I discuss some evidence which indicates that insertion occurs only when the quantifier binds the subject of the next clause down. This means that there is no representation for (11) in which the \textit{lion}-phrase has wider scope than \textit{hope}.
There is one interesting case which would be accounted for by this kind of analysis. Take a sentence like:

14. The man who discovered that there was a lion in the garden shot it.

There are two conceivable representations for this sentence:

15. a. The man who discovered that there was a lion in the garden shot the lion that was in the garden

b. The man who discovered that there was a lion in the garden shot the lion that he discovered was in the garden

If (15b) is a possible representation for (14), then (14) does not require a context in which there is only one lion in the garden. There could be several lions, provided that only one was discovered by the relevant man. While it is difficult to sort out the two readings, I believe that (14) does have the (b)-reading; this comes out clearer in a sentence like:

16. Every man who discovered that there was a lion in the garden shot it.

Here the two representations corresponding to (15) are:

17. a. Every man who discovered that there was a lion in the garden shot the lion that was in the garden

b. Every man who discovered that there was a lion in the garden shot the lion that he discovered was in the garden

(17a) requires a context with only one lion in the garden, and thus refers to one lion which was shot by a number of men. (17b) can be used in a situation where there are several lions in the garden, and hence several lions shot. This appears to be a possible reading for (16); thus these sentences can be derived from the (b)-representations.

In fact, a closer look indicates that the (a)-sentences are not possible representations for (14) and (16). Thus take a sentence like
18. The man who discovered that there had been a burglar in his house wrote him a nasty letter.

Suppose that the relevant man — Jack — came home and found his front door open and his jewels gone, from which he correctly concluded that there had been a burglar in his house. Moreover, suppose that Sam was the burglar, and that Jack wrote Sam a nasty letter, but didn't know that Sam was the burglar. (18) cannot be used in this situation. This would mean, then, that (18) cannot be derived from (19a), but only from (19b):

19. a. The man who discovered that there was a burglar in his house wrote the burglar that had been in his house a nasty letter

b. The man who discovered that there had been a burglar in his house wrote the burglar that he discovered had been in his house a nasty letter

This should be accounted for by the same principle which predicts that (12) cannot be derived from (11). Thus we have the following two structures:

![Diagram of sentence structures](image-url)
If the condition for pronominalization is formulated in such a way that $z$ can pronominalize here only if in all contexts where $0_n$ is a replacement for $z, S_2$ (rather than $S_3$) is true, then it is predicted that (18) can be derived from (20b), but not from (20a). If $0_n$ is a replacement for $z$ in (20a) then $S_2$ need not be true. In other words, there could have been a burglar, but $x$ might not have discovered him. But if $0_n$ is a replacement for the $z$-phrase in (20b), then $S_2$ must be true.

11.2. Some Predictions

The claim that some pronouns with indefinite antecedents can be derived from full NP's gives rise to the question of why all pronouns with indefinite antecedents cannot be derived in this way. Thus, for example, it was argued earlier that the ungrammaticality of a sentence like:

21. *The man who saw it shot a lion

is accounted for by the fact that a pronoun with an indefinite antecedent must correspond to an unsubstituted variable, combined with the fact that the Leftmost Constraint predicts that no unsubstituted vari-
able can precede its antecedent. But given the assumption that there are pronouns derived from full NP's on the basis of some kind of identity with indefinite NP's, it can be asked whether the ungrammaticality of (21) is in fact accounted for. Although the variable source for this pronoun is blocked by the Leftmost Constraint, this constraint does not block a full NP source.

However, there is no reasonable representation parallel to those discussed above which can be constructed for this pronoun. Thus the identity condition above would allow this pronoun to be derived from a full NP representation like:

22. /the man who saw the lion that he shot shot a lion/

But the surface sentence corresponding to (22) is itself impossible, since the subject NP presupposes the assertion of the main clause.

Although the above analysis is extremely sketchy, we can now turn to a class of cases which should be accounted for by some analysis along these lines. As mentioned in Sec. 8, an indefinite NP within a relative clause cannot always serve as the antecedent for a pronoun not contained within this clause; all of the following are impossible:

23. *Only the man who saw a lion_{i} shot it_{i}
24. *The woman who wrote to the man who saw a lion_{i} shot it_{i}
25. *Every man saw a lion_{i} and then Fred shot it_{i}

The ungrammaticality of these sentences is accounted for by the kinds of constraints discussed in Part I. Thus consider, for example, the contrast between (23) and (2):

2. The man who saw a lion_{i} shot it_{i}
23. *Only the man who saw a lion_{i} shot it_{i}

If the pronoun in (2) must be derived from the full NP the lion that he
saw, where he is a variable bound by the man-phrase, then it is predicted that (23) is impossible. The subject NP in (23) must be, roughly:

26. Only x: Ty : y saw a lion (x is y)  
    (man)

and the representation for the object NP would have to be:

27. Tz : y saw z  
    (lion)

But y in the object NP cannot be bound by the man-phrase in the subject NP, since this phrase is contained within the only-QP. The only representation for (23), then, which could be constructed would be:

28.  

\[
\begin{array}{c}
\text{S} \\
\text{QP} \\
\text{Ty} \\
\text{QP} \\
\exists y \; y \text{ saw } v \\
\text{QP} \\
\text{Only} \\
\text{S} \\
\text{S} \\
\text{S} \\
\text{S} \\
\end{array}
\]

But this derivation requires the y-phrase to be substituted into the only-phrase; this violates the constraint that no QP can be substituted into another QP.

The ungrammaticality of (24) is accounted for in a similar way. Here the object pronoun it would have to be derived from the full NP the lion that he saw where he is a variable bound by the man-phrase in the subject NP. But if the man-phrase binds a variable within the object NP, then it must have wider scope than the woman-NP. Thus the derivation of this sentence violates the constraint that no QP can be substituted into a relative clause.
Similarly, (25) is impossible since the full NP underlying \textit{it} must contain a variable bound by the phrase \textit{every man}. But it has been shown that \textit{every} cannot bind a variable in a different conjunct; evidence for this comes from the ungrammaticality of a sentence like:

29. *Every man\textsubscript{i} saw a lion, and then he\textsubscript{i} shot it

Thus the constraint blocking (29) will also block (25).

There is, finally, one more case accounted for by this kind of analysis. In contrast to a sentence like (30), (31) is impossible:

30. The man who saw a lion\textsubscript{i} wrote to the woman who shot it\textsubscript{i}

31. *The woman who shot it\textsubscript{i} was written to by the man who saw a lion\textsubscript{i}

The Leftmost Constraint predicts that \textit{it} in (31) cannot be derived from an unsubstituted variable, since it precedes its antecedent. Moreover, the antecedent in both (30) and (31) is in a relative clause, and so cannot bind \textit{it}. This means that \textit{it} in (30) must have the full NP source: (30) can be derived from:

32. The man who saw a lion wrote to the woman who shot the lion that he saw

If \textit{he} in (32) corresponds to a variable bound by the \textit{man}-phrase, the identity condition characterized above predicts that the \textit{lion}-phrase can pronominalize. In other words, the representation for both (30) and (32) is:
Here in any context in which $O_n$ is a replacement for $z$ in $S_5$, $S_2$ is true, and $S_3(y=O_n)$ is true, and there is no $O_m$ such that the truth of $S_2$ depends on the truth of $S_3(y=O_m)$. Given this, $z$ can pronominalize, yielding (30).

It would appear, then, that (31) can also be derived from this structure, where Passive applies on the main sentence. But this derivation violates the Leftmost Constraint. Thus, after the substitution of all but the $x$-QP the structure is:

34. $Tx : S (Tw [w shot Tz [x saw z]] was written to by $x$

The substitution of the $x$-phrase onto the variable in the by-phrase violates this constraint; this occurrence of $x$ is preceded by the $x$ within the lion-phrase.
Section 12

The Problem(?) of Extra Structures

12.1. The Potential Problem

12.1.1. The Problem in Karttunen's Analysis

Karttunen (1971) claimed that his analysis of Crossing Coreference sentences derives a sentence like:

1. The woman who wrote to him saw the man who loves her

from the following three sources:

2. a. the woman who wrote to the man who loves the woman
   saw the man who loves the woman

   b. the woman who wrote to the man saw
   the man who loves the woman who wrote to the man

   c. the woman who wrote to the man saw
   the man who loves the woman

However, Fauconnier (1971), Ayres (1972) and Wasow (1972) have all shown that Karttunen's analysis actually provides an infinite number of sources for a Crossing Coreference sentence. Thus another representation for (1) can be constructed by embedding one more relative clause into both the subject and the object NP of (2a):

3. \( NP_1 \) [the woman who wrote to \( NP_2 \) [the man who loves \( NP_3 \) [the woman who wrote to the man]]] saw

   \( NP_4 \) [the man who loves \( NP_5 \) [the woman who wrote to \( NP_6 \) [the man]]]

Karttunen's Pronominalization rule requires formal identity between the pronominalized NP and some other NP at the point in the derivation at which Pronominalization applies. Given this, (1) can be derived from (3) as follows:
i. $NP_4$ pronominalizes $NP_2$, yielding:

$$NP_1[\text{the woman who wrote to } NP_2[\text{him}]] \text{ saw}$$

$$NP_4[\text{the man who loves } NP_5[\text{the woman who wrote to } NP_6[\text{the man}]]]$$

ii. $NP_6$ is pronominalized on the basis of identity with the head noun (the man) of $NP_4$; this yields:

$$NP_1[\text{the woman who wrote to } NP_2[\text{him}]] \text{ saw}$$

$$NP_4[\text{the man who loves } NP_5[\text{the woman who wrote to } NP_6[\text{him}]]]$$

iii. $NP_5$ is pronominalized by $NP_1$; this results in the surface sentence (1).

