TOWARD A UNIFIED THEORY OF CONTROL IN FUNCTIONAL GRAMMAR

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Introduction

There appear to be two rather different control patterns: one in which the antecedent and anaphoric element are a relatively short distance from each other, and one in which they are a relatively longer distance from each other. Examples of the former are shown in (0.1) and of the latter are shown in (0.2):

(0.1) a. Malcolm tried to kiss the Blarney Stone
b. Malcolm forced Ayn to kiss the Blarney Stone

(0.2) a. Malcolm thought that kissing the Blarney Stone would upset Ayn
b. Kissing the Blarney Stone would be traumatic for Ayn

The patterns exemplified by (0.1) and (0.2) differ in two principal ways in addition to the distance differences. Firstly, control is obligatory in (0.1) and optional in (0.2). Both (0.2a) and (0.2b) have interpretations in which the subject of the embedded verb *kissing* is neither *Malcolm* nor *Ayn*. This is not true of examples like (0.1) in which an argument of the matrix verb must be chosen as the understood subject of the embedded verb. Secondly, the structural relationship between the antecedent/controller and subject of the controlled complement in examples like (0.1) is quite different from that in examples like (0.2). In the S-structures of examples like (0.1), the antecedents command the anaphoric element in some sense, while this is not necessarily true for the S-structures of examples like (0.2), in which *Ayn* is a possible antecedent.

In neither Lexical Functional Theory (LFG) nor GB Theory has a single principle primarily responsible for the choice of the antecedent in both short-range and long-range control patterns been proposed. In GB theory, the controlled element in the structures of (0.1) and (0.2) is the empty category PRO, which occupies the complement subject position. The control theory, properly formulated, should determine the potential antecedents of PRO, and choose among them. Its central principles dictate that PRO itself must be ungoverned, and in examples like (0.1), its antecedent must be either the subject or object of the matrix clause. This latter condition would follow from the binding theory, but it is not clear that this theory applies to PRO. In any cased, this condition does not extend to exarpples like (0.2b), in which the antecedent is neither the subject nor the object of the matrix verb, and the binding theory itself must not apply to PRO in examples like (0.2a) or (0.2b), in which it is not c-commanded by its antecedent. Chomsky (1981) suggests a number of additional conditions on antecedents of PRO, some of which are needed in some form by any theory. Among these are pragmatic conditions, conditions on Θ-roles, or other semantic properties of the verb. These conditions are so vaguely formulated as to have little or no predictive value. However, they appear to serve only to choose from among possible antecedents, which, in examples like (0.1), must first satisfy the above structural condition, and consequently do not form the basis of a unified analysis of short-range and long-range control.

In LFG, the general condition that applies to choose the antecedents of controlled complement subjects in examples like (0.1) is the Lexical Rule of Functional Control, which is formulated as shown below:

(0.3) The XCOMP of a lexical form is functionally controlled by the OBJ2 if there is one, otherwise the OBJ if there is one, otherwise the SUBJ.

This condition applies to examples like (0.1), but it does not apply so readily, if at all, to choose the controller in examples like (0.2), which, in contrast to examples like (0.1), are considered to be examples of non-lexical control.

In the proposed analysis, these two control patterns are manifestations of a single control process, which applies over both short and long distances. The patterns in (0.1) and (0.2) are produced by a generalized co-indexing system (GCS), which consists of a co-indexing operation and associated general principles. A single primary condition governs all of its subcases. The contrast between the subcase in (0.1) and that in (0.2) as regards the relative distance between antecedents and targets, and the observed structural relationship between possible antecedents and controlled subjects, as well as the optionality of the long-range subcase and obligatoriness of the short-range one, are a consequence of independent factors.

The proposed control system and associated conditions extends in a natural way to explain the relevant patterns of bound anaphora, in which overt anaphors, reflexive and reciprocal forms, are associated with antecedents. Thus the proposed analysis embodies a significant unification.

In the next section, I briefly discuss the theory of which the proposed analysis is a part. In Section 2, I present the analysis of short-range control. In Section 3, I extend this analysis to bound anaphora, and in Section 4, to long-range control. In Section 5, these control patterns are shown to be produced by a unified control system, and the most important points of the discussion are summarized.

Background:

The proposed analysis is formulated within the context of a variant of lexical/functional theory presented in Horn (1985 & 1988), which differs from that curently being developed by Bresnan and others in a number of ways, some of which will become evident in the course of the discussion.

In the proposed theory, the syntactic component of UG is organized into a categorial component (some version of X-bar theory), a lexical component, and four rule systems, one of which is the Generalized Co-Indexing System (GCS), the subject of this paper. There are two significant levels of structure: (a) S-structure, and (b) Derived F-structure. The rules of the categorial component and the lexical insertion rules, and scrambling rules in certain cases apply to produce the S-structures of sentences. These are the analogs of Bresnan's C-structures and of PF in GB theory. Derived F-structures are simple and complex predicate/argument structures in which the NP[Θ] and non-Θ arguments of each predicate are ordered. The canonical form of basic predicate/argument (PRED/ARG) structures, which appear in the lexical entries of predicates, is shown in (1.1):

(1.1) PRED 1-NP[α] 2-NP[β] X

The position designated as X can be occupied by either a third NP[Θ] argument or by a non-Θ argument. The set of non-Θ argument types includes uncontrolled and controlled complements, shown in (1.2a) and (1.2b), respectively:

(1.2) a. S
b. [(NP*)XP]

Type (1.2a) is the F-structure correlate of S-structure sentential complements, and Type (1.2b) is the F-structure correlate of S-structure XP phrases embedded in the VPs of higher predicates, where XP can be VP, NP, AP.

Derived F-structures are produced from simple and complex PRED/ARG structures by the application of various operations of the relevant rule systems. The ones that apply in every derivation are the index insertion rule, which assigns F-structure arguments the indices of their S-structure correlates, and the Semantic Relations Assignment (SRA) rule, which assigns semantic relations (theta-roles) to indexed NP arguments. These rules are formulated as follows:

(1.3) a. *Index Insertion Rule*: Into each NP argument position of the PRED/ARG structure, insert the index of the S-structure correlate of that argument.
b. *Semantic Relations Assignment Rule (SRA)*: Assign the semantic relations, α, β, Γ, to x-NP arguments in the PRED/ARG structure in the linear order in which these appear in the basic F-structure of the relevant predicate.

Two sample derivations follow. Consider the sentences shown in (1.4) along with their S-structures (from which unnecessary structure has been omitted):

(1.4) a. Murry_i hit Murgatroyd_j
$_S[_{NP}[\text{Murry}_i]\ \ _{VP}[_V[\text{hit}]\ \ _{NP}[\text{Murgatroyd}_j\ ]]]$

b. Nobody_i believed that Murry_j hit Murgatroyd_k
$_S[_{NP}[\text{Nobody}_i]\ \ _{VP}[\text{believed}]\ \ _S[_{COMP}[\text{ that}]\ \ \ VS[_{NP}[\text{Murry}_j]$
$_{VP}[_V[\text{hit}]$
$_{NP}[\text{Murgatroyd}_k]]]]]$

The basic F-structures of HIT and BELIEVE are shown in (1.5):

(1.5) a. HIT 1-NP[α] 2-NP[β]
b. BELIEVE 1-NP[α] S

The predicate HIT has two NP[Θ] arguments, while the predicate BELIEVE, in this sense, has a single NP[Θ] argument and a non-Θ argument of category S, an uncontrolled complement. The SR α of the first NP[Θ] argument of HIT does not necessarily have the same value as the SR α of the NP[Θ] argument of BELIEVE. I adopt the convention of labelling SRs as α, β, Γ, according to their linear order in the argument structure of a single predicate.

The derived F-structures of these sentences are produced from the bare PRED/ARG structures of the relevant predicates. These are shown below:

(1.6) a. HIT 1-NP 2-NP
b. BELIEVE 1-NP [HIT 1-NP 2-NP]

In Structure (1.6b), the PRED/ARG structure of HIT has been inserted into the S argument position in the PRED/ARG structure of BELIEVE. In English, the S-structure correlate of the 1-NP argument is the S-structure subject NP and the S-structure correlate of the 2-NP argument is the S-structure object NP. The index insertion rule and the SRA rule apply to (1.6) to produce (1.7):

(1.7) a. HIT NP_i NP_j
α β

b. BELIEVE NP_i [HIT NP_j NP_k]
α α β

I will refer to structures like (1.7a), which contain a single predicate as non-complex, and to structures like (1.7b), which contain more than one predicate, as complex. Derived F-structures are well-formed if they satisfy the following condition:

(1.8) *Well-formedness Condition I*: Each NP argument in the argument structure of the predicate, PRED, must be assigned a single index and a single semantic relation.

