

In this article, I will outline a point of view on the nature of representations at the linguistic level of *logical form* (LF) and on some presumed interpretive principles that apply to these representations. In light of this general viewpoint, I will then advocate: first, a revision in the basic notation of *binding theory* in the sense of Chomsky (1981); second, an account of the principles governing anaphoric relations between *operators* and *pronouns*, suggesting still further revisions in binding theory; and third, a basic rule of *nominal interpretation*, which expresses some known fundamental differences between nominal and verbal constructions and has other desirable consequences, as I will explain. Both with respect to the general discussion in section 1 and with respect to the particular applications that form the topics of subsequent sections, this article omits various details, elaborations, and possible critical discussion, due to lack of space. I hope, nevertheless, to have indicated some points where further research may prove fruitful, either by extending the view suggested here, or by refuting it.

## 1. Some Structures at LF

I assume here the broad outlines of the Extended Standard Theory of grammar. In particular, I assume, following Chomsky (1976) and subsequent writings, that syntax is organized as shown in (1),

$$(1) \quad DS \text{ --- } SS \text{ --- } LF$$

where DS is deep structure (D-structure), SS is surface structure (S-structure), and LF is logical form. As the diagram indicates, LF is fixed through S-structure, and it is in the mathematical sense the image of S-structure under some rule or rules to be deter-

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mined. Furthermore, structures at LF are to determine the contribution of grammar to semantic interpretation.

Within a program of research that aims at comprehending the basis for human linguistic knowledge, the properties of LF may be of particular interest, especially if LF-structures differ significantly from S-structures. For in that case, the remoteness of logical forms from the structure of sentences as actually heard will tend to make the relation between the evidence available to the child, on the one hand, and the properties of the system grasped, on the other, so tenuous that we should expect the evidential gap to be closed largely by unlearned principles of grammar. A good working hypothesis would be that the shape of LF is the same for all languages (apart from the meanings of lexical items), and that is the hypothesis that I shall adopt here.

LF-structures look toward (the rest of) syntax, and toward semantics. The past several years have seen many proposals on the nature of rules mapping from S-structure to LF (the syntactic side), and on the interpretive principles that might be supposed to apply at LF (the semantic side); I have in mind work on the scope of quantifiers and *wh*-expressions, rules of predication in the sense of Williams (1980), principles of assignment of anaphor-antecedent relations, and the like. I will take this work as a point of departure.

Suppose, following May (1977), that quantificational NPs are assigned scope at LF through the transformational rule of Quantifier Raising (QR), a rule of adjunction. Then, for instance, from the S-structure underlying (2a) we will obtain the LF-structure (2b), where the trace *t* of the application of QR marks the place of a variable:

- (2) a. John saw everybody.  
b. [[everybody] John saw *t*]

In general, QR Chomsky-adjoins a quantificational NP to some admissible position, or 'landing site', its scope then extending over that site, i.e. over its c-command domain. In the case of (2b) in particular, the variable *t* is within the scope of the quantifier *everybody*.

In May's theory, the relative scopes of quantifiers are entirely fixed at LF. Hence, we can explain ambiguities of scope in terms of the availability of multiple representations at LF; inversely, we can relate the occasionally surprising lack of ambiguities to conditions on QR, or to independent filters that rule out certain structures at LF, and so forth. Of course, in all such explanations, semantic principles are presupposed; one of my purposes in this discussion will be to make these presuppositions more explicit.

Consider possible transformational rules mapping between S-structure and LF. If we assume the Projection Principle of Chomsky (1981), then these rules are forbidden from assigning to a given S-structure an LF-representation to which it fails to conform in categorial selection (see Chomsky (1981, 38ff.)). QR is consistent with the Projection Principle; specifically, the selection observed in (2a) is not disturbed in (2b), because the NP *everybody* appears there as an operator, to which selection does not apply. Few

other hypothetical rules could be consistent with the Projection Principle, which if assumed acts as a narrow gate through which any proposed rule must pass.

Assuming QR, the following structures will be major types available at LF:

- (3) a. [ $x^* \dots x^{n-1} \dots$ ]  
b. [ $x^* \text{Spec } X [x \dots]$ ]  
c. [ $x^0 O [x \dots t(O) \dots]$ ]

(3a) is the familiar structure of head and arguments; (3b) creates maximal projections by adding specifiers; (3c) is the form of structures consisting of an operator *O* on *X* with an argument *t*(*O*) within its scope. The types (3a)–(3c) are all available at S-structure as well as LF, the first two by base rules and the third by any sort of peripheral movement with Chomsky-adjunction, as discussed for instance in Baltin (1981). Let us concentrate for a moment on the structures defined by (3b). For  $X = S$ , I assume that Spec  $X = \text{Comp}$ , so that Spec  $X$  may be filled by a complementizer, by words such as *if* or *whether*, by *wh*-expressions, or by certain frontable 'negative' quantifiers, as in (4):

- (4) [not a single book] did John read *t*

From the point of view of interpretation, (4) might be viewed as a case where the semantic equivalent of QR has been carried out in the syntax. The *wh*-expressions, whether related to argument positions in *S* or, like *if* and *whether*, given in place, might be supposed to be sentential operators. Finally, complementizers do not seem to contribute to interpretation at all. For the case  $X = S$ , then, (3b) could be regarded as semantically equivalent to (3c), in the sense that Spec  $X$  is an operator *O*, provided that it is semantically significant.

What of the case (3b) with  $X = \text{NP}$ ? Bypassing complexities of the sort discussed, for example, in Jackendoff (1977), this gives rise to Spec  $X = \text{Det}$  (*the, every, which, \dots*) or Spec  $X = \text{NP}$ . Under the assumption that determiners bind variables, phrases like *every man* are taken in the way suggested by (5):

- (5) [every  $x$ : man ( $x$ )]

These phrases become restricted quantifiers once QR has applied. This sort of account can be elaborated for the cases of determiners that may build nonquantificational singular terms, such as *the*, and for *wh*-expressions; the result is a type of variable-binding different from that shown in (3c), but, it appears, readily understandable. Finally, case (3b) gives rise to the structures represented by (6) (*John's cat, my beliefs, \dots*).

- (6) [ $NP \text{ NP}_1$ 's  $N'$ ]

I will assume that they are interpreted as follows.

- (7) [the  $x$ :  $N'$  ( $x$ ) &  $R$  ( $x$ ,  $NP_1$ )]

where *R* expresses some contextually determined relation. *John's cat*, for instance, with the understood relation of ownership, would have the interpretation (8):

- (8) [the *x*: cat (*x*) & John owns *x*]

I will elaborate in section 4 on some consequences of this view of structures of the form

(6).

