North East Linguistics Society

Volume 18
Issue 3 *NELS 18: Volume 2*

Article 10

1987

Binominal Each

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BINOMINAL EACH

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1.0 A Dyadic Quantifier

Within the research tradition of generative grammar, quantifiers have typically been assumed to be fundamentally different from predicates such as verbs or adjectives, insofar as only the latter categories take one or more arguments, to which they assign grammatical functions, such as subject, object, etc. Thus in a sentence like (1a), the predicate loves assigns its thematic roles to a subject every man and an object Jane. The LF representation (1b) treats the subject of loves as a variable bound by the quantifier. Crucially, the quantifier introduces no new grammatical relation of its own.

1a) Every man loves Jane
b) [every man]$_i$ [[e]$_i$ loves Jane]

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We contend that there is at least one natural language quantifier that acts exactly like adjectival or verbal predicates, in that it has a dyadic argument structure parallel to that of an adjective.[1] The quantifier in question is each, in a particular construction that we will call "binominal each". This is exemplified in (2), where each distributes over two NP arguments:

2) The men saw two women each

A number of issues about the nature of LF operations will emerge from our analysis of binominal each, but we reserve these matters for their natural place in our presentation.

1.1 Some Relational Properties of Binominal each

The structural position of each in (2) is not immediately apparent, in that each might be either a subconstituent of the direct object NP or a direct constituent of VP, analogous to the structure in (3), where it occurs in VP-initial position:

3) The men have each seen two women

We will refer to this usage of each as adverbial each, to distinguish it from binominal each in (2).

Two factors argue in favor of an NP-internal position for binominal each. First, if the VP does not contain a direct object, then each may not occur to the right of the verb:

4a) The men each decided to leave
 b) *The men decided to leave each

The contrast between (4a) and (4b) suggests that true adverbial each may only occur VP-initially, and that (2) involves a distinct structure, with each as a subconstituent of NP. This is confirmed by the paradigm in (5-6), where the direct object undergoes movement (cf. Burzio (1981, 1986):

5a) How many girls each did the men see
 b) One girl each was seen by the men
6a) *How many girls did the men see each
 b) *One girl was seen by the men each
 c) *One girl was seen each by the men
 d) How many girls did the men each see

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The contrast between (5) and (6a-c) follows automatically if binominal each is a subconstituent of NP in (2). When each does not occur as a subconstituent of NP, it must occur in VP-initial position as in the adverbial each construction in (3), (4a), and (6c).

The contrasts between these two usages of each extend to a number of other phenomena that lie beyond our immediate concerns. By distinguishing binominal each from adverbial each we do not intend to imply that there are two distinct homophonous lexical items each. Rather, we suggest that there are two clusters of properties that each has, depending on its syntactic position and its interpretation. In the remainder of our discussion we confine our analysis to binominal each.

Binominal each constructions impose certain restrictions on the two NPs that each takes scope over. We will refer to the NP containing postnominal each as the Distributing NP (D-NP); thus in (2), two women is the D-NP. The D-NP must always be cardinal and indefinite -- definite NPs, bare plural NPs, and quantified plural NPs are all excluded:

7a) The men saw one jewel each
b) ?The men saw a jewel each
c) The men saw two/several jewels each
d) *The men saw some/certain jewels each
e) *The men saw the/those jewels each
f) *The men saw both/most/all jewels each

Note the contrast between cardinal indefinites (7a, c) and noncardinal indefinites (7b,d). Many speakers find singular indefinite D-NPs like that in (7b) fully acceptable, perhaps indicating that the article a can function as a numeral in this dialect.

Among D-NPs of the form [X of the Ns each] we find the judgments in (8):

8a) ?The men saw one/two/several of the women each
b) ??The men saw some/many/few of the women each
c) *The men saw most/all/both of the women each

The other NP, which we refer to as the Range NP (R-NP), is typically plural and specific; it corresponds to the

NP the men in (2). The range of possible R-NPs is illustrated in (9):

9a) They/The men/Those men/The five men saw two women each
b) Bill and Joe saw two women each
c) Some men/Several men/Many men saw two women each
d) Five men/A few men/A group of men saw two women each
e) *The man/*A man/*Someone/*She/Joe saw two women each
f) ?Everyone/*Every man saw two women each
g) ?All the men/Both the men saw two women each
h) ?All men/Both men/Most men will see two women each
i) ?Two/many/Several/A lot of the men saw two women each
j) Martian men marry two women each
k) *No men/No man/Few men married two women each

The R-NP may be a definite plural (9a) or a conjoined definite NP (9b). As (9c-d) show, the R-NP may also be an indefinite plural NP, but the interpretation of (9c-d) clearly requires a specific reading of the indefinite R-NP. (9e) indicates that the R-NP may not be a singular NP, regardless of whether it is definite, indefinite, quantified, or whatever. Although everyone is marginally possible as an R-NP in (9f), it is probably a lexical idiosyncrasy of everyone that it behaves like a plural, since every man is plainly worse; cf. Williams (1986). When the R-NP is a universally quantified plural NP, as in (9g-h), or a partitive NP, as in (9i), the judgments are delicate, but the sentences seem basically acceptable, and generic plurals (9j) seem fine. Negatively quantified plurals (9k) are excluded as R-NPs.