Another source for (1) can be constructed by embedding another relative clause into each of the NP's in (2b):

4. the woman who wrote to the man who loves the woman saw
   the man who loves the woman who wrote to the man who loves the woman

Moreover, Karttunen's Pronominalization rule allows additional sources for (1) to be constructed by embedding another relative clause into each of the NP's in (3) or in (4):

5. a. the woman who wrote to the man who loves the woman who wrote to the man who loves the woman saw
   the man who loves the woman who wrote to the man who loves the woman

b. the woman who wrote to the man who loves the woman who wrote to the man saw
   the man who loves the woman who wrote to the man who loves the woman who wrote to the man
This process can be continued indefinitely, and so there are an infinite number of structures which can underlie (1). Each of these structures contains a subject NP of depth \( n \) and an object NP of depth \( n + 1 \).

Since structures like (2)–(5) cannot be taken as semantic representations, the semantic predictions of Karttunen's analysis can be determined only by translating these structures into semantic representations. In 12.2 it will be shown that the representation corresponding to (3) is logically equivalent to the representation corresponding to (2b), while the semantic representation corresponding to (4) is logically equivalent to the one which corresponds to (2a). Given this, the fact that (1) can be derived from both (3) and (4) presents no new problem for Karttunen's analysis. Since his theory provides both (2a) and (2b) as sources for (1), no additional meanings are predicted.

It will also be shown that the representations corresponding to (5a), (5b), and all more complex structures (i.e., all structures which contain an NP of depth four or more) mean one of two things, where neither of these meanings is equivalent to either (2a) or (2b).\(^1\) This means that Karttunen's analysis does assign two additional readings to a sentence like (1). However, it is not clear that this is a problem, since one of these meanings is entailed by (2a) and the other by (2b). If Karttunen were correct in claiming that (1) has the meaning of (2a) and (2b), then it would be impossible to determine whether or not these sentences actually have these extra meanings.

\(^1\)Actually, (5a) and (5b) can each be translated into two different semantic representations. For example, the subject NP in (5a) can be represented as (roughly) either (i) or (ii):

\[ i. \ Tx[x \text{ wrote to } Ty[y \text{ loves } Tw[w \text{ wrote to } Tz[z \text{ loves } x]]]] \]
\[ ii. \ Tx[x \text{ wrote to } Ty[y \text{ loves } Tw[w \text{ wrote to } Tz[z \text{ loves } w]]]] \]

For the sake of simplicity, I will only discuss structures like (ii).
12.1.2. The Potential Problem for the Pronominalization Theory

While these extra structures present no problem for Karttunen's analysis, the existence of semantic representations corresponding to structures like (3)-(5) could present a problem for the analysis developed here. Thus it was claimed in Part I that a Crossing Coreference sentence like (1) is not ambiguous, and has only the meaning of (6), which is the representation corresponding to Karttunen's (2a):

2a. the woman who wrote to the man who loves the woman
    saw
    the man who loves the woman

6.

\[
\begin{align*}
&\text{QP} \\
&\text{Tx} \quad \text{(woman)} \\
&\text{Ty} \quad \text{(man)} \\
&\text{S} \quad x \text{ wrote to } y \\
&\text{S} \quad y \text{ loves } x \\
&\text{S} \quad x \text{ saw } z
\end{align*}
\]

The Leftmost Constraint predicts that (1) cannot be derived from (7), which corresponds to Karttunen's (2b):

2b. the woman who wrote to the man
    saw
    the man who loves the woman who wrote to the man

7.

\[
\begin{align*}
&\text{QP} \\
&\text{Ty} \quad \text{(man)} \\
&\text{Tw} \quad \text{(woman)} \\
&\text{S} \quad y \text{ loves } w \\
&\text{S} \quad w \text{ wrote to } y \\
&\text{S} \quad x \text{ saw } z
\end{align*}
\]

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Moreover, the framework here provides no semantic representation corresponding to (2c):

\[ 2c. \text{ the woman who wrote to the man saw the man who loves the woman} \]

Any pronoun which Karttunen's analysis derives from a simple NP (such as the woman) is derived in the Pronominalization theory from an unsubstituted variable. A derivation of (1) from a representation corresponding to (2c) would therefore involve deriving both pronouns from unsubstituted variables. But in a framework with restricted quantification and without the device of double binding, no such representation can be constructed. Thus, of the three structures (2a)-(2c) which can underlie (1) in Karttunen's analysis, only a representation corresponding to (2a) - (6) - can underlie (1) in the analysis here. It appears then that the Pronominalization theory accounts for the nonambiguity of (1). Moreover, a theory which provides only (6) as the semantic representation for (1) accounts for a number of syntactic facts.

However, the existence of additional structures in Karttunen's analysis gives rise to the question of whether or not the Pronominalization theory also provides extra representations for (1). In the next section it will be shown that the Pronominalization theory does not, in fact, allow (1) to be derived from the representations corresponding to (3) and (4). It does however appear to provide more complex representations (such as those corresponding to (5)) for (1). It is actually not clear whether or not this is a problem; these structures are not true in any context in which (1'):

\[ 1'. \text{ The woman who wrote to him saw the man who loves her (where the pronouns are free variables) is not true. Nevertheless, I} \]
will assume that the derivation of (1) (or, (1')) from these structures should be blocked, and will discuss a tentative solution to this problem in 12.4.

12.2. The Problem in Detail

12.2.1. The Representations Corresponding to (3) and (4)

As discussed earlier, structures like (8) and (9) (which are the subject NP's in (6) and (7) respectively) are not interpretable in the same contexts:

8. Tx [x wrote to Ty [y loves x]]
   (woman) (man)

9. Ty [y loves Tx [x wrote to y]]
   (man) (woman)

(8) requires a unique x-y pair such that x is a woman who wrote to y and y is the only man who loves x, while (9) requires a unique x-y pair such that x is the only woman who wrote to y and y loves x. Therefore (8) but not (9) is interpretable in Crime and Punishment:

10. Women wrote to Men loves Women
    Sonia  Raskolnikov  Sonia
    Dunia  Razumikhin  Dunia

while (9) but not (8) is interpretable in The Insulted and Injured:

11. Women wrote to Men loves Women
    Natasha  Alyosha  Natasha
    Katya  Vanya  Katya

Now consider the meaning of structures like (12) and (13):
12. Tw \[w \text{ wrote to } Ty \ [y \text{ loves } Tx \ [x \text{ wrote to } y]]\]
\[(\text{woman}) \quad (\text{man}) \quad (\text{woman})\]

13. Tz \[z \text{ loves } Tx \ [x \text{ wrote to } Ty \ [y \text{ loves } x]]\]
\[(\text{man}) \quad (\text{woman}) \quad (\text{man})\]

(12) requires a context in which its $y$-phrase is interpretable and in which there is one and only one woman who wrote to the man described by this phrase. The $y$-phrase within (12) is identical to (9). This means that (12) is interpretable in some context only if (9) is interpretable in that context, and if one and only one woman wrote to the man picked out by (9). In any context in which (9) refers to some man, it must be the case that one and only one woman wrote to that man. It follows then that (12) is interpretable in all of the same contexts as (9). Similarly, (13) is interpretable in the same contexts as (8).

In Sec. 2 it was argued that (1) is interpretable in *Crime and Punishment* but not in *The Insulted and Injured*, while the reverse holds for:

14. The man who loves her was seen by the woman who wrote to him

This is predicted if the only source for (1) is (6) (where the subject NP is (9)) and if the only source for (14) is (7). But suppose that the Pronominalization theory also allows a derivation of (1) from a structure in which the subject NP is (12) and the object NP is (9):

15. Tw \[w \text{ wrote to } Ty \ [y \text{ loves } Tx \ [x \text{ wrote to } y]]\]
\[(\text{woman}) \quad (\text{man}) \quad (\text{woman})\]

saw

Tz \[z \text{ loves } Tu \ [u \text{ wrote to } z]]\]
\[(\text{man}) \quad (\text{woman})\]

\[2\text{Since neither the subject nor the object contain a variable bound by the other, (15) actually corresponds to two structures. In one the subject has wide scope, and the object has wide scope in the other; these two structures are equivalent.}\]
(15) is equivalent to (7); both the subject and the object NP are interpretable in *The Insulted and Injured* (and neither are in *Crime and Punishment*). While the Leftmost Constraint blocks the derivation of (1) from (7), it does not block a derivation from (15). Here the object NP has not been substituted onto a variable which is preceded by another occurrence of the same variable, since there is no variable in the subject NP bound by the object. Thus if Pronominalization could apply here to yield (1), then the Pronominalization theory would predict that (1) is ambiguous.

