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THE PARSING OF ANAPHOR BINDING
& LEVELS OF REPRESENTATION

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0.0 Introduction

The, by now traditional, Binding Theory (Chomsky 1981) suffers from a number of inadequacies. Many of these have been discussed in the literature (Aoun 1986; Barsa & Lasnik 1986; Kayne 1984; Higginbotham 1983 and Reinhart 1983) and a number of alternative views of binding theory have been proposed. Nevertheless, even for English, a consistent account of the entirety of the data has not been achieved.

I will begin this paper by examining the main areas of inadequacy of the 1981 (henceforth "standard") version of the binding theory. Two of the central issues which arise, concern a) the level(s) of representation at which the principles of the binding theory apply and b) the way in which the A/A bar distinction is encoded in the binding theory. The primary concern of this paper will be to examine the psycholinguistic evidence relating to these two areas. I will focus on the parsing of sentences containing

* This paper was written in 1988 as a Umass general. I would like to thank the members of my committee, Juan Uriagereka and Edwin Williams and especially the chair Lyn Frazier who has spent hours discussing the issues with me then and since. I would also like to thank Gautam Sengupta and Jim Blevins for interesting discussion as well as everyone I bothered for judgements. All mistakes and inconsistencies are, of course, mine. Part of this work was completed while I was in receipt of a Foreign Fellowship from the American Association of University Women to whom I am very grateful.

anaphors.¹ These will be used as a window through which some central issues in binding theory may be studied.

During the paper I will lay out an approach to the parsing of anaphors. The correct formulation of the parsing principles involved will lead us to certain conclusions about what the parser is like, what the grammar is like with respect to the aforementioned issues and the interaction of the parser and the grammar.

Before discussing the psycholinguistic data which consists of evidence from a questionnaire and the intuitions of myself and others it will be necessary to examine, in some detail, the syntactic problems which arise in the binding theory. In order to do this I will discuss two proposed revisions of the standard binding theory. These were chosen because they contrasted in a number of crucial respects including both their approach to the A/A bar distinction in binding and the manner in which binding applies, derivational versus representational.

The two theories, those of Riemsdijk & Williams (1981) and Barss (1985) agree that it would be desirable for all the principles of the binding theory to apply at a single level of representation. They disagree as to which one it should be. An important issue in the study of parsing is what representations the parser needs to have access to. The answer to this question should shed some light on the actual organisation of the grammar. This motivated the choice of the theories to be discussed and we will be in a position to answer this question at the end of the paper.

As far as the parsing of anaphors is concerned, little work has been done in the area. Work by Janet Nicol (1988) suggests that only grammatically licenced antecedents are accessed in the parsing of anaphors but no analysis is given of how this is accomplished. Work by Cowart & Cairns (1987) provides evidence that when the parser encounters a pronoun, a search for an antecedent is initiated. I will suggest that a similar search occurs for antecedents to anaphors.

Much of the parsing analysis will concern the question of preferred interpretation in binding sentences. One parsing principle which has been used

1. The principle reason for this is that anaphor binding is probably the most problematic area in binding theory, particularly with respect to levels of representation. Another reason is space but I will discuss pronoun binding and principle C where necessary.

with success to explain interpretation preferences in extraction domains is the Minimal Chain Principle (De Vincenzi 1988). This principle, based on an idea in Frazier (1987) is as follows:

- (1) Minimal Chain Principle
Avoid postulating unnecessary chain members at S-structure, but do not delay required chain members.

In the section on parsing I will discuss whether it would be possible to exploit this independently motivated principle.

0.1 Structure

The structure of this paper will be as follows. In section one, I will review some of the problems with the traditional Binding Theory. Next, I will look briefly at some of the attempts to deal with them. In the following section (2) I will consider in turn, the two syntactic theories of binding mentioned above. To conclude that section I will discuss the different claims which the two theories make about the organisation of the grammar with respect to binding theory.

In section three we will discuss the results of a questionnaire and formulate a parsing approach, based on a few simple principles which account for why sentences containing anaphors are interpreted in a particular way. It will be seen that the Minimal Chain Principle taken as it stands, will not be of much help although in a modified form it may be used to explain certain aspects of the parsing analysis.

Having elaborated a view of the parser it will be possible, in section four, to determine certain facts about the syntax of binding. We will conclude the paper by determining a) at what level the binding principles should apply b) whether the A/A bar distinction is relevant to the binding of anaphoric elements and c) whether binding is better accomplished within the grammar by a derivational or a representational approach.

It will also be possible to draw some conclusions about the interaction of the parser with the grammar.

1.0 Background: The Binding Theory 1981 and its problems.

In this section I will identify three main problem areas for the Binding Theory 1981 and discuss each of them in turn.

The first type of problem relates to the difficulty in determining which is the appropriate domain for an element to be bound in. The second problem area concerns the level of representation at which the principles of the Binding Theory should apply. The third set of problems relates to the dominance and precedence relations which need to be considered in elaborating the principles of the theory.

1.1 Binding Domains

Perhaps the most often discussed problem with the standard Binding Theory is that it incorrectly predicts a complementarity of occurrence between pronouns and anaphors. One version of the Binding Theory in Chomsky (1981) is as follows:

- (2) Condition A: An anaphor is bound in its governing category
 Condition B: A pronoun is free in its governing category
 Condition C: An R-expression is free

where: α is the governing category for β iff α is the minimal category containing β and a governor of β , where $\alpha = NP$ or S .

This theory predicts that either (3) or (4) should be ungrammatical.

- (3) John likes those pictures of him
 (4) John likes those pictures of himself

By and large, of course, pronouns and anaphors are in complementary distribution in English. This complementarity breaks down however, when the pronoun/anaphor is embedded inside another phrase as it is here. One solution to this problem is to say that the larger phrase may sometimes count as a binding domain itself, but at other times it may not. This is essentially the solution adopted in Chomsky 1986.²

Another problem with domains arises in cases like (5). As far as I am aware this type of data has not been discussed in the literature but in (5) the anaphor

 2. It is possible to count the NP "pictures of ..." as the binding domain of the pronoun in 3) but not of the anaphor in 4) because the theory requires an anaphor to be bound. It is therefore incompatible with the theory for the NP "pictures of himself" to be a binding domain for himself since the anaphor cannot be bound in that domain. In 3), on the other hand him may be free in "pictures of him" and since this is compatible with the theory, the larger NP may be a binding domain for the pronoun.

appears to be able to be bound in either of two domains.^{3 4}

- (5) John and Bill thought that the men were kissed by each other's wives

Here, the antecedent of each other can be either the men (as predicted by the theory) or John and Bill. In this case what is to be accounted for is that the men does not induce a violation of the Specified Subject Constraint⁵ when John and Bill is taken as the antecedent. Compare (6) where a true Specified Subject Constraint violation occurs.

- (6) * They expected me to point the gun at each other

1.2 The Binding Theory and its level of application.

One plausible view (and one that several have found attractive) is that it would be desirable to be able to say that the principles of the Binding Theory apply at a single level of representation. Within the traditional Binding Theory this was a difficult thing to do.

In some cases, the principles appear to apply at D-Structure (or a structure which reconstructs this).

- (7) John knows which picture of herself Mary likes best

At S-structure, the anaphor has been moved out of the c-command domain of its antecedent Mary. In other cases, however, it appears that the principles must be allowed to apply later in the derivation. In (8) the anaphor is bound after movement by a subject which was not within its binding domain at D-structure, as can be seen by comparing (8) and (9).

- (8) John knows which picture of himself Mary likes best

3. In the presentation of data which is my own I will not annotate the examples. While I accept that not all readers will find the sentence in (5) grammatical on both readings I prefer not to bias the reader by indicating this. The text will usually make clear what my own judgement is and in nearly all cases I found at least some other speakers who agree with me.

4. Examples like (5) bear a striking resemblance to examples in Chinese, first discussed in Shen (1990) and again in Tang (1989). In Chinese ziji, an anaphor, may be bound by a subject outside of the local domain, even when a closer binder is available. However, this is only possible when the two binders agree in gender and number.

5. The Specified Subject Condition was first laid out in Chomsky (1973) and in the '81 theory it was encoded in the notion of SUBJECT which was incorporated into the Binding Theory.

(9) * John knows Mary likes that picture of himself

In other words, movement of the phrase containing the anaphor appears to have avoided the violation of the Specified Subject Condition (SSC) which would otherwise have arisen. To account for the grammaticality of (8) the theory must ignore the D-structure position of the anaphor while to account for (7) it is allowed to consider that position.

The most often proposed solution to this dilemma is to say that Binding Theory applies at LF. This means that the cases where S-structure is relevant can easily be dealt with. The cases where D-structure position is important are then dealt with by the introduction of a rule known as Reconstruction. This allows for part of a moved wh-phrase to be put back in its D-structure position before the principles of Binding Theory apply. Various versions of this rule have been proposed, one version discussed in Riemsdijk & Williams (1986 p212) can be seen in (10).

(10) Wh-Interpretation Rule

[COMP[...[_b ...]_b...]_i]COMP ...e_i ...

Where b is a wh -phrase^a, replace e_i with a ,
replace b with x_i and place $?x_i N^i$ in COMP, where
 N^i is the head of b . Or, if $b_i = who$, place
 $?x_i[x_i:person]$ in COMP.

There is much to say about this area but it has been discussed more fully in various other places (see for example chapter 3 of Uriagereka (1983)).

1.3 Dominance, Precedence and the Binding Theory

In constructions where Wh-Movement is not involved it is generally the case, in English, that an antecedent precedes the anaphor it binds. Within the Binding Theory the requirement that a binder must c-command its bindee will entail that in most cases its antecedent will precede an anaphor. We have seen cases (7) where this was not true at S-structure but where they could be ruled in because the c-command requirement was met at D-structure. There are some other cases where the c-command requirement does not hold at S-structure and some of them have been explained in a similar way. In general, sentences containing "Psych" verbs⁶ have this property. Thus (11), purportedly, is markedly better than (12).

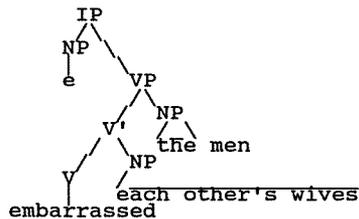
6. This name was given by Postal (1971) who first discussed the properties of these verbs. This includes the class now often referred to as "Experiencer" verbs.

(11) Each other's wives embarrassed the men

(12)* Each other's wives murdered the men

One approach to the grammaticality of (11) has been to say that in this construction the surface subject originated in a D-structure object position, from which it could be c-commanded by its antecedent. This is the approach taken in Belletti and Rizzi (1988) in which the D-structure for (11) is assumed to be as follows:

13)



They assume that in this type of construction the experiencer NP remains in position while the theme moves to subject position. A rule of A movement is posited in this case rather than A bar movement but the explanation depends on the D-structure in the same way that the explanation for (7) does.

However, as we will see later, this approach to Psych verbs is not without problems and we need to ask ourselves whether the c-command requirement is perhaps too strict.

The traditional Binding Theory, in some sense, makes it accidental that an antecedent precedes its anaphor. The theory has no means of predicting the fact that while (11) may be grammatical (14) is much better.

(14) The men were embarrassed by each other's wives

We might think that (14) is to be preferred because the c-command requirement holds at S-structure, but we should consider the possibility that antecedent anaphor relations are simply preferred when the antecedent precedes -as the traditional name would suggest. It has often been suggested that in many languages what is now termed "backwards anaphora" is simply not accepted (see Mohanan (1982) for such a restriction on pronouns in Malayalam).

2.0 Revisions of the Binding Theory.

It seems fair to say that, of those mentioned above, the problem of the level of application of the Binding Theory has been taken to be the most serious, in particular that aspect of it which has come to be known as the Reconstruction problem. It is this issue which many of the major revisions of the theory have addressed most centrally. In this section I will consider in turn two theories which address this issue in quite different ways.

The first theory to be discussed is the theory of binding of the NP-Structure model of grammar (Riemsdijk & Williams 1981). This is a derivational approach to binding which seeks to apply all the principles of the binding theory at a single level of representation. The level to which they are said to apply, in this account, is the level of NP-structure. This level of representation is motivated partly on the basis of binding facts. As a consequence of treating binding at this level certain distinctions between A and A bar binding disappear. At the level at which binding applies it is not possible to tell either whether a binder or a bindee will be in an A or an A bar position at S-structure. Nevertheless the separation of A and A bar movement into distinct components of the grammar makes it particularly salient in other ways.

The second theory to be discussed is that of binding by Chain Accessibility Sequences (Barss 1985). This is a representational approach based on Kayne's path theory (Kayne 1984). This account of binding also seeks to apply binding at a single level of representation, this time S-structure. Since elements are bound in their surface positions in this approach, it becomes necessary to unify the A/A bar distinction of anaphoric elements. On the whole this theory does a good job but still leaves a few gaps in the data.

I will outline the theories in turn, mentioning the difficulties that each claims to be able to deal with. In each case I will also examine the ability of the theory to deal with certain problems of my own concoction. Finally, at the end of the section, I will compare the two theories briefly.