In this presentation we shall not attempt to devise a single characterization that will pick out all possible D-NPs or all possible R-NPs, but these distinctions serve to illustrate the asymmetry between the arguments of binominal each, and will play essentially a diagnostic role in our analysis.

1.2 The Interpretation of Binominal Each

Our terminological distinction between the D-NP and the R-NP is based on the logical interpretation of these constructions. In (2), binominal each effects a mapping between individual men and sets of two women, such that the men see the women. Generalizing, we suggest that (10) provides a rough informal characterization of the interpretation of binominal

each:

10) The individuals in the set denoted by the R-NP are exhaustively mapped onto sets denoted by the D-NP such that no two R-individuals are mapped onto the same D-set.

Thus in a sentence like (11), at least six books must be purchased, and no two of the men can have combined in the purchase of any of the books. (We owe the latter observation to James Higginbotham).

11) Three men bought two books each

This may explain why the cardinal NPs in (8a) are awkward, since the exhaustive mapping is limited to a portion of the individuals in the larger set of men.

Insofar as it establishes a relation specifically between two NPs, binominal each is unlike most other quantifiers. It is instructive to show how binominal each, differs from other "floated" usages of each, such as adverbial each, which relates the subject and a VP. These two usages are contrasted in (12).

12a) The girls each had a good time
b) *The girls had a good time each
c) ?The girls met a boy each

Abstracting away from the marginality of the noncardinal indefinite D-NP in (12c), we note that (12b) fails because have a good time is an idiom, where a good time fails to refer and cannot serve as a (cardinal) D-NP. (12a) is grammatical because adverbial each is directly adjoined to VP, and does not require a D-NP, as shown above.

2.0 The Syntactic Diathesis of Binominal each

2.1 Partitive Each

As is well known, each also occurs prenominally, either as a specifier of a singular NP, as in (13a), or as the specifier of a partitive NP, as in (13b):

13a) Each boy (*boys) went home
b) Each of the boys (*boy) went home

The of-NPs that may follow each in a partitive NP are a proper subset of the class of R-NPs selected by

binominal each in (9):

14a) Each of them left
b) Each of the/those/Mo's/the ten men left
c) Each of five/a few men left
d) ?Each of Bill and Joe left
e) ??Each of some/several/many/a few men left
f) ??Each of all the men/both the men left
g) *Each of all/both/most men are tall
h) *Each of the/that/a/every man left
i) *Each of Martian men have two antennae
j) *Each of no/few men left

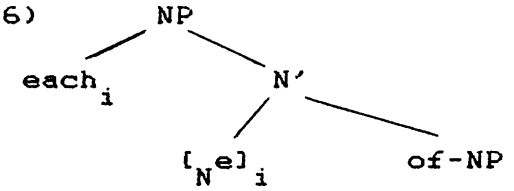
With the exception of conjoined names and quantified NPs, the set of possible R-NPs is equivalent to the set of possible of-NPs occurring with partitive each.

We suggest that partitive each should be analyzed as the specifier of an NP headed by a null singular cardinal noun (or pronoun), parallel to the overt cardinal proform one in (15):

15a) Each one of them left
b) Each one of the/those/Mo's/the ten men left
c) Each one of five/a few/ men left
d) ?Each one of Bill and Joe left
e) ?Each one of some/several/many/a few men left
f) ?Each one of all the men/both the men left
g) *Each of all/both/most men are tall
h) *Each of no/few men left

Although the questionable examples (15d-f) are somewhat better than their counterparts in (14), the pattern of judgments is basically similar. This suggests (17) as the structure for partitive NPs with prenominal each in (14), where each occurs in the specifier position of NP and the null head N acts as a proxy complement-taker:

16)



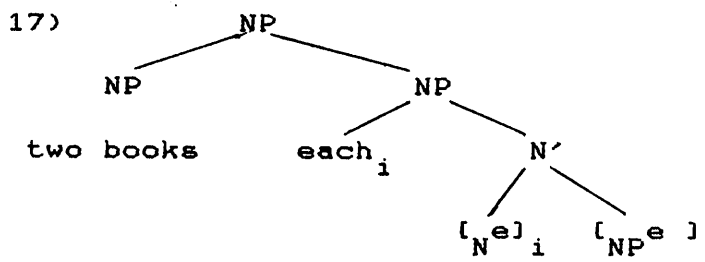
Alternatively, we might analyze each and other quantifiers as heads of QP, taking N' complements, in the spirit of Abney (1986). Unlike most quantifiers, each has the added ability to sanction an empty N

head.