But given the claim that Pronominalization requires referential identity, and given the definition of referential identity in Sec. 10, (15) is not a possible source for (1). Here the *z*-phrase can pronominalize the *y*-phrase since these two are formally and referentially identical. However, the *x*-phrase cannot pronominalize the *u*-phrase (nor can the *w*-phrase). The two phrases the woman who wrote to *y* and the woman who wrote to *z* are not referentially identical, since *z* and *y* are different. This is parallel to a sentence like:

16. The woman who wrote to the man who loves her saw
the woman who spoke to the man who loves her.

Here the two *man*-phrases are not referentially identical because they contain different variables. While it will turn out that *y* and *z* within the *woman*-phrases in (15) refer to the same person (since the *y*-phrase and the *z*-phrase are themselves identical), this is irrelevant in determining possible replacements for the two *woman*-phrases *x* and *u*.

12.2.2. More Complex Structures

We can now consider a more complex structure like (17), which corresponds to (5a):
17. Tw [w wrote to Tz [z loves Tx [x wrote to Ty [y loves x]]]]
   (wom)  (man)  (wom)  (man)

   saw

   Tt [t loves Tu [u wrote to Tv [v loves u]]]  
   (man)  (wom)  (man)

Here the x-phrase and the u-phrase are referentially identical, as are
the y-phrase and the t-phrase. If we assume that an NP_a can pronomi-

dize NP_b if the two are referentially identical and are formally iden-
tical in semantic representation, then the u-phrase should be able to
pronominalize y while the x-phrase can pronominalize u; this will yield
(1). (Notice that this problem does not arise if we assume that the
two NP's must be formally identical at the input to Pronominalization;
once y is pronominalized the z-phrase and the t-phrase are no longer
formally identical. I will, however, assume that the condition that
the two are formally identical holds for their semantic representation,
rather than at the input to Pronominalization.)

It is actually not clear what it means to say that the output of
this derivation is the Crossing Coreference sentence (1), as opposed
to the sentence:

1'. The woman who wrote to him saw the man who loves her

Notice that the u-phrase, which corresponds to the surface pronoun her
is not pronominalized by the subject NP (the w-phrase), but rather
by the x-phrase which is embedded within the subject NP. Thus it
could be argued that while this derivation yields (1'), it does not
yield a sentence with crossing coreference. For the sake of argument,
I will assume for now that it does make sense to call the output of

3 Like (15), (17) is actually an abbreviation for two equivalent
structures, one in which the subject has wide scope and the other
in which the object has wide scope.

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this derivation the Crossing Coreference sentence (1). This is perhaps
justified on the grounds that the x-phrase, which pronominalizes the u-
phrase, must refer to the same woman as the w-phrase. However, I will
return to this question in 12.3.

(1) can apparently also be derived from (18), where the subject NP
(18a) is of depth 3 and the object NP (18b) is of depth 4:

18. a. Tu [u wrote to Tt [t loves Tv [v wrote to t]]]]
    (wom) (man) (wom)
    saw

b. Tz [z loves Tw [w wrote to Ty [y loves Tx [w wrote to y]]]]]
    (man) (wom) (man) (wom)

Here the y-phrase and the t-phrase are referentially identical; so are
the u- and the w-phrases. As in Karttunen's analysis, an infinite
number of representations like this can be constructed. For example,
another possible source would have as its subject (18b) embedded within
a woman-phrase, while the object would consist of (18a) embedded in a
man-phrase:

19. Tr [r wrote to (18b)] saw Ts [s loves (18a)]
    (woman) (man)

12.2.2.1. The Semantic Predictions

The possibility that (1) can be derived from structures like (17)
appears to present a problem for the Pronominalization theory. Thus
let us consider the meaning of an NP like (20), which is the subject
NP in (17):

20. Tw [w wrote to Tz [z loves Tx [x wrote to Ty [y loves x]]]]]
    (wom) (man) (wom) (man)

(20) requires a context in which the z-phrase is interpretable, and
in which one and only one woman wrote to the man picked out by this
phrase. The $z$-phrase is identical to (13) above; it requires that one and only one man loves the woman picked out by the $x$-phrase. The $x$-phrase is identical to (8), and requires a context with a unique man-woman pair such that he is the only man who loves her and she wrote to him. Since the $x$-phrase can only refer to a woman who is loved by only one man, the $z$-phrase and the $x$-phrase are interpretable in the same set of contexts. Both are interpretable in Crime and Punishment, where the $x$-phrase refers to Dunia and the $z$-phrase to Razumikhin:

\[
\begin{array}{ccc}
\text{Sonia} & \xrightarrow{} & \text{Raskolnikov} \\
\text{Dunia} & \xrightarrow{} & \text{Razumikhin}
\end{array}
\]

While both the $x$-phrase and the $z$-phrase within (20) are interpretable in Crime and Punishment, (20) itself is not. (20) requires a context in which one and only one woman wrote to $z$. But two women in (10) wrote to $z$ (Razumikhin). Thus (20) is interpretable only in a subset of contexts in which the $z$-phrase is interpretable.

In other words, (20) requires a context in which: (a) there is a unique $x$-$y$ pair such that $x$ is a woman who wrote to $y$ and $y$ is the only man who loves $x$, and (b) there is a unique $w$-$z$ pair such that $w$ is the only woman who wrote to $z$ and $z$ is the only man who loves $w$. Of course in any context in which (a) and (b) are both satisfied, the $x$-$y$ pair will be the same as the $w$-$z$ pair. Notice, though, that (20) is not equivalent to a structure requiring only (b), since there are contexts in which (b) is satisfied and (a) is not. Such a context can be constructed by adding a pair with unique members to Crime and Punishment:
Although (b) is satisfied here, there is no unique pair such that the 
woman wrote to the man and he is the only man who loves her. Given 
this, the x-phrase within (20) is not interpretable, and so (20) is 
not either. On the other hand, while (20) is not interpretable in The 
Insulted and Injured (since (b) is not met), it is interpretable in a 
context in which a pair with unique members is added to The Insulted 
and Injured:

22. Women        Men        Women
        wrote to        loves
Sonia    Raskolnikov    Sonia
Dunia    Razumikhin    Dunia
Eve     Adam     Eve

Both (a) and (b) are satisfied here; the relevant pair is Eve and Adam.

The situation is reversed for an NP of depth 4 in which the man 
is the outermost NP:

23. Tz [z loves Tw [w wrote to Ty [y loves Tx [x wrote to y]]]]
        (man)  (wom)  (man)  (wom)

(23) requires: (a) a unique x-y pair such that x is the only woman 
who wrote to y and y is a man who loves x, and (b) a unique w-z pair 
such that w is the only woman who wrote to z and z is the only man 
who loves w. Thus (23) is not interpretable in (22) since (a) is not 
satisfied, but it is interpretable in (21).

All NP's of this type of greater complexity have either the re-
quirements of (20) or of (23). For example, a woman-NP of depth 5 can be constructed by embedding (23) into another NP:

24. Tu [u wrote to (23)]
   (woman)

where (24) requires a context in which (23) is interpretable, and in which only one woman wrote to the man picked out by (23). In any context in which (23) refers to some man, it must be the case that only one woman wrote to him. (24), then, is interpretable in the same contexts as (23). A man-NP of depth 5 has the same requirements as (20).

Thus every NP of this type of depth 4 or more requires a context with a unique pair with unique members. In addition, each NP requires either: (i) that there is a unique x-y pair such that x is a woman who wrote to y and y is the only man who loves x, or (ii) that there is a unique x-y pair such that x is the only woman who wrote to y and y is a man who loves x. If the most deeply embedded NP is (8) then (i) is required:

8. Tx [x wrote to Ty [y loves x]]
   (woman) (man)

If (9) is the most deeply embedded NP then (ii) is required:

9. Ty [y loves Tx [x wrote to y]]
   (man) (woman)

This means that (17), (18) and all more complex structures require a unique pair with unique members, and either (i) or (ii). In all of these structures, the most deeply embedded NP in the subject and in the object is the same. So, for example, both the object and the subject in (17) have (8) as the most deeply embedded NP and so both require (i), and the subject (though not the object) additionally requires a unique pair with unique members.
The fact that the Pronominalization theory appears to provide (17) as a possible source for (1) in itself presents no real problem. It was argued earlier that (1) requires a context in which (i) above is satisfied, as is predicted if its only representation is (6):

6. \( \text{Tx} [x \text{ wrote to Ty } [y \text{ loves } x]] \)
\( \text{(woman)} \quad \text{(man)} \)
\( \text{saw } Tz [z \text{ loves } x] \)
\( \text{(man)} \)

While (17) is not equivalent to (6) (since it requires a unique pair with unique members), it also requires a context in which (i) is satisfied. It is, therefore, interpretable in a subset of contexts in which (6) is. Thus a theory which provides (17) as a representation for (1) does not make any semantic predictions which can be shown to be incorrect by a consideration of the contexts in which (1) is interpretable; there are no contexts in which (17) is interpretable and (1) is not.