2.1 Binding at NP-Structure

The theory of NP-Structure (Riemsdijk & Williams 1981) differs from the theory in LGB (Chomsky 1981) in one major respect. Although it posits both A and A bar movement, just as LGB does, the essential difference between them is that in the former the output of A

movement is said to constitute a linguistic level of representation- a level known as NP-Structure. In LGB on the other hand, the output of A movement is merely an intermediate stage in the derivation from D-structure to S-structure and has no theoretical significance. Once NP-structure has been recognised as a level it is possible that certain processes take place at that level. Riemsdijk & Williams propose just this. For them, NP-Structure is the level at which Binding and other processes such as Predication take place. If the binding principles apply at NP-Structure, Riemsdijk & Williams claim, it will not be necessary to introduce a rule of Reconstruction at LF.⁷ Cases such as (15) would be dealt with automatically, because Binding would apply before Topicalisation moved the anaphor out of the c-command domain of its antecedent.

(15) Pictures of themselves, they liked best of all

Cases like (7) would be dealt with in the same way but, of course, examples like (8) where surface binding occurs will not be so easy to deal with. This theory also claims to be able to explain crossover restrictions in a much more coherent manner. One simple explanation of crossover restrictions equates the status of (16) and (17) (Riemsdijk and Williams's (32) and (33)) with (18) and (19) (their (35a) and b)).

(16)* Who do you think he⁸ likes?

(17) Who thinks he likes wine?

(18)* Do you think he likes John?

(19) John thinks he likes wine

In this treatment of crossover, wh-traces are variables and these behave just like R-expressions with respect to the Binding Theory. The variables in (16) and (17) would be wrongly bound by the pronouns, just as the R-expressions are in (18) and (19). However, this explanation falls down in (18) (Riemsdijk & Williams's (36)) unless Reconstruction or something similar is resorted to.

(20)* [Whose mother]_i do you think he likes [e]_i?

In (20) the trace is not the variable bound by whose.

7. Indeed, for them the level of LF itself may be dispensed with in the end.

8. Underlining here and in other examples indicates intended coreference.

However, if Binding Theory applied at NP-Structure (20) could be treated parallel to (16) and (18), without resort to special mechanisms. In this case the Wh-expressions themselves in (16) and (17), would be improperly bound by the pronouns. In (19) the wh-word whose rather than the whole wh-phrase, would be incorrectly bound by a coreferential he.

Riemsdijk & Williams give many other reasons for positing a level of NP-Structure but the main thrust of all their arguments which relate to Binding Theory depends on the desirability of dispensing with Reconstruction and like mechanisms. However, they point out some data which might be a problem for their account of binding relations though they claim it does not decide between their model and a T model with Reconstruction. In these examples, an NP embedded within a moved wh-phrase must be prevented from undergoing Reconstruction with the rest of the phrase. An example of this can be seen in (21) (Riemsdijk & Williams's (86b)).

(21) Which picture that John saw did he like best?

As Riemsdijk & Williams point out, the pre-Wh-movement structure of (21) does not allow coreference between he and John. They point out that any filter preventing Reconstruction in certain cases would be a purely *ad hoc* device and that due to this fact, the data would be just as problematic for both theories. They note several facts about the relevant data, among them that the depth of embedding of the NP which must resist reconstruction is of particular relevance and that only definite anaphora are involved, since wh-movement can never change the ability of a quantified NP to bind a pronoun.

Riemsdijk & Williams admit that their model cannot account for all the data, they propose "that coreference possibilities between definites can be readjusted on the basis of S-structure linear order" in their model. Without going into the details of their proposal it seems clear that any data which might be accounted for in this way might also be susceptible to a parsing explanation, I will therefore postpone further discussion of this data till section three.

We might usefully ask, at this point, whether this last set of data falls into a class with examples like (9) (repeated here for convenience).

(9) John knows which picture of himself Mary likes best.

For a model with Reconstruction this would certainly seem to involve an NP which had to be exempt from Reconstruction. Here, of course, the exemption would be necessary to enable binding of the anaphor, rather than to prevent it, as in (21). We might consider too, the possibility that this type of example could be accounted for on the basis of linear order at S-structure. I postpone discussion of this matter too, until the following section.

2.1.2 Other types of data.

I would now like to examine some more of my own data which I consider to be problematic for the Binding Theory. I will then discuss whether the data will be equally problematic for the NP-structure account of binding.

One problem that any binding theory must account for is the ambiguity found in (22).

- (22) John liked every picture of himself that Bill had ever taken

This is in contrast to the lack of ambiguity in (23).

- (23) John liked every picture that Bill had ever taken of himself⁹

In (22) the antecedent of himself may be either John or Bill, while in (23) the only possible antecedent is, Bill. (23), in fact, behaves just as expected and the NP-Structure model can deal with it unproblematically. As for (22), their treatment of it would depend on their analysis of Relative Clause Formation. Assuming that this involves actual movement of a wh-phrase

 9. One might consider the possibility that (23) arises from the application of Extrapolation to (22) and that this process gives rise to the difference in coreference possibilities. One reason that I will assume that this is not the case is that the coreference possibilities are fewer in (23) than in (22) whereas in other cases of Extrapolation they remain the same. Another reason is that (i) is unambiguous.

- i) John listened to every joke that Bill knew about him

The only possible (sentence internal as opposed to discourse) antecedent for him is John. If (i) were derived via extraposition of the "of-phrase" from the head then the sentence ought to have a reading in which Bill is the antecedent of him. If the PP had come from inside an NP "every joke about him" then it should be free in its binding domain and therefore able to take either John or Bill as its antecedent. Since the latter reading is unavailable it must be the case that the binding domain for him is the lower clause within which it must be free. Another reason why (23) should not be derived via Extrapolation will be discussed in section 2.2. (22) and (23) must derive then, from distinct D-structures and in one of them the PP must be an independent constituent which is outside of the NP every picture. For arguments that complex NP's containing "of" phrases must be susceptible to two syntactic analyses, the reader is referred to Horn (1974).

followed by its deletion¹⁰ then when Binding takes place at NP-Structure the deleted NP picture of himself would still be in its D-structure position as in (24).

- (24) John liked [every picture of himself _{α} that Bill had ever taken wh picture of himself _{β}]

Bill can, of course, bind himself in this configuration, just as John can bind himself. However, there must be some mechanism by which either instance of himself can pass its index onto the other.¹¹ It can be ensured that each of the NPs himself does not receive a different index for, were this to happen, the necessary deletion rule which follows Relative Clause Movement, would be blocked. This is due to the identity requirement which operates under the principle of Recoverability of Deletion.

It must be the case then, that the anaphors have access to an index-sharing mechanism for the NP-structure binding approach to work here. Notice though, that such a mechanism is no less necessary for a treatment in which the provision of one reading is made possible only by the application of Reconstruction. One small difference is that the mechanism would seem to be required earlier (since binding applies earlier) in the Riemsdijk & Williams approach.

Before continuing, I would like to say a word about the problems which are encountered in accounting for the ambiguity in (22) if a different approach to Relative Clauses is taken.

Chomsky, (1986b p85) has suggested that relative clauses may be derived by the base-generation of an empty operator which moves into spec of Comp. If this was correct, whether Reconstruction was available to us or not, we would have no explanation of the possibility of taking the lower antecedent in a case like (22). It does not seem possible to reconstruct an anaphor inside of an empty operator solely so that this might be bound by the subject of its clause in order to pass its index on to another anaphor in the head of the relative. Chomsky's suggestion that relative clauses may either be viewed as involving empty operators or wh-phrases

10. This is the type of analysis which they use in their book (Riemsdijk & Williams (1986), Chapter 3) although in discussion of the NP-structure approach to grammar they express doubt as to whether actual movement need take place.

11. This might be a case where the Binding/Linking distinction would be relevant. Both Bars and Williams (in later work) adopt the Linking framework of Higginbotham (1983)

simply cannot be correct. Only the latter is a possibility.

It should be noted that this type of construction bears some similarity to the problematic construction in (21). In a standard model, NPs in A bar positions are not covered by the Binding Theory. Since the head position of a relative clause might be regarded as an A bar position, a model with Reconstruction might try to account for the reading of (22/24) in which John is taken as the antecedent of himself by saying that it arises when a moved wh-phrase containing an embedded NP (the anaphor) blocks Reconstruction of that NP when the rest of the phrase is reconstructed. However, since the other reading is also available, the filter required to block Reconstruction, in this way, would have to be made optional under certain circumstances. The NP-Structure account can neatly avoid this problem, at least. Notice too that on the NP-Structure model, binding relations do not normally involve A bar positions but this is simply because of the level at which binding applies. The theory does not need to specifically exclude NP's in A bar positions and this is why the account suggested above can go through.

2.1.3 Recap

To recap briefly, the main advantages of the NP-structure application of the Binding Theory is that it admits a very simple explanation of cases where binding appears to have applied at D-structure. This in turn, makes for a tidy treatment of crossover facts. The theory is however unable to deal straightforwardly with cases in which binding is done off S-structure.

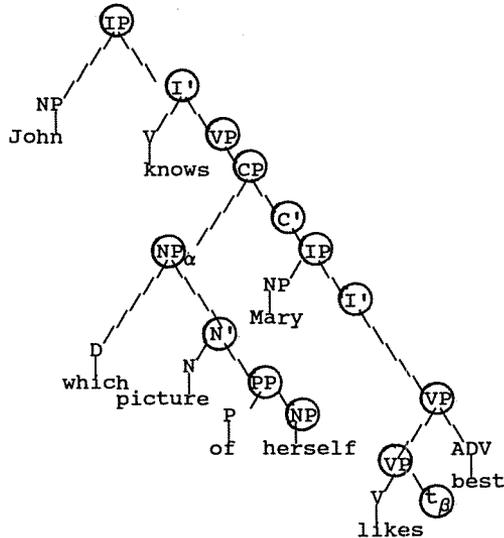
2.2 Chain Accessibility

The chain accessibility Condition is a convention introduced in Barss (1985). Barss, like Riemsdijk & Williams, argues strongly against Reconstruction as the solution to the problems with the Binding Theory mentioned in section 1. Unlike Riemsdijk & Williams, whose main argument against Reconstruction was one of simplicity, Barss argues that many of the proposed accounts of Reconstruction are incoherent in that they are incompatible with accepted principles of the Government and Binding framework. Like Riemsdijk & Williams, Barss believes that the Binding Theory should apply at a single level of structure. He believes that the level is S-structure (at least for anaphor binding).

In Barss's system anaphors are licenced when they are able to access an antecedent. Pronouns are licenced only when they are unable to access an

antecedent via the same procedure. The accessing of an antecedent is done by following a path (known as a Chain Accessibility Sequence) usually from node to node up a tree. Crucially however, for cases that would otherwise require Reconstruction, the path followed from an anaphor may contain sub-paths which are non-contiguous. When the path contains a node which is a member of a chain, the path may stop and start again at a co-node in the chain. The simplest way to illustrate this mechanism is with a concrete example. Consider example (8) again and the tree of its S-structure (25).

(25)

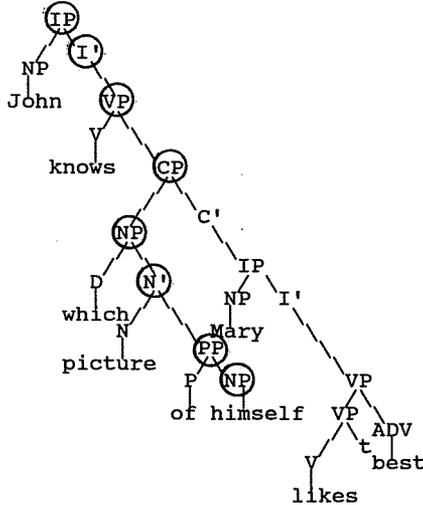


In (25) the Chain Accessibility Sequence contains the circled nodes. The sequence begins with the anaphor and proceeds upwards via successively immediately dominating nodes, until the node NP is reached, at this point the sequence may move to the t node, marked β which is in a chain with α . The sequence proceeds upwards as before, it ends at IP. The chain therefore includes I' which is a sister to the antecedent Mary. In this instance Mary is chain accessible to herself because the Chain Accessibility Sequence contains a) the anaphor, b) a projection of the governor of the

anaphor and c) a sister of the potential antecedent¹² (Mary).

The mechanism which Barss develops can deal equally well, with cases like (9) where the surface position of the anaphor counts. The tree is the same as in (25) but with a masculine rather than a feminine anaphor.

(26)



Once again, the Chain Accessibility Sequence begins at the anaphor. Here though, it does not break as it did before but continues until the highest IP node past I' which is a sister to the potential antecedent John. Since the Chain Accessibility Sequence contains a projection of the governor of the anaphor (PP), John is chain accessible to himself.

