University of Massachusetts Occasional Papers in Linguistics

Volume 4 *Studies presented to Emmon Bach by his students* Article 10

1979

Functional Structures & Control

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Chomsky (1978) utilizes the following conditions to account for bound anaphora, control, and certain movement facts:

(1) The Nominative Island Condition (NIC): A nominative anaphor cannot be free in $\overline{S}$.

(2) The Opacity Condition (Opacity): If α is in the domain of the subject of β, β minimal, then α cannot be free in β.

By making other assumptions which will not be discussed, his analysis predicts that only the subjects of tenseless embedded sentences can be externally controlled, and that bound anaphors (reflexives, reciprocals, traces) in non-subject position cannot be controlled from outside their clause (or noun phrase with a POSS-marked NP determiner.) Thus (3) are grammatical and (4) are not:

(3) a John tried to leave
b John forced Fred to leave
c A funnelweb was believed to have bitten Bill
d The koala seemed to be dangerous
e Bill believed himself to be a kangaroo
f Mary believed Fred to have shaved himself
g John saw a picture of himself

(4) a *John tried had left
b *A funnelweb was believed had bitten Bill
c *The koala seemed was dangerous
d *Bill believed that himself was a kangaroo
e *John seemed a kangaroo to see
f *Mary believed Fred to have shaved herself
g *John saw Mary's picture of himself

Examples (4)a-d violate (1). In a, the PRO subject of the tensed clause *PRO had left* is controlled by the NP *John* outside of the clause, and in b the subject, *t*, of the clause: *t had bitten Bill* is controlled by the external NP *a funnelweb*. In c, the subject, *t*, of the embedded clause: *t was dangerous* is controlled by the external NP *the koala*, and in d, *himself* is controlled by *Bill*. Examples e (with *t* in object position), f, and g violate Condition (2)

I will demonstrate that if we assume with Brame (1976) and Bresnan (1977) that verbs like *try*, *force*, *believe*, and *seem* have $\overline{VP}$ rather than $\overline{S}$ complements in (3), and if raising, equi, and reflexive/reciprocal interpretation, as well as the rule that interprets the subjects of embedded gerundive and infinitive $\overline{\text{VP}}$s in non-complement positions, are formulated as operations on functional structures, these rules can apply freely and no constraints are necessary to account for the above data. I will not discuss wh-movement and the Subjacency Condition.

First, I assume, more or less in line with Bresnan (1977), that the verbs in the above examples have functional structures something like the following:

(5) a BELIEVE $NP_{\alpha 1}$ ((NP_2) VP)

b SEEM ((NP_1) VP)

c FORCE $NP_{\alpha 1}$ $NP_{\beta 2}$ ((NP_{β}) VP)

d TRY $NP_{\alpha 1}$ ((NP_{α}) VP)

NP_1 and NP_2 are grammatical functions, subject and object, respectively, and are defined as the circled NPs in the following configurations:

(6) a NP_1: $_S$[(NP) VP]

b NP_2: $_{VP}$[V (NP)]

α, and β represent thematic relations. NP_2 in (5)a, and NP_1 in (5)b are not assigned a thematic relation by their respective verbs.

The examples in (7) have structures like those shown in (8):

(7) a John believed Bill to have left
b The koala seemed to be dangerous [3d]
c A funnelweb was believed to have bitten Bill [3c]

(8) a $_{\overline{S}}$[John believed $_{NP}$[Bill] $_{\overline{VP}}$[to have left]]

b $_{\overline{S}}$[The koala seemed $_{\overline{VP}}$[to be dangerous]]

c $_{\overline{S}}$[A funnelweb was believed $_{\overline{VP}}$[to have bitten Bill]]

To interpret these examples, we begin by forming complex functional structures by combining the functional structures of their verbs. These are shown in (9):

(9) a BELIEVE $NP_{\alpha 1}$ ((NP_2) LEAVE $NP_{\beta 1}$)

b SEEM ((NP_1) BE $NP_{\alpha 1}$ ADJ)

c (∃x) BELIEVE x ((NP_1) BITE $NP_{\alpha 1}$ $NP_{\beta 2}$)