If (3) gives basic types of structures available at LF, with subtypes and interpretive

rules as sketched above, the result is a very tight theory of both the structure and the semantics of LF for the most fundamental and productive kinds of phrases. It gives rise to a picture of LF that might be expressed succinctly by saying that LF-representations instantiate the schemata of generalized quantification theory.<sup>1</sup> May's QR is not only the sort of rule we should expect if this picture is approximately correct: it is virtually the only sort of rule available, or needed. We can envisage extensions of QR that assign scopes to constituents that are neither heads nor arguments of heads. LF-representations built by an extended Scope Assignment rule applying to S-structures would bear more than a casual relation to the structures proposed some years ago by James McCawley and others adopting Generative Semantics.

## 2. Binding Theory: Indexing and an Alternative

With the background sketched in section 1, I now consider some of the central questions of binding theory. This theory is concerned with the conditions imposed by grammar on the relation of *antecedence* between positions in syntactic structures, and with the conditions on interpretation to which the assignment of this relation gives rise. The syntactic conditions have for some years been expressed as conditions on *coindexing*—that is, conditions on when two or more positions, which may be occupied by arguments or by operators, may, must, or cannot be assigned the same numerical index. The indices are, of course, meaningless in themselves; they serve only to indicate the relation of an anaphoric element to its antecedent.

I shall take the type of account given in Chomsky (1981) as a point of departure. On this account, each element, operator or argument, of a syntactic structure is assigned some numerical index or other, and binding theory consists of conditions governing the output of such indexing. With respect to *argument positions* (those occupying the space shown by the dots in schema (3a)), the binding conditions make specific mention of the features of arguments occupying those positions. Arguments may be *pronominal* (as are all of the personal pronouns of English), or *anaphoric* (as are the reflexive *-self* and the reciprocal *each other*), or *R-expressions* (as are proper names and definite descriptions). An argument *A* is said to be *free* in domain *D* if *A* is not c-commanded by any argument *B* in *D* with which it is coindexed; otherwise, it is *bound* in *D*. For anaphors and pro-

<sup>1</sup> I use the notion of a *schema* in the sense of Quine (1970), and by saying that schemata are generalized I mean to allow both for generalized quantifiers and for types of restricted quantification not found in the classical theory.

nominals, the critical domain to consider is the one that constitutes their *minimal governing category*, where the minimal governing category *G(A)* for an argument *A* is the smallest domain among *S*, NP containing *A* and its governor. (For details of the formulation of the notion of government, see Chomsky (1981); for this discussion, they are not critical.) The binding theory for argument positions may now be stated, in one simple form, as (9):

- (9) A. If *A* is pronominal, then *A* is free in *G(A)*.

B. If *A* is an anaphor, then *A* is bound in *G(A)*.

C. If *A* is an R-expression and *D* contains *A*, then *A* is free in *D*.

The binding conditions (A)–(C) combine to give the familiar array of data shown in (10):

- (10) a. \* [s he<sub>i</sub> saw him<sub>i</sub>]  
b. [John<sub>i</sub>, resented [NP what Mary said to him<sub>i</sub>]]  
c. [s he<sub>i</sub> saw himself<sub>i</sub>]  
d. \* [John<sub>i</sub>, resented [NP what Mary said to himself<sub>i</sub>]]  
e. [s [NP his<sub>i</sub> mother] saw John<sub>i</sub>]  
f. \* [s he<sub>i</sub> saw John<sub>i</sub>]

In (10a), with *him<sub>i</sub>* = *A*, *G(A)* = *S*, and *him<sub>i</sub>* is bound in *S*, violating (A) of (9). In (10b), however, where again *A* = *him<sub>i</sub>*, *G(A)* = NP; and since *A* is then free in *G(A)*, the coindexing shown violates no conditions. (10c), with *himself<sub>i</sub>* bound in *S*, satisfies (B) of (9); but (10d) violates this same condition, since *himself<sub>i</sub>* is free in the governing category NP. (10e) violates no condition, since neither one of *his<sub>i</sub>* or *John<sub>i</sub>* c-commands the other; but (10f) violates (C) of (9), *S* being in this case a domain in which *John<sub>i</sub>* an R-expression, is not free.

The binding theory summarized in (9) is not without its descriptive problems, and modifications have been suggested, for English and for other languages, to overcome them. The interpretive issues that I will consider, however, are indifferent to these recent further developments, and for this reason I restrict the discussion to the simple formulation (9). As Chomsky notes (1981, chapter 5), crediting the central observations to Howard Lasnik, a binding theory whose only primitive notion is that of coindexing has no direct way of exhibiting the possible anaphoric interactions among plurals, or between singulars and plurals. Thus, to take a well-worn example, such a theory offers no immediate account of the interpretation of (11) in which both John and Mary are to be included in the reference of the plural pronominal *they*:

- (11) John told Mary they should leave.

Lasnik (1981) raises further serious issues of this sort. The limitations imposed by a reduction to the sole primitive of coindexing ill suit the general structure of the theory

of Chomsky (1981), or any theory that otherwise allows the explicit representation of optional coreference.

Now, it is evident that the problem of expressing the "split antecedent" reading of examples like (11) can be overcome simply by devising an indicial notation to distinguish referential *overlap* from *identity*. The notation shown in (12) suggests itself:

- (12) John<sub>i</sub> told Mary<sub>j</sub> they<sub>(i,j)</sub> should leave ( $i \neq j$ )

More formally, binding theory might be revised so as to assign to each argument a set of numerical indices, this set to be a singleton if and only if the argument is grammatically singular. The theory of (9) can then be revised to suit the new situation; but some care must be taken, because indices can now overlap without being identical. Preliminary to revising (9), we define: A is *overlapped* in domain D if A is c-commanded in D by an argument whose index set has a nonempty intersection with that of A; and A is *exactly spanned* in D if c-commanded by an argument whose index set is identical to that of A.

The binding theory may now be expressed as follows:

- (13) A'. If A is pronominal, A is not overlapped in G(A).

B'. If A is an anaphor, A is exactly spanned in G(A).

C'. If A is an R-expression, A is not overlapped in D, for any D containing A.

The clauses (A')-(B') of (13) do not have the symmetry of the clauses (A)-(B) of (9). The reasons for this are two. First, unlike pronominals, anaphors cannot split their

antecedents. (14) is ungrammatical:

- (14) \*John<sub>i</sub> told Mary<sub>j</sub> about themselves<sub>(i,j)</sub>

This consequence would not follow if *exactly spanned* in binding condition (B') were replaced by *overlapped*. Second, anaphors are required to pick up the *whole* reference of their antecedents. In (15),

- (15) John expected that they would see themselves.

there is no interpretation on which *they* denotes John, Mary, and Tom, while *themselves* denotes only Mary and Tom.

Expansion of the primitive notation of binding theory to allow sets of numerical indices as the index of arguments, and the concomitant revision in (13), together overcome many of the problems noted in Chomsky (1981) and Lasnik (1981). There is a further issue, also noted by Lasnik. The sentences in (16) are often thought to be ungrammatical:

- (16) a. I like me.  
b. We like me.