It is easy to see that the structures in (1.7) satisfy this condition. The determination of grammaticality, ambiguity, and synonymy (of sentence pairs) is made at the level of derived F-structure. Grammatical sentences are ones from whose S-structures a well-formed (complex) derived F-structure can be produced, and ungrammatical sentences are ones from whose S-structures no well-formed (complex) derived F-structure can be produced. Ambiguous sentences are ones for which a well-formed (complex) derived F-structure corresponding to each interpretation can be produced, and synonymous sentences are ones which have equivalent derived F-structures.

A basic assumption of the theory is that argument structures are linearly ordered. Consequently, the NP[Θ] arguments can be distinguished from one another on the basis of their position in the argument structure. I adopt the convention of labelling them as 1-NP, 2-NP, and 3-NP, but it should be understood that this is merely a convenient notational device, and it has no theoretical significance. Because argument structures are ordered, the concept of distance, or perhaps more accurately, relative distance, as it relates to two or more F-structure constituents, can be defined. Thus in the F-structure in (1.6b), the NP_j argument is closer to the NP_k argument than the NP_i argument is. The significance of this concept of relative distance will become apparent in the following discussion.

Short Range Control:

The control relation, formulated to apply to F-structure arguments, appears in (2.1), below:

(2.1) *The Control Relation*: The relation between an antecedent NP_i argument and a target NP argument elsewhere in the (complex) derived F-structure which must be co-indexed with the antecedent.

An adequate theory of control should specify the constraints on possible controllers (antecedents) and possible controlled elements (targets), and contain general principles which dictate the choice of controller from several NP arguments in the F-structure by defining the necessary structural and/or functional relationship between controllers and controlled elements.

The paradigm cases of short-range (obligatory) control in English are illustrated by the examples in (2.2) - (2.7), shown with their S-structures:

(2.2) a. Jethro_i tried to skin a lizard_j
b. $_S[_{NP}[\text{Jethro}_i]\ _{VP}[\text{tried}]\ _{VP2}[\text{to skin a lizard}_j]]]$

(2.3) a. Kelly$_i$ forced Cynthia$_j$ to commit unnatural acts$_k$
b. $_S[_{NP}[\text{Kelly}_i]\ _{VP}[\text{forced}]\ _{NP}[\text{Cynthia}_j]\ _{VP2}[\text{to commit unnatural acts}_k]]]$

(2.4) a. Mavis$_i$ told/asked Fiona$_j$ to leave
b. $_S[_{NP}[\text{Mavis}_i]\ _{VP}[_V[\text{told/asked}]\ _{NP}[\text{Fiona}_j]\ _{VP2}[\text{to leave}]]]$

(2.5) a. Roth$_i$ made Gertrude$_j$ angry
b. $_S[_{NP}[\text{Roth}_i]\ _{VP}[_V[\text{made}]\ _{NP}[\text{Gertrude}_j]\ _{APc}[\text{angry}]]]$

(2.6) a. Roth$_i$ made Gertrude$_j$ a virtuous woman
b. $_S[_{NP}[\text{Roth}_i]\ _{VP}[_V[\text{made}]\ _{NP}[\text{Gertrude}_j]\ _{NPc}[\text{a virtuous woman}]]]$

(2.7) a. The members$_i$ elected Bertram$_j$ president
b. $_S[_{NP}[\text{the members}_i]\ _{VP}[_V[\text{elected}]\ _{NP}[\text{Bertram}_j]\ _{NPc}[\text{president}]]]$

In such examples, the controller is in the clause in which the controlled complement is embedded. Short-range (obligatory) control verbs like *try*, *force*, *ask*, and *tell*, occur with controlled VP complements. The control verbs in (2.5), (2.6), and (2.7) occur with controlled complements of other categories which I have labelled APc (AP complement) and NPc (NP complement) for convenience. (These labels have no theoretical significance and NP and AP complements need not be distinguished from other NPs and APs in S-structures.)

Obligatory control verbs have basic F-structures of the form shown in (2.8), below:

(2.8) PRED 1-NP[α] ... [(NP*)XP]

In this structure, ... may or may not contain a 2-NP[β] argument. The NP* argument is the controller of the embedded XP complement, and the value of XP is VP, NP, or AP, as seen above, depending on the particular control predicate. The NP* argument has no S-structure correlate, unlike NP[Θ] arguments.

The PRED/ARG structures for examples (2.2a), (2.5a), and (2.7a) appear in (2.9a, b, and c), respectively. As in (1.6), above, the PRED/ARG structures of the embedded predicates have been inserted into the XP argument positions in the PRED/ARG structures of the matrix predicates, TRY, MAKE, and ELECT. The heads of AP and NP complements function as non-verbal predicates, which occur with a single NP[Θ] argument:

(2.9) a. TRY 1-NP [(NP*)[SKIN 1-NP 2-NP]]
b. MAKE 1-NP 2-NP [(NP*)[ANGRY 1-NP]]
c. ELECT 1-NP 2-NP [(NP*)[PRESIDENT 1-NP]]

The index insertion rule and the SRA rule apply to the structures in (2.9) to produce the structures in (2.10), below:

(2.10)

a. TRY	NP$_i$	[(NP*)[SKIN	NP	NP]]		
	α		α	β		
b. MAKE	NP$_i$	NP$_j$	[(NP*)[ANGRY	NP]]		
	α	β		α		
c. ELECT	NP$_i$	NP$_j$	[(NP*)[PRESIDENT	NP]]		
	α	β		α		

At this point, the following co-indexing rule applies:

(2.11) *General Co-Indexing Rule (GCR)*: In the PRED/ARG structure: [... Φ... σ...], co-index Φ and σ, and optionally delete Φ.

In the GCR, Φ is the indexed antecedent NP and σ is the unindexed target. The rule makes no reference to the other elements of the relevant PRED/ARG structure. This rule applies to co-index the NP* target with NP$_i$ in (2.10a), and NP$_j$ in (2.10b & c). It then applies again in each structure to co-index NP*, the antecedent for this application, and the leftmost unindexed NP argument of the embedded predicate. The NP* arguments are deleted, and the following derived F-structures are produced:

(2.12)

a. TRY	NP$_i$	[SKIN	NP$_i$	NP$_j$]
	α		α	β
b. MAKE	NP$_i$	NP$_j$	[ANGRY	NP$_j$]
	α	β		α
c. ELECT	NP$_i$	NP$_j$	[PRESIDENT	NP$_j$]
	α	β		α

The derived F-structures of the examples in (2.3), (2.4), and (2.6) are produced in the same way.

Obviously, the GCR must be constrained. First, note that the antecedent of the NP* argument in (2.10a) is the initial (only) NP argument of the predicate TRY, while in (2.10b and c), the antecedents of the NP* arguments are the NP$_j$ arguments of the respective predicates MAKE and ELECT. In all cases, the antecedent is the closest indexed NP argument to the NP* argument. Next, note that only the initial NP argument of the predicate of a controlled complement can be externally controlled. The following generalized structure illustrates these constraints on co-indexing:

(2.13) PRED1 X NP$_i$ Y [(NP*$_i$)[PRED2 NP$_a$ NP$_b$ ...]]

In (2.13), I assume that Y does not contain an indexed NP argument.This situation brings to mind the Minimal Distance Principle (MDP), which was first proposed by Rosenbaum (1967 & 1970), who noticed that the NP which controlled the syntactic rule of equi-NP deletion in the then prevailing framework was the one closest to the deletion target in the syntactic structure. This principle governed the choice of controller in what were considered to be the "normal" cases. These were sentences containing verbs like *try*, *force*, *ask*, *tell*, and so forth, in sentences like (2.2) to (2.7), above.