In (8)a, *John* is NP_1 of *believe* and is indexed as i, and *Bill* is NP_2 of *believe* and is indexed as j. In (8)b, *the koala* is NP_1

of *seem* and is indexed as i. In (8)c, *a funnelweb* is NP_1 of *be believed* and is indexed as i, and *Bill* is NP_2 of *bite* and is indexed as j. Insertion of these indices into (9) yields the following:

(10) a BELIEVE i_α ((j) LEAVE $NP_{\beta 1}$)

b SEEM ((i) BE $NP_{\alpha 1}$ adj) adj = *dangerous*

c ($\exists$x) BELIEVE x ((i) BITE $NP_{\alpha 1}$ j_β)

The interpretive analog of raising is the insertion of the index of the NP immediately preceding the verb in the complex functional structures in (10) into the unindexed NP_1 position. This rule can be formulated as follows:

(11) $_{NP}$[i] VERB $_{NP_1}$[ ]

1 2 3 $\Rightarrow$ $\emptyset$ 2 $_{NP_1}$[i]

Rule (11) applies to (10) to produce (12):

(12) a BELIEVE i_α (LEAVE j_β)

b SEEM (BE i_α adj) adj = *dangerous*

c ($\exists$x) BELIEVE x (BITE i_α j_β)

This completes the relevant part of the interpretation of these examples.

Now consider the following examples:

(13) a John forced Fred to leave [3b]
b John tried to leave [3a]
c John was forced to leave

The surface structures of (13) are shown below:

(14) a $_{\bar{S}}$[John forced $_{NP}$[Fred] $_{\overline{VP}}$[to leave]

b $_{\bar{S}}$[John tried $_{\overline{VP}}$[to leave]]

c $_{\bar{S}}$[John was forced $_{\overline{VP}}$[to leave]]

The complex functional structures of (14) are shown in (15):

(15) a FORCE $NP_{\alpha 1}$ $NP_{\beta 2}$ ((NP_β) LEAVE $NP_{\gamma 1}$)

b TRY $NP_{\alpha 1}$ ((NP_α) LEAVE $NP_{\beta 1}$)

c ($\exists$x) FORCE x $NP_{\beta 1}$ ((NP_β) LEAVE $NP_{\gamma 1}$)

In each case, *John* (NP_1) is indexed as i. In (14)a, *Fred* is NP_2 of *force* and is indexed as j. Insertion of the indices into (15) produces (16) below:

(16) a FORCE $\underset{\alpha}{i}$ $\underset{\beta}{j}$ ((NP$_\beta$) LEAVE $NP_{\gamma 1}$)

b TRY $\underset{\alpha}{i}$ ((NP$_\alpha$) LEAVE $NP_{\beta 1}$)

c (∃x) FORCE x $\underset{\beta}{i}$ ((NP$_\beta$) LEAVE $NP_{\gamma 1}$

Two rules apply to (16). The first one inserts the index of the NP functioning as α into the NP_α position, and may be formulated as shown below:

(17) $_{NP}[\underset{\alpha}{i}]$ (NP) NP_α α ε {thematic rel.}

1 2 3 ⇒ 1 2 $_{NP}[i]$

Rule (17) applies to (16) to produce (18):

(18) a FORCE $\underset{\alpha}{i}$ $\underset{\beta}{j}$ ((j) LEAVE $NP_{\gamma 1}$)

b TRY $\underset{\alpha}{i}$ ((i) LEAVE $NP_{\beta 1}$)

c (∃x) FORCE x $\underset{\beta}{i}$ ((i) LEAVE $NP_{\gamma 1}$)

At this stage, rule (11) applies to produce the following:

(19) a FORCE $\underset{\alpha}{i}$ $\underset{\beta}{j}$ (LEAVE $\underset{\gamma}{j}$)

b TRY $\underset{\alpha}{i}$ (LEAVE $\underset{\beta}{i}$)

c (∃x) FORCE x $\underset{\beta}{i}$ (LEAVE $\underset{\gamma}{i}$)