Their ungrammaticality follows from the binding theory if they are constrained to be

assigned the indices shown in (17):

- (17) a. I<sub>i</sub> like me<sub>i</sub>  
b. we<sub>(i,j)</sub> like me<sub>i</sub>

But it is not clear why they should be so constrained. What prohibits the indexing in (18)?

- (18) a. I<sub>i</sub> like me<sub>j</sub> ( $j \neq i$ )  
b. we<sub>(i,j)</sub> like me<sub>k</sub> ( $k \neq i$  or  $j$ )

The problem suggests, and Lasnik does suggest, that binding theory may not be able to make do with a single primitive notion of antecedence (in either its single- or multiple-index versions), but will have to incorporate in addition a *disjoint reference condition*, as proposed and developed in Lasnik (1976). Such a condition would require a new primitive notion; call it *unlikeness of interpretation*. The binding theory, enriched by adding this new notion as a primitive, is easily modified to account for such examples as (16), at the cost of a certain redundancy in other cases. Here, however, I shall cleave to the single primitive of antecedence, putting the problem just noted aside for another occasion.

Thus far I have presented a minor revision of the binding theory of Chomsky (1981), designed to overcome specific problems that arise in connection with plurals. Taking this revision, as summarized in (13), to be an improvement upon the simpler (9), I proceed now to a somewhat different proposal.

I have noted that the role of numerical indexing of syntactic structures is to indicate the *antecedence* relation. The numerals themselves are a mere typographical means of expressing this relation. The role of indexing is unchanged in the more elaborate binding theory of (13). Evidently, however, numerical indexing of structures loses information in comparison with a direct assignment of antecedence, because indexing abstracts both from the particular choice of antecedents giving rise to the indexed structure, and from the direction in which the relation was assigned. Let us represent the assignment of the anaphor-antecedent relation to two positions in a syntactic structure by linking those positions with a headed arrow, whose head points to the antecedent. In (19), for instance, the linking shown is one among many that would reduce to the indexed structure (20):

- (19) John said he thought Mary liked him


- (20) John<sub>i</sub> said he<sub>i</sub> thought Mary liked him<sub>i</sub>

The question arises, then, whether the content of binding theory is appropriately expressed in terms of conditions on indices in reduced structures such as (20), or in terms of conditions on linking in unreduced structures such as (19). I will argue that the latter is preferable, on several grounds.

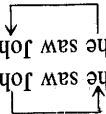
First, I will articulate further the point of view to be developed here. I will suppose that the anaphor-antecedent relation is given by the rule (21),

- (21) Link  $X$  to  $Y$ .

where (21) applies freely between argument positions at S-structure, and automatically in the case of movement rules. The free application of (21) and its automatic application for cases of movement correspond to free indexing and conventional coindexing upon application of movement in the account of Chomsky (1981). That (21) applies between arguments only at S-structure will be essential for some developments considered below. Rule (21) immediately overcomes the problems with the account summarized in (9) that led to reformulating the binding theory of Chomsky (1981) as (13): nothing in (21) prohibits an element from being linked to more than one antecedent, so that links can be assigned to (11), for instance, as follows:

- (22) John told Mary they should leave
- 

Linking is by its nature antisymmetric, whereas coindexing, or in the more general binding theory based on linking we shall have to rule out the two structures displayed in (23) and (24), corresponding to the single earlier example (10f), since either of the linkings shown would depict *he* and *John* as coreferential.

- (23) he saw John  
(24) he saw John
- 

This complication repeats itself for the other examples given in (10): in each case the replacement of coindexing by linking multiplies by two the number of cases to consider. I shall argue, however, that this complication is only apparent. Recall that binding theory relies on the notion of c-command, itself not in general a symmetric relation. I suggest, as a universal principle, (25):

- (25) If  $X$  c-commands  $Y$ , then  $Y$  is not an antecedent of  $X$ .<sup>2</sup>

Condition (25) rules out structures like (24), and thus leaves the same number of cases to be considered as in accounts with coindexing. Another point supports the conceptual advantage of linking. The binding theory of (9) or (13) requires three clauses, one for each type of argument NP. The third of these,

<sup>2</sup> (25) of course is not new; analogous conditions on "pronominalization" were proposed in early versions of generative grammar.

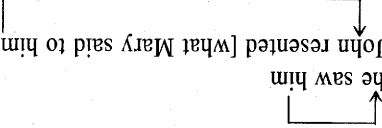
the category of R-expressions, includes only argument NPs whose *interpretation* is dependent upon their *lexical content*. If such expressions are allowed to have antecedents, then their interpretations will have to be understood as derived in two different ways, namely, (a) through their own content and (b) through the content of their antecedents. I think it natural to suggest that this situation cannot arise, and I propose, somewhat informally, the condition (26):

- (26) The interpretation of an expression is given in one and only one way.

Among the consequences of (26) is the ungrammaticality of (23) (I shall make use of another consequence as well, later in this discussion). Thus, under the assumptions made here, both (23) and (24) are correctly ruled out. From this analysis, we reap the following advantage: there need be no clause of binding theory that corresponds to condition (C') of (13) or (C) of (9). Moreover, since neither condition (25) nor condition (26) mentions R-expressions, the behavior of elements of this category follows as a special case, without specific mention in the theory. Given these conditions, binding theory may be recast as follows:

- (27) A". If  $A$  is pronominal and  $B$  c-commands  $A$  in  $G(A)$ , then  $B$  is not an antecedent of  $A$ .  
B". If  $A$  is an anaphor, then there is exactly one  $B$  in  $G(A)$  such that  $B$  c-commands  $A$ , and  $A$  is linked to  $B$ .

Note that (B'') specifically mentions linking, whereas (A'') uses instead the notion "antecedent of". The reason for this difference will be explained later in this section. The clauses in (27) cover cases (28) and (29), the respective analogues of (10a) and (10d):

- (28) \*he saw him  
(29) \*John resented [what Mary said to himself]
- 

If linking is taken as the primitive notion of binding theory, it is possible to account directly for cases of *circularity*, discussed from a different point of view in Higginbotham and May (1981) and considered also in Brody (1981). Standard cases of this phenomenon are sentences like (30),

- (30) His wife saw her husband.

where intuition suggests that at least three persons must be involved; that is, it cannot simultaneously be the case that *her* is anaphoric to *his wife* and *his* is anaphoric to *her husband*.

First, consider that from linking a *generalized* notion of antecedence can be derived. Roughly, the antecedents of  $X$  include the elements to which  $X$  is linked, the elements

to which *they* are linked, and so on. Thus, in (31),

- (31) John thought he would shoot himself
- 

with the links shown, *John* is in the extended sense an antecedent of *himself*: appropriately, since it is the name that ultimately fixes the interpretation of the reflexive pronoun. More precisely, we define:

- (32) *Y* is an antecedent of *X* if *X* is linked to *Y* or, for some *Z*, *X* is linked to *Z* and *Z* is an antecedent of *Y*.

