

VARIABLES IN THE THEORY OF TRANSFORMATIONS
PART I: BOUNDED VERSUS UNBOUNDED TRANSFORMATIONS

Joan Bresnan

*Department of Linguistics
Massachusetts Institute of Technology
Cambridge, Massachusetts*

1. The Problem

Although the problem I am concerned with in this study has given rise to a complex theoretical controversy, it can be described in elementary terms.

Natural languages exhibit many syntactic dependencies that hold over unbounded contexts. One such dependency is illustrated in (1):

- (1) a. **Should we remove bombs from?*
b. *Should we remove bombs from the sacks?*
c. *Which sacks should we remove bombs from?*

(1a) is ill-formed because the preposition *from* lacks an object, which is present in (1b). (1c) shows that the object can occur displaced from its governing preposition. The dependency is this: the dangling preposition of (1c) can occur if and only if a displaced object also occurs. Compare:

- (1) d. *Should we remove bombs?*
e. **Which sacks should we remove bombs?*

The dependency between the displaced object and the dangling preposition can extend, in principle, over contexts of arbitrary length (unbounded contexts):

- (2) a. *Which sacks will they allow us to remove bombs from?*
b. *Which sacks will they consider allowing us to remove bombs from?*
c. *Which sacks are they willing to consider allowing us to remove bombs from?*
d. *Which sacks do they appear to be willing to consider allowing us to remove bombs from?*

It is easy to continue the sequence begun in (2); although the sentences become harder to remember, they are well formed grammatically. In each case, if the dangling preposition is present but its displaced object is absent, the result is an ill-formed sentence:

- (3) *Do they appear to be willing to consider allowing us to remove bombs from?

-And vice versa:

- (4) *Which sacks do they appear to be willing to consider allowing us to remove bombs?

If the syntactic structures of the sentences in (2) are analyzed, it emerges that the context over which the object can be displaced is not finitely specifiable, in the sense that there is no finite sequence of categories that exhaustively describes all the possible contexts of displacement. See Figure 1.

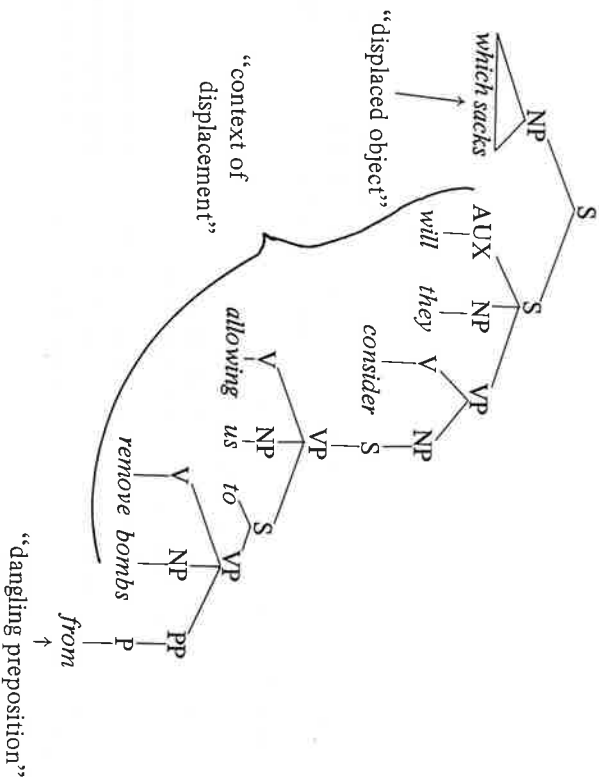


Figure 1: Syntactic Structure for Example (2b)

It is clear from Figure 1 that the context of displacement is a nonconstituent sequence of categories: the sequence of verbs and nouns that intervene between the displaced object, and its preposition is not dominated by a single node. Because the VP-embedding shown in Figure 1 is recursive, the nonconstituent sequence lengths with each layer of embedding, and so the context of displacement is not finitely specifiable. Facts like these can provide one of the most convincing arguments that phrase structure grammars are inadequate for describing the syntactic structure of natural languages.

Transformational grammar has provided basically two means for describing such unbounded syntactic dependencies. One is to permit transformations to have unbounded domains of application by making essential use of syntactic variables. The other is to permit transformations to have unbounded numbers of iterative applications by making use of the transformations cycle. These two analytic options for the example of Figure 1 are illustrated in Figures 2 and 3, respectively.