An analog of this principle can be formulated as a condition on the GCR. This appears in (2.14), below:

(2.14) *The F-structure Minimal Distance Principle (FMDP)*: In (complex) PRED/ARG structures, co-indexing rules must involve the antecedent/target pair relevant to the operation whose members Φ and σ are least distantly separated.

The FMDP, as formulated here, chooses the NP antecedent of the NP* argument in the PRED/ARG structures of examples like the ones in (2.2), (2.3), and (2.4), which contain controlled VP complements (the "classical" control verbs), as well as examples like (2.5), (2.6), and (2.7), which contain controlled complements of other categories. It also dictates that only NPa in (2.13) can be co-indexed with the indexed NP* antecedent. As a consequence, non-initial NP arguments of controlled complements are never externally controlled.

Now, consider the second part of the GCR: the optional deletion of the antecedent Φ. Structure (2.10a), after the application of the GCR, is repeated below:

(2.10) a. TRY $\underset{\alpha}{NP_i}$ $[(NP^*_i)[$SKIN $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}]]$

For the first application of the GCR, NP_i is the antecedent and NP* is the target. After these are co-indexed, if NP_i is deleted, the predicate TRY will have no $NP[\alpha]$ argument, and the resulting derived F-structure cannot be the basis of a complete interpretation of the sentence. This is the consequence whenever Φ is an $NP[\Theta]$ argument. However, the only requirement on derivations is that for grammatical sentences, it must be possible to produce a well-formed derived F-structure. If the deletion does not occur, a well-formed derived F-structure will be produced. For the second application of the GCR, NP^*_i is the antecedent. If it is not deleted, the resulting structure will contain an indexed NP argument that does not bear a SR, and will thus violate WFC I. If the deletion occurs, a well-formed derived F-structure will be produced. Therefore, no specific additional conditions need be placed on the optional deletion process. Similarly, if the GCR fails to apply in structures like (2.10), the resulting derived F-structures will not be well-formed. Consequently, no conditions on applicability need be placed on the GCR itself.

The FMDP analysis extends without modification to sentences like the following, shown with their S-structures, in which an optional controlled complement is embedded in the VP of the matrix verb:

(2.15) a. $Jesse_i$ gave $Zelma_j$ the $letter_k$ unopened
b. $_S[_{NP}[Jesse_i]\ _{VP}[_V[gave]\ _{NP}[Zelma_j]\ _{NP}[the\ letter_k]\ _{APc}[unopened]]]$

(2.16) a. $Danton_i$ served the goanna $stew_j$ cold
b. $_S[_{NP}[Danton_i]\ _{VP}[_V[served]\ _{NP}[the\ goanna\ stew_j]\ _{APc}[cold]]]$

(2.17) a. $Smyth_i$ carried $Zelma_j$ naked (through the town)
b. $_S[_{NP}[Smyth_i]\ _{VP}[_V[carried]\ _{NP}[Zelma_j]\ _{APc}[naked]\ _{PP}[through...]]]$

The verbs *give*, *serve*, and *carry* are not obligatory control verbs, and their basic F-structures do not contain controlled complement arguments. The derived F-structures of these examples are produced from PRED/ARG structures which are constructed by embedding the F-structure representation of the optional controlled complement in the PRED/ARG structure of the matrix predicate. These structures, after the application of the index insertion rule and the SRA rule, are shown in (2.18):

(2.18) a. GIVE $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$ $\underset{\Gamma}{NP_k}$ $[(NP^*)[$UNOPENED $\underset{\alpha}{NP}]]$

b. SERVE $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$ $[(NP^*)[$COLD $\underset{\alpha}{NP}]]$

c. CARRY $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$ $[(NP^*)[$NAKED $\underset{\alpha}{NP}]]$

It is easy to see that the GCR applies, as above, to these structures to produce the derived F-structures of the examples in (2.15) - (2.17), shown in (2.19):

(2.19) a. GIVE $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$ $\underset{\Gamma}{NP_k}$ [UNOPENED $\underset{\alpha}{NP_k}$]

b. SERVE $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$ [COLD $\underset{\alpha}{NP_j}$]

c. CARRY $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$ [NAKED $\underset{\alpha}{NP_j}$]

Although the FMDP is the primary condition which determines the choice of the antecedent from among several possible antecedents, and defines possible target (controlled) positions as well, there are additional constraints on possible antecedents themselves. These are rather complex. Working in their respective frameworks, Bresnan (1982d) lists some lexical restrictions on the controllers of embedded complements, and Chomsky (1981) suggests that Θ-roles, pragmatic conditions, and/or semantic properties of verbs, as well as the possible requirement that the controller of an embedded complement be an element of the clausal argument structure of the matrix predicate, are all constraining factors. We can borrow, at least in spirit, from these observations and formulate the following condition on possible controllers, that is, on possible antecedents, Φ, of Φ/σ pairs to be co-indexed by the GCR:

(2.20) If the target, σ, is the NP* argument of a controlled complement of the form [(NP*)XP] embedded in, or adjoined to, the PRED/ARG structure of a predicate, $PRED_x$, then:
(a) the antecedent, Φ, must be an NP argument of $PRED_x$;
(b) for predicates of Class X, the antecedent, Φ, must bear the SR, Θ_x.

Condition (2.20a) dictates that the antecedent of the NP* argument in examples like the ones discussed above must be either the 1-NP argument, 2-NP argument, or 3-NP argument of the matrix predicate. Condition (2.20b) accounts for a well-known set of apparent counterexamples to the FMDP. Consider the following examples:

(2.21) a. $Thor_i$ promised $Agnes_j$ to leave
b. $Davis_i$ made $Mavis_j$ a good husband

The basic F-structures of the verbs *promise* and *make* (in this sense) are shown in (2.22):

(2.22) a. PROMISE 1-NP[α] 2-NP[β] [(NP*)VP]
b. MAKE 1-NP[α] 2-NP[β] [(NP*)NP]

The PRED/ARG structures of the examples in (2.21), after the application of the index insertion rule and the SRA rule, are shown in (2.23a and b), respectively:

(2.23) a. PROMISE $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$ [(NP*)[LEAVE $\underset{\alpha}{NP}$]]

b. MAKE $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$ [(NP*)[[GOOD HUSBAND] $\underset{\alpha}{NP}$]]

In both of these structures, the NP_j argument is an argument of the matrix predicate, and is the closest argument to the target NP* argument. Yet the NP_i argument in each case must be the antecedent Φ for the application of the GCR. The predicates *promise* and *make* in this sense are subject to the condition in (2.20b). The controller of the complement of these verbs must be an NP argument that bears a particular specified SR, or set of SRs, say Θ_p for *promise* and Θ_m for *make*. In neither case is this the SR borne by their 2-NP arguments, represented as β in (2.22) and (2.23). Therefore, their 2-NP arguments cannot be the antecedents of the NP* arguments of their complements. The NP_i arguments in (2.23) are the closest appropriate antecedents, and are chosen by the FMDP to produce the following derived F-structures:

(2.24) a. PROMISE $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$ [LEAVE $\underset{\alpha}{NP_i}$]

b. MAKE $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$ [[GOOD HUSBAND] $\underset{\alpha}{NP_i}$]

Next, consider the following examples:

(2.25) ?$Aethelbert_i$ gave the $manuscript_j$ to $Boris_k$ naked

(2.26) a. $Sebastian_i$ served the $koalaburgers_j$ naked
b. $Efraim_i$ spotted $Senta_j$ walking down the $corridor_k$

These examples also contain optional controlled complements of various syntactic categories. They appear to be exceptions to the FMDP since, in each case, the subject, NP_i, can be interpreted as the controller of the complement. For pragmatic reasons, this is the only plausible interpretation of (2.25) and (2.26a) since manuscripts and koalaburgers are not often thought of as being naked.