But if (1) can be derived from (17), then it can also be derived from (18), where the subject NP is of depth 3 and the object of depth 4:

18. \( \text{Tu} [u \text{ wrote to Tt } [t \text{ loves } Tv [v \text{ wrote to } t]]] \)
\( \text{(woman)} \quad \text{(man)} \quad \text{(woman)} \)
\( \text{saw } \)
\( Tz [z \text{ loves } Tw [w \text{ wrote to Ty } [y \text{ loves } Tx [x \text{ wrote to } y]]]] \)
\( \text{(man)} \quad \text{(woman)} \quad \text{(man)} \quad \text{(woman)} \)

(18) does not require (i), since its most deeply embedded NP's are (9). Rather, it requires (ii) - a unique pair in which no other woman wrote to the man - in addition to a unique pair with unique members. Thus (18) is interpretable in a context like (21):
21. Women wrote to Men loves Women

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sonia</td>
<td>Raskolnikov</td>
<td>Sonia</td>
</tr>
<tr>
<td>Dunia</td>
<td>Razumikhin</td>
<td>Dunia</td>
</tr>
<tr>
<td>Eve</td>
<td>Adam</td>
<td>Eve</td>
</tr>
</tbody>
</table>

But (1) is not interpretable in (21), since there is no unique woman loved by only one man.

12.2.2.2. The Syntactic Predictions

Moreover, if a Crossing Coreference sentence like (1) can be derived from these more complex structures, then its syntactic behavior is not accounted for. Take for example the ungrammaticality of:

25. *The woman$_i$ who he$_j$ wrote to saw the man$_j$ who loves her$_i$

That (25) is bad is predicted if it must be derived from:

26. $\text{Tx \ [Ty [y loves x] wrote to } \times \text{] saw Tz [z loves x]}

since the relativized $x$ is preceded by another occurrence of $x$. But suppose that the first pronoun can instead be derived from a more complex NP like (27), which is analogous to the subject NP in (17):

27. $\text{Tw \ [Tz [z loves Tx [Ty [y loves x] wrote x]] wrote } \#w \text{]}

The relativized $w$ is not preceded by any other occurrence of $w$, and so the Leftmost Constraint does not block its relativization. Nor would there be any violation within the object NP in the representation of (25) which is parallel to (17). Here the object is derived from (28), which is identical to the $z$-phrase in (27):

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28. \[ (t) \text{ loves } (t) \text{ wrote to } (u) \]

Here the problem could perhaps be solved by the assumption that Relative Clause Formation is obligatory. This means that one of the variables in each embedded NP must be relativized. The most deeply embedded woman-NP within (27) is:

29. \[ (y) \text{ loves } (x) \text{ wrote to } (x) \]

Neither occurrence of \( x \) within (29) can be relativized. Relativization of the first \( x \) violates the Complex NP Constraint; relativization of the second \( x \) violates the Leftmost Constraint. Thus if Relative Clause Formation is obligatory, then the derivation of the subject NP in (25) from (27) is blocked. Although \( w \) can be relativized, the embedded \( x \) cannot be.

But the assumption that Relative Clause Formation is obligatory is of no help in cases where the subject in (25) is derived from an NP of odd number depths. Consider, for example, a representation for (25) analogous to (18) - where the subject is of depth 3 and the object of depth 4:

30. \[ (w) \text{ loves } (t) \text{ wrote } (u) \text{ saw } (t) \]

Moreover, the existence(?) of such that relatives would make this assumption untenable. If Relative Clause Formation is obligatory then there is no way to derive NP's like:

i. the man such that the woman wrote to him

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The Leftmost Constraint does not block the relativization of the circled \( u \) in (30), since it is not preceded by any other occurrence of \( u \). Nor does the relativization of any of the other variables violate the constraint; none of these are preceded by another occurrence of that variable.

The basic problem here is that if these extra sources exist, the pronoun \( he \) in (25) need not be derived from a full NP which contains a variable bound by the subject NP. Rather, it can be derived from a more complex full NP. In a structure like (30), or in any other structure where the subject NP has an odd number depth, the most deeply embedded NP is:

\[
31. \ Ty \ [y \ loves \ Tx \ [y \ wrote \ to \ x]] \\
\quad (\text{man}) \quad (\text{woman})
\]

which corresponds to the grammatical NP:

\[
32. \ the \ man_i \ who \ loves \ the \ woman \ he_i \ wrote \ to
\]

Thus a derivation of the subject NP in (25) from a source like (30) should yield a grammatical NP, just as (32) is grammatical.

12.3. Is This a Problem?

Actually, it is not clear whether the problems discussed above are real; this discussion assumed that the sentences derived from these more complex structures are "Crossing Coreference sentences". But here one of the two pronouns is pronominalized not by the other NP but by an embedded NP; it could therefore be argued that we are not dealing with a sentence in which each pronoun is understood as coreferential with the other NP.

As discussed earlier, the question of what it means to talk of a particular reading of some surface sentence is, in general, irrelevant.
For example, we can take the contrast between (1') and (14') (where no particular reading is intended here):

1'. The woman who wrote to him saw the man who loves her

14'. The man who loves her was seen by the woman who wrote to him

In both sentences the pronouns can range freely over all individuals in the context. Nevertheless, these sentences are not true in all of the same contexts. Thus take a context like:

33. Women wrote to Men loves Women
   Gretel → Hansel → Gretel
   Snow White → Grumpy → Snow White
   Cinderella → Prince Charming → Cinderella

where Gretel saw only Hansel, and no other woman saw any man. (14') is false here; the phrase the woman who wrote to him must refer to some woman such that there is some individual (him) who she and no one else wrote to. Thus it cannot be Gretel. But (1') is true here, since the woman who wrote to him can be a woman who wrote to a man that other women wrote to, provided that he and no one else loves her. The situation is reversed in:

34. Women wrote to Men loves Women
   Sarah → Abraham → Sarah
   Rebecca → Isaac → Rebecca
   Rachel → Jacob → Rachel

where Sarah saw only Abraham, and no other woman saw any man.

Consider then, (15) (which is equivalent to (7)):
Suppose that this structure could underlie (1'), where the $x$-phrase pronominalizes the $u$-phrase and the $z$-phrase pronominalizes the $y$-phrase. Here too it could be argued that the "reading" of (1') with this representation is not a Crossing Coreference sentence, since the pronoun *her* is not pronominalized by the subject NP. But here it doesn't matter whether this is called a Crossing Coreference sentence or not; a theory which derives (1') from (15) incorrectly predicts that (1') is true in (34), since (15) is true in (34). As shown earlier, the Pronominalization theory does not in fact allow a derivation of (1') from (15); the $u$-phrase and the $x$-phrase are not referentially identical. Nor does it allow (1') to be derived from (7) (which is also true in (34)).

While the Pronominalization theory does appear to derive (1') from more complex representations like (17) and (18), this does not pose the same kind of problem. Both of the pronouns in (1') can function as free variables. Given this, there is no context in which (17) or (18) is true and (1') is not. Thus, on the free variable interpretation of the pronouns, the subject must refer to a woman such that there is some man who was written to only by her, and the object to a man such that there is a woman who is loved only by him. In other words, (1') minimally requires: an a-b pair such that a is the only woman who wrote to b and a c-d pair such that c is the only man who loves d (where the two pairs need not be the same). (18) requires a unique x-y pair...
such that x is the only woman who wrote to y and y is a man who loves x, and a unique w-z pair such that w is the only woman who wrote to z and z is the only man who loves x. Any context satisfying these requirements will meet the requirements of (1'). Thus, unlike a structure like (15), there is no context in which (18) is true and (1') is not.

This is perhaps clarified by a consideration of a much simpler version of the same problem. Take a structure like:

35. $T_x [x \text{ wrote to } T_y [y \text{ loves } T_w [w \text{ danced}]]] \text{ saw}$

$T_z [z \text{ loves } T_v [v \text{ danced}]]$

Here the y-phrase and the y-phrase are referentially and formally identical, as are the w-phrase and the v-phrase. Thus the y-phrase should be able to pronominalize the z-phrase, and the w-phrase should be able to pronominalize the v-phrase; this will also yield (1'). In fact, there are an infinite number of possibilities here; the pronoun her in (1') could be represented as:

36. the woman who $\{\begin{array}{l}
danced \\
wove a prayer rug \\
sat on top of the roof
\end{array}\}$

The derivations of (1') from the complex structures discussed above is simply a special case of this more general problem.

It certainly seems counterintuitive to derive (1') from all of these structures. Yet if we consider only the contexts in which (1') is true, a theory with this property cannot be shown to be incorrect. Each of these representations is entailed by the free variable reading of (1'). In other words, the pronoun her in (1') can be used to designate some unspecified object in the context. Thus in any context with a woman
who danced and only one man who loves that woman, the NP the man who loves her in (1') can refer to that man. Similarly, the object NP in (35) refers, in this context, to that man. In other words, any man who satisfies the z-phrase in (35) can be referred to by the object NP in (1') under the free variable interpretation of her.