12. The precise formulation of the conditions (p96) is as follows:

Chain Accessibility Sequence (definition)

$S = (a_1, \dots, a_n)$ is a well-formed chain accessibility sequence for an NP

A only if:

- i) A is a_1
- ii) some a_i is a projection of the governor of A
- iii) for every pair (a_i, a_{i+1}) , either (1) or (2):

- 1) a_i immediately dominates a_{i+1}
- 2) (a_i, a_{i+1}) is a link of a well-formed (A' or A) chain

Chain Accessibility (definition)

B is chain accessible to A through an accessibility

sequence $S = (a_1, \dots, a_{i+1}, \dots, a_n, \dots)$ such that:

B is a sister to some a_j in S

One appealing feature of this system is that it allows an anaphor access to more than one potential antecedent. We have seen in the preceding discussion that this is sometimes necessary for anaphors as well as pronouns. One of the ways Barss does this is by incorporating the notion of Complete Functional Complex (CFC) (Chomsky 1986c) into his definitions. He requires that the final member of any Chain Accessibility Sequence be the root node of a Complete Functional Complex. Any accessible antecedent within that Chain Accessibility Sequence will be licenced. However, it is important that the system be able to account for cases where only a subset of a number of potential antecedents is actually accessible. This is done by capturing the notion of governing category within the definitions, in requiring "minimal" chain accessibility. When several Chain Accessibility Sequence's are available in a tree, if one of them is a proper subpart of another, then only antecedents contained within the smaller are "minimally" chain accessible. This still permits more than one licit antecedent under the right circumstances. For example Barss predicts that the sentences in (27) will both be ambiguous (although he only gives examples like b)).

- (27)a. Sue knows which picture of herself Mary likes best¹³
 b. Which picture of himself does Bob think Joshua likes?

In (a) since the anaphor in its surface position cannot be bound and since this is incompatible with the Binding Theory, a minimal Chain Accessibility Sequence must be created which reaches as far as the next Complete Functional Complex. Through this Chain Accessibility Sequence Sue should be accessible to herself. Notice however, that it is only from the anaphor's surface position that the lower clause appears not to be Binding Theory compatible. There is, however, a Chain Accessibility Sequence available from the surface position through which the anaphor can be bound in a manner compatible with the Binding Theory.

In b) neither of the Chain Accessibility Sequence's which licence either Bob or Joshua is a subsequence of the other so both are accessible. However, in (27b) the question of the Binding Theory-incompatibility of the clause within which the anaphor is contained at S-structure does not arise, since this is the largest domain available. Notice however, that it is crucial for Barss that whenever an NP moves through

 13. This type of example was first discussed in Jackendoff (1977).

a position on its way up a tree, binding must be licenced from that position and this can only be done by allowing an extension of the binding domain. If this were not possible Bob would not be an accessible antecedent in (27b).

Barss argues against explaining the ambiguity of (27b) by allowing the Binding Theory to apply successive cyclically. He points out that this could in principle be done without globality, if a feature marking system were used (akin to the τ marking system of Lasnik & Saito (1984)). He claims however, that this approach can be independently ruled out, given the ungrammaticality of (28).

- (28) *The men think that John was kissed by each other's wives

Barss argues that in the D-structure representation of (28) the minimal Binding Theory-compatible Complete Functional Complex is the matrix IP and that the men would be an accessible antecedent to each other, wrongly predicting the sentence to be good. He contrasts (28) with (29) where the derived subject antecedes the anaphor.

- (29) John thinks that [the men were [kissed t] by each other's wives]

Here the Binding Theory must apply at S-structure by which time the minimal Complete Functional Complex is the lower IP so that the men is an accessible antecedent. This point seems reasonable and Barss is not the first to make it (Barss attributes this observation to Jacobson & Neubauer (1976)). Compare (29) to the example given in (5) (repeated here) where it was claimed that some speakers accept the higher antecedent. Although (28) is undoubtedly ungrammatical, any binding theory which will rule it out will also rule out (5).

- (5) John and Bill think that the men were kissed by each other's wives.

Let us now reconsider the case of multiple binding in (22) (repeated here for convenience).

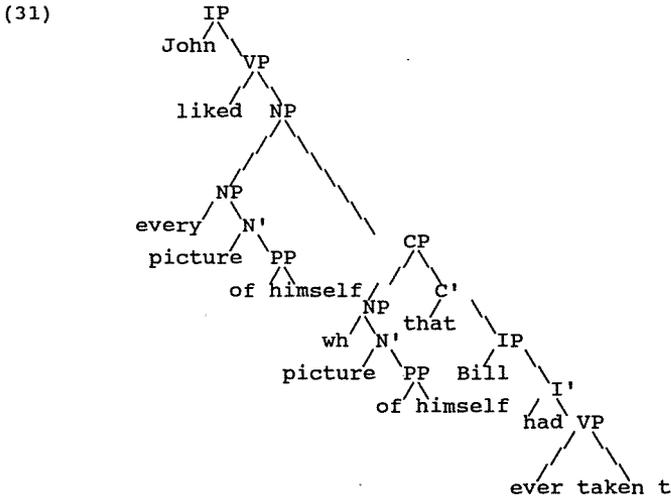
- (22) John liked every picture of himself that Bill had ever taken.

Under the analysis of relative clauses which was standard until the '80s the s-structure of (22) was (30).

- (30) John liked [every picture of himself [which picture of himself [that Bill had ever taken t]]]

Barss's theory can deal with the ambiguity of (22) in a way very similar to the one outlined for Riemsdijk & Williams. For Barss, nothing special needs to be said about the Chain Accessibility Sequence leading from himself in the head position and ending with the IP dominating John. In the same way, a path leads from himself, in the wh-phras in spec, up to the NP immediately dominating the whole wh-phrase and then to the trace position from which it further extends to Bill. Barss needs to invoke the same kind of condition required in the Riemsdijk & Williams theory to account for the impossibility of different antecedents for each case of himself.

In fact though, there is another way in Barss's theory to derive the ambiguity of (22). Consider the s-structure tree for (22).



What is the appropriate binding domain for the anaphor himself? If we follow the logic used to explain the ambiguity of (27) the binding domain may be extended to the upper IP since the CP containing the anaphor is not a Binding Theory-compatible Complete Functional Complex. If this is the case, then there are two separate Chain Accessibility Sequence's for himself neither of which is a subpart of the other. Through

these two Chain Accessibility Sequence's different antecedents are available to the anaphor, in one case John and in the other Bill. This treatment avoids the possibility of himself being assigned two different antecedents. One or other of the antecedents will be accessed and whichever one it is will pass its index on to himself before deletion.

Recall the contrast between (22) and (23). (23) (repeated below) can also be handled as it was in the Riemsdijk & Williams approach.

- (23) John liked every picture that Bill had ever taken of himself.

In this case, since the anaphor is not moved along with the wh-phrase, the lower clause is the only appropriate binding domain. As a result, Bill is the only accessible antecedent. However, one problem arises for Barss here, he must be able to ensure that (23) could not be derived via Extraposition (as discussed in fn 8). If this were feasible, we would expect the ambiguity of (22) to re-emerge in (32) when the latter was pronounced with the appropriate prosody. This prediction seems to be false. However, we may wish independently to rule out the possibility of such an extraposition. (32), where the presence of an adjunct clearly shows that the "of" phrase has been extraposed, is ungrammatical.

- (32)* John liked [[every picture] that Bill had ever taken t [t]_{pp} in the nude [of himself]

The last set of problems for Barss's theory which I would like to draw attention to, lies in the realm of the application of condition B. The first thing is that, as Barss himself observes, multiple binding domain effects do not occur with pronouns. In other words, when a pronoun inside a wh-phrase has passed through an intermediate spec position in which there is a c-commanding coreferential NP, the sentence is not ruled out as a condition B violation. The grammaticality of examples such as (33) demonstrates this.

- (33) John never knew quite how many pictures of him Mary had taken

In this case, despite the fact that the pronoun is outside the lower Complete Functional Complex, the binding domain is not extended to the higher clause. Barss is required to revise his theory in order to account for this; he defines condition B in terms of obviation. If Barss's account of anaphor binding is

correct, what we would expect for condition B would be that a pronoun must be free from all possible antecedents within its binding domain. However, since multiple binding domain effects do not occur, what Barss must say is that the pronoun must be free from all the antecedents which have access to it via a Chain Accessibility Sequence which includes the original θ -marked trace. Barss attempts to derive this added condition from the Projection Principle. His claim is that since the Projection Principle requires only the θ -marked trace to be present, it is natural that only this (and any other trace required to τ -mark the D-structure trace) may count for the application of principle B. There is no discussion of why principle A should behave differently and the arguments, especially those relating to τ -marking are highly theory internal. We will see, in the following section, that this stipulation will force Barss into problems with his analysis of Psych verbs.

In fact, in a way, there is something very natural about the lack of multiple binding domain effects with pronouns. Recall the explanation for the grammaticality of an anaphor in the subject position of an embedded clause. Since nothing can bind the anaphor within the lower clause, that clause is Binding Theory non-compatible as a binding domain for the subject. The binding domain for the subject is thus extended to the higher clause. Consider now what happens when a pronoun occurs in subject position. In this case no extension of the binding domain occurs. This is because the lower clause is one within which the pronoun can be free. The lower clause is therefore a Binding Theory-compatible binding domain for the subject. Compare this situation with the one in which movement of an anaphor causes an extension of the binding domain for that anaphor. Non-extension of the domain when the anaphor is replaced by a pronominal is, in fact, just what we ought to expect.

Barss seems to regard this lack of multiple binding domain effects with pronouns as rather surprising whereas, looked at in this light, it should not be surprising at all. The problem may lie in the definitions of Complete Functional Complex and binding domain.¹⁴

Although we will not attempt new definitions here we can outline the following descriptive generalisation

14. Redefining these in order to capture this fact is not a trivial task, since there are problems with saying that CP is the Complete Functional Complex. A solution to this problem is beyond the scope of this paper.

about the binding domain of pronouns and anaphors. Whenever the presence of an element occurring in the subject position of an IP causes an extension of the binding domain for that element then the presence of that element in the spec of CP of that same IP will cause a parallel extension of the domain. On the other hand, when the presence of an element in the first position causes no such extension of the domain, then an extension of the domain will not be provoked in the latter, either.

Barss's solution to the problem of the non-extension of binding domains for pronouns is almost exactly equivalent to the Riemsdijk & Williams approach when binding only occurs between D-structure positions. It is important to note that Barss is not simply saying that the smallest domain possible acts as the binding domain for pronouns, if it did, when a pronoun was affected by clause internal movement we would predict that the pronoun would be required to be free via all Chain Accessibility Sequences. Barss's approach predicts that the pronoun need only be free in its originating position.¹⁵

2.2.2 Summary

The main import of Barss's revisions to the Binding Theory is that they make possible, binding into positions at all levels of representation (except LF), without recourse to a rule of Reconstruction. In addition, Barss's theory attempts to bring together cases of binding from both A and A' positions. The latter may be useful in explaining data from languages in which binding can take place from the adjunction site of Scrambling (Sengupta (1988) shows that this is the case in Bangla, and says that the same has been claimed for Japanese). Barss does not, however, discuss how the familiar case of A' binding, namely bound pronouns, should be handled.¹⁶

In Barss's theory the traces created by movement licence binding so that, by adopting a movement theory of Psych verbs, Barss claims to be able to explain the binding facts in these constructions.

Another problem area for Barss, which I have not discussed, is that in order to explain the

15. Barss wrongly predicts then that

(i) *He seems to him to be sick
is grammatical since at D-structure both pronouns are free. At NP-structure, on the other hand, him is bound by he and the sentence is ruled out in Riemsdijk & Williams' theory.

16. I have not investigated how Barss's theory might deal with these since it is beyond the immediate scope of this paper, but it is an interesting area.

"connectedness" effects in Pseudo Clefts he is led to posit a movement analysis for them. He does this despite being aware of the very convincing arguments given in Higgins (1974) against a movement analysis of any kind.¹⁷

We will also see in the final section that Barss's analysis appears to make certain counter-predictions in cases of wh-island violations and other constructions where current Government & Binding theory predicts these traces, which appear to invoke binding, to be impossible. However, any argument against his binding theory on these grounds would be purely theory-internal.

Lastly, as we will see, his own analysis makes just as bad predictions as the traditional binding theory about the binding facts in double object constructions which he noticed himself in an earlier paper (Barss & Lasnik 1986).

2.3 The Theories Compared

I will now briefly compare the two theories, first with respect to the different ways in which they approach binding theory and then with respect to the specific differences in their predictions about the binding configurations which will be grammatical.

2.3.1 Binding and the grammar

As we have seen, the theories differ in a variety of ways. The Riemsdijk & Williams approach to binding is a derivational one while the one adopted by Barss is a representational one. To my mind this is one of the most appealing facets of the Barss approach. Another essential area in which the two theories diverge is in their treatment of the A/A bar distinction in binding. The matter is of concern to both.