2.2 A Structure for Binominal Each

Returning now to binominal each phrases, their structure might be similar to that of partitive each. One obvious difference between the two constructions is that no overt material follows each in the binominal examples, so the of-NP following the null head N in (16) would itself have to be null with binominal each:

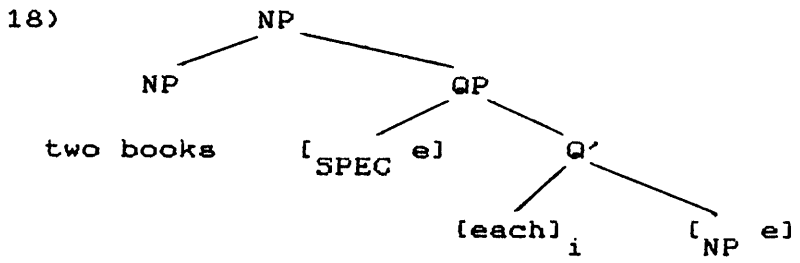
17)



This empty NP could then be treated as a kind of anaphor taking the R-NP as its antecedent, thus providing the basis for a possible account of the rough correlation between the class of possible R-NPs in binominal each constructions in (9) and the class of possible of-NPs in the partitive constructions in (14) and (15).

Alternatively, the binominal each phrase might havve the structure in (18) if the quantifier is really the head of QP rather than a Specifier of NP:

18)



An obvious objection to (17) or (18) as the structure of the D-NP is that it fails to explain the fact that neither an overt one nor an overt of-NP may follow binominal each:

19a) *The boys bought [two books [each one (of them)]]
b) *Sam and Bill saw [two women [each [e] of them]]
c) *[How many books [each one (of them)]] did the

boys see
d) *[How many books [each [e] of them]] did the boys see

We believe that the structural parallel between binominal each and partitive each is genuine, and that the structures in (19) are excluded on Case-theoretic grounds. However, we shall not develop this analysis here, for the sake of brevity.

Whether there is evidence favoring (17) over (18) will not be examined here. Rather we wish to exploit a key property that these analyses have in common: in both (17) and (18) there is an empty object complement following each. First, we suggest that the presence of the null NP provides an explanation for the postnominal position of each within the D-NP. Second, we suggest that the anaphoric relation holding between the null NP and its antecedent (the R-NP) provides the basis for an explanation of certain restrictions on binominal each constructions. The rest of the paper develops these arguments more fully.

2.3 A Parallel With AP

Turning first to the issue of why binominal each-phrases occur postnominally within the D-NP, we suggest that this mirrors the the distribution of adjectival modifiers in NP. It is well known that modifying adjectives may appear postnominally only if they take complements; otherwise they appear prenominally:

20a) A man happy about his plans discussed his hopes
b) A student willing to try is likely to succeed
c) *A man happy discussed his hopes
d) *A student willing is likely to succeed

21a) a happy man, an obvious fact, two crafty cooks
b) *A happy about his plans man discussed his hopes
c) *A willing to try student is likely to succeed

The prenominal APs in (21b-c) can be excluded by Williams' (1982) Head Final filter, while the postnominal APs in (20c-d) can be excluded under the assumption that an adjective with no internal argument must adjoin to the left of a head noun, perhaps by an incorporation rule of the sort suggested in Stowell (1981) (cf. Baker (1985)).

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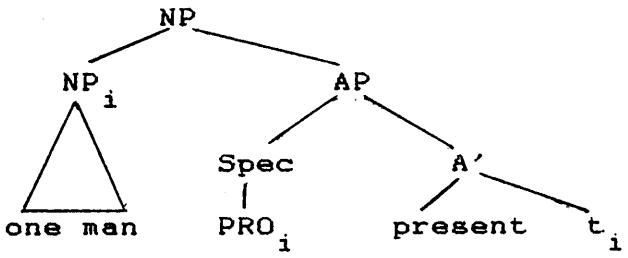
As observed by Safir (1985), a few adjectives such as present must appear postnominally, despite having no overt complement:

22a) One man present/*sick complained about the food
b) One sick/*present man complained about the food

Such adjectives can be naturally analyzed as unaccusatives in the sense of Perlmutter (1978) (i.e. as ergatives, in Burzio's (1981) terminology.) On this view, these adjectives are monadic predicates selecting a single internal argument. If this null argument is equated with PRO, it presumably undergoes movement to the ungoverned Subject or Spec position in AP (cf. Stowell (1983)), where it may be controlled by the head NP:

23)



If present always requires an empty category object, its inability to appear prenominally can be attributed to Williams' (1982) Head Final Filter. The empty object would thus explain the postnominal position of present in (22).[1]

Binominal each occupies the same postnominal position as the adjectives just described. This suggests that each likewise has a null complement when it occurs postnominally within NP, as we have already suggested. The existence of a null object would thus reduce the postnominal position of the binominal each-phrase to the same factor determining the position of AP modifiers.