To return to the derivation of (1') from a structure like (18), it was argued above that a Crossing Coreference sentence like (1) is not interpretable in a context like:

21. Women wrote to Men loves Women

Sonia → Raskolnikov → Sonia
Dunia → Razumikhin → Dunia
Eve → Adam → Eve

(18), however, is interpretable in (21) (and refers to Eve and Adam). Thus it was claimed that a theory which derives (1) from (18) does not account for the meaning of (1). But this problem assumed that the sentence derived from (18) is the Crossing Coreference sentence (1); it is not clear what this assumption means. Notice that (1') is interpretable in (21), and can refer to Eve and Adam.

In fact, the only representations whose meanings are not subsumed under the free variable interpretation are those like (6), (7) and (15). These do not require a unique a-b pair such that a is the only woman who wrote to b and a unique c-d pair such that c is the only man who loves d. But here the Pronominalization theory does not permit representations like (7) and (15) - which have the wrong meaning - for (1').

Despite the fact that these extra representations are all entailed by the free variable reading, a theory which derives (1') from these
structures seems counterintuitive. Therefore, the next section will suggest a solution to this problem.

12.4. Towards a Solution

The basic problem here is that Pronominalization applies non-recoverably; one NP entirely disappears. For example, in the derivation of (1') from (35) the woman who danced is not recoverable:

35. The woman who wrote to the man who loves the woman who danced

\[ \downarrow \text{him} \]

saw the man who loves the woman who danced

\[ \downarrow \text{her} \]

Thus some constraint is needed to block this kind of derivation.\(^5\) Unfortunately, this constraint does not fall out from the formulation of Pronominalization assumed here. Nevertheless, it is easy enough to formulate a constraint which will block this derivation. Moreover, it would not be surprising to find that the rule is subject to a constraint which ensures that its input is recoverable.

Thus there might be a constraint to the effect that any NP which controls Pronominalization must be a full NP on the surface. This means that a controller cannot pronominalize, nor can it be contained within an NP which pronominalizes. Notice that this would rule out one possible derivation of a sentence like (36) from (37):

36. The woman who wrote to John\(_i\) gave the book that he\(_i\)

\[ \downarrow \text{wanted to him}\(_i\) \]

\[^5\text{The derivation of (1')}\text{ from (35) can be blocked if we assume that formal identity at the input to Pronominalization is required, rather than underlying formal identity. However, this still fails to block a derivation of (1') from structures of the type discussed in 12.2.}\]
37. /the woman who wrote to John\textsubscript{1} gave the book that John\textsubscript{2} wanted to John\textsubscript{3}/

Here John\textsubscript{3} cannot be pronominalized by John\textsubscript{2} since John\textsubscript{2} is pronominalized. But both can be pronominalized by John\textsubscript{1}, and so (36) can be derived.

There are other ways to formulate a constraint to block the derivation in (35) and the derivation of (1') from the structures discussed in 12.2; the existence of some such constraint does not seem unnatural. Still, though, this might indicate a problem with the formulation of Pronominalization assumed here, since this kind of constraint on its application is not automatic.
Section 13

On the Question of Treating Pronouns Syntactically

I have been assuming a theory in which surface structures are related to semantic representations by a single set of syntactic rules. However, a variety of arguments have been given for the claim that the semantic representation of pronouns must be determined by non-syntactic, or interpretive, rules. This section will try to answer some of these arguments.

A number of different issues arise in discussions about the correct treatment of pronouns. Jackendoff (1972), for example, argues that the semantic representation of a pronoun is merely a specification of which NP's (if any) the pronoun is coreferential to. If this is correct, then it cannot be maintained that pronouns are related to their semantic representations by syntactic rules, since Jackendoff's semantic representations are not syntactic objects. However, I will consider only those arguments which are compatible with the notion of a semantic representation assumed here; to try to justify this notion is far beyond the scope of this work.

There is also a group of arguments against a syntactic treatment of pronouns which are actually arguments against a theory which relates all pronouns to full NP's. For example, Dougherty (1969) claims that there can be no syntactic Pronominalization rule since, if there were such a rule, (1a) would have as its source the ill-formed (1b):

1. a. Each man said that he was the tallest
   b. *Each man said that each man was the tallest

This is similar to the arguments reviewed in Sec. 3 against the Full NP

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Theory. It indicates only that not all pronouns can be derived from a full NP identical to its antecedent. Moreover, this argument is neutral between a syntactic and an interpretive treatment of pronouns. It shows that neither theory can relate all pronouns to full NP's in semantic representation; both theories must provide a non-full NP representation for the pronoun in (1).

A slightly different kind of argument is given in Bresnan (1970). She shows that

2. Some students_{i} believed that they_{i} were in the administration building

cannot be syntactically derived from the structure underlying

3. Some students believed that some students were in the administration building

on the basis of the fact that there-Insertion can apply in (3):

4. Some students believed that there were some students in the administration building

but not in (2):

5. *Some students_{i} believed that there were they_{i} in the administration building

Assuming that there-Insertion is a cyclic rule, it must apply in (4) on the cycle of the complement sentence. However, if they in (2) can be derived from the full NP some students, then the complement sentence in (5) is indistinguishable from that in (4) at the time that there-Insertion applies. It is only on the cycle of the matrix sentence that the conditions for Pronominalization are met. Thus there-Insertion will not be blocked in (5).

Unlike Dougherty's argument, this argues only against a theory which syntactically derives they in (2) from the full NP some students; it does not provide evidence against the corresponding interpretive
theory. But like Dougherty's argument, it shows only that not all pronouns can be derived from their full NP antecedents. These facts provide no evidence against either the Pronominalization theory or the No Pronominalization theory within a syntactic framework, since neither theory derives the pronoun in (2) from a full NP.

There are, however, a series of arguments which have been put forth by Wasow (1975) against the position that Q Sub is a syntactic process. If these hold, then pronouns cannot be related to their semantic representations by syntactic rules. These arguments are based on the premise that there are cyclic processes whose applicability depends upon properties of NP's which are not determinable until after the application of Q Sub. Such properties include the nature of a quantifier attached to some NP on the surface, the number of the NP, and whether or not that NP is a surface pronoun. Given the hypothesis that Q Sub is a cyclic (or post-cyclic) syntactic rule, this type of information is not present on the cycle of the first sentence containing the relevant NP. On this cycle, the NP is simply a variable.

\[\text{Hankamer and Sag (1976) claim that the pronoun in (2) can be derived from the full NP the students (where the NP the students is marked as coreferential with some students). Such a theory correctly prevents the application of there-insertion in (5), since there-insertion is also blocked in a sentence like:}
\]

\[\text{i. *There are the students in the administration building}
\]

\[\text{But, as discussed in Sec. 3, the claim that all pronouns are derived from definite full NP's seems unfeasible. A theory which derives a sentence like (ii) from (iii):}
\]

\[\text{ii. A student; said that she left}
\]

\[\text{iii. /a student said that the student left/}
\]

appears to predict that (ii) requires a context with one and only one student. This could perhaps be avoided by the assumption that there is a primitive notion of coreference and that the two NP's in (iii) are marked as coreferential, but it is not clear what the semantics of such a theory would be.
Notice that this type of argument would not provide evidence against a theory which treated Q Sub as a precyclic syntactic rule. But the assumption that this process is precyclic is incompatible with the formulation of the Leftmost Constraint given in Sec. 6. Thus, if the ungrammaticality of a sentence like:

6. *The dragon that chased him was attacked by a knight is attributed to the fact that the knight-QP is not substituted onto the leftmost variable that it binds, then the application of Q Sub must follow Passive. Prior to Passive, the structure for (6) is identical to the structure of the grammatical (7):

7. A knight attacked the dragon that chased him

13.1. The There-Insertion Argument

13.1.1. Answering the Argument

Wasow's first argument is a modification of Bresnan's there-Insertion argument. There-Insertion can apply only in clauses whose subjects are of a certain type; it can apply in (8a) to give (8b):

8. a. A man was in the garden
   b. There was a man in the garden

but if the subject is a pronoun the rule cannot apply:

2Similarly, Wasow shows that his arguments can be translated into a theory without a cycle, provided there is some principle (whether extrinsic ordering or some other principle) which ensures that the application of Passive precedes the substitution of a QP onto one of the NP's reordered by Passive. Wasow assumes that a theory with a syntactic rule of Q Sub needs some such principle in order to account for the Precede and Command Constraint; in Sec. 3 it was argued that this constraint cannot be a constraint on the rule of Q Sub. Nevertheless, the interaction of the Leftmost Constraint with Q Sub shows that such a principle is necessary in the analysis here.