Optional controlled complements can occur in S-structures embedded in the VP of the matrix predicate as in (2.18) and (2.19), above, or adjoined to the VP of the matrix predicate. Examples (2.25) and (2.26), with the interpretations in which the NP_i constituent is the controller of the complement have the latter type of S-structure, shown below:

(2.27) a. $_S$[$_{NP}$[$Aethelbert_i$] $_{VP}$[$_{VP}$[$_V$[gave] $_{NP}$[the $manuscript_j$] $_{PP}$[to $Boris_k$]] $_{APc}$[naked]]]
b. $_S$[$_{NP}$[$Sebastian_i$] $_{VP}$[$_{VP}$[$_V$[served] $_{NP}$[the $koalaburgers_j$]] $_{APc}$[naked]]]
c. $_S$[$_{NP}$[$Efraim_i$] $_{VP}$[$_{VP}$[$_V$[spotted] $_{NP}$[$Senta_j$]] $_{VP2}$[walking down the $corridor_k$]]]

The derived F-structures of these sentences are produced from the PRED/ARG structures in (2.28), below, shown after the application of the index insertion rule and the SRA rule:

(2.28) a. [GIVE $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$ [TO $\underset{\alpha}{NP_k}$]] [(NP*)[NAKED $\underset{\alpha}{NP}$]]
b. [SERVE $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$] [(NP*)[NAKED $\underset{\alpha}{NP}$]]
c. [SPOT $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$] [(NP*)[WALKING $\underset{\alpha}{NP}$ [DOWN $\underset{\alpha}{NP_k}$]]]

In these structures, the F-structure correlates of the controlled complements are adjoined to, rather than embedded in, the PRED/ARG structures of the matrix predicates. In all cases, both the NP_i argument and the NP_j argument satisfy the conditions in (2.20), and are potential antecedents of the NP* arguments.

These structures, however, contrast with those discussed previously in an important respect. The closest potential antecedents of the NP* arguments, represented as NP_j in each case, are located in the PRED/ARG structures of GIVE, SERVE, and SPOT, respectively, while the NP* arguments themselves are not located in the PRED/ARG structures of these verbs. In this situation, the following condition applies:

(2.29) *The Neutralization Principle*: If Φ is located in the PRED/ARG structure of PREDx and σ is not, then the FMDP is neutralized over the relevant domain.

We may now define this neutralization domain as in (2.30):

(2.30) *Neutralization Domain (ND)*: The minimal (complex) PRED/ARG structure(s) of which Φ and σ of the least distantly separated antecedent/target pair relevant to the operation are members.

In Structure (2.28a), the ND comprises the PRED/ARG structure of GIVE and that of NAKED. In (2.28b), the ND comprises the PRED/ARG structure of SERVE and that of NAKED, and in (2.28c), the ND comprises the PRED/ARG structure of SPOT and that of WALKING. Within the ND, the FMDP does not choose an antecedent from among the potential ones, so all indexed NPs in the relevant domain are appropriate antecedents, provided that they satisfy any additional conditions on the relevant subcase of the GCR. Hence both the NP_i and NP_j arguments in these structures are appropriate antecedents.

When more than one appropriate antecedent occurs, the following condition applies:

(2.31) *Hierarchy Condition (HC)*: The antecedent Φ is the highest appropriate argument which is above, or on the same level as, the target σ in the following hierarchy of argument types, HA = {1-NP, 2-NP, 3-NP, NPp}.

The HC chooses the 1-NP arguments, NP_i, in the structures in (2.28) as the antecedents of the NP* targets. The GCR applies to these structures to produce the derived F-structures of (2.25) and (2.26). These appear in (2.32), below:

(2.32) a. [GIVE $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$ [TO $\underset{\alpha}{NP_k}$]] [NAKED $\underset{\alpha}{NP_i}$]

b. [SERVE $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$] [NAKED $\underset{\alpha}{NP_i}$]

c. [SPOT $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$] [WALKING $\underset{\alpha}{NP_i}$ [DOWN $\underset{\alpha}{NP_k}$]]

The FMDP, then, applies without exception to determine the choice of antecedent when the controlled complement is embedded in the PRED/ARG structure of the matrix predicate in structures like (2.10) and (2.19). It applies regardless of whether the controlled complement is an obligatory argument in the basic F-structure of the predicate (with verbs like *try* and *force*) or an optional argument in the complex PRED/ARG structure of a sentence that contains a non-control verb (like *give*, *serve*, and *carry*). The Neutralization Principle applies to those PRED/ARG structures like (2.28), in which the controlled complement is not embedded in the PRED/ARG structure of the matrix predicate. Even when the FMDP is neutralized within a specified domain, it nevertheless applies outside that domain. Thus the antecedents Φ are always chosen from indexed NP arguments within the relevant ND. This will be demonstrated more clearly in the next section, in which the neutralization analysis is extended to apply to [+ANAPHOR] targets.

In situations where the FMDP is neutralized, the HC applies within the ND to choose the antecedent. In examples in which the FMDP is not neutralized, it is the primary condition, and applies to choose the appropriate antecedent. The HC, then, applies only to the NP arguments designated as appropriate by the FMDP. This is illustrated by the following example, shown with its complex F-structure after the application of the index insertion rule and the SRA rule:

(2.33) Murphy$_i$ forced Maybeline$_j$ to kiss Myrtle$_k$
[FORCE $\underset{\alpha}{NP_i}$ $\underset{\beta}{NP_j}$ [(NP*)[KISS $\underset{\alpha}{NP}$ $\underset{\beta}{NP_k}$]]]

Here, the FMDP is not neutralized and applies to choose NP_j as the antecedent. This choice does not violate the HC since NP_j is the only appropriate antecedent, and therefore the highest one in HA. The GCR applies as discussed earlier to produce the derived F-structure of this example.

Finally, let us consider the question of the directionality of the GCR. Unindexed NP* arguments always occur in PRED/ARG structures like the following:

(2.34) PRED1 ... NP_i ... [(NP*)[PRED2 1-NP ... NP_j ...

PRED1 represents the class of control predicates like *force*, and PRED2 is the predicate of the embedded complement of PRED1. Actually, there are two targets in this structure: the NP* argument and the 1-NP argument of PRED2. Let us now consider the case in which the former is the target σ.

Condition (2.20a) on NP* targets dictates that the antecedent ϕ must be an NP[Θ] argument of PRED1, limiting the choice of Φ to NP_i and any other NP[Θ] arguments in the argument structure (...) of PRED1 in Structure (2.34). The FMDP further restricts the choice to the NP_i argument provided no other NP[Θ] argument of PRED1 occurs between it and the NP* argument. These two conditions ensure that the antecedent is always the closest indexed NP preceding the NP* target. Consequently, directionality need not be specified for the co-indexing operation discussed in this section, and the GCR need not be formulated as a unidirectional rule as in (2.11). The significance of this will become apparent later. In the next section, I discuss bound anaphora.

Bound Anaphora:

The analysis extends naturally to account for the behavior of overt anaphors (reflexives and reciprocals.) The bound anaphora relation, formulated to apply to F-structure arguments, appears in (3.1):

(3.1) *The Bound Anaphora Relation*: The relation between an antecedent NP_i argument and a designated argument with the feature [+ANAPHOR] elsewhere in the derived F-structure which must be co-indexed with it.

Now consider the following sentences:

(3.2) a. $Archibald_i$ hated himself
b. Those basset $hounds_i$ disliked each other

S-structure NP constituents with the feature [+ANAPHOR], which I adopt as a cover symbol for the features [+REFLEXIVE] and [+RECIPROCAL], do not have indices at the level of S-structure. These are represented in PRED/ARG structures as shown in (3.3), below, which are the PRED/ARG structures of the examples in (3.2), after the application of the index insertion rule and the SRA rule:

(3.3) a. HATE NP_i NP[+REFLEX]
α β

b. DISLIKE NP_i NP[+RECIPROCAL]
α β

The rule that co-indexes overt anaphors with some other NP argument in the PRED/ARG structure may be formulated as in (3.4):

(3.4) *Bound Anaphora Co-Indexing Rule*: In the PRED/ARG structure: [... Φ ... σ ...], where σ is NP[+ANAPHOR] and Φ is an indexed NP, co-index Φ and σ.