Antecedence of *Y* to *X* is a special case of *dependence* of *X* on *Y*, in a sense that I believe approximates that of Evans (1980). The intuitive idea is that an item is dependent upon those elements from which it receives its interpretation, as both pronouns are dependent upon *John* in (31). Besides these simple cases, there are also more complex cases of *multiple dependence*, illustrated by (33):

- (33) John told [his wife] that she was beautiful
- 

To interpret *she*, we must interpret *his wife*, which requires in turn interpreting the pronoun that it contains. The pronoun *she* is thus dependent upon *John*, because the latter is used in fixing the interpretation of the former. In view of this type of case, we define a general notion of dependence by (34):

- (34) *X* is dependent on *Y* if (i) *Y* is contained in an antecedent of *X* or (ii) for some *Z*, *X* is dependent on *Z*, and *Z* is dependent on *Y*.

In (34), the relation "is contained in" is understood as reflexive: *Y* is always contained in *Z* if *Y* = *Z*. Denoting the relation of dependence by *D\**, I propose the following condition on L-F-representations:

- (35) Not:  $D^*(X, X)$ .

(35) is an interpretive condition, reflecting the fact that the interpretation of an item cannot be given in terms of that item itself. As a special case, it follows from (35) that nothing can be its own antecedent. According to this analysis sentences like (36), with the linking shown, are "circular", in that (35) is violated:

- (36) [his wife] saw [her husband]
- 

These consequences, and others of a similar nature, can easily be deduced from a binding theory with linking, and the simple condition (35).

To sum up the discussion thus far: I have suggested, first, that the type of binding theory proposed in Chomsky (1981), which recognizes only the primitive notion of co-indexing, should be conceptually strengthened so as to express anaphoric relations involving plurals. Assigning sets of numerical indices to arguments is one means to this end; but, I have suggested further, one may formulate binding theory in terms of an antisymmetric primitive of *linking* instead. This binding theory retains the advantages of assigning sets of numbers as indices, and there are two further points in its favor besides. First, a binding theory stated in terms of linking can dispense with any reference to R-expressions, so that in particular no analogue of Chomsky's (C) of (9) (or (C')) of (13) is required. Second, the linking analysis leads to a transparent characterization of "circular" constructions.

My proposal on behalf of linking is, in a certain respect, a throwback. Generative grammars with pronominalization transformations, or with optional coreference assignments as in Jackendoff (1972), also took an asymmetric notion as primitive (for instance, that of *X being pronominalized by Y*). Certain descriptive difficulties were noted in these accounts, however, and in concluding this section I will remark on how they show up in the present context. One of them will in fact prove recalcitrant for the linking account as so far developed, and I will propose a further condition as a solution to it.

Lasnik (1976) discusses sentence (39) apropos of Jackendoff (1972):

- (39) The woman he loved told him John was a jerk.

In (39), either *he* = *him*, or *he* = *John*; but not both. Lasnik shows that a disjoint reference condition, which forces *him* ≠ *John* since the former c-commands the latter, is sufficient to account for these cases. But the account of binding given here has not included such a condition, and Lasnik's device is consequently unavailable. Now, (39) and the like are not a descriptive problem for coindexing theories such as that of Chomsky (1981), because the forbidden interpretation could only be forced by assigning the indexing shown in (40):

- (40) the woman he<sub>i</sub> loved told him<sub>j</sub> [John<sub>i</sub> was a jerk]
- 

This indexing, however, violates (C) of binding theory (9)—*John*, an R-expression, is

- (38) [his wife] saw John<sub>i</sub> [her husband]<sub>j</sub>
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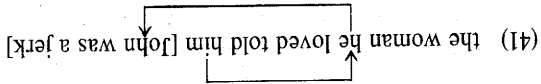
(37) escapes condition (35), because links can be assigned as in (38):

- (37) His wife saw John, her husband.

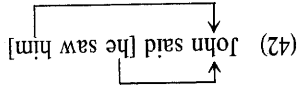
On the other hand, (37) is not circular:

not free in the domain of the sentence (40) itself, being c-commanded by the argument pronoun *him* and coindexed with it. But it remains to be seen whether the forbidden interpretation can be ruled out on the linking account.

We have, then, to consider whether any linking of all three of *he*, *him*, and *John* in (39) is allowed, compatible with the binding theory (27) and the universal conditions in (39) is allowed, compatible with the binding theory (27) and the universal conditions (25) and (26). The answer is that no such linking is permitted, by the following reasoning: (i) the R-expression *John* cannot be linked to anything, by (26); but (ii) (26) also prohibits a singular pronominal from being linked to more than one argument (for, if it were, its interpretation would not be given in just one way); and (iii) by (25), the pronoun *him* cannot be linked to *John*, since the latter is in its c-command domain. Consequently, the only linking that could relate all three of *he*, *him*, and *John* in (39) is as follows:



At this point, however, the generalized notion of antecedence (32) applies. By the transitivity of the antecedence relation, the antecedent of *him* in (41) is *John*, and this again violates (25). Sentences like (39), then, do not pose a descriptive problem for the type of binding theory suggested here. There is another type of case, however, whose solution does require an extension of the principles proposed thus far. What prevents the linking shown in (42)?



For these cases, I propose a further principle. Let us say that *X* and *Y* share an antecedent if some argument *Z* is antecedent of both. Then (43) holds:

(43) If *X* and *Y* share an antecedent and *Y* c-commands *X*, then *Y* is an antecedent of *X*.

Condition (43) is violated in (42), where *he* c-commands *him*, and they share the antecedent *John*.

In conclusion, and modulo earlier remarks about cases like (16), it seems that there is no need to supplement the proposed analysis with a disjoint reference condition.

### 3. Pronouns, Operators, and Linking

I turn now to a discussion of pronominal binding, and especially of the "crossover" phenomena, in connection with the account of anaphor-antecedent relations given in the last section. Crossover has been most extensively discussed in connection with examples

like (44)–(47):

- (44) who did he see t  
 (45) He saw everybody.  
 (46) who did his mother see t  
 (47) His mother saw everybody.

In each of these examples, the interpretation of the pronoun as a bound variable is excluded, "strongly" in the case of (44) and (45), "weakly" in the case of (46) and (47). For the "strong" cases, the analogy between (44) and (45), on the one hand, and the simple (10f), on the other, leaps to the eye:

- (10) f. He saw John.

That is, just as disjoint reference obtains in (10f), triggered by the structural relation of c-command that holds between the pronoun and the name, so binding is impossible in (44), where the pronoun c-commands the site of *Wh* Movement, and in (45), where it c-commands the quantificational NP to which it would be bound. Hence, if traces of *Wh* Movement or QR are assimilated to names (R-expressions) in binding theory, the status of (44) and (45) follows at once.