In the NP-structure model of grammar the A/A bar distinction is given an importance which other theories do not accord to it. When it comes to binding the difference between A movement and A bar movement is given special status in that the former is predicted to be able to affect binding while the latter is not. However, in another way the A/A bar distinction is blurred in this approach since all binding

 17. In particular, Barss would be led into positing a movement analysis for specificational pseudo clefts, like (i), and a non-movement analysis for predicational ones, like (ii), since the latter do not show connectedness effects.

i) What John is is important to himself
 ii) What John is is important to him

automatically takes place into A positions.¹⁸

In Barss's approach an essential point is that the binding of anaphoric elements by referential NPs is done by a system which incorporates both binding from and binding into A and A bar positions. Since the positions are not distinguished as to type this makes possible a view of binding in which it is the actual referential items which do the binding as opposed to the positions and the indices which they bear. This possibility seems appealing since, if it is correct, it makes precise predictions about the way in which "reconstruction" may work. In a derivational approach, where binding is done at a particular level, all NPs must be "reconstructed" into the positions which they occupied at that level. This is why cases in which an NP must be reconstructed leaving part of its referential material behind were objected to. However, on the Barss approach, when binding is done through a Chain Accessibility Sequence, an NP may be bound as though it was in a position which it occupied earlier in the derivation, only if its potential antecedent in its S-structure position is in a Chain Accessibility Sequence with it. We discuss below the empirical claim that the type of position (A/A bar) from or into which binding is done is not relevant.

Several of the revisions of the binding theory which have been proposed attempt to collapse A and A bar binding though most do this in ways quite different from Barss. Notice that the A/A bar distinction can not be dismissed from the grammar completely since current theories all resort to a different treatment of NP traces and WH-traces. When we have formulated a parsing theory, as we will in the following section, it may be able to tell us whether it is correct to maintain the A/A bar distinction within Binding Theory.

2.3.2 Grammaticality Predictions in Binding Sentences

I will now briefly compare the predictions about binding made by the two theories, especially in areas which will be of relevance to the discussion of parsing.

The NP-structure theory predicts that binding will only be possible into positions which exist after NP movement. This means that in sentences involving Wh-Movement but no NP movement, D-structure binding should occur. The Chain Accessibility approach on the

18. This may not be quite accurate in that certain A bar positions may be filled before the application of A bar movement and it would presumably be possible to bind into these at NP-structure.

other hand, predicts that binding will be possible without preference into deep, intermediate and surface positions, for anaphors. In the case of pronouns they must be free at D-structure for Barss while for Riemsdijk & Williams they need not be free until NP-structure.

The two theories make different predictions about binding in Psych verb constructions. Since the proposed movement is a type of A movement, whatever the correct analysis, Riemsdijk & Williams predict that binding will be possible only via surface configurations. Since, for Barss the derivation of a Psych verb construction will depend on its interpretation his theory predicts a contrast in binding possibilities which depends on interpretation.

Barss's theory allows backwards anaphora when this arises via wh-movement, the other theory does not. Neither theory accounts for backwards anaphora under other circumstances.

When binding is done at NP-structure it is predicted that topicalised anaphors will be licenced when they could have been bound in their D-structure positions. Anaphors should not be possible in left-dislocated positions. Here Barss's theory makes the same predictions for the latter case, however, in the case of topicalisation the theory makes different predictions depending on whether the anaphor is topicalised alone or as part of a larger phrase. In the former case his theory predicts that a violation of principle B may occur, this result appears to be correct but there may be an independent explanation for it.

Both theories predict that anaphors may occur in subject position only if they can be bound from above. In fact though, the circumstances in which such binding will be possible are different in each case. For Riemsdijk & Williams the higher binder must be present at least by the level of NP-structure and may not therefore arise via wh-movement. In any case, like the traditional binding theory this theory only sanctions binding from A positions. In Barss's theory, on the other hand, since both A and A' binding come under the purview of the Chain Accessibility Condition, in theory new binders for subjects can arise as a result of wh-movement. It should be noted that in principle this should allow Barss to rule in a whole set of sentences which neither the traditional Binding Theory nor Riemsdijk & Williams's theory was able to account for. In English however, it is particularly difficult to

test the prediction that an anaphor in subject position may be bound by an element in spec of COMP. The reason for this is that most of the examples, by their very nature, contain weak crossover violations so that at best they will have marginal status. Consider (34) for example;

(34)??I know which men each other's friends visited

Here, each other does not create a condition C violation but which men is in a position to bind each other. However, movement over the anaphor creates a weak crossover violation.¹⁹ There are some contexts though, in which weak crossover appears to disappear. This is true in relative clauses, perhaps due to the depth of embedding. Compare (34) with (35).

(35) These are the men who each other's friends visited

Notice that in (34) the theory predicts that the anaphor's binding domain will extend past the lower IP so that the wh-phrase will be in the right domain to bind the anaphor.

Though the evidence from English is somewhat weak we will tentatively adopt the position that it is correct to assume that referential elements in A bar positions may bind. Aoun (1986) provides further evidence that such binding must be available, particularly in a system such as his which unifies quantifier and referential binding. As noted above such a unification should also be possible in Barss's theory.

3.0 Parsing Theory and the Syntactic Theories

I will begin this section by outlining some of the assumptions I will be making about the value of the type of data which will be used. I will also discuss what we might expect a parsing theory to tell us about the grammar with respect to the binding of anaphors. I will then lay out the range of data which my analysis will account for and give the bare bones of the analysis before motivating it in detail. Finally, in developing the analysis more fully, I will discuss the relevant examples and compare judgements about their grammaticality with the predictions made by the two syntactic theories discussed. The judgements which

19. The Weak Crossover Constraint bars the binding of two separate coindexed elements by a wh-operator (which has moved over one of them). While usually construed as referring to movement over a pronoun, in English many of the current formulations (for example Safir (1984)) would also rule out movement over a coreferential anaphor.

will be cited were collected via a series of short informal questionnaires submitted to some of my undergraduate Linguistics students, all of whom were native speakers of English.²⁰ These will be supplemented by the intuitions of myself and other linguists. During this discussion I will consider how the Minimal Chain Principle might be used to explain certain facts.

3.1 Expected Results of a Parsing Account and the Issues Involved

Our parsing theory should be able to tell us, for any individual sentence, how we arrive at the interpretation of it which we end up with. In the case of potentially ambiguous sentences the very least we should demand of it would be that it account for any context-free preference between readings. My analysis will do this and I will assume that the investigation of preferred readings will tell us a lot about more general parsing mechanisms involved in the interpretation of sentences with bound anaphora.

In addition, I will assume that by examining the way in which the parser analyses anaphors we can gain some insight into which kinds of representation the parser needs to access for binding. This in turn will suggest the correctness of a grammatical analysis in which binding is done at a particular level of representation, rather than at all levels.

3.2 The data

I will examine interpretation preferences in the following range of data. Firstly, sentences where no movement is involved. Next, those where leftward movement has occurred. Finally sentences which involve rightward movement. As we will see, these may be further divided into sub-types.

For the purposes of clarifying the exposition I will first outline what the results of my investigation have shown the basic judgements to be.²¹ I will then propose some principles to explain them before examining individual cases in more detail.

20. The questionnaires were not answered by identical sets of people, so that some sentence types were judged by 24 students others by 25 and yet others 27. For certain sentence types two versions were used so that there were only 12 responses to an individual sentence. I will refer to judgements as proportions for this reason. The sentences were constructed so as to make all potential ambiguities plausible.

21. The sentences from the questionnaires which relate to the data discussed appear with the questions which were asked and the percentage responses in the appendix. The questionnaires also contained filler sentences and various sentences relating to other types of data not immediately relevant to this paper.

3.2.1 No movement

In the simple case, only one potential antecedent exists. In these cases a preceding antecedent is always preferred.

There is some dispute about whether movement is involved in the generation of some sentences which may contain a following antecedent. Barss assumes a movement analysis for Psych verbs. I will discuss this question below. Larson (1988), develops a movement analysis for double object constructions in which they are derived via movement from dative constructions. I will assume that both of these are generated at D-structure. Barss also exploits a movement analysis for Pseudo Clefts. I will assume, following Higgins (1974) that movement is not required for the basic order. I will however, assume that a stylistic rule may permute the order of subject and predicate in specificational Pseudo Clefts, for this reason I will not discuss these cases.

More complex cases involve two competing antecedents.

- (36) Jaye told quite a few things about himself to George, that day
- (37) John gave Bill a picture of himself
- (38) John gave a picture of himself to Bill

In the cases of (36) and (38)²² a preference exists for the preceding antecedent. In (37) however, no such preference seems to arise. This is a situation where the pragmatics can most often be left to decide between the two readings.

3.2.2. Leftward Movement

The bulk of the data in the investigation involves leftward movement. The configurations involved are of various types. The principal two were seen in (27). In a) the competition is between a preceding and a following antecedent. In b) it is between two following antecedents.

 22. Some speakers reject the lower antecedent altogether here. Barss & Lasnik (1986) claim that in both the dative and double object constructions only the first NP can bind the second. Although everyone agrees about the facts in double object constructions the facts are disputed in the case of the dative construction. I will discuss this matter further, below.

- (27)a. Sue knows which picture of herself Mary likes best.
 (27)b. Which picture of himself does Bob think Joshua likes?

Here, in both cases, the majority of speakers prefer the higher antecedent. In each case, the lower antecedent, although non-preferred, is available. I will discuss this later in the section.

3.2.3 Rightward Movement²³

Here, in contrast to the situation in (38) the closer of two preceding antecedents seems to be preferred.

- (39) John gave to Bill several old pictures of himself

Two generalisations emerge from these three types of data. The first holds across all three categories; preceding antecedents are always preferred. The second is that in general, precedence aside, when antecedents compete the antecedent closest to the anaphor is preferred. An exception to this generalisation was seen in the no movement case in (37). Before preceding with the analysis I would like to dispense with this apparent exception.

Foss (1982) has shown that there is evidence from parsing for the existence of what he calls a Topic Buffer. The existence of such a buffer accounts for the fact that sentence topics (where this refers to a discourse role rather than a structural position) have a special salience in the parse and seem to be accessed again and again. Due to the independent motivation of such a buffer, I do not hesitate to explain the lack of preference in (37) by the play off between a preference for closest antecedents and the extra "visibility" of an NP in the topic buffer. I will discuss other cases below but it appears that all cases where preferences are blurred may be explained by the existence of such a buffer.

One might ask why the topic buffer should blur preferences only when no movement has taken place, since a preference for the closer antecedent remains in (39). First, the preference is weak in (39) and second I suggest that since Heavy NP Shift is a stylistic

 23. These cases differ in minor ways from the preceding ones. It is an interesting question whether this should be attributed to a difference in the direction of movement or to the fact that the movement is "stylistic" as most rightward movements are. This question will be left to further research.

rule²⁴ it has an effect on focus, which presumably also lies at the heart of topic effects. The interaction of focus effects may account for the continued preference for a closer antecedent in (39). In what follows then, I will assume the existence of both a topic buffer and an underlying preference for the closest of two antecedents.

3.3 The Analysis in Brief

I would like to propose that the preferences for preceding and closest antecedents are both due to a single parsing principle favouring early interpretation. I will assume the following principle:

(40) Early Interpretation

On encountering an anaphor, find an antecedent which permits its interpretation *as soon as possible*.

This principle and the Minimal Chain Principle (MCP) mentioned in (1) may both be sub-cases of a more general parsing principle. I will return to discussion of the MCP below.

Why should a principle such as (40) operate? It seems obvious that if an anaphor is the type of element which requires an antecedent in order to be licenced, then when the parser encounters one it will not be possible to dismiss it from memory until an antecedent has been found. Retaining an element in short-term memory like this obviously imposes an extra load on the parser. This is sufficient reason to expect that there be a pressure on the parser to find an antecedent as quickly as possible so as to be able to dismiss the item from immediate consideration.

I propose that, much as the parser actively searches for a gap on encountering an unmistakable filler (Frazier 1987), it places an anaphor on hold and actively searches out an antecedent for it. This parallels the search for antecedents of pronouns, motivated by Cowart & Cairns (1987).

Assuming that this is the case, it remains to be determined what the process of "find(ing) an antecedent" entails. In the case of anaphors this may be quite different from what is required in the location of an antecedent for a pronoun. This is because, in the latter case there is no syntactic requirement that they be bound.

24. Wherever it applies, the rule is stylistic in the way in which it is meant here.

We may translate the normal binding requirements into three conditions which must be met in order for an anaphor to be assigned an antecedent.

(41) Conditions on Antecedent Assignment

- a) Find an NP of the right gender and number²⁵
- b) Check that the potential antecedent c-commands the anaphor²⁶
- c) Check for locality between the anaphor and potential antecedent (ie check that they are in the same binding domain)

In what follows I will assume that all three of these conditions must be met before an anaphor may be shunted from short-term memory. In addition, I will assume that each anaphor (or a copy of it) is inserted into a buffer, in short-term memory, with a checklist for these three requirements. The anaphor is shunted from the buffer once an antecedent has been assigned. Since the grammatical requirements have been satisfied the parser no longer needs to actively look for an antecedent. As we will see, however, this does not mean that the anaphor may never be reassessed nor that pragmatic and other factors may not play a later role in determining the final interpretation of the anaphor.