Rule (3.4) applies to the structures in (3.3) to produce the derived F-structures of (3.2), which appear in (3.5), below:

(3.5) a. HATE NP_i $NP[+REFLEX]_i$
α β

b. DISLIKE NP_i $NP[+RECIPROCAL]_i$
α β

From a formal standpoint, if we ignore the details of its SD, this is the same type of rule as the GCR in (2.11). Targets with the feature [+ANAPHOR], however, differ from NP* targets in that the former, in English sentences, can be co-indexed with either the closest indexed NP in the PRED/ARG structure, or with the closest 1-NP argument in the PRED/ARG structure. This is illustrated by the examples in (3.6), which are shown with their PRED/ARG structures before the application of Rule (3.4):

(3.6) a. $Mahoney_i$ told $Mallone_j$ about himself
TELL NP_i NP_j [ABOUT NP[+REFLEX]
α β α
b. The $Simpsons_i$ told their $friends_j$ about each other
TELL NP_i NP_j [ABOUT NP[+RECIP]
α β α
c. $Mason_i$ forced $Dixon_j$ to pinch himself
FORCE NP_i NP_j [PINCH NP_j NP[+REFLEX]
α β α β

In Example (3.6a), the reflexive *himself* can refer to either *Mallone* or *Mahoney*. In (3.6b), the reciprocal form *each other* can refer to either *The Simpsons* or *their friends*. In (3.6c), the reflexive form can only refer to the 1-NP argument of PINCH, NP_j, and not to the 1-NP argument of FORCE, NP_i. This pattern is summarized in the following generalization:

(3.7) If the target σ is an NP argument with the feature [+ANAPHOR], then the antecedent Φ is the closest indexed NP argument in the PRED/ARG structure, or the closest indexed 1-NP argument.

In accordance with (3.7), Rule (3.4) can apply to the structures in (3.6a & b) to co-index the NP[+ANAPHOR] target with either NP_i or NP_j. Thus two derived F-structures can be produced for each example, and this accounts for their ambiguity. In structure (3.6c), the rule can only apply to co-index the NP[+ANAPHOR] target and the NP_j argument of PINCH.

We can explain this pattern without the need for any new mechanisms by extending the neutralization/HC analysis to apply to [+ANAPHOR] targets as shown in (3.8):

(3.8) If the target σ is an NP with the feature [+ANAPHOR], then the FMDP is optionally neutralized over the relevant domain.

Now consider the structure in (3.6a), repeated below:

(3.9) TELL NP_i NP_j [ABOUT NP[+REFLEX]
α β α

If the FMDP is not neutralized, then it chooses NP_j as the antecedent. If neutralization occurs, both NP_i and NP_j are in the neutralization domain as defined in (2.30) and the HC chooses NP_i as the antecedent. The same situation applies to the other structures in (3.6).

This analysis extends without modification to account for the more restricted pattern of anaphora observed in many languages, in which [+ANAPHOR] arguments can only refer to the subject of the sentence. Polish is such a language. The Polish counterparts of the examples in (3.6a and b) are unambiguous. These appear in (3.10):

(3.10) a. $Jacek_i$ powiedział $Włodzimierzowi_j$ o sobie
Jacek (NOM) told Włodzimierz (DAT) about himself (LOC)
Jacek told Włodzimierz about himself
b. ?$Jacek_i$ spytał $Adama_j$ o siebie
Jacek (NOM) asked Adam (ACC) about himself (ACC)
Jacek asked Adam about himself
c. $Przyjaciele_i$ nigdy nie rozmawiają z $wrogami_j$ o sobie
Friends (NOM) never not talk with enemies (LOC) about each other (LOC)
Friends never talk with enemies about each other

In example (3.10a), *sobie* can only refer to *Jacek*. In (3.10b), *siebie* can only refer to *Jacek*, and in (3.10c), *sobie* can only refer to *przyjaciele*. Example (3.10b) is odd for the same reason that its English translational equivalent is odd with the interpretation in which *himself* refers to *Jacek*.

These examples have the following PRED/ARG structures after the application of the index insertion rule and the SRA rule:

(3.11) a. POWIEDZIEĆ NP_i NP_j [O NP[+REFLEX]]
α β α
b. SPYTAĆ NP_i NP_j [O NP[+REFLEX]]
α β α
c. ROZMAWIAĆ NP_i [Z NP_j] [O NP[+RECIP]]
α α α

In each of these structures, the [+ANAPHOR] argument must be co-indexed with the NP_i argument. This can be explained by assuming that neutralization of the FMDP in such cases is obligatory in Polish sentences. The HC then chooses NP_i in each structure as the antecedent, just as it did in the English sentences under the same circumstances.

We can incorporate a mechanism which allows this parametric variation into the analysis by simply labelling languages like English as, say, Type X languages, and languages like Polish as, say, Type Y languages. Now Condition (3.8) can be modified as shown below:

(3.12) If the target σ is an NP[+ANAPHOR] term, then the FMDP is neutralized over the relevant domain, optionally for languages of Type X and obligatorily for languages of Type Y.

This analysis automatically accounts for the apparent directionality of the bound anaphora relation, as well as its restriction to clausemates. First, consider the following examples, shown with their PRED/ARG structures at the relevant stage in the derivation:

(3.13) a. $Merv_i$ talked about himself/*herself to $Meryl_j$
TALK NP_i [ABOUT NP[+REFLEX]] [TO NP_j]
α α α
b. $Marcus_i$ gave himself/*herself $Sheila_j$
GIVE NP_i NP[+REFLEX] NP_j
α β Γ

Example (3.13b) is somewhat odd because *give* must be interpreted metaphorically. Here, however, it is only relevant that this example is more acceptable with the anaphor *himself* than it is with the anaphor *herself*.)

In these examples, the subjects, NP_i, but not the NP_j constituents, can be the antecedents of the reflexive forms. Let us assume for the moment that, contrary to its statement in (3.4), the Bound Anaphora Co-indexing Rule can apply in either direction. In the PRED/ARG structures in (3.13), NP_i and NP_j are equally close to the NP[+REFLEX] target. If the FMDP is not neutralized, it chooses both of these arguments as appropriate antecedents. Both are as high as, or higher than, the target on the hierarchy HA. The HC then chooses the NP_i argument in each case, and the following structures are produced by the co-indexing rule:

(3.14) a. TALK NP_i [ABOUT $NP[+REFLEX]_i$] [TO NP_j]
α α α
b. GIVE NP_i $NP[+REFLEX]_i$ NP_j
α β Γ

On the other hand, if the FMDP is neutralized, both the NP_i and NP_j arguments are in the neutralization domain, and the HC again chooses the NP_i argument as the antecedent. The co-indexing rule again produces the structures in (3.14). This explains the ungrammaticality of (3.13a and b) with the reflexive form *herself*, which is not the appropriate form to be co-indexed with the NP_i arguments, *Marcus* and *Merv*.

Now, consider the following example, shown with its PRED/ARG structure prior to the application of the co-indexing rule:

(3.15) *Himself liked $Merv_i$
DISLIKE NP[+REFLEX] NP_i
α β

Here, the target is the 1-NP argument of DISLIKE and the only indexed NP argument is the 2-NP argument of DISLIKE. Since this latter argument is lower on the hierarchy HA than the target, the HC in (2.31) disallows its choice as the antecedent. Consequently, the NP[+REFLEX] argument cannot be indexed, and the resulting derived F-structure violates WFC I. This explains the ungrammaticality of (3.15).

As these examples indicate, the proposed analysis eliminates the need for an explicit precedence condition on the bound anaphora co-indexing rule.

Let us turn now to the clausemate condition on this rule. Consider the following examples:

(3.16) a. Hortense$_i$ believed herself to be intelligent
b. Delilah$_i$ seemed to like herself
c. Alicia$_i$ believed the frogs$_j$ to like *herself/themselves
d. Alicia$_i$ forced the frogs$_j$ to like *herself/themselves

The PRED/ARG structures of these examples are shown below. The arrows indicate the application of the co-indexing rules:

(3.17) a. BELIEVE NP$_i$ [(NP*[+REFLEX])[[BE INTELLIGENT] NP]]
α α
b. SEEM [(NP*$_i$)[DISLIKE NP NP[+REFLEX]]]
α β
c. BELIEVE NP$_i$ [(NP*$_j$)[DISLIKE NP NP[+REFLEX]]]
α α β
d. FORCE NP$_i$ NP$_j$ [(NP*)[LIKE NP NP[+REFLEX]]]
α β α β

In Structure a, the NP*[+REFLEX] target is co-indexed with NP$_i$, and then the NP argument of [BE INTELLIGENT] is co-indexed with the NP*[+REFLEX]i antecedent. In Structure b, the 1-NP argument of DISLIKE is co-indexed with the NP*i antecedent and in Structure c, the 1-NP argument of DISLIKE is co-indexed with the NP*j antecedent. In Structure d, the NP* target is first co-indexed with the NP$_j$ argument of FORCE, and then the 1-NP argument of LIKE is co-indexed with the newly indexed NP*j. In all three structures, NP[+REFLEX] is then co-indexed with the initial NP argument of the embedded predicate, DISLIKE in b & c, LIKE in d.