The above considerations, due to Chomsky (1976) and elaborated in subsequent writings, dispose of the simplest cases of "strong crossover". Several more recent discussions (Higginbotham (1980a,b), Reinhart (1980), Koopman and Sportiche (1981), Huang (1982)) have concentrated chiefly on the "weak" cases, (46)–(47). I will not consider the "weak" cases here; instead, I will point out some issues for the "strong" cases that are not immediately solved by Chomsky's suggestion that operator-traces be assimilated to R-expressions for the purposes of the binding theory, and I will analyze these cases in terms of the notion of linking presented here, extending some ideas in Higginbotham (1980b).

From one point of view, taking variables as R-expressions is rather unnatural, at least if proper names are the paradigm of R-expressions; for, unlike names, variables are always cross-referencing devices and have no inherent semantic content. More significantly, there are several cases for which taking variables as R-expressions fails to block binding that is, intuitively, "strongly" unavailable. One such case, of a sort discussed in Higginbotham (1980a,b), is exemplified by (48):

- (48) \*[[which biography of which artist] do you think he wants to read t]

The account suggested in (1980a) is demonstrably inadequate, for reasons given in (1980b). Besides the suggestion of (1980b), to be developed below in a somewhat different form, I am aware of two other types of approaches to examples like (48). The first, which may be found at least as early as Wasow (1972), is that some form of reconstruction, or layered traces, will assimilate (48) to cases like (44) or (49):

- (49) \*[with whom] did he speak t

The second, due to Van Riemsdijk and Williams (1981), proposes that binding theory applies at a level of 'NP-structure', at which the complex phrase in Comp in (48) appears in the position of its S-structure trace. Since, for binding theory, the pronoun *c-command*s the phrase *which artist*, it follows that binding is blocked in (48) in the same way as in (45), where the pronoun *c-commands* a phrase subject to Scope Assignment only after the conditions on binding have applied.

Reconstruction in the case of (49) is unexceptionable from the point of view toward LF that I have taken here. The logical form of (49) is (50):

- (50) [whom] he spoke with *t*'

In the case of (48), however, since the entire phrase in Comp and the phrase *which artist* that it contains are both operators, subject to Scope Assignment, the view that logical forms instantiate quantificational schemata would mandate the logical form (51):

- (51) [which artist] [which artist] do you think he wants to read *t*

Worse than this, however, appeals to reconstruction or layered traces in such cases as (48) must be accompanied by special stipulations of two sorts. First, it must be stated how scope is to be assigned to elements, such as the phrase *which artist* in (48), contained in a reconstructed phrase. Second, there must be some provision for the fact that *Wh* Movement affects possibilities for optional coreference, although not for pronominal binding; thus, (52) is better than (48):

- (52) [[which biography of *Picasso*] do you think *he* wants to read *t*]

The latter point raises questions also for the analysis of Van Riemsdijk and Williams, as pointed out in Fourier (1980).

Reconstruction, conceived as an approach to (48) and similar examples, and the more precise suggestions of Van Riemsdijk and Williams have in common the aim of assimilating the more recalcitrant cases of 'strong' crossover to the more basic cases such as (44)–(45). The latter, in turn, are taken to reflect an extension of the principles of grammar that prohibit a pronoun from having its antecedent within its own *c-command* domain. These principles, encapsulated in condition (C) of the binding theory of Chomsky (1981), accord the status of R-expressions to operator-bound traces. Both the hypothesis of reconstruction and the proposal that binding theory applies at a level of NP-structure prior to *Wh* Movement have the effect of 'putting back' the offending operator, or a trace of it, within the *c-command* domain of the pronoun that fails to admit binding. Higginbotham (1980b) suggested a somewhat different approach, one that assigned to (48), for instance, the logical form (51), and at the same time prohibited the binding of the pronoun on the grounds that it was not *accessible* to its operator, where *accessibility* was defined inductively on phrase markers. Rather than rehearse (1980b), I will define *accessibility* in terms suitable to the present context, where linking has replaced co-indexing, and then show, first, how this notion provides an analysis of (48) and similar

examples as cases of 'strong' crossover, and, second, how the accessibility principle solves two further problems that seem quite beyond the scope of the methods suggested so far, stemming from the original proposal of Chomsky (1976).

I have suggested above the possibility of extending QR to other elements than quantifiers, and in particular to all elements that are neither heads nor the arguments of heads. Elements subject to Scope Assignment will be called *operators*. I will leave the extension of this concept partially open, but operators certainly include quantificational elements and *wh*-elements. Not only *may* operators be assigned a scope, but, we may suppose, they *must* be assigned a scope to create a well-formed LF-representation. I assume the following condition, really an extension of May's (1977) Condition on Quantifier Binding:

- (53) All operators are assigned scope.

(53) makes application of Scope Assignment to the embedded *wh*-phrase *which artist* obligatory in (48); since *wh*-phrases are operators, they cannot appear in the position of arguments at LF. Recall the assumption that linking is automatic under applications of movement rules. Consequently, application of Scope Assignment in, say, (54) gives the logical form (55):

- (54) Everybody saw his father.  
(55) [Everybody] [*t* saw his father]

Furthermore, the analysis calls for linking apart from movement to take place between argument positions at S-structure. Let us further stipulate that such linking is to a *position* and is preserved under movement. Thus, to derive the reading of (54) with *his* interpreted as a bound variable, we begin with the S-structure (56) and then apply QR, obtaining (57):

- (56) [everybody] saw his father  
(57) [everybody] [*t* saw his father]

Given these assumptions, the question is: what prohibits example (48)? I will assume that it is the underderivability of the appropriate logical form. To make this suggestion precise, a few definitions are required.

By a *formal variable* I shall mean an empty category that occurs in an argument position and is linked to a nonargument; the operator to which a formal variable is linked will be called its  *binder*. A sequence ( $v_1, \dots, v_n$ ) of formal variables such that each  $v_i, 1 \leq i \leq n-1$ , is contained in the binder of  $v_{i+1}$  will be called a *V-chain*. For example: in (55) (*t*) alone is a V-chain; in (51) (*t*), since the formal variable *t*' is contained in the binder of *t*, the sequence (*t*', *t*') is a V-chain, as is each of its consecutive subsequences.