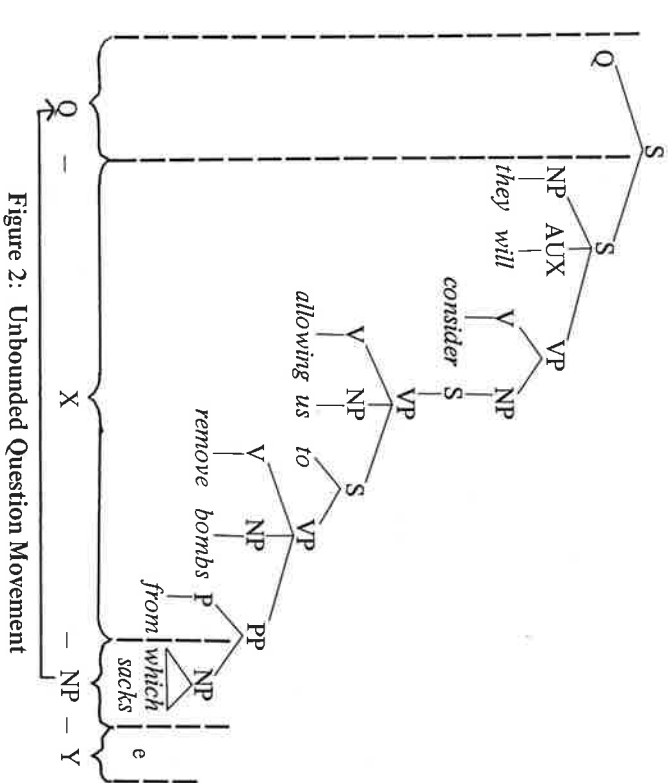


Figure 2: Unbounded Question Movement

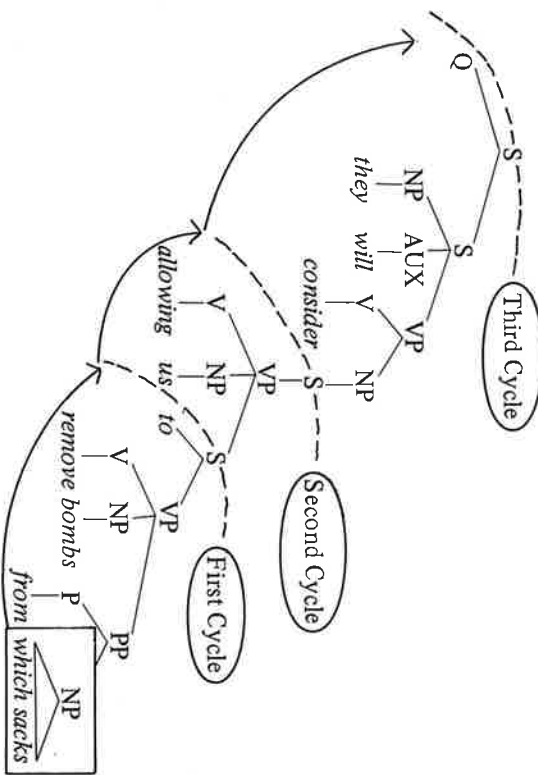


Figure 3: Iterated Question Movement

An unbounded transformational analysis of Question Movement, like that illustrated in Figure 2, has been adopted by many linguists; see Ross (1967), Postal (1972), and Bresnan (1976a), for example. An iterative-cyclic analysis has been advanced recently by Chomsky (1973, 1975), who has proposed that all syntactic transformations are subject to a bounding condition known as the Subadjacency Condition. This condition limits the domain of application of transformations to adjacent cyclic nodes, and thus eliminates the type of analysis shown in Figure 2. Chomsky has also argued that the evidence of Ross (1967) and Postal (1972) can be explained without unbounded transformation. The problem I would like to consider is that of finding independent evidence to decide between these two types of analyses.