The search for an NP which will meet condition (41a) takes place backwards over prior material in the first instance. If no candidate is found, the search then proceeds forwards. I will assume that this is due to the fact that a preceding antecedent usually permits earlier satisfaction of the conditions in (41).

The principle in (40) forces the application of the operations in (41). Once a potential antecedent has been assigned, (40) has been satisfied. I assume that the elements of (41) are unordered but that they most often apply in the stated order. It is not always possible to complete the checks in b) and c) immediately after a). When these cannot be done immediately the NP found under a) is assumed to be stored in memory with the anaphor. This means that when the parser has an opportunity to reanalyse the anaphor a potential antecedent NP may have been identified quite some time before. We will see that

25. Cowart & Cairns (1987) show that gender and number information must be available to the parser at the stage when potential antecedents are located. Work by Nicol (1988) supports this view.

26. I wish to use the term in a theory neutral way here. If Barss's approach is correct we should say that the check ensures that the antecedent is a sister to an element in a Chain Accessibility Sequence for the anaphor. Except in cases where "segments" of a node are involved (see May (1985) for an explanation of this term) these seem to be equivalent.

the longer such an NP has been so identified the harder it is for the speaker to give it up. This type of effect is also in evidence in sentences involving garden paths.

We will now proceed to a detailed examination of the constructions involved and their various sub-cases. We will see how the processes in (41) are carried out and refine certain notions.

3.4 Preceding Antecedents are Preferred

The normal case of anaphor binding involves an antecedent preceding an anaphor.

(42) John hates himself

Thus, the fact that this turns out to be the preferred relation between anaphoric elements and their binders is of no surprise.²⁷

The principle of Early Interpretation will not be required in the case of (42) but the conditions in (41) must apply in such a way as to access an antecedent which has already gone by. One way in which (41) could be applied would be for the parser to scan the previously constructed phrase marker, right to left starting at the position of the anaphor. In so doing it would encounter John and be able to check off a) in (41). It this point b) and c) would come into play. Since no IP node was crossed in the phrase marker between himself and John it is clear that locality is met.

We are maintaining that the steps of (41) are accomplished as soon as possible so it must be the case that during the course of the leftward scan of the phrase marker, the parser has been able to keep track of whether or not an IP node has been crossed. I will assume that the parser has this ability. If this is the case we can also assume that in the majority of parses, once the parser encounters an IP node the leftward scan will be halted since an NP following that node will usually not meet the locality condition.²⁸

27. However, we know that the syntactic theory would attribute such a preference to the fact that the binder usually dominates the anaphor when it precedes it. We might expect that in a language with a different word order from English the order of preference might be reversed. If this was the case then a parsing principle which would capture the facts could not be based solely on linear order.

28. Something special will have to be added so that when an anaphor occurs within a subject, the binding domain will extend to the next IP.

We will consider now, how the c-command condition can be met. The question arises of whether the parser has the power to compute c-command relations and if so, how this is accomplished.

As we saw above, Barss's notion of "sister to an element in a Chain Accessibility Sequence" and c-command are largely equivalent. Taking advantage of this we can say that what the parser scans are not entire chunks of the phrase marker but paths from the anaphor to an IP node and the sisters of those paths. Notice that the path which must be scanned in (42) is equivalent to the only Chain Accessibility Sequence for the anaphor. As long as an element is a sister to something on this kind of path it will meet the c-command requirement.

Another way of achieving the same result would be to say that the NPs which will meet condition (41a) are inserted into a list of potential antecedents as the parse proceeds. These NPs would be retrievable when required and in order to meet c-command requirements we could say that only sisters to elements on the trunk of the tree would be inserted into the list. For the purposes of this paper I will assume them to be equivalent.

Whether a list or a backwards scan of a path is involved, if (40) is the motivating principle for an antecedent search it must be the case that the parser receives instructions to always search backwards first. If this were not the case, we would not expect to find the predicted contrast in a case like (43).

- (43) Sue knows which picture of herself Mary likes best

When students were presented with this sentence and asked to indicate who was in the picture, two thirds chose Sue. (44) shows a pair of sentences which differ only in the placement of the antecedent. In this case students were simply asked to choose which sentence they preferred.

- (44)a. Sue wonders which picture of himself Bob hates most
 b. Sue wonders which picture of herself Bob hates most

Once again two thirds of the students (though not the same ones) preferred the antecedent to precede the anaphor.

If the principle in (40) accounts for the preferences cited because the anaphor can be interpreted sooner in (44b) than in (44a), it must be the case that a backwards search is initiated as soon as the anaphor is reached.

However, this account does not lead us to expect that some speakers may indeed prefer a following antecedent as some subjects clearly did. Although this type of difference of opinion is not unusual where parsing preferences are concerned it is worth making a couple of observations about this particular example. Notice here that the preceding antecedent is competing against one which is right next to the anaphor. It might be the case here that the following antecedent is close enough to the anaphor for the principle of Early Interpretation to be met equally well by the assignment of either antecedent. Nevertheless, if the operation of (41) is such that the parser always scans backwards before looking further on in the string we would expect that the preceding antecedent would always win out in a contest such as this.

Suppose we say that since a second potential antecedent enters the parse before the anaphor has been shunted from the buffer the adjacent antecedent is checked simultaneously with the preceding one. Speakers are of course, unaware of this. Perhaps the speed at which a person parses will determine which antecedent is preferred.

There is a problem with saying this. Although the adjacent antecedent may be identified as meeting condition (41a) before the anaphor is shunted, the checks on the following antecedent cannot be completed until later in the parse. To be precise, they cannot be completed until the position of the gap is reached since it is only with respect to that position that c-command and locality can be ensured. Notice that once again, what is required in order for these checks to be made is that a path be scanned backwards, this time from the position of the trace. Once again, a Chain Accessibility Sequence is being scanned. In order to account for the higher antecedent in (43) the scan must begin as soon as the anaphor is reached. If a scan were not instituted until the trace position was reached the lower antecedent ought to be preferred. The fact that the checks on the lower antecedent cannot be completed until the trace position is reached leads us to expect the preference for sentence (44b) over (44a).

The fact that certain speakers prefer a lower antecedent, even in the ambiguous (43) would seem to indicate that (at least for those speakers) the principle of Early interpretation refers only to the requirement (41a) of finding an NP which matches in gender and number. Once this has been done no final decision need be made until all possible checks have been accomplished.

This would seem to run contrary to the claim that Early Interpretation is required in order to permit shunting of the anaphor, because shunting may not occur until all checks have been completed. We could avoid this conclusion if we took account of the fact that once the checks on the preceding antecedent have been completed, the anaphor is marked as being licenced by the grammar. Speakers are not consciously aware of such processes. However, in this case the existence of a potential antecedent adjacent to the anaphor may make the speaker aware of a second choice of antecedent. When the speaker, after checking its attributes, finally accepts this antecedent s/he will not be aware of having already licenced the anaphor by way of an earlier antecedent. If this is the case, the parser must retain the ability to check (41b) and c) even when the anaphor has been shunted from the buffer.

Alternatively, it might be suggested that once the antecedent is licenced, however this has been achieved, the checks do not need to be carried out for other NPs. This, can be shown not to be the case. Consider (45)

(45)* Sue knows which picture of herself Mary's father likes best

This sentence is ungrammatical on an interpretation with a non-c-commanding antecedent, even though another viable antecedent is available.²⁹ In addition Nicol (1988) has shown that only grammatically licenced antecedents for anaphors are accessed during the parse. It must either be assumed, counterintuitively, that checks against further antecedents may continue to occur once the anaphor has been shunted from short-term memory or we must assume that when the speaker has located two potential antecedents (by 41a) the anaphor may not be shunted until the checks have been completed. Checks on the first antecedent will be completed first so it will still be preferred. I will -----

29. See section 4 where the question of accessing antecedents for pronouns is discussed. There is evidence that even for pronouns which do not require their antecedents to c-command them non-c-commanding NPs may be accessed only indirectly

make the latter assumption despite the fact that this appears to impose unwelcome demands on memory. We will see later that this does not happen every time another possible antecedent occurs but in a limited number of situations and for independent reasons.

Yet another plausible account for the preferences in (43) and (44) exists. As the NP-structure model of binding would lead us to expect, speakers may have a preference for binding into A positions and it may be this preference which is played off against the parsing pressure to interpret early. As promised, we must pay special attention to any data indicating that the A/A bar distinction is accorded special status in the grammar/parsing of binding. Another way in which such a distinction might manifest itself would be in a preference for the binders themselves to be in either an A or an A bar position. We turn to this matter now in a further examination of the claim that precedence aside, the closer of two antecedents is preferred.

3.5 Closest Antecedents are Preferred

The perfect ambiguity of (37) was accounted for by appeal to the topic buffer. We will now examine further the claim that the closest of two preceding or two following antecedents is preferred.

3.5.1 Two Preceding Antecedents

Consider the following example.

(46) ?John and Mary know which men each other's friends visited

It was argued in section 2.3 that an NP in the position of which men in cases like (46) should be able to bind each other (barring the weak crossover effect). That it can, is illustrated by (47).

(47)??Which men did each other's friends visit

However, when a higher binder in an A position is available (as in (46) this would seem to be the preferred antecedent rather than the A bar binder. There are several possible explanations for this preference. First, the higher antecedent is in the topic buffer, second the grammatical system accords a special status to binders in A positions or third, the parser will always prefer an antecedent which does not induce a grammatical violation. One would expect something like this last statement to be true in any case but there is some evidence that other factors may be at stake too.

Even on the interpretation in which John and Mary binds each other, (46) is not a perfect sentence. This is despite the fact that neither a weak crossover violation nor an NIC violation is involved. As (48) shows, an NP in the position of John and Mary in (46) can clearly bind the lower subject position without marginality arising.

- (48) John and Mary know where each other's friends went

What seems to be at fault in (46) is the presence of an available intervening (though non preferred binder).³⁰ Compare (49) where the wh-phrase does not match the anaphor in number and is therefore no longer a plausible antecedent.

- (49) John and Mary know which teacher each other's friends visited

(49) seems much better. I take the contrast between (46) and (49) to be evidence both of the fact that NPs in A bar positions can in principle bind and that the closest antecedent is normally preferred. Despite various reasons for preferring a higher binder in (46) including the existence of a competing antecedent in the topic buffer and the fact that a grammaticality violation would occur if the closest binder were taken, there is a residual desire to interpret the closest matching NP as the antecedent. This argues against the independent need to accord special status to A binders. True, the A binder is preferred in (46) but there are many reasons for preferring it.³¹

3.5.2 Two Following Antecedents

As we saw in section 3.4, given a choice between preceding and following antecedents there is a preference for those which precede. The preceding/following preference in (43) and (44) corresponded to a choice between deep and surface binding and contrary to the predictions of the NP-structure model of binding, the surface binding was preferred.

Recall that the most fundamental difference in predictions made by the two syntactic theories we have considered is that, in one, only binding pre wh-movement should be syntactically licenced. The choice between binding at different levels was tested again.

30. Thanks to Kai Uwe von Stechow for this observation.

31. "Topics" are not always in A positions, so preference for topic antecedents may not be equated with preference for A binders.

This time the choice was between two following antecedents and it corresponded to the difference between binding in D-structure position and binding at the position of an intermediate trace. Students were asked to give judgements on sentences similar to either those in (50) or on those in (51).

- (50)a. Which stories about himself did Fred know Mary liked?
 b. Which stories about herself did Fred know Mary liked?
- (51)a. Which pictures of himself did Franz know Martha liked?
 b. Which pictures of herself did Franz know Martha liked?

The overwhelming preference was for the sentences in a) and about one third of the subjects had a tendency to reject the b) sentences as ungrammatical.^{32 33} This result is again clearly contrary to the predictions of the NP-structure framework. It is also unaccounted for on a straightforward application of Barss's theory, however, since both bindings should be equally possible on his account.

Once again, an ambiguous case (taken from Barss) was tested too.

- (52) Which picture of himself does Bob think Joshua likes best?

Here again the higher reading was preferred two to one over the lower one. When we turn to our parsing theory for an account of this contrast we find that, as predicted, an anaphor on the look-out for a binder always tries to take the first available candidate as its antecedent. If a candidate NP had already occurred in the sentence, this would be accessed immediately via a backwards scan of certain paths in the tree. If no such candidate had occurred the first one encountered would be preferred. If this is what is going on, it accounts for the contrast seen in (50) and (51) because in the b) sentences the first available antecedent fails to match the anaphor in gender, in this case then, the second referential NP might be considered the "first available" antecedent. Suppose that the

 32. See appendix. By "a tendency to reject" I mean that the judgements were ?? or worse on. Sentences marked ?* or worse were basically considered ungrammatical while ? and "perfect" were considered grammatical with ?? considered "marginal".

33. The rejection of the b) sentences here is reminiscent of an SSC effect.

application of (41) is broken into steps which stipulate the order of the search, (53) would apply first and if this failed to turn up a candidate, as it would in these cases, (54) would apply.

(53) Antecedent Search Procedure I

- a) On encountering an anaphor insert it into a buffer in short-term memory.
- b) Scan a path on the tree and the sisters to the path backwards, from the anaphor to the end of the current binding domain, for an NP which matches in number and gender.