- (58) Every turn from every exit on some freeway is dangerous.  
 (59) [some freeway] [every exit on t'] [every turn from t'] t is dangerous

Sentences whose logical forms show still longer V-chains are easily constructed, and arise whenever "inversely linked" quantification is involved, in the sense of May (1977). The fundamental idea here is that for a pronoun to have for its antecedent a formal variable  $v$ , it must be *accessible* to  $v$ , through a certain V-chain. Suppose, then, that a pronoun  $P$  is *dependent*, in the sense of definition (34), upon a formal variable  $v$ . Let  $C$  be the longest V-chain  $(v_1, \dots, v_n)$  such that  $v_1$  is  $v$  and the binder of  $v_n$  does not contain  $P$ . Under these circumstances we say:

- (60)  $P$  is accessible to  $v$  if  $v_n$  c-commands  $P$ , and  $P$  is not accessible to  $v$  if  $P$

c-commands  $v_n$ .

The criterion (60) partially fixes the extension of the notion "accessible to". The condition (61) is assumed:

- (61) If a pronoun  $P$  is dependent upon a formal variable  $v$ , then  $P$  is accessible to  $v$ .

Let us see how (60) and (61) rule out binding in the earlier example (44):

- (44) \**who* did *he* see *t*

Given the linked S-structure (62) (recall that linking is automatic when a movement rule applies),

- (62) [[*who*] did *he* see *t*]

we wish to rule out any possible dependency of the pronoun *he* on the operator *who*. Such dependency could be expressed *directly* by (63) or *indirectly* by (64):

- (63) [[*who*] did *he* see *t*]  
 (64) [[*who*] did *he* see *t*]

But we have assumed that, apart from movement, linking applies only between argument positions, so that (63) is ruled out straightaway (that the linking rule applies only between argument positions is the linking account analogue to Chomsky's (1981) view that binding theory is fundamentally concerned with "argument binding", in his sense). In (64), *he* has the trace *t* of *Wh* Movement for its antecedent and is therefore dependent upon a formal variable, whose V-chain is the one-element sequence (*t*) consisting of that variable

itself. Hence, in terms of the definitions above,  $v_1 = v_n = v = t$ , and since  $P = he$  c-commands  $t$ ,  $P$  is not accessible to  $t$ . Thus, (64) violates (61).<sup>3</sup> Similar reasoning shows that the standard cases of strong crossover are derivable from the assumptions made here. More significantly, this analysis extends automatically to cases like (48), although here the reasoning is somewhat more involved. Given the S-structure (65) for (48),

- (65) [[which artist] do you think *he* wants to read *t*]

nothing prevents the linking of *he* to *which artist*, because at this level that phrase occupies an argument position. For this reason also, (52), with linking as shown in (66), is admitted at S-structure:

- (66) [[which biography of Picasso] do you think *he* wants to read *t*]

The crucial difference between the cases is that the phrase *which artist*, being an operator, must undergo the rule of Scope Assignment. This rule applies without destroying the link established at S-structure between the pronoun and the argument position, so that the result of its application must be (67):

- (67) [[which artist] [which biography of *t*] do you think *he* wants to read *t*]

But (67) violates (61): in (67) the pronoun *he* has as antecedent the formal variable  $t'$ , which heads up the V-chain (68):

- (68) ( $t'$ ,  $t$ )

Since *he* c-commands  $t$ , it is not accessible to  $t'$ . This reasoning shows that Scope Assignment cannot apply, because that would violate (61); but Scope Assignment *must* apply, because *wh*-phrases are operators. This is a contradiction. This analysis of (48) has the advantage over those discussed above that it explains why *Wh* Movement, although it affects possibilities for optional coreference, does not affect possibilities for pronominal binding. I proceed now to the discussion, promised above, of two further advantages of the system proposed here. The following generalization, drawn in part from the seminal work of Jacobson (1977) and expressed here in terms drawn from the previous discussion, appears to hold without exception.

- (69) A pronoun  $P$  can be dependent upon an operator  $O$  only if the rules of grammar would permit  $O$  to be its antecedent.

<sup>3</sup> Notice that (59) will in fact violate the much better supported condition (25), which forbids a pronoun from c-commanding its own antecedent. But (61) represents a strengthening of (25), as we will see directly.

(70) [[which man [who] t admires his wife]] t tries to please her  
(71) [[which man [who] t admires his wife]] does she try to please t?

The LF-representation with this interpretation is secured through the linking given in (73):

(73) [[which man [[who] t<sub>i</sub> admires [his wife]]] t<sub>j</sub> tries to please her]

(75) [[which man [who] admires [his wife]]] does she try to please t'?

(76) [[which man [[who] t<sub>i</sub> admires [his<sub>i</sub> wife]<sub>j</sub>]] t<sub>j</sub> does she<sub>j</sub> try to please t<sub>i</sub>]

But just here, it appears, the analysis of crossover in terms of conditions on accessibility makes a virtue of necessity; for, to the degree that the crossover phenomena are governed by these conditions, there is no reason to regard variables as R-expressions, a move that may have consequences for the general theory of empty categories. The analogy between the simplest cases of "strong" crossover and the disjoint reference condition, shown by such examples as *He saw John*, may prove to have been misleading.<sup>4</sup> A second advantage of the account proposed here is that it applies immediately to the central cases of what Haik (1981) calls *indirect binding*. Haik has observed that crossover conditions apply even in the case of "donkey-sentence" anaphora—that is, in contrasts like (77)–(78):

I will assume, as do Kamp (1980) and Heim (1981; 1982), that the anaphoric relation shown in (77) is *not* a case of binding of the pronoun by the indefinite description *a donkey*, or at least not so to be construed at the level LF. In this case, I shall take the LF-representation of (77) to be (79), in which the indefinite description does not c-command the pronoun.

(80) which man [who [la donkey] t owns t'] does it hate t'  
In both (79) and (80), we are interested in the possibility of making the trace *t'* of QR, which has applied to the phrase *a donkey*, the antecedent of the pronoun; and in both cases we are obliged by (61) to consider the pronoun's accessibility to *t'*, as determined

<sup>4</sup> Notice also that condition (61) cannot be strengthened to become a condition on elements other than formal variables. A pronominal may be dependent on an R-expression to which it is not accessible, and indeed on one that it c-commands, as in (i):

(i) when she corrected John's homework, [his instructor] was pleased

by the V-chain ( $t'$ ,  $t'$ ). The results coincide with those for the standard crossover cases, yielding the data (77)–(78).<sup>6</sup> I now turn to a last type of crossover case, due to Jacobson.<sup>7</sup> Jacobson (1977) presents the following sort of data:

- (81) Which man who loved her kissed his wife?  
 (82) Which man whom she loved kissed his wife?