In each co-indexing process, the FMDP chooses the relevant antecedent/target pair. Note that in Examples c, and d, only the closest NP, the leftmost argument of the embedded predicate, can be the antecedent of the NP[+REFLEX] target. This explains the ungrammaticality of Examples (3.16c and d) with *herself*. There is no need for an explicit clausemate condition on the bound anaphora co-indexing rule to account for this. For a more complete discussion of the distribution of bound anaphors in complex sentences, see Horn (1988).

We see, then, that the bound anaphora co-indexing process is subject to the same general principles, the FMDP, and the HC, which apply to the co-indexing rule associated with short-range control (GCR). Moreover, there is no need for either an explicit directionality condition or a clausemate condition on bound anaphors and their antecedents. Finally, the deletion of antecedents, Φ, will have the same consequences regardless of whether the target is a bound anaphor or not, so this process may be applied to the Bound Anaphora Co-indexing Rule and the GCR in the same way. I return to these points below.

Long Range Control:

The following examples illustrate the long range control relation:

(4.1) a. Shaving himself in the morning was hard for Morrison$_i$
b. Morrison$_i$ thought that shaving himself would disturb Mabel$_j$

The derivation of the F-structures of examples like these involves a rule that I call Subject Interpretation (SI). It is the analog of a cluster of rules that have been referred to variously as super equi (Grinder (1970)) and dative deletion. In examples (4.1a and b), the NP *Morrison* is interpreted as the subject of the embedded predicate *shaving* and the antecedent of the reflexive form *himself*.

At the S-structure level, the complement constructions, *shaving himself* in each case, are subjectless VPs embedded in NP positions: the subject position of the predicate *be hard* in (4.1a) and the subject position of *disturb* in (4.1b). The PRED/ARG structures of these sentences, after the application of the index insertion rule and the SRA rule, are shown in (4.2a and b), respectively:

(4.2) a. [BE[HARD]] $_{NP}$[[SHAVING NP NP[+REFLEX]]] [FOR NP$_i$]
b. THINK NP$_i$ [DISTURB $_{NP}$[[SHAVING NP NP[+REFLEX]]] NP$_j$]

All irrelevant information, including SRs and NP labels in some cases, will be omitted from the representations of F-structures throughout this discussion.

In the PRED/ARG structures in (4.2), the complements, *shaving himself* in each case, are embedded in the appropriate 1-NP argument positions of the predicates [BE[HARD]] and DISTURB. In these structures, the unindexed NP argument of SHAVING and the NP$_i$ argument of FOR and THINK, respectively, must be co-indexed. This is accomplished by the SI rule, which may be formulated as shown in (4.3):

(4.3) *Subject Interpretation (SI)*: Co-index the NP_i argument and the unindexed 1-NP argument in the following PRED/ARG structures:
(a) [... NP_i ... [PREDx 1-NP ...] ...]
(b) [... [PREDx 1-NP ...] ... NP_i ...]

Here, PREDx represents the predicate of the embedded complement. This rule is bidirectional. Structure (a) represents PRED/ARG structures like (4.2b) and Structure (b) represents PRED/ARG structures like (4.2a).

The SI rule applies to the PRED/ARG structures in (4.2) to produce the structures in (4.4), below:

(4.4) a. [BE[HARD]] $_{NP}$[[SHAVING NP_i NP[+REFLEX]]] [FOR NP_i]
b. THINK NP_i [DISTURB $_{NP}$[[SHAVING NP_i NP[+REFLEX]]] NP_j]

Now the [+REFLEX] targets are co-indexed to produce the following:

(4.5) a. [BE[HARD]] $_{NP}$[[SHAVING NP_i NP[+REFLEX]$_i$]] [FOR NP_i]
b. THINK NP_i [DISTURB $_{NP}$[[SHAVING NP_i NP[+REFLEX]$_i$]] NP_j]

It is easy to see that the SI rule is of the same formal type as the GCR and bound anaphora co-indexing rule. Here, the antecedent Φ is an indexed NP argument (represented as NP_i in (4.3)), and the target σ is the unindexed 1-NP argument of an embedded PREDx.

It has been observed by a number of linguists that some version of the minimal distance principle plays a crucial role in choosing the antecedent of the understood subjects of embedded complements like the ones in (4.1), as well as the antecedents of bound anaphors when these occur in such complements. This was first observed, I believe, by Rosenbaum. (See, for example, Rosenbaum (1970).) Jacobson and Neubauer (1976) discuss a constraint, the so-called Intervention Constraint (IC), which was first proposed by Grinder to apply to at least some cases of the analog in their framework of the SI rule. This constraint is quite similar to the Minimal Distance Principle.

Although judgements can vary significantly from speaker to speaker, examples like the ones to be discussed below show that the FMDP as formulated in (2.14) properly constrains the application of the SI rule. The difficulty of making clearcut judgements of both the relative and absolute acceptability of some individual sentences of these types is probably due to their relative complexity, so that performance factors, which may not be properly a part of the formal theory, tend to obscure the general pattern predicted by the FMDP analysis. See Horn (1988) for more discussion.

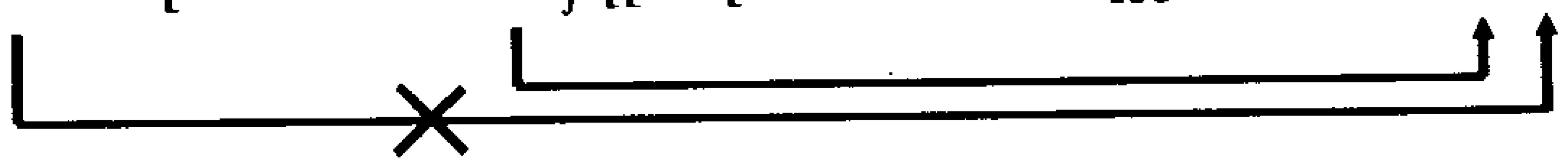
Now consider the following examples:

(4.6) a. $Flora_i$ knew that $Marvin_j$ realized that shaving $himself_j$ twice a day was necessary
b. *$Flora_i$ knew that $Marvin_j$ realized that shaving $herself_i$ twice a day was necessary

Example (4.6a) is grammatical. In this example, *Marvin* is interpreted as the subject of the embedded predicate *shaving* and as the antecedent of the reflexive form *himself*. In Example (4.6b), the reflexive form *herself* dictates that *Flora* be the antecedent, and is therefore also interpreted as the subject of *shaving*. The ungrammaticality of this example and the contrast between it and (4.6a) demonstrates that only *Marvin*, and not *Flora*, can be the antecedent. The PRED/ARG structure relevant to both of the examples in (4.6), after the application of the index insertion rule and the SRA rule, is shown in (4.7):

The term NPR represents the NP[+REFLEX] argument. In this structure, the

(4.7) KNOW NPi [REALIZE NP_j [[BE[NECESSARY]][SHAVING NP NPR]]



target σ of the SI rule is the 1-NP argument of SHAVING. The only possible antecedent Φ of this argument is the NP_j argument of REALIZE. This is indicated by the arrows in (4.7).

Now consider Example (4.8), below:

(4.8) $Alfonse_i$ knew that shaving himself/herself annoyed $Gertrude_j$

This example is analogous to (4.1b). Here, either *Alfonse* or *Gertrude* can be interpreted as the understood subject of *shaving*, and the antecedent of the reflexive argument of this predicate. The PRED/ARG structure of this sentence, before the application of the SI rule, is shown in (4.9):

In this structure, the target σ is the NP argument of SHAVING. Either NP_i

(4.9) KNOW NP_i [ANNOY [SHAVING NP NPR] NP_j]

or NP_j can be the antecedent Φ of this target. This is indicated by the arrows in (4.9). The structure in (4.9) differs from the structure in (4.7). In (4.7), both potential antecedents are to the left of the target, while in (4.9), one of them is to the left of the target and the other is to the right of the target.