Summarizing, the each-phrase is adjoined to the D-NP because the D-NP controls the each-phrase's PRO subject, just as NP controls the PRO subject of an AP or PP modifier (or the Wh-pronoun in a relative clause). The each-phrase is right-adjoined to the D-NP because of its null internal (object) argument, which invokes a Head-final filter effect, preventing the EP

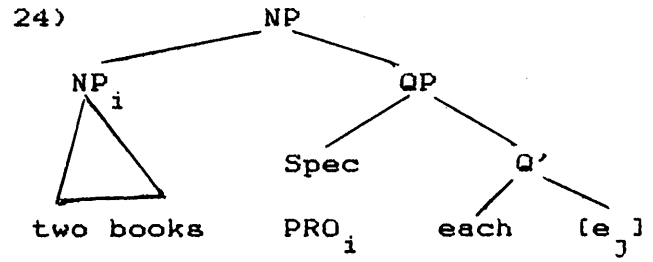
from occurring prenominally in the D-NP.

3.0 Structural Constraints on the R-NP / D-NP Relation

3.1 Background Assumptions

Assuming that we are correct in supposing that binominal each governs a null object complement, the question arises whether each is a monadic unaccusative predicate like present or a dyadic predicate like aware. If binominal each is monadic, we would expect its null object to be a trace bound by PRO in the Spec position of AP, as in (23). On the other hand, if binominal each is dyadic, then its structure would more closely resemble (24), where the subject argument of each is a PRO controlled by the D-NP head, and the null object argument of each is a different type of empty category, one that is not bound within the D-NP:

24)



We suggested above that the null object of binominal each is anaphorically related to the R-NP in some way. So far we have not considered the nature of this binding relation in any detail, but if the null object is indeed a type of anaphor that requires a plural (R-NP) antecedent, we would expect the binding relation between them to affect their relative structural positions. This would inevitably affect the structural position of the D-NP as well, since the EP is adjoined to the D-NP. (In this respect, our theory recalls Burzio's (1981, 1986) account of R-NP and D-NP distribution in terms of the idea that binominal each is itself an anaphor.)[2]

In this section, we examine the syntactic distribution of the R-NP and the D-NP. There are several interesting distributional restrictions exhibited by these NPs, which we will use as clues to the nature of the binding relation involved in this construction. As we shall see, the observable

restrictions on the distribution of the R-NP and D-NP can be interpreted theoretically in many ways, by invoking various combinations of familiar structural conditions such as C-command, Subjacency, CED, Binding Condition "A" (SSC/NIC), etc.

3.2 The D-NP May Not Be a Subject

In simplex sentences with active transitive verbs, the R-NP may occur as an external argument in the subject position of IP, but the D-NP may not:

25a) The men saw one woman each
b) John and Bill gave presents to one woman each
c) Sam and Dave will love one woman each
26a) *One student each left
b) *One woman each saw John and Bill
c) *One student each gave presents to the teachers
d) *One woman each loves Sam and Dave
e) *One student each received (the) presents
f) *One woman each will please Sam and Dave

In all of the examples in (26), the subject of IP is singular, thus ruling out the adverbial each interpretation. These examples show that D-NP subjects are uniformly excluded. Notice, moreover, that grammatical function, rather than thematic role, is involved here. The D-NP may occur as the Goal indirect object of give in (25b) and as the Theme object of love in (25c) but not as the Goal subject of receive in (26e) or as the Theme subject of the Psych-verb please in (26f).[3]

There are three ways of interpreting the prohibition against the D-NP occurring as an external argument in the subject position of a simplex clause. First, one might assume that the R-NP must itself occur in the subject position for some reason, thereby preventing the D-NP from occurring there. We consider this possibility in Section 3.3.

Second, the structural relation between the R-NP and the D-NP might be the crucial factor. For example, it is possible that the R-NP must c-command either the D-NP or some element within it (such as each or its null object). We will examine Burzio's proposals along these lines in Sections 3.4 and 3.5.

Third, one might assume that the D-NP simply can't occur in a subject position of any sort. We will cite evidence supporting this view in Section 3.5, and in Section 4 we will provide a possible motivating principle for this.

3.3 The R-NP May Be an Object

The first idea (that the R-NP must be a subject) can be dismissed on the basis of examples such as the following:

27a) Jo sent/introduced his kids to two coaches each
b) The dean put the professors on one committee each
c) ?Mary sent one book each to the professors
d) The capt. presented to his spies five medals each
e) Mary sent the professors one book each
28a) *One coach each sent/introduced his kids to Bill
b) *One dean each put the professors on the board
c) *One woman each sent the books to the professors
d) *One capt. each presented to the spies the medals
e) *One woman each sent the professors the books

In all of these examples, the subjects are singular, so the R-NPs must be either direct or indirect objects. In (28), the R-NPs occur in the same positions as in (27). Evidently the ungrammaticality of D-NP subjects can't be attributed to any general prohibition against VP-internal R-NPs.