(81) can have the interpretation shown in (83); but (82) cannot have the interpretation shown in (84):

- (83) [which  $x$ : man ( $x$ ) &  $x$  loves  $x$ 's wife]  $x$  kissed  $x$ 's wife  
 (84) [which  $x$ : man ( $x$ ) &  $x$ 's wife loves  $x$ ]  $x$  kissed  $x$ 's wife

To derive the interpretation (83) of (81) within the present framework, the S-structure of (81) must be linked as shown in (85):

- (85) [which man [who [t loved her]]]  $t'$  kissed [his wife]

Since every operator of (85) is already in operator position, (85) is also the logical form of (81). Now in (85) the pronoun *her* is not (by virtue of (60)) accessible to the formal semantics of relatives justifies regarding  $t$  and  $t'$  in (85) as distinct occurrences of the *same* formal variable, so that the pronoun can be accessible to this variable through its occurrence as the subject of the embedded relative clause. Then (61) is satisfied, and the interpretation (83) secured.

On the other hand, the very strategy adopted for (81) is of no use for (82), and indeed classifies the unavailability of the interpretation shown in (84), most appropriately as far as intuitive judgments go, as a case of strong crossover. For, in the linked S-structure

- (86) [which man [whom [she loved t]]]  $t'$  kissed [his wife]

the pronoun *she* actually c-commands the trace  $t$ , an occurrence of the formal variable on which it depends. Thus, (86) violates (61). In conclusion, the binding theory suggested here, besides possessing some intrinsic advantages, is consistent with the general hypothesis of section 2, that LF-representations instantiate generalized quantificational schemata; and I have shown that specific departures from that hypothesis, involving reconstruction or layered traces, are neither necessary nor sufficient to account for crossover phenomena.

<sup>6</sup> For reasons of space, I will not attempt to do justice to Haik's full discussion, nor analyze the empirical differences between her approach and mine.  
<sup>7</sup> Inclusion of these cases was prompted by the very interesting suggestions of an LI reviewer.

#### 4. Nominal Interpretation

In this last section, I will discuss in further detail the appropriateness of the interpretive rule (7) for (6), repeated here:

- (6) [<sub>NP</sub> NP<sub>1</sub>'s N']  
 (7) [the  $x$ : N' ( $x$ ) &  $R$  ( $x$ , NP<sub>1</sub>)]

It will turn out that the rules formulated here provide an account, among other things, of the absence of NP-movement in nominals, illustrated in hypothetical cases of *raising* in (87) and *movement passive* in (88):

- (87) \*John's certainty/likelihood/necessity [t to leave]  
 (88) \*John's belief/knowledge/expectation [t to be a nice fellow]

Williams (1982) and Kayne (1981) have both offered explanations of such examples, Williams in terms of conditions on indexing, and Kayne in terms of the Empty Category Principle (ECP) of Chomsky (1981). Rappaport (1980) poses some problems for Kayne and has independently proposed an analysis similar to the one given below, in (1982). I find the analyses of Kayne and Williams both unsatisfactory as general explanations; but rather than give criticisms, I will proceed directly to sketch my own suggestions. Afterward, I will discuss Williams's view, with an eye toward highlighting a quite fundamental difference between his approach toward indexing and the one supposed here. I begin by reviewing some properties of simple and derived nominals, excluding both gerunds and nominals of the "mixed" type (as in *John's proving of the theorem*). Inside N' are to be found structures of type (3a) (namely, (89)), where the  $A_i$  are arguments to N.

- (89) [<sub>N'</sub> N  $A_1$   $A_2$  . . .  $A_p$ ]

Now, in contradistinction to V, all arguments to N are optional, so that, for example, (90) is permitted but (91) is not:

- (90) John's/the [<sub>N'</sub> purchase]  
 (91) \*John purchased.

Subject of N' is optional, too: only a few isolated nouns, such as *sake* and *behalf*, require an NP specifier (furthermore, these nouns are not modifiable). But the optionality of the subject is a special case of the more general fact.<sup>8</sup>

Although the arguments to a nominal are all optional, those that occur inside N' Sometimes whether a nominal has a subject makes a crucial difference to interpretation, as in (i)–(iii):

- (i) John's destruction  
 (ii) the destruction

<sup>8</sup> Sometimes whether a nominal has a subject makes a crucial difference to interpretation, as in (i)–(iii):  
 (i) can refer only to an event of destruction; (ii) only to the broken remains left after such an event. However, Rappaport (1980) notes limitations on any generalizations that may be obtained from these facts, which are in any case neutral with respect to the present discussion.

must be compatible with the thematic selection imposed by the head noun. The subject, however, need not be thematically selected; this is most obvious in the case of simple nominals like (92), where there is nothing to select.

(92) John's cat

To the above familiar points, Kappaport (1980) makes an addition: thematic roles inside N' are in English assigned through prepositions, where, as she shows, the "proper" preposition for the role must be chosen. Suppose, then, that an N' of the form shown in (89) is always taken to have the logical structure exhibited in (93).

(93)  $N(x) \ \& \ R_1(A_1, x) \ \& \ R_2(A_2, x) \ \& \ \dots \ \& \ R_p(A_p, x)$

where the  $R_i$  spell out the thematic roles of the respective arguments  $A_i$ . This hypothesis is not only compatible with, but might be said to explain, the fact that arguments to N are optional—it is not implausible to suppose that conjuncts can always be omitted.

Expressions of the category N' then have the interpretive status of open sentences, crucially of the form (93). NP then may be completed (i) by a *binder* (a Spec not itself an NP), such as *the, a, which, every*, etc., giving rise to the familiar quantifier-variable structure; or (ii) by a subject NP. In the latter case, a default binder is required for semantic coherence, which, in English, presumably has the features of the definite article. The NP subject bears *some* relation to the variable-place, however; this leads to assigning for instance to (92) the semantic structure (94),  $R$  being, in effect, a relational demonstrative.

(94) [the  $x$ : cat ( $x$ ) &  $R$  (John,  $x$ )]<sup>9</sup>

I have been assuming that thematic roles inside NP are given by fixing the interpretation of various relation-symbols  $R$ , which may be overt (as contentful prepositions) or tacit, in such a way as to make the interpretation of the whole N' in some appropriate sense compatible with the thematic selection governed by the head N. Where  $r$  interprets  $R$ , let us say that  $r$  is an  $R-\theta$  if it is a relation taken from among those licensed by the head of N', and an  $R$ -non- $\theta$  otherwise. Now, even where  $r$  is an  $R$ -non- $\theta$ , we may still regard its assignment as subject to the conditions of the  $\theta$ -Criterion of Chomsky (1981). According to this criterion, every argument is assigned a unique thematic role, and in one and only one way. The  $\theta$ -Criterion is understood in such a way as to rule out, say, (95), which shows two goals for the verb *give*.

(95) \*I gave that to you to your children.

Furthermore, the criterion applies to rule out  $R$  as *goal* in the representation (97) of (96).

<sup>9</sup> Independent evidence for these structures, and for thinking that the subject of NP is analogous to a thematic position, comes from the absence of pleonastic subjects of NP, illustrated by (i):  
(i) \*I didn't expect [it to rain]  
See also Anderson (1982).