If one is found check c)

- c) the NP c-commands the anaphor.

If any of the above fail apply (54).

(54) Antecedent Search Procedure II

Search a string Left to Right from the anaphor for a matching NP. whenever one is found stop at the next position through which the anaphor has passed and reapply (53 b) and c).

Once again the notion that the parser has access to number and gender information in determining antecedents is crucial to the formulation of the principle. The preference for the a) sentences over the b) ones would be due, on this account, to the fact that assignment of an antecedent was delayed slightly in the b) cases, the antecedent being further away from the anaphor. Whether all NPs must be checked to see if they match the anaphor in number and gender would need to be determined experimentally. The evidence from Nicol (1988) suggests that when potential antecedents are accessed non matching ones are left out. It is not clear however, how they may be left out if gender and number has not first been checked in some way. If there was no evidence for such a check it might lead us to prefer an analysis in which potential antecedents were taken from a list. This is because referential NPs might actually be inserted in different lists depending on number and gender. The "check" would actually be happening at the occurrence of the referential NP, it would not therefore show up when the area around the anaphor was probed.

Returning to the examples, in the ambiguous (52) the antecedent which may bind the anaphor in its D-structure position is not adjacent to the anaphor as it was in (43). For speakers who do prefer the lower antecedent the only apparent explanation is that there is indeed a special status accorded to deep binding (or binding into A positions). We cannot say here that (53a) has caused the second antecedent to be identified

as a candidate before the checks on the first have been completed.

Surely if the parser imposes a certain amount of pressure for early interpretation it seems implausible that an anaphor should keep trying alternative antecedents. Instead we might say that in both these cases ((43) and (52)) the existence of a θ -marked wh-trace is at stake. When such a trace is encountered the speaker is independently required to perform operations which permit the interpretation of the wh-phrase. The performance of these operations may cause the anaphor to be refreshed. If this is the correct interpretation of the data we expect that such reanalysis will not occur when the parser has no independent reason to refresh the anaphor.

On such an account the special status of certain binding positions would be due not to the fact that the position was filled by an anaphor at a particular level of structure (D-structure of NP-structure) but to whether they are θ -positions or not. Such a distinction could indeed be regarded as an A/A bar distinction but it would cause the subject position of a passive verb, for example, to be classified as an A bar position. Even though, in a passive sentence, the D-structure object position is a θ -position, we would not expect to see evidence of the refreshment effect since there are usually no intervening NPs between deep and surface positions of a passive subject.

It seems then that the nature of long distance movement is such that the interpretation of a wh-phrase in its D-structure position allows us to become aware of certain ambiguities in the binding possibilities. There is even sometimes a conscious awareness of having assigned one antecedent and then changing one's mind. The distance between Bob and Joshua in (52) is very short which makes it difficult to tap intuitions about reanalysis, however, the ambiguity of the sentence seems fairly accessible and there is no great reluctance to give up Bob as the antecedent. It remains to be determined whether the fact that the θ -marked trace is a wh-trace is crucial to the choice of reanalysis.

We will consider next a case in which speakers are often consciously aware of the opportunity of assigning a new antecedent during the parse. We would remind the reader however, that the majority of speakers preferred the higher antecedent in (52) which confirms our predictions that closer antecedents are preferred.

3.6 Dual Domains

Consider again the sentence in (22) of the type we have called dual domain (repeated here).

- (22) John liked every picture of himself that Bill had ever taken

Despite the short distance between himself and Bill in this sentence I have a clear impression on hearing this sentence that I have already accepted John as an antecedent when I reach Bill but that on doing so I immediately become aware of an alternative antecedent. Notice that this is not like the temptation to reanalyse in (52), it does not occur when the gap is reached, it seems to occur as soon as Bill is reached. The first thing that this tells us is that the acceptance of an NP as a potential antecedent occurs as soon as an appropriate NP has been located (step (53a)). Since Bill is close to the anaphor, as was originally suggested for (43), it may be because the checks on the first antecedent have not yet been completed that we begin the process on the second. The refreshment effect is not felt in the same way as in (52) since we have already begun the checks on Bill before the anaphor is refreshed. On the other hand the process may be begun again because the parser encounters another anaphor, coreferential with the first, in the fronted wh-phrase.

One difference remains between this case and the other cases involving θ -marked wh-traces. Here there is no particular desire to reanalyse only an awareness of ambiguity. This difference actually provides added evidence for the suggestion that the θ -marking of the trace is crucial. This is because when Bill is taken as an antecedent in (22) the overt anaphor is bound only indirectly via the coreferential anaphor in the wh-phrase which gets deleted. Both anaphors originate in θ -positions so although we are aware of ambiguity, a preference for binding into θ -positions will not tempt us into reanalysis here. If this is the case it suggests that these sentences do not really involve dual domains. In section 2.2 it was noted that Barss's binding system could handle these sentences in two ways, a) in the same way as Riemsdijk & Williams would have to or b) via two non-intersecting Chain Accessibility Sequences from the anaphor in the fronted wh-phrase. The lack of temptation to reanalyse here suggests that the former account is correct. In the S-structure string two anaphors are present, one in the head of the relative and one in a wh-phrase. We need not claim that the wh-phrase is fronted if the near adjacency of Bill to the anaphor is invoked to explain

the immediate awareness of a competing antecedent. However, for this account to go through, it must be the case that relative clauses involve the movement of a wh-phrase rather than that of an empty operator.

When sentences of this type were tested the judgements once again indicated a clear preference³⁴ for the higher binder in every case. Consider one of the test cases.

- (55) The professors loved the snapshot of themselves that the students took at the end of the semester

When presented with this sentence, only one student could not accept the professors as the antecedent for themselves and this person was one of those who rejected the sentence. Everyone else (including two who attributed a * to the sentence) found the professors to be the only or preferred antecedent. This evidence certainly argues strongly for the analysis which has been developed. Many other sentences of this type were tested and there was a consistent preference for the upper reading despite general agreement that the sentences were ambiguous.

We will now test whether the realisation that Bill is a potential antecedent in (22) is due to its closeness to the anaphor, or to the presence of a Wh-phrase in Spec of COMP. Let us look at a sentence type which was tested where the distance between the anaphor and the following antecedent is increased.

- (56) John liked, every picture of himself with a desert landscape in the background, that Bill had ever taken

In this case the preference for John is even stronger than in (22). This could be due to the fact that Bill is not longer so close to the anaphor. However, in cases similar to this one, subjects were still aware of the ambiguity. My intuitions suggest that here, the ambiguity does not become obvious when we reach Bill but much later. This is consistent with the account we have proposed in which, the anaphor will be refreshed when the D-structure trace position is met. The stronger preference for the higher antecedent here must be due to the reluctance we discussed, to change one's mind when it has already been made up for so long. The

34. For some speakers the lower reading was not possible at all. In an unambiguous case which forced this reading, about half the students rejected the sentence. This may be due to the fact that the lower antecedent actually binds an anaphor which is not present in the surface string.

same account applies to the following example.

- (57) John wondered which picture of himself Mary thought Sue believed Tom to have destroyed

Despite refreshment of the anaphor at the wh-trace we are more likely to stick with John since its status as an antecedent had been maintained over a long stretch of material.

It would seem then, that distance and not the fronted wh-phrase was what caused the following antecedent to be checked early in (22). Distance between an anaphor and its potential antecedents is relevant in a different way in (57) and in general may be crucial to the preference for one antecedent over another. Despite the very strong preference for the higher antecedent in constructions like (22) we find that increasing the distance between the preceding antecedent and the anaphor makes it less preferred.

- (58) John, while at the exhibition, asked every single friend, including Mary, which picture of himself George painted first

In this example it seems clear that John is no longer the preferred antecedent. Compare a similar case in which the following antecedent is not adjacent though still closer to the antecedent.

- (59) John, while at the exhibition, asked every single friend, including Mary, which picture of himself it had been claimed that George painted first

In this case too George seems to be the preferred antecedent. Since both anaphors originate in θ -positions, we have no explanation of this. It may simply be that, due to the long distance between John and the anaphor the checks on George are completed first.

There is another plausible explanation. We have seen evidence that the parser scans S-structure and not surface strings. It is possible that at S-structure the CP containing George immediately follows the anaphor. In the pre-Extraposition position, George, being much closer to the anaphor would obviously be preferred. This would entail that Extraposition take place in PF.

This brings us to a closer consideration of the cases involving rightward movement.

3.7 Rightward Movement

Consider again the example in (39).

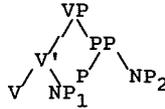
- (39) John gave to Bill, a picture of himself with all his grandchildren around him

This is a case, where despite rightward movement the second of two preceding antecedents is preferred. Although this is exactly what the parsing analysis would lead us to expect, it is interesting because we now prefer an antecedent which is strongly non-preferred in the unmoved case in (60).

- (60) John gave a picture of himself with all his grandchildren around him, to Bill

Clearly, John is the preferred antecedent here. This is one of the problematic structures discussed by Barss & Lasnik (1985). In the structure usually assigned to Dative clauses Bill does not c-command the anaphor. There is no difference here between the predictions made by Barss's theory and one with a strict version of c-command (as opposed to what is now known as m-command).

- (61)

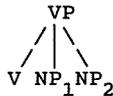


NP₁ can clearly bind NP₂ in this structure as (62) shows but c-command is not met here either. As we saw in (37) NP₁ can bind NP₂ in the double object construction too. For this reason, Barss & Lasnik argue that the structure of the VP must be flat in both dative and double object constructions, as in (63).

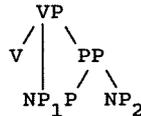
- (62) I introduced John and Mary to each other

- (37) John gave Bill a picture of himself

- (63)a.



- b.



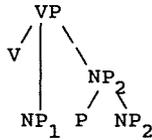
If these structures are correct, in a) we have mutual c-command and the lack of cases in which NP₁ binds NP₂ must be accounted for. In b) NP₁ c-commands NP₂, which accounts for the grammaticality of (62), but NP₂ does not c-command NP₁. This would be as expected if all

speakers rejected (64), but this is not the case.

(64) Mary gave a picture of himself to John

Two solutions to this problem are available; a) at S-structure the preposition is not present so that NP₁ may c-command NP₂, b) the preposition is Chomsky-adjoined to NP₁ so that the right c-command relations obtain. If b)² is correct, the disagreement between speakers may be due to the uncertain status of the preposition, some speakers treating it as belonging to an independent PP. Notice that this is a case where the difference between Chain Accessibility and c-command may turn up. If the correct structure is as in (65)

(65)



In Barss's treatment the two segments of NP₂ must be regarded as being a sister to NP₁.

Consider the nature of the rule involved in the derivation of (39) from (60). The Rule of Heavy NP Shift has often been called "stylistic" and as such it has been suggested that it takes place in the Phonological component i.e. in the derivation from S-structure to surface structure. In this analysis we have been assuming that binding is done off S-structure. If Heavy NP Shift does indeed take place in PF the preference for Bill as an antecedent in (39) but for John in (60) is somewhat unexpected. We might expect that the S-structure for these two sentences would be identical, and thus that the binding preferences should be identical too. This is true if a derivational approach to binding is taken. We would have to put the heavy NP which had been moved, back into its S-structure position. The fact that preferences differ here might be taken as additional evidence that a representational view of binding is correct. The parser needs access to a level of representation which contains information about the derivational history of a sentence; the surface string alone is inadequate. However, as long as the S-structure representation of (39) contains the information that the heavy NP once preceded the "to" phrase it is not necessary that the order of elements in the S-structure string be any different from in the surface string. Since Bill precedes the anaphor

(though not the trace of the phrase containing it) it is a preferred antecedent. This is completely as we would expect on a representational approach.

Suppose on the other hand, as some writers have suggested, that Heavy NP Shift applies in the syntax. If there are speakers who, while rejecting (64), accept Bill as an antecedent in (39) then it must also be the case that Heavy NP Shift changes the c-command relations. No matter where Heavy NP Shift causes the NP to move to, if the presence of a preposition is what blocks c-command for these speakers it is not possible to change the c-command relations in the required way. I will assume then, that whatever blocks binding of NP₁ by NP₂ in double object constructions is at work here³⁵ too. Heavy NP Shift is not possible in the double object construction so we cannot check to see if rightward movement would change the judgements there too, for certain speakers.

In consideration of the rightward movement structure in (39) one other factor is worthy of note. It behaves like the structure in which no movement was involved in not tempting the parser into reassigning antecedents. In (39), before either Bill or the anaphor is encountered one would expect that a trace of the moved NP would occur. Yet here, we see no effect of the "refreshment" of an anaphor despite the fact that the trace is in a θ position. This fact can be accounted for in the following way: When a wh-trace is encountered, the parser is already in the "active filler mode", this means that the parser knows a gap must exist. In the case of rightward movement no such cue occurs. Since sentences like (66) occur, the parser has no reason to posit a gap following "give" in (39).