3.4 Reconstruction, C-Command, and Principle "A"

Recall that D-NP objects are unaffected by preposing under Wh-movement in (5a-b), despite the reversal of the relevant precedence and c-command relations. The <u>too</u>-movement construction in (38b) exhibits the same phenomenon as do Burzio's oft-cited examples involving Passive, Raising, and Pseudocleft constructions in (39):

29a) How many women each do you think the boys visited
b) Five books each is too much for the boys to read
30a) One interpreter each was assigned to the visiting diplomats
b) One book each appears to have been given to the boys
c) One interpreter each is what they want to have

All of the examples in (29) and (30) are grammatical,

despite the fact that the D-NP precedes and asymmetrically c-commands the R-NP in every case. As (29b) and (30) show, the D-NP subject prohibition does not necessarily hold if the subject position in question is a non-theta position. Evidently the structural condition responsible for (26/28) must hold either at D-structure (as in Burzio (1981)) or at LF (as in Burzio (1986)).

As Burzio remarks, the strongest evidence for an LF-based account comes from examples like (30c), where the R-NP neither precedes nor c-commands the D-NP at either D-structure or S-structure. He notes that judgments about quantifier scope provide independent evidence for the possibility of reconstructing pseudoclefted constituents to the position of Wh-trace (i.e. to the position occupied by Wh at D-structure). Assuming that this option is also available for the D-NPs in (29-30), the most natural way of accounting for the ungrammaticality of (26/28) is to assume that the relevant structural condition holds at LF.

Burzio (1986) maintains that the LF c-command relation between the R-NP and the D-NP is the crucial factor in (26/28). He seeks to derive this from Principle "A" of Chomsky's (1981) Binding Theory, under the assumption that binominal <u>each</u> is an anaphor, with the R-NP as its antecedent. Since the R-NP must bind <u>each</u> in order to satisfy Principle "A", it follows that it must c-command the D-NP containing <u>each</u> at the level where the Binding Theory applies. The subject asymmetrically c-commands all VP-internal arguments, so Principle "A" is violated in (26) and (28). It would also be violated in (29-30) if the Binding Theory were assumed to hold at S-structure; since (29-30) are grammatical, he concludes that the Binding Theory applies to the output of Reconstruction at LF (cf. Chomsky (1981: 145; Belletti and Rizzi 1986).

Burzio provides independent support for the relevance of Principle "A" to binominal <u>each</u> constructions. He shows that it is not sufficient for the R-NP to c-command the D-NP (and thereby bind <u>each</u>); in addition, the R-NP binder of <u>each</u> must occur within the governing category of <u>each</u>. He cites examples like the following as classical NIC and SSC effects:

31a) *The boys said that three women each had left
b) *The boys expected Mary to kiss one child each

In each case, the R-NP falls outside of the governing category of the D-NP, and the sentences are ungrammatical. Thus there seems to be some empirical justification for Burzio's binding-theoretic account.

3.5 Problems With the Condition "A" Based Account

We see two fundamental problems with Burzio's proposal. First, as Burzio acknowledges, the D-NP may not occur in a theta-marked subject position even when Principle "A" would be satisfied:

32a) The boys expected that pictures of each other would be on sale
b) The boys expected pictures of themselves to be on sale
c) The boys considered themselves/each other (to be) smart
d) *The boys believed that themselves/each other were smart
33a) *The boys expected that one picture each would be on sale
b) *The boys expected one picture each to be on sale
c) *The boys considered one girl each intelligent

If each is the relevant anaphor, as Burzio suggests, then all of the examples in (33) should be grammatical, assuming that each has the same governing category as the garden variety anaphors in (32). Even if one assumes that the LGB accessibility condition does not apply in (33) (so as to exclude (33a) on par with (32d)), this would still fail to account for the exclusion of (33b-c), where an NIC-style account is unavailable.

Similar problems arise if the relevant anaphor is assumed to be either the null object of each or the entire D-NP. If the former, (33a) is allowed unless the accessibility condition is dropped, and (33b-c) are permitted regardless. If the latter, (33a) is excluded but (33b-c) are again permitted. Thus some additional principle is needed to exclude some or all of the examples in (33), and it is possible that this principle would also account for the exclusion of (26/28).