(96) Mary's gift to John

(97) [the  $x$ : gift ( $x$ ) &  $R$ (Mary,  $x$ ) & to (John,  $x$ )]

even though *Mary* may be taken as the goal of the N *gift* in the simple nominal (98):

(98) Mary's gift

The  $\theta$ -Criterion, understood as above and applied to the derived representations of nominals, now suffices to block raising nouns and movement passives in nominals. Thus, in (99)

(99) \*[John's [likelihood [t to leave]]]

*John* is already assigned a thematic role through the VP *to leave*; hence, it cannot also be assigned a role through interpretation of a relation-symbol  $R$ , as the present hypothesis requires. The same considerations block movement passives. Two further points, I believe, support this diagnosis of the failure of raising and movement passive in nominals. The first is that, unlike Kayne's (1981) analysis, the one proposed here allows *Wh* Movement freely in cases like (100):

(100) who did you hear [<sub>NP</sub> talk about t]

The second is that this analysis appropriately disjoins the question of raising in nominals from the question of raising for corresponding adjectives. Thus, to my ear, (101) is crashingly ungrammatical, although (102)–(103) have the same status, and (104) is fully well formed:

(101) John is necessary [t to leave]

(102) John's necessity [t to leave]

(103) John's likelihood [t to leave]

(104) John is likely [t to leave]

I conclude this section by discussing the analysis of nominals in Williams (1982). In Williams's type of account, building on his earlier work, several varieties of coindexing are proposed. These interact with one another and with other conditions he defends to yield the consequence that NP-movement fails to apply in the domain NP. This deduction thus rules out raising nouns and movement passives in nominals. It proceeds as follows. There are three cases of obligatory coindexing: (i) of the head of  $X$  with  $X$ ; (ii) of the predicate of a subject  $X$  with  $X$ ; (iii) of the trace left by application of a movement rule with the moved element. As a result of (i)–(iii), an NP that shows NP-movement will be indexed as in (105) (adapted from Williams (1982)):

(105) [<sub>NP</sub> <sub>NP</sub>'s [<sub>N</sub>'  $N_k$  [<sub>t</sub> . . .  $t_i$  . . . ]]]

By Williams's Strict Opacity Condition (SOC), whose details need not concern us in the present connection, the trace  $t_i$  will be free in  $N_k$  if  $i \neq k$ , and this will suffice to rule

out (105). Hence,  $i = k$ . But if  $i = k$ , then (105) is "semantically incoherent", since it will then exhibit the circularity of constructions like (106):

(106) [a picture of it]<sub>i</sub>

It follows that (105) is ruled out in any case.<sup>10</sup>

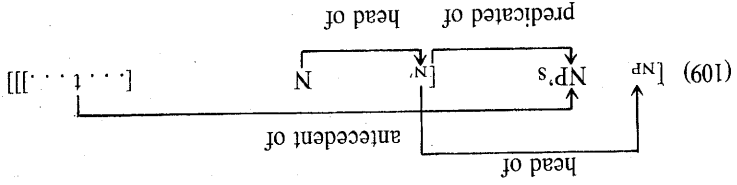
Of course, circular constructions *are* incoherent, and (106) should be ruled out in a binding theory with coindexing. On the account of section 2, the analogue of the circularity of (106) is that of (107):

(107) [a picture of it]<sub>i</sub>

Examples like (107) in fact represent the simplest cases of circularity. However, it is not clear that Williams's account can apply these semantic considerations to rule out (105), with  $i = k$ . The reason is that the coindexing of the whole NP with the determiner NP arises on quite a different basis, and does not have the same interpretation as the coindexing shown in (106). In the indexed structure (108), where all indices have been identified with one another,

(108) [<sub>NP<sub>i</sub></sub> NP<sub>i</sub>'s [<sub>N<sub>i</sub></sub> N<sub>i</sub> [<sub>i</sub> . . . t<sub>i</sub> . . . ]]]

it is only the coindexing of the determiner NP with its trace that has anything to do with NP-interpretation. The other coindexings express either the relation *head of*, in the case of the N' and the determiner NP, *predicated of*. Thus, there is no reason why (108) should be incoherent, as may be seen by replacing the numbers with explicit representation of the relations involved, as in (109):



Williams's account turns on collapsing the distinctions between these relations.

The above considerations are not submitted as a refutation of Williams's general approach; but they do, I think, reveal that such a theory is committed to a very different perspective on the mechanisms of indexing from the one taken here. I have supposed throughout that indices, intrinsically meaningless, serve only to encode in a convenient format the assignment of linguistic relations. One might, however, adopt the view that indices are themselves syntactic parts of linguistic descriptions (in this case, they would no longer be meaningless; indeed, their interpretations would have to be stated in an indicial lexicon, just as if they were formatives). Then, although it would still not be

<sup>10</sup> Strictly, in Williams's analysis, for the case in which the whole NP (105) is "referential". It will be sufficient to confine our attention to this case, however.

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## On Control and Control Theory

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In section 1 of this article we present the facts of control and propose a theory for them. If we are correct, control is an essentially configurational phenomenon and control theory is essentially configurational theory; in particular, control theory is constructed on essentially the same notions on which binding theory is constructed in Chomsky (1981). Our approach to control as a configurational phenomenon and to control theory and binding theory as one theory is new, as far as we know, in the context of both Chomsky's (1981) theory of grammar and alternative theories. In the last part of the section we present other analyses of control, in particular the fragment of a theory in Chomsky (1980) and the theories in Williams (1980) and Bresnan (1982), and we compare them to our theory. If we are correct, the comparison altogether weighs in favor of our theory. In section 2 we propose a modification of Chomsky's (1981) theory of binding and discuss the consequences of our modified theory of binding, as well as of our theory of control, for binding phenomena. Most notably, our theory, contrary to Chomsky's, predicts that pronominals and anaphors in the subject position of nominals or in the object position of subjectless nominals are not in complementary distribution; and it implies, contrary to Chomsky's theory, that the distribution of PROs does not depend entirely on the theory of binding, but must depend partially on Case properties.

In section 3 we suggest a revision of Chomsky's (1981; 1982) theory of empty categories. Our idea, derived from proposals in Bouchard (1982) and Sportiche (1982), is that PROs, like NP-traces, are pure anaphors. Our conclusions are admittedly tentative. Finally, in the appendix, we present a modification of Chomsky's theory suggested in Chomsky (1981), and we examine it in the light of our theory.

Before proceeding to the body of the article, we now sum up the notions and principles in the literature crucially referred to there.

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In the time elapsed between the first and the published versions of this article a few works on control and related subjects have been completed. In some cases, as in the case of Bouchard (1982) and Sportiche (1982), the topics dealt with are much the same as in this article and the comparison transparent if not explicitly discussed; in other cases, as in the case of Guéron (1982), the topics dealt with are too much outside the original scope of this article to be discussed at all. In all cases I regret I have not been able to give these and other recent works better attention.