2. Significance of the Problem

It is a fundamental assumption of transformational grammar that questions of linguistic theory are ultimately questions about the nature of the human faculty of language. But unlike many questions of linguistic theory, the question of whether there are unbounded transformations has a direct bearing on the construction of experimentally plausible models of human sentence perception. For example, the Augmented Transition Network parsing system developed by Woods (1973) has several facilities for recognizing sentences like (2). In one of them, when the displaced constituent (e.g., *which sacks*) is found in a left-to-right parse, it is held in temporary memory as the parsing continues until a position is found in the sentence structure where the constituent would have been accepted if it had not been displaced (e.g., as object of *from*); the displaced constituent is then retrieved and treated as though it had actually occurred at that position. Woods (1973, p. 110) notes that the same effects can be achieved alternatively by passing the displaced constituent up and down from level to level of phrase structure, using a different set of memory actions. As Woods observes, these two methods of processing questions have a correspondence to alternative linguistic analyses, the first method corresponding to the essential use of variables in unbounded transformations. Since general parsing systems can be experimentally utilized as psychological models of sentence perception (see, for example, Wanner and Maratsos, 1974), it is quite reasonable to ask which parsing operations would more closely approximate the functioning of the human syntactic processor. This is one way in which the linguistic question of whether there are unbounded transformations could bear on the characterization of human language processing, or "the nature of the human faculty of language," as I put it above. There are, of course, many other ways. For example, a bounding condition on transformations, together with several other constraints whose empirical justification is currently being explored, has been assumed in a proof of the 'learnability' of transformational grammars, as discussed in Culicover and Wexler (1976). (But cf. Baker, 1976, for alternative restrictions that could yield a different proof of learnability.)

The question of whether there are unbounded transformations is also embedded in theoretical issues within transformational grammar. Chomsky's bounding condition is part of a system of conditions designed to restrict radically the form and functioning of transformations (Chomsky, 1975). Whether the resulting impoverishment of the expressive power of transformations yields a more restrictive overall theory of grammar is questionable, however, because the proposed impoverishment of the transformational component of the grammar must be offset by the enrichment of other components, particularly the surface-structure filtering component; an alternative theory of grammar permitting a somewhat richer class of transformations could drastically limit the class of possible surface-structure filters (Bresnan 1976d). But the bounding condition by itself appears to be a strong constraint on grammars. If it turns out that the bounding condition is empirically unjustified, then to what extent is present transformational theory thereby weakened and made less constrained?

Although a definitive answer cannot be given without comparing total theories, a partial answer is suggested by Friedman (1973) and Woods (1973). Friedman (1973, p. 26) argues that "Peters and Ritchie's proof that every recursively enumerable set is generable by a transformational grammar with minimal base goes through even for grammars without essential variables." In other words, for the model of transformational grammar formalized by Peters and Ritchie (1973) and Friedman et al. (1971), a constant bound on the domain of applicability of transformations does not by itself restrict the weak generative capacity of transformational grammars. (It is assumed that a restriction is desirable, since there is evidence that natural languages are recursive sets; cf. Peters, 1973.) On the other hand, Woods (1973, p. 125) has claimed that "[i]t is relatively easy to place a sufficient restriction on the transition network grammar model to ensure that the class of languages accepted by the restricted model falls completely within the class of recursive languages (for which effective recognition procedures exist), while preserving the power for full and efficient linguistic expression (e.g., the equivalent of the use of 'general variables' in the classical transformational theory)." Because *unrestricted* Augmented Transition Network grammars are equivalent to transformational grammars in weak generative capacity, Woods' claim suggests that a significant restriction in the weak generative capacity of transformational grammars is possible *without* imposing a bounding condition on transformations. So a bounding condition in itself may not be such a strong constraint as it first appears to be. (Ronald Kaplan [personal communication] has also suggested a possible proof of the recursiveness of restricted ATN grammars.)

In any case, if a constraint on transformations is empirically unjustified, leading to losses of generalizations in individual grammars, its theoretical 'restrictiveness' cannot justify it. In general, metagrammatical arguments must not be confused with descriptive grammatical arguments. The argument from restrictiveness (i.e., the argument that theory A is preferable to theory B because theory A is more restrictive, more narrowly characterizing the class of possible languages) is a metagrammatical argument: it presupposes that descriptively preferred grammars meet the

proposed universal restrictiveness conditions. To inject an argument from restrictiveness into a descriptive grammatical argument (e.g., to argue that formulation A of the passive is preferable to formulation B *because* A, not B, is consistent with such and such a 'more restrictive' metagrammatical theory) is to beg the fundamental empirical question. What must be shown first is that descriptively preferred grammars meet the proposed restrictiveness conditions. If they do not meet them, then some other metagrammatical constraints must be sought.

In this study I will give evidence that descriptively preferred grammars of English contain unbounded syntactic transformations, making essential use of variables.

3. An Unbounded Deletion Rule

There is one immediate consequence of a bounding condition that can be tested directly. A bounding condition on all transformations predicts an asymmetry between transformational movements and deletions. The movement of a constituent over an (in principle) unbounded context can be achieved by iterative bounded movements, but the deletion of a constituent must occur within a bounded context, for unlike a bounded movement transformation, a bounded deletion transformation cannot iteratively reapply to remove the same constituent. As pointed out in Bresnan (1975a), the existence of unbounded deletion transformations applying in comparative and relative clause constructions would disconfirm the Subadjacency Condition of Chomsky (1973, 1975).