Next, let us look at examples like the following:

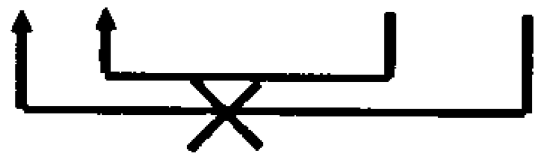
(4.10) a. That $Myrtle_i$ was angry that dressing herself in sackcloth frightened the $children_j$ astonished $Phillip_k$
b. *That $Myrtle_i$ was angry that dressing himself in sackcloth frightened the $children_j$ astonished $Phillip_k$

(4.11) That Myrtle$_i$ was angry that dressing themselves in sackcloth frightened the children$_j$ astonished Phillip$_k$

In example (4.10a), *Myrtle* is interpreted as the understood subject of the predicate *dressing*, and as the antecedent of the reflexive form *herself*. The ungrammaticality of (4.10b) shows that *Phillip* cannot be interpreted as the subject of *dressing* and the antecedent of the reflexive form *himself*, which forces this interpretation. In example (4.11), *the children* is interpreted as the understood subject of *dressing* and the antecedent of the reflexive form *themselves*. The PRED/ARG structure relevant to both of the examples in (4.10), before the application of the SI rule, is shown in (4.12), and the PRED/ARG structure of example (4.11), before the application of the SI rule is shown in (4.13):

(4.12) ASTONISH [[BE ANGRY]NP_i [FRIGHTEN [DRESS NP NPR] NP_j]] NP_k

(4.13) ASTONISH [[BE ANGRY]NP_i [FRIGHTEN [DRESS NP NPR] NP_j] NP_k



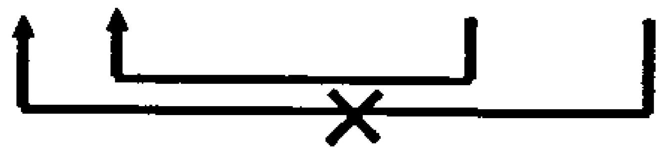
In both of these structures, the target σ is the 1-NP argument of DRESSING. As before, the arrows indicate the permissible antecedent/target (Φ/σ) pairs, and distinguish these from the impossible pairs.

Finally, consider the following examples:

(4.14) a. That dressing herself in sackcloth annoyed Myrtle$_i$ surprised Phillip$_j$
b. *That dressing himself in sackcloth annoyed Myrtle$_i$ surprised Phillip$_j$

In example (4.14a), *Myrtle* is interpreted as the subject of the predicate *dressing* and the antecedent of the reflexive form *herself*. The ungrammaticality of (4.14b) shows that *Phillip* cannot be interpreted as the subject of *dressing* and the antecedent of the reflexive form *himself*, which forces this interpretation. The PRED/ARG structure relevant to these examples is shown in (4.15):

(4.15) SURPRISE [ANNOY [DRESSING NP NPR ...] NP_i] NP_j



The target σ is the 1-NP argument of DRESSING. Again, the arrows indicate the permissible antecedent/target pair and distinguish this from the impossible pair.

If we compare the PRED/ARG structures of all of these examples, we see that the SI rule must co-index the target σ and the closest indexed NP in accordance with the FMDP. In structure (4.7), both of the potential antecedents, NP_i and NP_j, are to the left of the target, and NP_j is the closest one to the target. In structure

(4.9), one of the potential antecedents, NP_i, is to the left of the target and the other, NP_j, is to the right. Both are equally close to the target in the sense that there is no other indexed NP between either of them and the target, and both can be its antecedent. Similarly, in structures (4.12) and (4.13), NP_i, to the left of the target, and NP_j, to the right of the target, are equally close to the target and either can be its antecedent. NP_k in these structures is more distant, and cannot therefore be the antecedent of this target. In structure (4.15), both potential antecedents, NP_i and NP_j, are to the right of the target. Only NP_i, which is the closest indexed NP to the target can be the antecedent of this target.

These long-range control examples differ from the short-range ones in one respect, however. When the FMDP chooses two equally close, and hence appropriate, antecedents, as it does in structures like (4.9), the SI rule can apply to either, regardless of whether one is higher on HA than the other. Consequently, the following condition on the SI rule must be added to the theory:

(4.16) If the target σ is a 1-NP argument, then the Hierarchy Condition is neutralized.

The SI rule applies to the PRED/ARG structures in (4.7), (4.9), (4.12), (4.13), and (4.15) to co-index the 1-NP argument of the relevant embedded predicate and the appropriate indexed NP antecedent. The application of this rule to (4.7) produces the following PRED/ARG structure:

(4.17) KNOW NP_i [REALIZE NP_j [[BE[NECESS]][SHAV NP_j NPR]]]

The NPR target is then co-indexed with the NP_j argument of SHAVING to produce the derived F-structure of example (4.6a), which is shown below:

(4.18) KNOW NP_i [REALIZE NP_j [[BE[NECESS]][SHAV NP_j NPRj]]]

Structure (4.19a), below, is produced by the application of the SI rule to structure (4.9) to co-index the NP_i argument of KNOW and the 1-NP argument of SHAVING, followed by the co-indexing of the NPR and the NP_i argument of SHAVING. Structure (4.19b) is produced by the application of the SI rule to structure (4.9) to co-index NP_j and the 1-NP argument of SHAVING, followed by the co-indexing of this argument and NPR:

(4.19) a. KNOW NP_i [ANNOY [SHAVING NP_i NPR_i] NP_j]
b. KNOW NP_i [ANNOY [SHAVING NP_j NPR_j] NP_j]

The derived F-structures of the other examples are produced in the same way.

The elements, specified in the structural description of the SI rule in (4.3) can be eliminated. The SI rule in (4.3) is formulated specifically to co-index the 1-NP argument of an embedded predicate, PREDx, and an indexed NP elsewhere in the PRED/ARG structure. However, the only elements of PRED/ARG structures which are unindexed after the application of the index insertion rule are certain NP* arguments, NP[+ANAPHOR] arguments, and 1-NP arguments of embedded VP complements in S-structures. Consequently, we need not specify in the SI rule that the unindexed target is a 1-NP argument rather than, say, a 2-NP or 3-NP argument.

The SI rule in (4.3) can be replaced by the more general statement in (4.20) and the condition in (4.21), which removes the need to mention the term PREDx in the SD of the rule itself:

(4.20) *Subject Interpretation Rule 2*: Co-index Φ and σ in the following PRED/ARG structures:
(a) [... Φ ... σ ...]
(b) [... σ ... Φ ...]

(4.21) *Condition*: If the target σ is a 1-NP argument, then the antecedent and target must not be Θ-arguments of the same predicate, PREDx.

My reasons for separating the original SI rule into the general statement in (4.20) and Condition (4.21) will become clearer in the final section of the paper. For a detailed discussion of this condition, see Horn (1988).

The antecedent φ in the SI rule is always an NP[Θ] argument of some predicate. Consequently, if it is deleted in structures like the ones discussed in this section, the derived F-structures produced would be the basis for only partial interpretations of the relevant sentences. The situation regarding the optional deletion of antecedents is therefore the same for the SI rule as it was for the GCR and bound anaphora co-indexing rule.

This completes the discussion of the SI rule. In the next section, I discuss the unification of all three co-indexing rules.

Unification/Conclusions:

It is easy to see that all three co-indexing rules, the GCR (2.11), the Bound Anaphora Co-indexing Rule (3.4), and the SI2 rule (4.20), are subcases of a single general co-indexing process. We have seen that the same general principles apply to all three rules, and it only remains to formally unite them into a single statement. The first two rules do not require explicitly unidirectional statements, and the optional antecedent deletion process of the GCR need not be excluded from the Bound Anaphora Co-indexing Rule or the SI rule. Consequently, the following general statement is possible:

(5.1) *General Co-Indexing Rule (GCR) 2*: Co-index and in the following PRED/ARG structures:
(a) [... Φ ... σ ...]
(b) [... σ ... Φ ...]

and optionally delete Φ, where Φ is the indexed NP antecedent and σ is the unindexed target.