In the discussion that follows I will continue to assume the existence of the cycle, and will assume that Q Sub is cyclic.
9. a. He was in the garden
b. *There was he in the garden

We can assume that the semantic representation for both (8a) and (8b) is roughly:

10. \( \exists x: x \text{ is a man} (x \text{ is in the garden}) \)

Wasow further assumes that the reason that there-Insertion cannot apply in (9) is that the subject is a pronoun (or, more generally, that it is "definite"). This assumption will be questioned below.

Wasow then considers a sentence like:

11. A burglar was shot by the man who discovered that he was in the closet

whose representation would be roughly:

12. (shown after the substitution of the man-phrase, and after the application of Passive on \( S_2 \)):

On the \( S_4 \)-cycle, the NP corresponding to the surface pronoun him is simply a variable; on the \( S_2 \)-cycle the NP corresponding to the surface NP a burglar is also a variable. Yet there-Insertion, a cyclic rule, must distinguish them. Thus the rule cannot apply in \( S_4 \) if the QP is

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substituted onto the occurrence of $x$ in $S_2$:

13. *A burglar$_i$ was shot by the man who discovered that there was him$_i$ in the closet

If, however, the QP is substituted onto the derived subject in $S_2$, there-Insertion can apply:

14. There was a burglar$_i$ shot by the man who discovered him$_i$ in the closet

The contrast between (13) and (14) in itself provides no real problem for a theory which syntactically derives (14) from (12). The ungrammaticality of (13) can be accounted for by the hypothesis suggested in McCawley (1970b) that there-Insertion applies only when the quantifier binds the subject of the next clause down. Thus, the rule could be formulated to apply only to the following structure:

15. 

(Actually the rule can apply with other quantifiers; the point relevant here, though, concerns only the position of the quantifier.) In other words, the ungrammaticality of (9b) and (13) need not be accounted for by the fact that the rule has applied in a clause with a pronominal subject. Nor is it necessary to consider any other property which can

---

3This assumes that (14) is derived from (12) by the application of Passive followed by there-Insertion. It has often been suggested that there-Insertion cannot in fact apply to the output of Passive, and that (14) is derivable only from

i. There was a burglar who was shot by the man who discovered him in the closet

by Relative Clause Reduction. However, I will continue to assume that (12) is a possible representation for (14).
be determined only after the substitution of the QP. Rather, these can be blocked by the fact that their subjects are not immediately bound by the appropriate quantifier. Notice that if (15) is the structural description of there-Insertion, then the rule applies in (14) not on the $S_2$-cycle but on the $S_1$-cycle.

Thus the ungrammaticality of (13), as opposed to the grammaticality of (14), does not argue against a theory that treats Q Sub as a syntactic process. The crucial sentence for Wasow's argument, then, is (16), which appears to refute the above proposal or any other formulation which ensures that the subject is immediately bound by the quantifier:

16. The man who discovered that there was a burglar$_1$
in the closet shot him$_1$
Wason assumes that the representation for (16) is (12). If this is the case, then it cannot be maintained that there-Insertion occurs only when the quantifier binds the subject of the next clause down. In other words, the contrast between (16) and (13):

13. *A burglar$_1$ was shot by the man who discovered that there was him$_1$ in the closet
combined with the assumption that the two have the same semantic representation argues against a syntactic treatment of Q Sub. (16) and (13) are indistinguishable both on the cycle of the subject which there replaces (the $S_4$-cycle) and on the cycle of the QP.

But (16) is an example of the type of sentence discussed in Sec. 8.1.2 and Sec. 11; the assumption that its semantic representation is (12) is incorrect. (16), like the simpler sentence:

17. The man who discovered that there was a burglar
in the closet knows how to waltz
requires a context in which there is one and only one man who discovered

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any burglars. This is not true of (12), nor of its surface realizations (11) and (14):

11. A burglar_i was shot by the man who discovered him_i in the closet

14. There was a burglar_i shot by the man who discovered him_i in the closet

These require only that there is some burglar such that one and only one man discovered him.

Thus (16) cannot be derived from (12); the burglar-phrase in (16) must originate within the man-phrase, and the object pronoun must correspond to a full NP. Although the fact that the derivation of (16) from (12) is blocked is consistent with the hypothesis that there-Insertion occurs only when the subject is immediately bound by the quantifier, it does not constitute evidence for this hypothesis. This derivation will be blocked independently by the constraint that no QP can be substituted into a relative clause. Thus the following, in which no there-Insertion has occurred, is also blocked as a surface realization of (12):

18. The man who discovered that a burglar_i was in the closet shot him_i

So far, I have argued only that the above facts can be accounted for by the hypothesis that there-Insertion applies only to clauses whose subjects are immediately bound by the quantifier. However, there is independent evidence for this hypothesis. First, it is well known that while someone can have either wide or narrow scope in a sentence like:

19. John hopes that someone is in the garden

only the narrow scope reading is possible when there-Insertion occurs:
20. John hopes that there's someone in the garden

Similarly, a sentence like (21a) is ambiguous while (21b) is not:

21. a. @It's likely that someone John likes will be at the party
   b. -@It's likely that there will be someone John likes at the party

Milsark (1974) notes that a sentence like (22b), in which there is Raised is also unambiguous; this can be contrasted with (22a):

22. a. @Someone John likes is likely to be at the party
   b. -@There is likely to be someone John likes at the party

The fact that someone must be within the scope of likely in (22b) is predicted by the hypothesis that there-Insertion occurs only when the subject is immediately bound by the quantifier. Since there is inserted in the lower clause and then raised, the quantifier must bind the subject of the lower clause. Thus (22b) can be derived from (23a) but not from (23b):

23. a. $S_1(S_2(\exists x: \text{John likes } x S_3(x \text{ be at the party} )) \text{ be likely})$
   b. $S_1(\exists x: \text{John likes } x S_2(S_3(x \text{ be at the party} ) \text{ be likely} ))$

Thus given the non-ambiguity of sentences like (21b) and (22b) there is no reason to suppose that the ungrammaticality of (13):

13. *A burglar was shot by the man who discovered that there was him in the closet

is due to a constraint prohibiting the application of there-Insertion in sentences with pronominal subjects. Rather, the principle that the subject must be immediately bound by the appropriate quantifier is sufficient to block (13). Notice that the hypothesis that the rule is formulated to apply only to structures like (15):

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15. $\exists x: S(x, VP)$

does not in itself predict that there cannot replace a surface pronoun. However, this formulation combined with other constraints does predict this. Thus consider a structure like:

24.

There-Insertion can apply in $S_2$ since the subject is immediately bound by an existential quantifier. If the QP is substituted onto the occurrence of $x$ in $S_3$, the $x$ in $S_2$ would be realized as a surface pronoun.

But other constraints block this derivation. The substitution of the QP onto $x$ within $S_3$ violates the Leftmost Constraint, since this occurrence of $x$ is preceded by the subject of $S_2$. The conjecture in Sec. 8 that the constraint should be extended to ensure that only the "topmost" variable is substituted also predicts that this derivation is blocked. Given this, it follows that there can never be inserted for a pronominal subject. Any subject immediately bound by a quantifier must be the variable onto which this quantifier is substituted, since it will be the leftmost and topmost occurrence of this variable.

---

4If no other rules apply here, then the surface structure produced by this derivation also violates the Precede and Command Constraint. However, it is conceivable that rules applying on higher cycles (or post-cyclically) could move the NP within $S_3$ into a position where it is not preceded and commanded by the pronoun within $S_2$. 

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13.1.2. **Further Discussion**

I have argued above that the contrast between (13) and (14):

13. *A burglar$_i$ was shot by the man who discovered that there was him$_i$ in the closet

14. There was a burglar$_i$ shot by the man who discovered him$_i$ in the closet

can be accounted for in a theory that treats Q Sub as a syntactic process. Still, it might seem that a theory which relates NP's to bound variables by non-syntactic rules can account for the above contrast in a way which is simpler or more intuitive. Thus it is worth exploring the situation in a bit more detail to see whether this contrast does, at least in spirit, constitute an argument for autonomous syntax.

I will begin by defining four positions that can be taken here (there are, undoubtedly, others). A and B both maintain that the constraint blocking (13) is a property of the structure to which there-Insertion applies. This constraint, then, is a "syntactic" phenomenon. C and D claim that the ungrammaticality of (13) is attributable to a constraint on the relationship between this sentence and semantic representation. There-Insertion applies freely, and some principle ensures that the semantic representation of a there-sentence is of a certain type. Presumably (13) would be blocked by the fact that other principles will ensure that it could not have the required semantic representation.

A and C both maintain that variables and quantifiers are in the syntax; B and D both maintain that the representation of surface NP's as variables bound by quantifiers is not a part of the syntax. Thus in B and D the nature or scope of a quantifier binding some NP cannot be
part of a condition on the application of a syntactic rule.

The formulation discussed above, where the rule applies to structures like (15), is consistent with A. (13) is blocked since the structure to which the rule applies does not meet the structural description of the rule. Position D would allow the rule to apply to produce (13), and the ungrammaticality of this sentence would be predicted by interpretive rules. (This is essentially the approach taken in Milsark (1974)). C is similar; the rule would apply freely and some global constraint would block there-sentences whose semantic representations are not of a certain type.