(Rule (17) plays a role in accounting for the ungrammaticality of: **John was promised to leave*, which contrasts with (13)c. The functional structure of *promise* is shown in (20)a, and the complex functional structure of this example is shown in (20)b: (i = *John*)

(20) a PROMISE $NP_{\alpha 1}$ $NP_{\beta 2}$ ((NP$_\alpha$) VP)

b (∃x) PROMISE x $_{NP_1}[\underset{\beta}{i}]$ ((NP$_\alpha$) LEAVE $NP_{\gamma 1}$)

The SD of (17) is not satisfied and the rule does not apply. Consequently, rule (11) is blocked, and the example cannot be interpreted. (See Horn (1978) for more discussion.))

Rules (11) and (17) are sufficient to account for control facts with verb complements. The rules will not apply with non-equi and non-raising verbs, such as those in (21)a and b which occur with $\overline{S}$ rather than $\overline{VP}$ complements, nor will they apply to equi- and raising-type verbs such as those in (21)c and d when these occur with $\overline{S}$ complements:

(21) a John implied that Bill was a fool
b John doubted that Fred left
c John believed that a funnelweb bit Mary
d John would prefer for Bill to leave

The complex functional structures of these examples are the following:

(22) a IMPLY $NP_{\alpha 1}$ (BE $NP_{\beta 1}$ $NP_{\gamma 2}$)

b DOUBT $NP_{\alpha 1}$ (LEAVE $NP_{\beta 1}$)

c BELIEVE $NP_{\alpha 1}$ (BITE $NP_{\beta 1}$ $NP_{\gamma 2}$)

d PREFER $NP_{\alpha 1}$ (LEAVE $NP_{\beta 1}$)

These examples differ from those in (7) and (13) in that NP_1 of the embedded verb occurs in the syntactic structures, in these cases as a lexical NP (*Bill* in a and d, *Fred* in b, and *a funnelweb* in c.) *John* is indexed as i; *Bill*, *Fred*, and *a funnelweb*, as j; and *a fool* and *Mary*, as k. Insertion of these indices in (22) produces (23):

(23) a IMPLY i_{α} (BE j_{β} k_{γ})

b DOUBT i_{α} (LEAVE j_{β})

c BELIEVE i_{α} (BITE j_{β} k_{γ})

d PREFER i_{α} (LEAVE j_{β})

The structural description of (11) is not satisfied, and the rule does not apply. Since lexical insertion rules must apply to all terminal nodes in syntactic structures, the subjects of embedded sentences will terminate in lexical NPs, pronouns, or possibly some phonologically zero terminal symbol such as Δ or PRO. In no case will the SD of (11) be satisfied. If Δ or PRO is inserted into the NP_1 position in the embedded clause of examples like (21), the following will result:

(24) *John implied that was a fool

FROM: $_{\overline{S}}$[John implied $_{\overline{S}_2}$[that PRO was a fool]]

Examples like (24) are ungrammatical because clauses (S) in English require an overt subject. Example (25) below is ungrammatical for the same reason as (24):

(25) *was a fool

Examples (4)a and c are automatically blocked because they must be derived from structures with sentential complements since tense is a constituent of S, not $\overline{\mathrm{VP}}$. *Try* does not occur with a sentential complement so there is no source for a. *Seem* occurs with sentential complements (e.g. *It seemed that Bill left*), but its functional structure in such cases is: SEEM [S], rather than (5)b. The structure underlying (4)c cannot be interpreted because there is no position in this functional structure in which to insert the index of *the koala* (NP_1 of *seem*). (4)e must also be derived from a structure with an $\overline{\mathrm{S}}$ complement (which has an overt subject, *a kangaroo*), and, as with c, there is no position in which to insert the index of NP_1 of *seem* (*John*). (The proposed analysis has no rule of NP movement.) (4)b must be derived by applying passive to the subject of the embedded clause, *a funnelweb*, but in this example, the lexical passive rule (see Bresnan (1977)) can only apply to an NP argument in the functional structure of *believe*, and thus not to *a funnelweb*. Consequently, (4)b is also automatically blocked in the proposed analysis.