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A second problem with Burzio's binding theoretic account lies in an empirical claim underlying it, namely that the R-NP must c-command the D-NP in its reconstructed position at LF. He observes that indirect object NPs are free to serve as R-NPs, as in examples like (34):

34a) The UN assigned one interpreter each to the visiting diplomats
b) John talked to Sam and Tom about two women each

Burzio suggests that the indirect object must be able to c-command other constituents of VP. (This would follow if the to-phrase is an NP projection of the indirect object rather than a PP projection of to.) Although Burzio claims that other types of PPs may not harbor R-NPs, we find that this is possible in many cases:[4]

35a) Tom is depending on the boys for two ideas each
b) Mat lived with Sue and Mo in one apartment each
c) Mat worked with Sue and Mo on two projects each
d) ?Reagan tried to put one medal each on the spies
e) ?John blamed three crimes each on the prisoners

In some cases, it even appears to be possible for the R-NP to be embedded in a small clause or ECM clause with the D-NP in a matrix adjunct phrase:[5]

36a) Jones proved the prisoners guilty with one accusation each
b) Bob made/let Sam and Tom leave on two occasions each

The distribution of true reflexive and reciprocal anaphors suggests that the R-NPs in (35-36) do not c-command the D-NP positions in question:

37a) ??Tom lived with Sue and Mo in each others' apartments
b) *Reagan tried to put themselves on top of the spies
c) ?*John blamed each others' antics on the prisoners
d) ??Jones proved the men guilty with each others' confessions

We conclude that the R-NP need not necessarily

c-command the D-NP -- even at LF, since none of examples in (35-36) contain a trace position within the c-command domain of the R-NP that the D-NP could reconstruct into.

3.6 Summary

We have seen that some of the structural constraints on the distribution of the D-NP and R-NP lend prima facie support to a binding theoretic account of binominal each, relying on Principle "A". However, this account is probably too strong in requiring that the R-NP must c-command the D-NP, and too weak in failing to exclude structures involving D-NPs in subordinate subject positions. In the next section we will propose an alternative theory of some of these effects, which we believe provides a more satisfactory account of the structural constraints on the R-NP and D-NP discussed here.

4.0 The LF analysis

The theory of binominal each must capture three basic generalizations, which we state in (38):

38a) The D-NP may not be a D-structure subject.
b) The structural relationship between the D-NP and R-NP R-NP is clausebound, in that the D-NP may not occur in a more deeply embedded clause than the R-NP (although the reverse is sometimes possible with nonfinite clauses.)
c) The structural relation between the R-NP and D-NP exhibits reconstruction ("connectivity") effects.

We will account for these as follows. Regarding (38a), we suggest that the subject prohibition is a special case of Chomsky's (1973) Subject Condition on movement. More specifically, we suggest that the each-phrase (EP) undergoes movement out of the D-NP at LF, and adjoins to IP. Regarding (38c), we assume that the D-NP may reconstruct into any trace position bound by it, including its D-structure position, and that the LF movement of the EP may originate from the reconstructed position (thereby evading potential Subject Condition violations in some instances.) Before turning to the problem posed by (38b), we will develop this analysis in a bit more detail, and then

provide some independent evidence in support of it.

4.1 The Subject Condition

The fact that the D-NP must be a D-structure object or indirect object suggests that either the D-NP or some element within it must undergo movement at LF. If the entire D-NP undergoes LF movement, then we might interpret the subject/object asymmetry in D-NP distribution as a classical ECP-style effect, under the assumption that the trace of the D-NP is not properly governed. Alternatively, if the each-phrase (or the null object of each) must undergo movement, then the subject/object asymmetry might really be a Subject Condition effect, as suggested above.

The fact that the D-NP may not be the subject of a small clause or ECM infinitival clause in (33b-c) shows that the Subject Condition, rather than the ECP, is at work here. If the entire D-NP were to undergo LF movement in these examples, then no ECP effect should arise, since LF extraction of Wh-phrases and other QPs is perfectly grammatical in these contexts:

39a) Someone considers everyone (to be) foolish
b) Who believes who (to be) foolish
c) *The boys consider one girl each (to be) foolish

On the other hand, if the each-phrase (or the null object of each) undergoes LF movement, then (33b-c) and (39c) are correctly excluded as Subject Condition violations, parallel to structures involving overt movement:

40a) Who did you buy [a picture of --]
b) *Who do you believe [a sister of --] to have left
c) *Of which book do you consider [a review --] important

Suppose, then, that binominal each constructions involve LF movement out of the D-NP. For concreteness, we will assume that the full each-phrase QP undergoes movement and adjoins to IP (S), just like other non-Wh QPs.

Most theories of movement derive Subject Condition effects from other, more general, principles: Kayne (1983) derives them from the Connectedness Condition, Huang (1982) derives them from the Condition

on Extraction Domain (CED), and Chomsky (1973, 1981, 1986) derives them from Subjacency. For the purposes of our presentation, it doesn't really matter which of these theories is adopted, as long as the effect holds at the level of LF.[6]

It is, however, incumbent upon us to justify the obligatory nature of this LF movement, so as to force the Subjacency/CED effect.