The primary conditions and principles which apply to the GCR2 are the following:

(5.2) *FMDP*: The GCR2 must involve the antecedent/target pair relevant to the operation whose members Φ and σ are least distantly separated.

(5.3) *Hierarchy Condition*: The antecedent Φ is the highest appropriate argument which is above, or on the same level as, the target in HA, where HA = {1-NP, 2-NP, 3-NP, NPp}.

(5.4) *Neutralization Principle*: The FMDP and HC may be neutralized in specified situations.

The following conditions apply to particular target types and structural configurations:

(5.5) If σ is the NP* argument of a controlled complement of the form [(NP*)XP] embedded in, or adjoined to, the PRED/ARG structure of a predicate, PREDx, then:
(a) the antecedent Φ must be an NP argument of PREDx;
(b) for predicates of Class X, the antecedent Φ must bear the specified SR Θ_x.

(5.6) If σ is an NP[+ANAPHOR] argument, the FMDP is neutralized, optionally in Type X languages and obligatorily in Type Y languages.

(5.7) If σ is a 1-NP argument, then:
(a) Φ and σ must not be Θ-arguments of the same predicate
(b) the Hierarchy Condition is neutralized

(5.8) When Φ is located in the PRED/ARG structure of PREDx and σ is not, the FMDP is neutralized over the relevant domain.

The FMDP, Neutralization Principle and HC, as well as the other more specific conditions, interact to explain the overall patterns of short-range (obligatory) control, bound anaphora, and long-rang control. The differences in detail among these phenomena are due to differences in the interplay of this relatively small set of major and target-specific conditions.

The FMDP is the primary condition on the GCR2. Although it can be neutralized under certain circumstances, it always plays a role in the choice of antecedent. The HC and other conditions are secondary to the FMDP. The HC only applies when the FMDP is neutralized, and then can only choose from the possible antecedents within the neutralization domain. Outside the ND, the FMDP always applies. The following examples, shown with their F-structures before the application of the GCR2, illustrate this:

(5.9) Flora$_i$ knew that Marvin$_j$ realized that Frieda's$_k$ serving koalaburgers$_m$ naked was necessary to peace on Earth
KNOW NP$_i$ [REALIZE NP$_j$ [[BE NEC...] [[*SERV. NP$_k$ NP$_m$*] [(*NP**)[*NAKED NP*]]]]]

(5.10) Freida$_i$ believed that Mahoney$_j$ told Mallone$_k$ about himself
BELIEVE NP$_i$ [*TELL NP$_j$ NP$_k$* [*ABOUT NPR*]]

In (5.9), the complement, [(NP*)[NAKED NP]], is adjoined to the PRED/ARG structure of SERVING. The ND relevant to the NP* target is underlined, and within it, both of the NP arguments of SERVING are appropriate antecedents. The HC chooses NP$_k$. However, the FMDP prevents the choice, allowed by the HC, of either of the more distant arguments, NP$_i$ or NP$_j$, outside of the ND as antecedent. In (5.10), either NP$_j$ or NP$_k$, within the underlined ND, can be the antecedent of NPR, but the FMDP again prevents the choice, allowed by the HC, of the more distant NP$_i$ as antecedent.

The other conditions, (5.5) and (5.7a), limit the set of appropriate controllers, but the FMDP applies to choose the least distantly separated Φ/σ pair from among those remaining. Consider the following examples, shown with their F-structures at the appropriate stage of the derivation:

(5.11) Rhoda$_i$ said that Boris$_j$ gave the manuscript$_k$ to Morris$_m$ unfinished
SAY NP$_i$ [GIVE NP$_j$ NP$_k$ [TO NP$_m$][(*NP**)[*UNFINISHED NP*]]]

(5.12) Ajax$_i$ promised to force Hermione$_j$ to promise Emilia$_k$ to leave
PROM NP$_i$ [FORCE NP$_i$ NP$_j$ [PROM NP$_j$ NP$_k$ [(NP*) [LEAV NP]]]]
Θp Θp

(5.13) Murphy$_i$ knew that Marvin$_j$ realized that killing Schaefer$_k$ was necessary
KNOW NP$_i$ [REALIZE NP$_j$ [[BE NECESS] [KILLING NP NP$_k$]]]

In the structure in (5.11), the controlled complement (underlined) is embedded in the PRED/ARG structure of GIVE, whose PRED/ARG structure is in turn embedded in that of SAY. Condition (5.5a) chooses both arguments of GIVE, NP$_j$ and NP$_k$, as well as the NP$_i$ argument of SAY, as possible antecedents. The FMDP applies to choose NP$_k$, the closest argument to the target, as the antecedent.

The F-structure of (5.12) is shown as it appears after two applications of the GCR2: in the argument structures of the leftmost PROMISE and FORCE, respectively. In this structure, the leftmost NP$_i$ and NP$_j$ both bear the appropriate SR, Θp. Both are therefore appropriate antecedents according to Condition (5.5b)

The FMDP chooses NP$_j$, the closer of these arguments to the target, NP*, as the antecedent of NP*.

In Structure (5.13), Condition (5.7a) precludes the choice of NP$_k$ as a possible antecedent of the unindexed NP argument of KILLING. However, the FMDP applies to choose the closest appropriate argument, NP$_j$, as the antecedent.

The optionality of long-range control and obligatoriness of short-range control, as well as the apparent differences in the "distance" separating the antecedent and target in each, follows from the nature of the complement types involved, and the general configurational properties of PRED/ARG structures. The two complement types are shown in (5.14), below:

(5.14) a. Controlled Complement: [(NP*)XP]
b. Optionally Controlled Complement: XP

The NP* argument of controlled complements, as mentioned previously, bears no SR and therefore must be co-indexed with the 1-NP argument of the predicate in XP and then deleted. If the GCR does not apply to do this, the resulting derived F-structure will not be well-formed. Consequently, control of such complements appears to be obligatory. In contrast, XP complements like (5.14b) contain no NP* argument, and the GCR need not apply to index any of their NP arguments with an external antecedent. Consequently, control of such complements is optional.

Let us turn now to the distance differences. Controlled complements occur in only two types of configuration, either embedded in, or adjoined to, some PRED/ARG structure, as shown in (5.15):

(5.15) a. ... [PRED1 ... NP[Θ]$_i$ ... [(NP*)XP]
b. ... [PRED1 ... NP[Θ]$_i$ ...] [(NP*)XP]

The FMDP and Condition (5.5a) limit the choice of antecedent of NP* to arguments of PRED1, so the antecedent will be either adjacent to NP*, or, if the FMDP is neutralized, at most one argument removed from NP*. This "short" distance between ϕ and σ, reflected in the corresponding S-structures of sentences which contain obligatory control verbs, is characteristic of this type of control.

XP complements occur embedded in NPs in matrix PRED/ARG structures of virtually any degree of complexity, like the following:

(5.16) [PRED1 $_{NP}$[[*PRED2 NP$_i$* [*PRED3* $_{NP}$[[***PRED4 NP.***]] *NP$_j$*]] NP$_k$]

Here, the PRED/ARG structure of PRED2, which is an XP complement, is embedded in the 1-NP argument position of PRED1. The PRED/ARG structure of PRED4, a second XP complement, is embedded in the 1-NP argument position (boldface) of PRED3. The target is the unindexed NP argument of PRED4. (This is the structure of examples like (4.10a), above.) Because there is no theoretical limit on the depth of embedding of such complements, the minimally distant antecedent of the NP target may be apparently further removed in these cases than in the obligatory control cases. This is reflected in the corresponding S-structures of sentences which contain such complements.

Finally, if we compare the S-structure correlates of Structures (5.15) and (5.16), we see that the antecedents of NP* arguments are always higher in the structure than the NP* targets, and thus command them in some sense. This is not always true for the antecedents of the 1-NP arguments of XP complements. However, the FMDP, and not "command" in any sense, determines the patterns of control in this analysis.

The proposed theory satisfies the requirements of any adequate theory of control. It defines the notions "possible controller (antecedent Φ)" and "possible controlled position (target σ)", and contains general principles which choose the controller/antecedent from several possible ones in the relevant PRED/ARG structure. A single set of general principles and conditions determines the patterns of short-range control, bound anaphora, and long-range control, thus unifying a seemingly disparate range of phenomena. This represents a significant generalization.

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