The details of C and D are not of concern here. If D is correct, then the contrast between (13) and (14) is not a syntactic fact. Therefore, this contrast could not constitute an argument for an autonomous syntax treatment of pronouns. The assumption implicit in Wasow's argument, then, is that B is correct. Here (14) but not (13) meets the structural description of the rule, and the property which distinguishes them is statable without reference to the nature or the scope of the quantifier binding the subject.

Thus Wasow assumes that the crucial difference between (13) and (14) is the "definiteness" of the subject at the time that the rule applies. This means that definiteness must be a syntactic property; we could suppose that there is some feature [+definite] (as suggested in Chomsky (1965)) which distinguishes the pronoun in (13) from the NP someone in (14).

There are at least two problems with this approach. First, there is no reason to assume that definiteness is relevant in defining the class of NP's which can trigger there-Insertion; none of the processes
which have been claimed to be sensitive to the definiteness of an NP have the same distribution as there-Insertion. In fact, there is no evidence for the claim that definiteness is a primitive notion (syntactic or otherwise), since each of these processes delimits a different class.

So, for example, Bach (1971) suggests that only indefinite NP's can occur with else:

25. a. Someone else came
   b. *The man else came

Yet else occurs with universally quantified NP's:

26. Everyone else came

while there-Insertion doesn't:

27. *There is everyone in the room

On the other hand, else does not occur with many:

28. a. *Many people else came
   b. *Some people left, but not many else will

while NP's quantified by many can trigger there-Insertion:

29. There are many people in the room

Similarly, Bach claims that only definites can occur as the object of a performative verb:

30. a. I hereby sentence that man to exile
   b. *I hereby sentence someone to exile

Unlike else, but like there-Insertion, this phenomenon groups universally quantified NP's with definites (as pointed out in McCawley, 1972):

31. I hereby sentence everyone to exile

\footnote{This is discussed in detail in Milsark (1974), who argues that the notion of definiteness does not play a role in characterizing the class of NP's which can occur in there-sentences.}
However, this phenomenon groups NP's quantified by most with indefinites:

32. *I hereby sentence most people to exile

Yet these NP's do not trigger there-Insertion:

33. *There are most people in this room

Of course in each of these cases it could be claimed that the feature [-definite] is a necessary but not sufficient condition for characterizing the co-occurrence restrictions. For example, the ungrammaticality of (28a) can be attributed to an additional constraint that else cannot occur with quantifiers attached to "true" nouns (as opposed to -body, -thing, -one). This constraint seems necessary to account for the contrast between (26) and (34):

26. Everyone else came

34. *Every man else came

But given this constraint, there is no motivation for positing the feature [-definite] to account for the ungrammaticality of (25b):

25b. *The man else came

In other words, the ability of some NP to trigger there-Insertion cannot be determined by a simple syntactic feature which is independently motivated. The fact that each of the above processes defines a different class casts doubt on the claim that there is a syntactic primitive [-definite] to which there-Insertion, or any other rule, is sensitive.

Secondly, this account says nothing about the non-ambiguity of sentences like (21b) and (22b) as opposed to (21a) and (22a):

21. a. @It's likely that someone John likes will be at the party

b. -@It's likely that there will be someone John likes at the party

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22. a. @Someone John likes is likely to be at the party
    b. -@There is likely to be someone John likes at the party

Two approaches could be taken here. The first would be to assume that there is an interpretive rule which ensures that the existential quantifier is within the scope of likely in (21b) and (22b). Thus while the ungrammaticality of (13) would be a syntactic fact the non-ambiguity of these sentences would be a semantic fact. Yet any semantic rule which predicts that the quantifier is within the scope of likely in these sentences would probably also predict that the quantifier must be within the scope of discover in (13):

13. *A burglar_i was shot by the man who discovered that there was him_i in the closet

Since the quantifier in (13) is attached to the subject of the matrix sentence, some other principle would presumably predict that it cannot be within the scope of discover but must bind the matrix subject. (21), then, violates one or the other of these principles, and so there would be no reason to claim that it violates a syntactic constraint.

The second approach would be to assume that there is additionally a syntactic feature [+specific] and that there-Insertion applies only to subjects which are [-specific]. Karttunen (1969a) and Partee (1972) have both noted the unfeasibility of handling the ambiguity of sentences like (21a) and (22a) by means of a binary feature specification. Moreover, this approach would be forced to claim that someone in (35) is [-specific]:

35. There's someone John likes likely to be at the party

Thus there is no motivation for the assumption that the distribution of there-Insertion can be stated in autonomous syntax terms. Given
this, the ungrammaticality of a sentence like (13) does not provide an argument for an autonomous syntax treatment of pronouns.

13.2. Number Agreement Arguments

A second group of arguments against a theory with a syntactic rule of Q Sub concerns the process by which verbs, and, in languages like French, adjectives and participles agree with their subjects. I will refer to both of these as Number Agreement, and will assume that they are the same or related processes.

It is generally assumed that the conditions for Number Agreement are cyclic. Assuming that Passive is a cyclic rule, it can be shown that the NP with which a verb agrees cannot be determined precyclically by considering pairs like:

36. That man \{likes\} those mushrooms
   \{*like\}

37. Those mushrooms \{*is\} liked by that man
   \{are\}

It is somewhat more difficult to show that the conditions for Number Agreement in English cannot be stated post-cyclically. Wasow notes that the NP with which a verb agrees must be determined before Wh-Fronting removes that NP, as in:

38. Which man did Mary say \{*was\} in the closet?
   \{*were\} was

39. Which men did Mary say \{*was\} the closet?
   \{*were\} were

---

The discussion in this section is somewhat oversimplified; there are a number of complexities in characterizing the conditions for Number Agreement, such as its interaction with there-Insertion, which do not seem to bear directly on the choice between a syntactic or an interpretive theory of pronouns. Also I will not discuss the interaction of Agreement with Quantifier Postposing; this is discussed in some detail in Fauconnier (1971) who argues that this interaction poses problems for both theories.
If Wh-Fronting is cyclic, then so must be the conditions for Number Agreement. While it has often been claimed that Wh-Fronting is post-cyclic, the same kind of argument can be made for French by considering Raising, a rule whose cyclicity is generally agreed upon:

40. Un homme semble être {malade} \{*malades\}  
    a man seems to be sick\{-sing.\} \{-*plur.\}

41. Les hommes semblent être {malade} \{malades\}  
    the men seem to be sick\{-*sing.\} \{-plur.\}

Here the number of the adjective in the lower clause is determined by the surface subject of the higher clause.

Yet in a theory with a syntactic process of Q Sub, the number of the NP with which a verb or adjective agrees cannot be determined on the cycle of that predicate. Thus one argument against such a theory, which is a modification of an argument discussed in Fauconnier (1971), concerns the contrast between (40) and (42):\footnote{Depending on the representation of plural NP's, the same argument could perhaps be made by simply considering singular vs. plural NP's (as in (40) vs. (42)).}

42. Tous les hommes semblent être {malade} \{malades\}  
    all the men seem to be sick\{-*sing.\} \{-plur.\}

Both (40) and (42) have a reading in which the quantifier has wide scope. Thus one representation for (40) is:

43. $\exists x: \text{homme}, x S_2(S_3(x \text{ malade}) \text{ sembler})$

and (44) has as a representation:

44. $\forall x: \text{homme}, x S_2(S_3(x \text{ malade}) \text{ sembler})$
The subjects on the $S_3$-cycle are indistinguishable in (43) and (44). These are distinguishable only on the $S_1$-cycle, which contains the QP. However, the number of malade is controlled by the subject on the $S_3$-cycle, and so the contrast between (40) and (42) appears not to be accounted for.

Wasow gives a similar argument. He points out that the pronoun they can have a singular antecedent, as in:

45. A friend of mine, said that they $\{$ were $\}$ coming over for dinner

As (45) indicates, a verb whose subject is they is plural, despite the fact that the antecedent for they is singular. Thus the contrast between (45) and (46) would seem to pose problems for a theory in which Q Sub was a syntactic process:

46. A friend of mine, said that he $\{$ was $\}$ coming over for dinner

The representation for both (45) and (46) is:

47. $\exists x: x$ is a friend of mine $S_2(x$ said $S_3(x$ was coming over for dinner $)$

The subjects in (45) and (46) are identical on the $S_3$-cycle; they are distinguishable only after Q Sub occurs on the $S_1$-cycle and after the unsubstituted variable is converted into a pronoun.

The facts in (36)-(41) indicate only that the NP with which a verb or adjective agrees is determined cyclically. But these arguments both assume that the number of the verb or adjective - and consequently of the NP - must be determined cyclically. It could instead by hypothesized that the predicate is marked with the surface number of its cyclic, or last, subject. I do not mean this as a formulation of the
rule, but simply as a description of the phenomenon. To formulate the rule in such a way that it has this effect involves no complications; almost every current theory within generative grammar includes mechanisms which allow for this type of phenomenon. This is due in part to the fact that there are other processes known to work this way.