4.2 LF Movement of Binominal Each

Suppose that the null object of each must be locally A-bar bound in order to be licensed as a variable at LF. The object argument of each is selected to be an R-NP, and so the R-NP must be the A'-binder at least by LF. Suppose further that there is a locality restriction on this binding relation (in the spirit of Aoun (1985)), such that the variable must be A'-bound in its governing category. The latter stipulation will force the each-phrase to move out of its D-NP, since the D-NP will be (or contain) the governing category for the empty category, and so the latter cannot be A'-bound by the R-NP unless the each-phrase escapes the D-NP. It follows that the Subject Condition will then be violated whenever the D-NP is in subject position because the each-phrase must always be extracted from the D-NP.

But how then does the R-NP come to be a local A'-binder? We have assumed, as is generally the case for QR, that the each-phrase adjoins to IP. If the R-NP is a Wh-phrase in Comp, as in (41a/b), it will locally A-bar bind the null object directly; otherwise, the R-NP will also have to undergo QR in order to A-bar bind the null object of each, as in (42c/d):

41a) Which men bought one book each
b) [Which men]$_1$ [[each [e]$_1$]$_2$ [t_1 bought [[one book] t_2]

42a) The men saw two women each
b) [The men]$_1$ [[each [e]$_1$]$_2$ [t_1 saw [[two women] t_2]

This LF derivation correctly predicts the relative scope relation between the R-NP and D-NP:

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43a) Fifty men (each) saw two women
b) Fifty men saw two women each

(43a) is ambiguous in that it allows either cardinal QP to take broad scope; but (43b) requires the cardinal D-NP to take narrow scope with respect to the R-NP subject. This is expected, given our LF representation of binominal each. The R-NP must take scope over the each-phrase in order to bind the nuill object of each, and the each-phrase in turn must take scope over the D-NP in order to bind its own trace within the D-NP.

4.3 Reconstruction Effects

Now consider the reconstruction effects noted in (38c). Assuming with Chomsky (1981) and Burzio (1986) (among others) that Reconstruction is freely available at LF, the D-NP may return to its D-structure position. This explains the fact that the D-NP is free to undergo syntactic A-movement to a subject position, as in (30a-b) above. If the D-NP reconstructs to an object position, the each-phrase is then free to move out of the D-NP without incurring a Subject Condition (Subjacency) violation. Thus (44a) would have the LF structure (44b):

44a) [Two interpreters each]$_i$ seem [t_i to have been
[t_i assigned t_i to the diplomats]]
b) [e]$_i$ seem [[e]$_i$ to have been [t_i assigned
[two interpreters each]$_i$ to the diplomats]

In terms of Lasnik and Saito (1984) and Chomsky (1986), this implies that the object position retains its [+gamma] feature after the D-NP has reconstructed into it, thus ensuring that the D-NP does not act as a Subjacency barrier. This derivation is not available to nonderived subject D-NPs, since they have no direct object trace position to reconstruct into.

Our account predicts that not all derived subjects can be legitimized in this way. If the trace position that the D-NP reconstructs into is itself a subject position, then reconstruction is of no help in avoiding a Subject Condition violation. Thus examples like (45) are correctly excluded:

45a) *Two women each seemed to the men [[e] to have shot themselves]
b) *Two women each seemed [[e] to love the men]

Finally, consider the status of reconstruction effects with D-NPs involving A-bar movement, as in (29), (30c), and (46a):

46a) [How many books each]$_i$ did the men say [t_i [the boys read t_i]]
b) [e] did the men say [[the boys read [how many books each]$_i$]]
c) [e] did the men say [how many books each]$_i$ [the boys read t_i]]

In each case, the D-NP can reconstruct to an object position, as illustrated by (46b). The each-phrase is free to move out of the D-NP without incurring a Subjacency/CED violation, as before.

In principle, the LF derivation in (46c) is also permitted, since the D-NP is free to reconstruct to the position of an intermediate trace left by successive cyclic Wh-movement. Evidence for this sort of reconstruction has been cited by Barss (1986) and Williams (1986) with respect to the binding of reflexive pronouns:

47a) *John said that Mary bought a picture of himself
b) [Which [picture of himself]]$_i$ did John say [t_i [Mary bought t_i]]

The fact that the reflexive pronoun may be bound by John in (47b) but not in (47a) suggests that the Wh-phrase (or a subconstituent thereof) can reconstruct to the intermediate trace position in the Spec of the embedded CP, where it can be locally A-bound by John.

But the analogous interpretation with binominal each is completely excluded. Thus in (46a), the only possible R-NP is the embedded subject the boys; the matrix subject the men cannot serve as the R-NP. Our theory predicts this, since the intermediate trace position is not a theta-marked object position, and so subsequent extraction of the each-phrase out of the

D-NP would incur a Subjacency/CED violation, analogous to extraction from the reconstructed subject positions in (45).