(66) John gave to Charity

As a result of these factors the speaker is not even aware of the ambiguity in (39). I will assume that rightward movement never tempts the parser into reanalysis. The preceding scenario is one which can be explained in a more formal way by invoking the MCP (repeated here).

35. I have no explanation for this.

- (1) Minimal Chain Principle (MCP)
 Avoid postulating unnecessary chain members³⁶ at S-structure, but do not delay required chain members.

If this principle were to apply here, in a situation in which there was no unambiguous need for a chain, the parser would not posit one, as a result no temptation to reanalyse would occur. We will consider now how this principle would apply in the case of different types of movement.

3.8 The Difference in Movement Types

Consider next, the fact that when A movement occurs the point at which the parser knows unambiguously that a chain is required is often fairly late; after the passive morphology or, in the case of Raising after the following infinitival marker. If the MCP lies at the heart of the "refreshment effect" we might expect that where A rather than A bar movement had occurred the effect would be dulled due to the lack of early cues to movement. Since A movement is local, most cases of it will not provide us with the right structures to test this, since no competing antecedent would occur between the surface position of a moved anaphor and its D-structure trace position. There is however one structure which Barss treats as involving A movement which it may be useful to discuss here, this is the structure involving Psych verbs. On Barss's analysis (following Belletti & Rizzi's treatment outlined in section 1) the same verbs may occur in both movement and non-movement structures depending on whether or not the subject of the Psych verb is interpreted as agentive or not. This means that the parser will often have no clue that movement has occurred. Even then movement need only be postulated when no binder has been found on a non movement analysis of the sentence. In certain cases, other clues may exist, the subject of the Psych verb may be of a type which cannot be agentive or a disambiguating adverb may occur before the verb. Consider the following examples.

- (67) George thinks that these pictures of himself
 upset Susan
- (68) George thinks that these pictures of herself
 upset Susan

In these cases the parser will know, at the verb, that movement has occurred. This being so, when the trace

36. Each NP is considered to be in a chain of length one.

position is reached the MCP will force construction of the chain, immediately. Given that this trace is in a θ -position the interpretation of the moved phrase should force a refreshment of the anaphor. The process by which an antecedent is located will be begun again. In (67) and (68) we cannot see evidence of the effect but this is because in (67) no further potential antecedent can be located. In (68) the parser is already looking for an antecedent for herself. However, in the case where a competition for antecedents occurred we should be able to test whether the effect occurs.

Unfortunately, the ambiguous case shown in (69) was not tested in any of the questionnaires. We can however use our own intuitions.

(69) George thinks that these pictures of himself upset John

Notice that here the competition is between two binders in A positions. This is, in fact, another dual domain case, if movement has occurred. Given this fact it is not to be expected that reanalysis will occur. We can test only whether an awareness of ambiguity arises. Despite my preference for the higher binder I am aware of the ambiguity of (69) when I get to the end of the sentence.

In a way this is very surprising since when subjects were asked for grammaticality judgements on the two sentences in (67) and (68) the contrast was felt to be much greater than in the other cases of surface versus non-surface binders that we have seen. When questioned about these sentences 85% assigned (67) a higher grammaticality status than (68). More than 60% considered (68) to be ungrammatical while the worst judgement attached to (67) was ?* (3 subjects).

Suppose our hypothesis that preceding antecedents are preferred was wrong and that, in fact, *surface* antecedents were preferred. In these cases, if the movement analysis of Psych verbs is correct, there is a competition for antecedenthood of the anaphor position between on NP which can only bind from its D-structure position and one which can bind at either level of representation (since at D-structure the lower clause is Binding Theory-incompatible). This would account for the preference here but, as well as contradicting the other evidence we have found, it would not account for the strength of the preference. I will argue shortly that the dislike of sentences such as (68) is due to a general dislike for "backwards anaphora".

Before doing this I would first like to digress briefly on the question of whether the MCP could usefully be used in other ways. Taken literally this principle would seem to lead us to expect a preference for deep binding in sentences involving wh-movement of an anaphor. This is because the existence of an unambiguous filler forces the parser into the active filler mode. Since the parser knows it must find a gap for the wh-phrase as soon as possible it would seem plausible to delay interpretation of the anaphor until this has been done.

Consider another way of looking at the MCP, however. If, in constructing a Chain Accessibility Sequence for the purposes of binding, we avoided postulating chain members of any kind, it would seem that we would be left with only the Chain Accessibility Sequences which lead to surface binding. This is exactly what our principles have motivated. However, we were forced to stipulate that a backwards search was initiated first on the grounds that this usually, though not always, led to the possibility of earlier interpretation. We might, instead, invoke the MCP interpreted in this way, to motivate the order in which Chain Accessibility Sequences are constructed.

The problem with interpreting the MCP in this way is that in a case like (70) we have to interpret "unnecessary" to mean, '*not required for binding*'.

- (70) Sue wonders [which picture of herself]_i Mary likes best [t]_i

This was not what was meant by "unnecessary" when the Minimal Chain Principle was formulated. To do the job it was designed to do "unnecessary" has to mean '*not required to exist by the grammar*'. In the case at hand we are trying to avoid construction of the chain member "t_i" since this would lead us to prefer deep binding. However, it is clear that by all reasonable interpretations of the term "required by the grammar" this chain member will be required. This is because if we postulate the chain member t_i in (70) immediately, as required by the MCP, we would construct the Chain Accessibility Sequence including it, immediately and in cases like (71) we might posit the deepest trace first.

- (71) [Which picture of himself]_i does Bob think t'_i Joshua likes best t_i

We would do so because, once we assume that which picture of himself has moved, the Projection Principle requires t_i to exist while it is not clear whether t'_i

must exist or not. Firstly this depends on whether we employ τ marking to licence traces. In addition, even if a higher trace is needed to licence t , this may be in a VP-adjoined position (as Barss assumes). If we were to assume the binding algorithm to involve special binding chains, then requiring that these be constructed only when necessary might get us the right results. If such operated to order the construction of Chain Accessibility Sequences, it would be crucial to first determine which traces the principle would deem "required". If only the lowest traces were required this might buy us the special status that these appear to bear with respect to reanalysis. The principles proposed above, on the other hand might lead us to prefer intermediate binding to deep binding on the basis that in these cases the distance between the antecedent and the anaphor would be less.³⁷

It can be seen that adopting such an interpretation of the MCP would be fraught with problems. It is however, possible that, as suggested at the beginning of this section, a single parsing principle involving early interpretation underlies both the principles governing the parsing of anaphors and the MCP.

3.9 Backwards Anaphora

Consider again, the case of psychological predicates. Riemsdijk & Williams do not assume a movement analysis for Psych verbs. Their theory therefore predicts no difference between binding possibilities in agentive and non-agentive interpretations of sentences like (72).

- (72) a. Each other's girlfriends deliberately irritated
the guys
b. Each other's girlfriends unknowingly irritated the
guys

Students were presented with both versions of this sentence type. While no-one found the sentences fully grammatical, there was a very slight preference for the non-agentive version.

Recall what our parsing principles predict. After the anaphor, the parser is actively searching for an NP which matches it in number and gender, this stage is accomplished at the end of the sentence in both cases. However, in the case of a) the ensuing c-command

37. If τ -marking was to determine the status of a trace with respect to the ordering of Chain Accessibility Sequences we might also expect to find differences in the importance of intermediate traces with respect to arguments and adjuncts (assuming the 1984 theory of Lasnik & Saito).

check should fail while in b) it should succeed if movement has occurred. This is because, at the trace position, the anaphor will have been refreshed and the parser will know that at some point in the derivation it could have been c-commanded by the guys. If no movement occurs in b), we would expect the sentences to be ungrammatical on either interpretation. This was, largely speaking, the response which was obtained. However, this approach would be unable to account for the minor preference attributed to the non-agentive interpretation. Nor would it account for the fact that some speakers found the sentences marginally acceptable.

The overall marginality of sentences like (72b) and the lack of contrast with a) would tend to support a non-movement analysis of Psych verbs. However, this does not jibe with the awareness of ambiguity in (69) discussed above.

Compare these results with those for backwards pronominalisation in sentences involving other types of predicate such as those in (73) and (74).

(73) A rumour about himself came to Stewart's ears

(74) Arriving at the museum, a massive statue of himself hit him in the eye

One third of the students assigned only one question mark to (73) while about one sixth found it fully grammatical, thus rating it above (72b). While (74) was viewed less favourably, it was still considered slightly better than (72b). (73) shares certain non-agentive properties with (72a) and might plausibly be analysed as involving movement too. If gerund constructions involve PRO subjects, c-command might be observed here too, otherwise it is not clear why these sentences are not considered fully ungrammatical. Nevertheless, if a grammatical analysis of the binding can be found for them we must still explain why they are only marginally good. For this reason I will take the data to be inconclusive as to the movement status of Psych verbs. We will come back to this construction briefly in the discussion of pronouns in section 4.

3.10 Review

This completes our analysis of the processing of sentences containing anaphors. We have developed an analysis in which a special procedure is set up for the location of an antecedent. We have argued that the processes involved are motivated by a parsing pressure for early interpretation. We have seen that when the

steps required of the procedure are set up to make the correct predictions about antecedent preferences, they also naturally reflect the usual order of antecedent-anaphor.

The assignment of an antecedent to an anaphor consists of three basic steps. The first step is the institution of an active search for a potential antecedent of the right type. The search proceeds backwards from the anaphor, in the first instance, if this fails a left to right search is begun. In addition to locating an appropriate NP the parser performs two checks, a check on locality and a check on c-command.

Our analysis captures two generalisations about antecedent preference. Preceding antecedents are always preferred and precedence aside the antecedent closest to the anaphor will be preferred.

In addition to the basic analysis we have explained one apparent inconsistency by appeal to the existence of a topic buffer. We have also proposed an explanation for the different behaviour of various sentence types with respect to a) whether the speaker is aware of ambiguity and b) when the answer is yes, whether there is a temptation to abandon one antecedent in favour of another.

Overall we have seen that both linear order and distance are relevant to the parsing of anaphors. The analysis which was developed turns out to mirror closely, the binding system of Barss (1985) discussed earlier in the paper. Although the parsing data sometimes points to a special status for binding into θ -positions we have not found real evidence that this needs to be encoded into the binding system. Instead we claim that it follows from independent grammatical and parsing processes.

In the following section we will consider what the results of the analysis lead us to assume about the grammar and the parser.

4.0 Conclusions and Some Remaining Problems

The account of anaphor parsing which was given in the preceding section bears a lot of resemblance to Barss's binding analysis. I will begin by discussing some precise predictions that such an analysis entails. I will then draw some conclusions about the way in which binding should be treated within the grammar.

Following this, I will look at some outstanding problems for Barss's binding theory and suggest certain revisions. Finally I will sum up with some conclusions about the types of representation to which the parser must have access.

4.1 Parsing and Chain Accessibility

When I began this investigation Barss's approach to binding had two major points of attraction. The most important was that it was based on the assumption that binding could be achieved at a single level of representation. The Riemsdijk & Williams' approach was attractive in precisely the same way. The second point in favour of Barss's account was that it adopted a representational approach to binding. The attraction of this lay in that, if representations were crucial to the syntactic binding, those same representations could be exploited by the parser to explain other factors (or vice versa).

We saw in section three that Barss's binding theory does quite a good job of accounting for the binding facts of English. Precisely because it is a representational account, it is able to account for binding into positions which do not correspond to the positions of a uniform level of representation (what I have called "intermediate binding"). These positions are the very positions containing antecedents which are chosen by the parser in order to achieve the earliest possible interpretation of an anaphor. Barss's theory is not concerned with explaining when it will be possible to bind into intermediate positions, only with the fact that it *is* possible.

Because, in Barss's theory elements can be bound while in their surface positions, it becomes necessary to allow binding into A bar as well as A positions. Once this has been allowed it seems natural to do away with the A/A bar distinction in binding all together. We saw that while binding from A bar positions rarely manifests itself in English, allowing such binding may be advantageous in the explanation of certain facts in other languages. While we found no parsing evidence which favours this approach we found none which contradicts it.

When translating the results of a syntactic binding theory into parsing mechanisms, another advantage of Barss's system was the way in which it treated c-command relations. By reference only to paths and their sisters it does not become necessary to invoke a complex algorithm by which the parser knows when an element c-commands another. One possible

problem here might arise if it could be shown that the binding conditions needed to make reference to m-command as well as c-command. Such a claim has been made for Condition C of the binding theory but Barss's system does not have a condition C as such. I will discuss this briefly below.

It is worth mentioning here, one crucial way in which Barss's system and the parsing system suggested here are different from approaches involving either Reconstruction or cyclic application of the binding conditions. In Barss's system anaphors may be bound in any position through which they might pass (on a derivational approach) it has passed during the derivation. Notice however, that since the binding is achieved at S-structure, potential binders must c-command the anaphor from their S-structure position. In a Reconstruction or cyclic approach, both binders and anaphors are considered in their relative positions at a given level of structure. In Barss's system, an NP which is a potential antecedent cannot be "reconstructed" in order to bind an anaphor only the reverse can happen. This is why movement of an anaphor creates an extension of the binding domain in Barss's system.