Unbounded deletion transformations have been independently proposed in linguistic analyses of various languages, including Albanian (Morgan, 1972), Basque (deRijik, 1972), Middle English (Grimshaw, 1975), Modern English (Bresnan, 1975a,b, 1976a), Japanese (Kuno, 1973), and Old Icelandic (Maling, 1976). However, it is possible at least in principle that all cases of unbounded deletion are only apparent, in that what appears to be deletion over an unbounded context is analytically decomposed into the iterative movement of some element over an unbounded context followed by obligatory "local" deletion of the moved item. Given this possibility, it is necessary to ask what independent motivation there is for the hypothesized movements. In some cases there appears to be not only no independent motivation for such iterative movements, but the movement analysis leads to unnecessary and ad hoc complications in the grammatical description; one such case from Middle English is given by Grimshaw (1975) and also discussed in Bresnan (1976d). In Modern English, too, it can be shown that an iterative-movement analysis of some constructions leads to losses of generalizations and descriptive inadequacies that do not arise in a theory permitting unbounded deletion rules (Bresnan, 1976d). I will review here briefly some of the evidence for this claim.

There is in English a rule of "Subdeletion" that applies in comparative constructions like those shown in (5) and (6):

- (5) *Why were there more women on t.v. than there were men?*

- (6) *There weren't as many men on t.v. as there were women.*

I will refer to the boldface phrases in examples like (5) and (6) as the "compared constituents." The one on the left in each pair is the "head" of the comparative (*than* or *as*) clause; the one on the right is affected by the rule of Subdeletion, which deletes an underlying modifier of the compared constituent. Although the missing modifier can be one of several different categories, in examples (5) and (6) it is a Quantifier Phrase ('QP') modifier, similar to *x many*, *x much*.

The existence of such underlying modifiers can be justified in detail; see Bresnan (1973, 1975a,b, 1976a,d). But here I will simply note that the deleted modifiers of examples (5) and (6) can be "detected" in the following way, among others. When *many* or *much* occurs in a partitive phrase, the preposition of appears: *many of those men*, *much of it*. And when the compared constituents are partitives, the *of* appears in both:

- (7) *Why were there more of those women on t.v. than there were of those men?*

- (8) *There weren't as many of them as there were of us.*

The rule of Subdeletion removes a subpart *x many* of the compared constituents in the *than* and *as* clauses of (7) and (8), converting *x many of those men* to *of those men*, and *x many of us* to *of us*. Note that Subdeletion in (7) and (8) accounts for the grammaticality of what would otherwise be an ill-formed sequence: compare *there were many of us* and **there were of us*.

Now the compared constituents upon which Subdeletion is defined can be separated by unbounded contexts. This is shown by (9)-(11). The locus of the removed modifier is indicated by a '___':

- (9) a. *Therefore, they can hire more women than they can hire ___ men.*
 b. *Therefore, they can hire more women than the Administration would allow them to hire ___ men.*
 c. *Therefore, they can hire more women than the Administration would even consider allowing them to hire ___ men.*
 d. *Therefore, they can hire more women than the Administration would be willing even to consider allowing them to hire ___ men.*
 e. *Therefore, they can hire more women than the Administration would appear to be willing even to consider allowing them to hire ___ men.*
 f. *Therefore, they can hire more women than the Administration would ever want to appear to be willing even to consider allowing them to hire ___ men.*
- (10) a. *You could have twice as many stocks as you now have ___ of these bonds.*
 b. *You could have twice as many stocks as you want to have ___ of these bonds.*

- c. *You could have twice as many stocks as you anticipate wanting to have ___ of these bonds.*
 d. *Your could have twice as many stocks as you are ever likely to anticipate wanting to have ___ of these bonds.*
 e. *You could have twice as many stocks as your broker considers you ever to be likely to anticipate wanting to have ___ of these bonds.*
 f. *You could have twice as many stocks as your broker claims to consider you ever to be likely to anticipate wanting to have ___ of these bonds.*

- (11) a. *We have ordered more warheads built than they have ___ missiles.*
 b. *We have ordered more warheads built than they claim to have ___ missiles.*
 c. *We have ordered more warheads built than we expect them to claim to have ___ missiles.*
 d. *We have ordered more warheads built than they expect us to expect them to claim to have ___ missiles.*
 e. *We have ordered more warheads built than they are reported to expect us to expect them to claim to have ___ missiles.*

As with the Question Movement sequences (2), the sequences of sentences in (9)-(11) can be extended to arbitrary lengths.