4.4 The Locality of Each-movement

Our analysis accounts for the fact that the D-NP may not be a D-structure subject, regardless of whether it is c-commanded by the R-NP. If the R-NP fails to c-command the D-NP, as in (35-36), it is still free to undergo LF movement into a position where it may locally A-bar bind the null object of each. However, we still encounter an important problem: our analysis does not exclude the possibility of the each-phrase undergoing successive-cyclic movement to a higher clause, where it might be bound by a distant R-NP, as in (48):

48) *The boys said Mary captured two snakes each

Notice that we can't appeal to Condition "A" of the binding theory to force the R-NP to occur within the governing category of the D-NP, in light of (35-36).

It seems that the only option available is to assume that the binominal each-phrase is unable to undergo successive cyclic movement for some reason. A possible explanation for this concerns the dyadic argument structure of binominal each. Recall that the each-phrase is a modifier of the D-NP, and contains a PRO subject argument bound by the head of the D-NP. Since extraposition of NP modifiers is in general clause-bounded, we must assume that some principle blocks successive cyclic movement of modifiers; see Gueron and May (1984) for discussion of this. It seems reasonable to suppose that the same principle is at work in constraining LF movement of the binominal each-phrase. The apparent clausemate restriction holding between the R-NP and the D-NP is will then follow from the locality of each-movement, the only exceptions occuring in structures like (36), where the R-NP is evidently permitted to QR out of its immediate clause at LF.

5.0 Concluding Remarks

Our analysis of binominal each has touched on a number of general issues, all of which ultimately deserve a deeper treatment, First, our analysis

suggests that quantifiers may have a dyadic argument structure, just like a conventional dyadic verbal or adjectival predicate. Although most quantifiers (any, all, some, etc.) are monadic intransitives (or perhaps unaccusatives), the behavior of binominal each suggests that this is not a necessary property of quantifiers.

We expect that it will prove fruitful to compare the properties exhibited by binominal each with those of other natural language quantifiers that that may be analyzed as syntactically and semantically dyadic. One such quantifier is the resultative operator so, must govern its complement clause at LF, according to Gueron and May (1984), as in John talked to so many people that he was exhausted The idea that the diathesis of so must be satisfied at LF is similar to our claim that the each-object receives its content at LF.[7]

Second, our account of the locality conditions on binominal each constructions relies on the idea that LF movement is subject to the standard conditions on syntactic movement, thus providing further support proposals along these lines in the references cited above. However, the fact that adjuncts behave as weak islands with respect to LF extraction of each raises an interesting descriptive problem for this view (e.g., The men cut the salami with one knife each).

Third, our assumption that the R-NP must also undergo QR in order to bind the null object of each implies that plurals (including conjoined NPs such as John and Bill) must be able to undergo QR. For suggestions along these lines motivated by other concerns, see Huang (1982; p.269ff.) and Clark (forthcoming), among others).

We believe that our analysis captures the core of the binominal each phenomenon, and that it has a variety of interesting consequences. However, we suspect that we have only scratched the surface of many of the semantic and syntactic issues that may be examined by means of this construction.

NOTES

We are indebted to Jim Higginbotham for much helpful discussion and for written comments on the contents of a preliminary draft of this paper. This is

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a somewhat abridged version of a longer paper in preparation on this topic.

1. Another class of superficial exceptions to the generalization that postnominal adjuncts must have a complement turn out to prove the rule. We have in mind verbal passives which may appear in postnominal position without an overt complement. But verbal passives presumably have a postverbal trace, and if so, should act like present. By contrast it is much more difficult to place adjectival un-passives in the same contexts:

i) Some of the food touched was contaminated
ii) Some of the untouched food was contaminated
iii) *Some of the food untouched was nonetheless contaminated

2. An alternative analysis for the internal argument of binominal each would be to assume that the empty category arises by A-bar movement, perhaps of an empty operator. At present we can see no advantage to such an account, and so we will not explore this possibility.

3. The exclusion of (26f) provides evidence against the analysis of Psych predicates proposed by Belletti and Rizzi (1986), where it is claimed that these subjects originate in direct object position at D-structure. The subsequent text discussion of reconstruction effects is of direct relevance in this respect.

4. We do not have a well worked out account of the contrast between Burzio's PP data and the examples in (35).

5. Although the data is too complex for us to discuss it here, we believe that dative structures allow for either the dative or the direct object to be the R-NP or D-NP, once a number of peculiar restrictions are controlled for. We hope to treat this issue in a lengthier treatment of these issues.

6. The distribution of Wh-in-situ led Chomsky (1973) and Huang (1982) to assume that Subjacency (and CED) do not apply at LF. While Subject Condition effects are more robust than other island effects at LF (cf. Kayne (1983)), the absence of other island effects suggests the neutralization of Subjacency. This would creates a

possible problem for our account, if we rely on the idea that Subjacency constrains the movement of the each-phrase out of the D-NP at LF. Recent work by Lee (1982), Pesetsky (1987), and Nishigauchi (1984), however, suggests that however Subjacency does hold at LF.

7. Other candidates for dyadic quantifiers might include comparatives, or and perhaps (polyadic) and.

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