Cases where only partial reconstruction are required may not be a problem for Barss's system then. Our investigation has shown that from the point of view of the parser, Chain Accessibility Sequences are constructed, as much for the purposes of finding antecedents as to check licencing conditions. If this is the case then there would be no motivation for an R-expression which has moved to be checked in its D-structure position, with respect to binding. There is no reason why the "refreshment" of John should cause the parser to initiate a new search³⁸ for an antecedent for it since it does not need one.

If it is desirable for a syntactic binding theory to treat binding at a single level of representation this is even more desirable as far as the parsing system is concerned. That essentially the same system can achieve syntactic binding and explain the preferred assignment of antecedents by the parser is remarkable. Especially since in both cases the results are achieved with access to the same level of representation.

38. This means that the case of "partial" reconstruction put forward as problematic by Riemsdijk & Williams will not be so for Barss. Barss treats condition C apart. From the point of view of the parsing system this makes sense since R-expressions require no antecedents. It makes less sense for a binding system that condition B should be subject to reconstruction if pronouns do not require binders. This may be why the movement of a pronoun does not result in the extension of its binding domain the way movement of an anaphor does.

4.1.2 Requirements on the Syntactic Approach to Binding

We draw the following conclusions from these results. Any adequate syntactic treatment of binding should apply the binding conditions (or at the very least Condition A) at S-structure. A representational approach to binding is required for this. Within the syntax, nothing special need be said about the A/A bar distinction in anaphor binding.

We will now look at some problems which remain with the Barss approach.

4.2 Problems with the Chain Accessibility Approach

4.2.1 Double Objects

The first of these problems has already been mentioned. This is the inability of the system to account for the parsing facts in double object constructions. Following the conclusions of Barss & Lasnik (1986) one might assume that a partial solution is to treat the VP structure as being flat. However, any approach based on paths most naturally invokes a system of binary branching. Given the fact that so little is known about the construction I will assume that this is not a reason for rejecting Barss's theory. I would like to point out however, that incorporating the Larson (1988) treatment of the construction into Barss's framework will not produce the right results, particularly where the binding of pronouns is concerned. We will return to the binding of pronouns below.

4.2.2 Intermediate Traces

One of the virtues of the Chain Accessibility approach is that it permits binding into intermediate positions. We have seen that parsing pressure encourages binding into these positions when no preceding antecedent is available. However, in certain cases Barss's system undergenerates with respect to these positions.

The first of these cases was noticed by Barss himself. His theory predicts that multiple binding domains will not arise when a lower clause is the complement of a verb which requires IP not CP complements. This prediction is incorrect as (75) shows.

- (75) Which pictures of himself did John believe Mary to have taken

Barss dismisses such examples on the basis that the lower IP may be the result of so called "S bar Deletion". Thus there may be a stage in the derivation (presumably S-structure) at which the trace is present

for the purposes of binding. In this case it would be necessary for Barss to order S bar Deletion and Case Assignment after binding although he states explicitly that such ordering of rules within a component of the grammar is inconsistent with the general program of Government and Binding. To be consistent, S bar Deletion and Case Assignment would have to take place after S-structure.

Other problem cases arise due to the fact that any sentence with an island violation and an anaphor in the wh-phrase which requires binding from an intermediate position, should exhibit a Binding Theory violation.³⁹ Barss's theory predicts that (76) should be markedly worse than (77).

(76) ?Which pictures of himself does John wonder how Mary acquired?

(77) ?Which pictures of herself does John wonder how Mary acquired?

According to this theory only one Chain Accessibility Sequence is available to himself in (76) and that sequence accesses Mary as the antecedent. An alternative Chain Accessibility Sequence, which would allow John to be accessed, is unavailable, due to the fact that the position in which one would otherwise expect an intermediate trace, is filled by how. In fact, (76) and (77) appear to exhibit the same level of ungrammaticality. In so far as (76) is acceptable John seems to be accessible to the anaphor and no SSC violation occurs.

Notice that both in the case of the S bar deletion and the wh-island violation the parsing account predicts the following NP will already have been located as a potential antecedent before the filled or absent trace position is encountered.

In the case of (76) we might say that since the wh-phrase managed to reach the front of the sentence speakers must be positing an available trace position whether there really is one there or not. This would account for why ambiguity can actually arise.

(78)? Which pictures of himself did John wonder how George acquired

The anomaly may be enough to force an unusual preference for the lower antecedent but the sentence is -----

39. This was pointed out to me by Jim Blevins.

nevertheless ambiguous.⁴⁰

There exist cases, similar to those above in which "intermediate" binding occurs but for which no current grammatical theory posits the existence of an intermediate trace. This case, involving a gerund can be seen in (79) (to be contrasted with (80)).⁴¹

- (79) Which picture of himself did John warn Mary about (*t) Susan's finding?
- (80) Which picture of herself did John warn Mary about Susan's finding?

This is an even more surprising case than the two already discussed. Once again it seems likely that Barss would invoke the presence of a trace in the VP from which himself could be bound.⁴²

It would seem then that these cases may be taken either as evidence of the inadequacy of Barss's theory or of the existence of traces in VP adjoined position. Pending evidence from other areas on this issue I will leave the question open.

4.2.3 Pronoun Binding

Recall from section 2.2 that Barss's analysis of pronoun binding states that pronouns need only be free in the Chain Accessibility Sequences for them which contain the θ -marked trace.

Recall also that he adopts the Belletti & Rizzi analysis outlined in section 1, with the D-structure shown for (11).

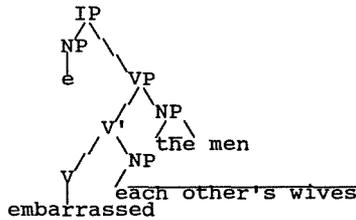
- (11) Each other's wives embarrassed the men.

40. Barss could also invoke the presence of traces in the VP-adjoined position to account for the interpretations here but I do not wish to commit myself on the issue of whether such traces exist.

41. Thanks to Bill Phillip for help in constructing this example.

42. In fact these three cases, (S' deletion, Wh Island violations and small clauses) suggest that the parsing procedures should not mirror Barss's so closely. Perhaps the surface position of the anaphor should simply be allowed to determine the extension of its binding domain and any compatible NP on the path between its surface position and the θ -marked trace should be an available antecedent.

(13)



An NP in the surface subject position may be bound by the post-verbal NP. This binding takes place via a Chain Accessibility Sequence involving the θ -marked trace of the subject NP. In the case where the subject of a Psych verb is a pronoun, Barss predicts that it could never be coreferential with the post-verbal NP.⁴³ This prediction is contrary to fact as (81) shows.

(81) They embarrassed each other

Now, if the movement analysis of Psych verbs is correct, (81) demonstrates that a pronoun need not be free in D-structure position. It suffices that the pronoun be free in the position to which it moves after A movement i.e. at NP-structure, exactly as Riemsdijk & Williams predict. This suggests that NP movement should not be reconstructed for condition B, but we have seen that Psych movement must be reconstructed for condition A. Since Wh movement involving a pronoun does not cause an extension of the pronoun's binding domain it seems that a pronoun need not be free at surface structure. In addition (82) shows that it is not sufficient for a pronoun to be free at surface structure (even when that is the same as NP-structure).

(82) *John seemed to have been beaten by him

This example seems to show that a pronoun needs to be free after every application of NP movement. John is clearly not within the domain of the pronoun after Raising, the sentence must be ruled out after Passive.

(83) *...John was beaten by him

Either it is not true that D-structure position is irrelevant for pronouns (which would suggest that the Psych Movement analysis is wrong), or it is the fact that the pronoun is free at NP-structure in (81) which is significant. Another case involving NP-movement

 43. Belletti and Rizzi were fully aware of this problem and for this reason they make clear that if their analysis is correct, Principles B and C cannot be held to apply at D-structure.

confirms that D-structure position is irrelevant.

(84) *John seemed to him to be sick

In this case, him is clearly free at D-structure. It is the post-Raising position which is at stake. In order for Barss to rule out (82) he will have to be able to reconstruct A movement. If he does, he will have to account for why c-command of the pronoun in its θ position does not matter. In fact, Riemsdijk & William's claim that NP-structure is the level at which binding should apply, appear to be correct for pronouns.

It is apparent then that some revision of Barss's binding theory is required in the area of pronoun binding. The further study of pronoun binding may well show that, with respect to them at least, the grammar is required to make a distinction between A and A bar binding.

4.3 Conclusions

We have demonstrated in this paper that all binding of anaphors can be accomplished at S-structure. None of the problems raised in this area would be made any better by allowing binding to apply at another level. To a large extent these problems are internal to the Government and Binding Framework which Barss adopts.

In addition, we have shown that all the steps required for the parser to check the syntactic binding requirements and locate antecedents, as well as choosing between, them can be achieved with reference to a single level of representation. We therefore propose that the parsing machinery should access the minimum number of levels of representation possible. In the case of the binding of anaphors this will be a single one, S-structure.

We claim that any parsing approach to anaphors must be able to account for the preferences for preceding and closest antecedents. In order to do this it will need to incorporate a general principle of Early Interpretation.

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APPENDIX

A. Wh phrase with anaphor in initial position

a/b tested grammaticality of deep versus surface binding

Judge the grammaticality of a) and b)

a) Which stories about herself did Fred know Mary liked?

a') Which pictures of herself did Fred think Mary liked?

b) Which stories about himself did Franz know Martha liked?

b') Which pictures of himself did Franz know Martha liked?

Judgements in %					
	?	?	?*	*	**
a)	6.5	21	46	16.5	
b)	41.5	50	4	4	

c/d tested preference for upstairs versus downstairs binding

Indicate a preference for c) or d)

20% c) Which picture of herself does Bob want Sue to like best?

80% d) Which picture of himself does Bob want Sue to like best?

e) tested preference in ambiguous cases

Indicate the person who is in the picture.

Bob= 57.5% Joshua=34.5% (8% error)

e) Which picture of himself does Bob think Joshua likes best?

B. Wh phrase with anaphor in intermediate position

f) tested binding preference in ambiguous case

Sue=65% Mary=31% either=4%

f) Sue knows which picture of herself Mary likes best

C. Dual domain

g)/h) compared grammaticality of ambiguous dual domain cases with single domain

g) John liked every picture of himself that Bill had ever taken

g') Sue read every opinion about herself that Mary had ever put down in writing

h) John liked every picture that Bill had ever taken of himself

h') Sue read every opinion that Mary had ever put down in writing about herself

	?	??	?*	*	***	
g)	42	11	17	18.5	9	4
h)	42	1 1	11	22	9	4

i)-k) tested grammaticality of unambiguous dual domains

i) v j) downstairs versus upstairs binding with an agentive verb

k) upstairs with an experiencer verb

i) Johnny destroyed every snapshot of herself that Anna had ever taken

j) Tommy destroyed one snapshot of himself that Patty had taken

k) Tommy cherished every remark about himself that Patty ever made

	?	??	?*	*	***
i)	17		33	50	
j)	62.5	37.5			
	25	75			

l)/m) tested grammaticality and binding preference in plural and singular ambiguous dual domain

l) The professors loved the snapshot of themselves that the students took at the end of the semester

m) The fighter began to believe every claim about himself that his manager had ever proclaimed

	?	??	?*	*	***
l)	66	4	4	18.5	7
m)	56	19		15	7

l') who was in the snapshot?

66% professors
4% students
15% ambiguous
15% everyone

m') Who did the manager make claims about?

74% fighter
26% manager

n) tested the effect of intervening material on ambiguous dual domain sentences

n) The gallery owner exhibited two pictures of himself, with a desert landscape in the background, that the artist had painted in his youth

	?	??	?*	*	***
	46	15	8	15	8

Who was in the pictures?

65% gallery owner
35% ambiguous (some students reported feeling that the owner and the artist were one person)

E. Psych verbs and bakwards anaphora

o)/p) tested the difference in acceptability between backwards anaphora in Psych verbs versus Dative constructions

in p) binding preference was also tested

o) One or two of the anecdotes about each other really pissed them off

o') Some of the stories about each other really pissed them of

p) Jaye called him a dirty liar; in fact, Jaye told quite a few things about himself to George that day

	?	??	?*	*	***
o)	4	26	47	24	
p)		20	36	44	

p') Who does "himself" refer to
 66% Jaye
 50% George

q)/r) compared acceptability of backwards anaphora with Psych verbs on agentive and experiencer reading

q) Each other's dates deliberately bugged the girls

r) Each other's girlfriends unknowingly irritated the guys

	?	??	?*	*	***
q)	25		25	50	
r)	41		33	25	

s)/t) compared grammaticality of surface versus deep binding on experimenter readings

s) George thinks that these pictures of himself upset Susan

t) George thinks that these pictures of herself upset Susan

	?	??	?*	*	***
44	33	11	11		
7	15	15	48	7	7

u) tested backwards binding of reflexives in non-Psych verbs for comparison

u) A rumour about himself came to Stuart's ears

u')Arriving at the museum, a massive statue of himself hit him in the eye

	?	??	?*	*	***
9	28	16.5	20	20	5.5