Let us now turn to examples containing reflexives. Consider the following:

(26) a John shaved himself
b John talked to Bill about himself

Example (26)b is ambiguous, and the reflexive form can either refer to *John* or *Bill*. These examples show that reflexive forms are anaphorically related to some NP that precedes them in the same clause. This is, more or less, the classical generalization. The functional structures of (26) are the following:

(27) a SHAVE $\mathrm{NP}_{\alpha 1}$ $\mathrm{NP}_{\beta 2}$

b TALK $\mathrm{NP}_{\alpha 1}$ ${}_{\beta}[\mathrm{P\ NP}_{p}]$ ${}_{\gamma}[\mathrm{P\ NP}_{p}]$

The reflexive rule can be formulated as an operation on functional structures as follows:

(28) ${}_{\mathrm{NP}}[\mathrm{i}]$ ((P) NP) (P) ${}_{\mathrm{NP}}[\mathrm{reflex}]$

1 2 3 4 ⇒ 1 2 3 ${}_{\mathrm{NP}}[\mathrm{i}]$

If we assume that *John* in (26)a and b is indexed as i, and that *Bill* in (26)b is indexed as j, the insertion of these indices into (27) will produce (29):

(29) a SHAVE i_{α} reflex_{β}

b TALK i_{α} ${}_{\beta}[\mathrm{TO\ j}]$ ${}_{\gamma}[\mathrm{ABOUT\ reflex}]$

Rule (28) will apply to co-index *reflex* and i in (29)a, and either *reflex* and i or *reflex* and j in (29)b.

Rule (28), along with rule (11), applies with no modification to reflexives in examples like the following:

(30) a Bill believed himself to be a kangaroo [3e]
b John forced Bill to shave himself
c Mary believed Fred to have shaved himself [3f]

These examples have functional structures like the following after index insertion: (In (31)a, i=*Bill* and j=*kangaroo*. In b, i=*John* and j=*Bill*; and in c, i=*Mary* and j=*Fred*.)

(31) a BELIEVE $\underset{\alpha}{i}$ ((reflex) BE $\underset{\beta}{NP_1}$ $\underset{\gamma}{j}$)

b FORCE $\underset{\alpha}{i}$ $\underset{\beta}{j}$ ((NP_β) SHAVE $\underset{\gamma}{NP_1}$ $\underset{\delta}{\text{reflex}}$)

c BELIEVE $\underset{\alpha}{i}$ ((j) SHAVE $\underset{\beta}{NP_1}$ $\underset{\gamma}{\text{reflex}}$)

Rule (28) co-indexes NP_i and *reflex* in (31)a, and then rule (11) produces (32)a. Rules (17) and (11) apply to (31)b and c to produce (32)b and c:

(32) a BELIEVE $\underset{\alpha}{i}$ (BE $\underset{\beta}{i}$ $\underset{\gamma}{j}$)

b FORCE $\underset{\alpha}{i}$ $\underset{\beta}{j}$ (SHAVE $\underset{\gamma}{j}$ $\underset{\delta}{\text{reflex}}$)

c BELIEVE $\underset{\alpha}{i}$ (SHAVE $\underset{\beta}{j}$ $\underset{\gamma}{\text{reflex}}$)

Now, rule (28) applies to co-index j and *reflex* in (32)b and c.

Examples like (4)d and f are automatically blocked. These have functional structures like (33)a and b respectively when (28) applies: (Rule (11) has applied to produce (33)b).

(33) a BELIEVE $\underset{\alpha}{i}$ (BE $\underset{\beta}{\text{reflex}}$ $\underset{\gamma}{j}$) i=*Bill*; j=*kangaroo*

b BELIEVE $\underset{\alpha}{i}$ (SHAVE $\underset{\beta}{j}$ $\underset{\gamma}{\text{reflex}}$) i=*Mary*; j=*Fred*

In (33)a, the structural description of (28) is not satisfied, and the reflexive form is not indexed. Consequently, (4)d is ungrammatical. In (33)b, rule (28) can only apply to co-index j and the reflexive form. However, j is *Fred*, and the form *herself* is inappropriate. Therefore (4)f is ungrammatical.