Thus Andrews (1971) shows that Case Agreement in Greek — by which a participle is marked with the case of its subject — is this type of phenomenon. If the cyclic subject of some participle is raised into a position where it takes, for example, the dative case, then that participle is marked as dative. It appears then that the correct description of the situation is that participles are marked with the surface case of their cyclic subjects. Given this, it would hardly be surprising to find that Number Agreement works the same way.

What is not at issue here is the question of what kind of theoretical mechanism can describe these phenomena. I believe that any theory which can account for the situation with Case Agreement will allow for Number Agreement to be formulated in such a way that the predicate is marked with the surface number of its cyclid subject. For example, both agreement processes could be formulated as global rules, as suggested in Lakoff (1970b). Baker and Brame (1972) argue that Greek Case Agreement can instead be handled by a feature system which encodes certain derivational information; such a proposal could be extended to Number Agreement.

Fauconnier (1971) formulates Number Agreement as a two-part rule (one part applying cyclically and the other post-cyclically) so that it has this effect. Wasow objects that such solutions are "essentially tricks allowing us to get out of almost any possible ordering paradox". Although Fauconnier's exact formulation might be a trick, it is hoped that the remarks that follow show that the basic insight behind his formulation is not.
Moreover, a theory of the sort outlined in Wasow (1972) and Fiengo (1974) - in which a moved NP leaves a trace in the position from which it is moved - also has the effect of allowing agreement to be determined by the surface number or case of a predicate's cyclic subject.\(^9\) The arguments above that the NP controlling agreement is determined cyclically assume that an NP which is moved by Raising or Wh-Fronting is entirely removed from its original position. If, however, that NP leaves some kind of trace, then both Number Agreement and Case Agreement can be late processes. The verb, adjective or participle will be marked with the number of case of the NP which created the trace.

One additional complexity which should be noted concerns the interaction of Agreement with deletion. Fauconnier (1971) points out that a participle is not always marked with the surface number of its cyclic subject; if that subject is deleted then the participle agrees with the deletion controller. Again, though, this is an instance of a more general phenomenon; Andrews (1971) shows that Case Agreement in Greek also works this way. Moreover, there are several other cases in which a deletion controller acts as though it were in the position of the deletion site (cf. Akmajian (1971) for one example). Any theory which can account for these cases would undoubtedly be able to account for the interaction of agreement with deletion.

Thus the Number Agreement arguments assume that the number of the verb or participle must be determined cyclically; this in turn is based on the assumption that an NP which is removed from some clause does not

\(^9\) Of course there are aspects of the trace theories cited above which are incompatible with a theory in which all rules are syntactic (and with a theory which includes a syntactic rule of Q Sub). Nevertheless, certain aspects of these proposals could be incorporated into a theory in which all rules are syntactic.
act as though it were in that clause with respect to any later processes. There are numerous cases which show that this assumption is untenable; Case Agreement is one of these. Moreover, there are a variety of theoretical devices to account for these cases. This means that there is no reason to conclude that Q Sub is not a syntactic rule on the basis of its interaction with Number Agreement.

13.3. Direct Object Pronouns

Wasow's third argument concerns the constraint discussed in Ross (1967) which, roughly speaking, blocks sentences in which a pronoun which is an underlying direct object does not immediately follow the verb. Thus Ross notes contrasts like the following:

48. a. I gave the book away
   b. I gave away the book
   c. I gave it away
   d. *I gave away it

49. a. I told the stories to the children
   b. I told the children the stories
   c. I told them to the children
   d. *I told the children them

The exact formulation of the constraint is not relevant here. The contrast between the (c)-sentences and the (d)-sentences indicates that the constraint must take into account the position of the pronoun; the contrast between the (b)-sentences and the (d)-sentences indicates that the constraint must distinguish between pronouns and full NP's.

Ross claimed that the constraint holds for surface structure. However, Wasow argues that the constraint must actually be cyclic. His
evidence for this is based on the fact that, when a rule applying on a higher cycle removes the material intervening between a verb and a pronoun, the violation remains. So, for example, while (50b) is somewhat bad, (51b) is significantly worse.10

50. a. It's hard to tell those children the stories
    b. ?*Those children are hard to tell the stories

51. a. *It's hard to tell those children them
    b. *Those children are hard to tell them

The contrast between (50b) and (51b) is not accounted for if the constraint holds for surface structure alone since the pronoun in the surface structure of (50b) does not directly follow the verb. However, on the tell-cycle there is an NP between the verb and the pronoun. Hence the claim that the constraint is cyclic accounts for this contrast.

Yet a theory with a syntactic process of Q Sub cannot maintain that the constraint is cyclic, since pronouns and full NP's are not distinguished on the relevant cycle. Consider, for example, the contrast between (52a) and (52b):

52. a. The stories are so scary that it would be hard to tell them to the children
    b. *The stories are so scary that the children would be hard to tell them

Both sentences have as one possible representation roughly:

53. Tx
    (stories) $S_2$x is so scary that $S_3$( $S_4$( to tell x to the children)
    is hard )

The constraint must hold after Dative Movement has applied on the S4-cycle, but before Tough-Movement on the S3-cycle has removed the intervening NP. But on the S4-cycle x is neither a pronoun nor a full NP,
but rather a variable. Before the application of Q Sub it is indistinguishable from the corresponding variable in a sentence like (50b):  

50b. ?*Those children are hard to tell the stories

Like the arguments based on Number-Agreement, this argument assumes a theory in which, once an NP is removed from some clause, it does not behave as though it is in that clause with respect to later processes. But a closer look at this constraint's interaction with Tough-Movement shows that the constraint cannot in fact be cyclic, and suggests that the framework assumed by Wasow is not correct. If the constraint holds cyclically, and if pronouns and full NP's are distinguished cyclically, then the violation should remain when the pronoun rather than the intervening NP is Tough-Moved. The fact that there is no contrast between (54b) and (55b) shows that this prediction is incorrect:

54. a. It would be hard to tell the children those stories  
   b. ?Those stories would be hard to tell the children

55. a. *It would be hard to tell the children them  
   b. ?They would be hard to tell the children

Wasow's claim that the constraint is cyclic, combined with the assumption that pronouns and full NP's are distinguished cyclically, predicts that (55b) is ungrammatical, just as (54b) is. On the tell-cycle the pronoun does not immediately follow the verb. It is only after the application of Tough-Movement on the higher cycle that the pronoun is removed from this position. Notice that Ross's claim that the constraint holds for surface structure accounts for the grammaticality of (55b), but it of course fails to account for the ungrammaticality of (51b).

It is not clear exactly how the constraint should be formulated
to account for the difference between (51b) and (55b). (This is dis-
cussed in greater detail in Jacobson (1977)). Interestingly, a theory
in which a moved NP leaves a trace accounts for this if the trace is
not treated as a pronoun. Thus in the surface structure of (51b) a
trace intervenes between the verb and the pronoun:

56. those children are hard to tell them

and so a surface constraint will block (56). The surface structure of
(55b) does not violate the constraint since there is no pronoun sepa-
rated from the verb, but rather a trace:

57. they would be hard to tell the children t

It is also possible that the constraint could be formulated globally to
account for this contrast.

Regardless of the exact formulation of the constraint, the con-
trast between ((55a) and (55b) indicates that the cycle of the verb is
not the only relevant level in the statement of the constraint; (55a)
and (55b) are indistinguishable on this cycle. Given this, there is
no reason to conclude that a theory with a syntactic rule of Q Sub -
in which pronouns are not cyclically distinguished from full NP's -
cannot handle this constraint.
References


Hintikka, Jaakko and Esa Saarinen (1975). Semantical Games and the

Horn, Laurence (1972). On the Semantic Properties of Logical Operators
in English. Dissertation, U.C.L.A. Reproduced by Indiana
University Linguistics Club, Bloomington, Indiana.

Jackendoff, Ray S. (1972). Semantic Interpretation in Generative


_________ (1977). "Some Implications of *I gave Mary it" to appear in
Papers from the Third Meeting of the Berkeley Linguistics Society.

Karttunen, Lauri (1969a). Problems of Reference in Syntax. Unpub-
lished ms.

_________ (1969b). "Pronouns and Variables" in R. Binnick, A. Davison,
G. Green and J. Morgan (eds.), Papers from the Fifth Regional
Meeting Chicago Linguistic Society, pp. 108-16.

_________ (1971). "Definite Descriptions with Crossing Coreference" in
Foundations of Language 7, pp. 157-82.

Inquiry 3, pp. 413-61.

of Language 7, pp. 183-98.

Kuno, Susumu (1975). "Three Perspectives in the Functional Approach to
the Parasession on Functionalism, Chicago Linguistic Society,
pp. 276-336.

Lakoff, George (1968). Pronouns and Reference. Reproduced by Indiana
University Linguistics Club, Bloomington, Indiana.

_________ (1970). "Linguistics and Natural Logic" in Synthese 22,
pp. 151-271.


Command" in D. Reibel and S. Schane (eds.), Modern Studies in

Lasnik, Howard (1976). "Remarks on Coreference" in Linguistic Ana-
alysis 2, pp. 1-22.

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