Rules (11), (17), and (28) account for control facts and for bound anaphora (reflexive) facts in simple sentences and sentences containing verb complements. No additional conditions are necessary. Rule (28) can be easily modified to account for the interpretation of reciprocals.

I turn now to examples containing embedded gerundive and infinitival phrases such as the following:

(34) a John thought that shaving himself would disturb Mary
b Shaving himself occupied most of the time that John spent getting ready for dates

c That shaving himself with her razor annoyed Mary surprised John

Let us assume that a rule of subject interpretation (SI) applies in examples like (34) to the embedded gerundive phrases. This rule, and the conditions under which it applies have been discussed extensively. See, for example, Grinder (1970), (1973), Jacobson & Neubauer (1976), Hayes (1976), and Andrews (1978). Example b suggests that such structurally defined notions as command and precedence play no role in constraining the rule. I will assume that the rule is semantically, rather than syntactically constrained, and that it is better stated as an operation on functional structures. The complex functional structure of (34)a is the following:

(35) THINK $NP_{\alpha 1}$ (DISTURB $_{NP_{\beta 1}}$[SHAVE $NP_{\gamma 1}$ $NP_{\delta 2}$] $NP_{\varepsilon 2}$)

Let us assume that *John* (NP_1 of *think*) is indexed as i; and that *Mary* (NP_2 of *disturb*) is indexed as j. Insertion of these indices produces the following:

(36) THINK i_{α} (DISTURB $_{NP_{\beta 1}}$[SHAVE $NP_{\gamma 1}$ $reflex_{\delta}$] j_{ε})

The rule of SI must apply to co-index NP_1 of *shave* with either i or j. The rule can be tentatively formulated as follows, assuming that the conditions under which it applies can be defined:

(37) Co-index NP_i and NP_1 in the following structures:

(a) ...NP_i ... $_{NP_1}$[ ] ...

(b) ...$_{NP_1}$[ ] ... NP_i ...

Rule (37) can apply to i and NP_1 of *shave* in (36) to produce (38):

(38) THINK i_{α} (DISTURB $_{NP_{\beta 1}}$[SHAVE i_{γ} $reflex_{\delta}$] j_{ε})

The rule could also have applied to co-index j and NP_1 of *shave*. With the appropriate form of the reflexive, this would also produce a grammatical sentence: *John thought that shaving herself would disturb Mary*. After NP_1 has been indexed, the reflexive rule, (28), can apply to co-index the reflexive form and i in (38). Examples (34)b and c are interpreted in the same manner.

Rule (28) and rule (37), slightly modified, account for the interpretation of reflexives in picture noun phrases. Consider the following:

(39) a John saw a picture of himself [3g]
b That picture of himself in the attic annoyed John
c *John saw Mary's picture of himself [4g]

Let us assume that nouns like *picture* have lexical entries something like the following:

(40) $\begin{bmatrix} \text{PICTURE} \\ +\text{N} \\ \ldots\ldots \\ \text{PICTURE} \quad \text{NP}_{\alpha\,\text{poss}} \quad \text{NP}_{\beta\,\text{of}} \end{bmatrix}$

Such nouns, like nominals and verbs, have functional structures that indicate their NP 'arguments' and the semantic functions that these bear. The complex functional structure of (39)a is the following:

(41) SEE $\text{NP}_{\alpha 1}$ $_{\text{NP}_{\beta 2}}$[PICTURE $\text{NP}_{\gamma\,\text{poss}}$ $\text{NP}_{\delta\,\text{of}}$]

John is NP_1 of *see*, and may be indexed as i, and NP_{of} is *reflex*. Insertion of indices produces (42):

(42) SEE i_α $_{\text{NP}_{\beta 2}}$[PICTURE $\text{NP}_{\gamma\,\text{poss}}$ reflex_δ]

If rule (37) is modified so that it co-indexes NP_{poss} as well as NP_1, and some other NP in the structure, the rule will apply to index NP_{poss} in (42) as i. Next, the reflexive rule can apply to co-index NP_{poss} and the reflexive form. Examples like (39)c (and (4)g) have complex functional structures like (43):

(43) SEE i_α $_{\text{NP}_{\beta 2}}$[PICTURE j_γ reflex_δ] i=*John*; j=*Mary*

Now the reflexive rule can only apply to co-index j with the reflexive form. The reflexive form *himself* is inappropriate and consequently (39)c/(4)g is ungrammatical.

This analysis is similar to one proposed by Grinder. One might argue that co-indexing some NP with NP_{poss} of a picture noun leads to semantically inappropriate interpretations. Such NPs do not function as 'subjects' in the sense that NPs in examples like (34) are the 'subjects' of gerunds. However, in the proposed framework, syntactic functions like subject (NP_1) are distinct from semantic relations like *agent* and so on. NP_{poss} can function in a number of ways: as *agent* in: *Rembrandt's portraits of famous men*; as *theme* in: *Bill's portrait by a famous artist*; as possessor in *John's book of Emily Dickenson's poetry*; and so on. The application of SI in examples like (39) signifies only that the NP co-indexed with NP_{poss} is associated with the picture noun in some way.

In conclusion, I have shown that the rules that pertain to control and bound anaphora interpretation can be stated relatively simply as (11), (17), (28), and (37). They apply when their SDs are satisfied and no special conditions are required to account for the ungrammaticality of (4), which contrast with (3).

Chomsky (1978) requires Conditions (1) and (2) as well as additional mechanisms to account for the same range of data. (Both analyses require constraints on SI.) Moreover, the proposed analysis provides the framework for a simpler account of control in tenseless indirect questions.

Tenseless indirect questions never have an overt subject, and are consequently always externally controlled. To account for the first fact, Chomsky's analysis requires some sort of surface filter. However, the lack of an overt subject is a characteristic of all embedded bare $\overline{VP}$s and follows automatically if tenseless indirect questions are also analyzed in this way. In the proposed analysis, examples like (44) can be assigned structures like (45):

(44) John asked who to visit

(45) $_{\overline{S}}$[John asked $_{\overline{S}}$[$_{C}$[who] $_{\overline{VP}}$[to visit _t_]]]

(I assume that wh-movement is an unbounded rule that applies non-cyclically and is formulated as in (46) below: It can apply to structures like (45), and there is no need to analyze tenseless indirect questions as [COMP S]:

(46) COMP X [+wh]
1 2 3 = 3 2 _t_

See Horn (1978) for more discussion.)

The complex functional structure of (44) is (47):

(47) ASK $NP_{\alpha 1}$ [(WHO)(VISIT $NP_{\beta 1}$ $NP_{\gamma 2}$)]

John (NP_1 of *ask*) is indexed as _i_ and *who* is indexed as _j_. The trace, _t_, (NP_2 of *visit*) is co-indexed with *who*$_j$ by a rule which I will not discuss. Insertion of these indices into (47) produces (48):

(48) ASK i_{α} [(WHO$_j$)(VISIT $NP_{\beta 1}$ j_{γ})]

At this point, SI (rule (37)) can apply to co-index NP_1 of *visit* with NP_1 of *ask* (_i_) to produce (49):

(49) ASK i_{α} [(WHO$_j$)(VISIT i_{β} j_{γ})]

The rule of SI is optional, and if it does not apply, NP_1 of *visit* is interpreted as indefinite (as in: *John asked who to visit if one wanted to buy a cheap TV.*) The same is true in examples like (34) above: *John thought that (anyone's) drinking at ballgames would disturb Mary.*

Because the proposed analysis provides a simpler account of the distribution of reflexives, reciprocals, and traces resulting from NP movement in Chomsky's analysis (in examples like (4)_b_, _c_, and _e_), as well as control facts, for verb complements, embedded

$\overline{VP}$s in non-complement positions, and tenseless indirect questions, it is preferable to Chomsky's analysis of these data. I have not discussed wh-movement and the distribution of traces produced by this rule, which is quite different from the distribution of traces resulting from NP movement. In fact, Conditions (1) and (2) play no significant role in constraining this rule, and consequently, wh-movement and the conditions under which it applies are better treated separately (see,for example, Horn (1978).)

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