Examples (9)-(11) have been chosen to exhibit certain properties. The context between the head of the comparative clauses and the Subdeletion site '___' is a non-constituent sequence of categories. (For brevity, I will call this context "the Subdeletion context.") The Subdeletion contexts in these examples consist solely of infinitival and gerundive construction types that cannot be used "parenthetically." This choice was made to obviate the possible objection that an apparently unbounded Subdeletion context is really just a long parenthetical insertion. And, finally, the Subdeletion context is free of certain obstacles to transformational applications that are known to be "constraints on transformations." (How a range of these constraints can affect Subdeletion is discussed in Bresnan, 1975a.) In particular, the Subdeletion contexts are free of "islands," such as Complex Noun Phrases, in Ross's (1967) terms. As Ross (1967) showed (see also Hankamer, 1971; Bresnan 1975a), complex noun phrases—relative clause constructions and nominal complement constructions—prevent the unbounded removal of their parts. The occurrence of such a construction in the Subdeletion context yields an ungrammatical sentence:

- (12) **Therefore, they can hire more women than I met a woman who has ___ boyfriends.*
 (13) **I predict that there will be twice as many of the "minority" applications as I have a report that there are ___ of the "majority" applications.*

The underlying structure for (12) is shown in Figure 4 (with irrelevant details omitted).

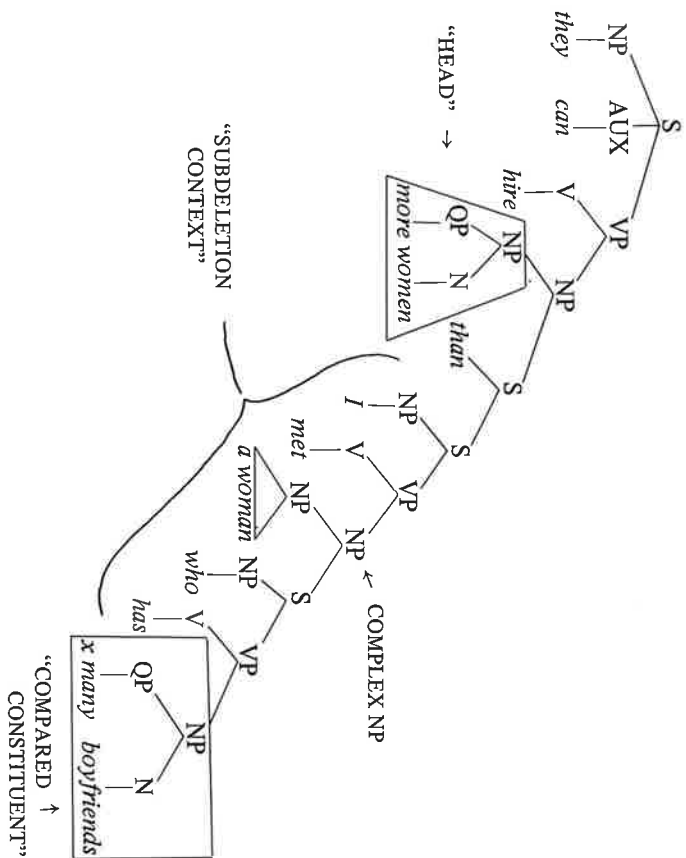


Figure 4: Underlying Structure for Example (12)

Thus, it is the "Complex NP Constraint" that accounts for the contrasts in examples (14)-(17).

- (14) a. *Then why have they produced only half as many job applicants as they claim to believe that there are ___ jobs?*
 b. **Then why have they produced only half as many job applicants as they believe the claim that there are ___ jobs?*
- (15) a. *We have ordered more warheads built than we expect them to announce that they have ___ missiles.*
 b. **We have ordered more warheads built than we expect the announcement that they have ___ missiles.*
- (16) a. *You could have more stocks than you would ever anticipate wanting to have ___ bonds.*
 b. **You could have more stocks than you anticipate the possibility that you might want ___ bonds.*
- (17) a. *He can always avoid this problem by hypothesizing as many protopositions as he needs to assume that there are ___ distinct empty sets of possible worlds.*

- b. **He can always avoid this problem by hypothesizing as many protopropositions as he needs the assumption that there are — distinct empty sets of possible worlds.*

The intended meaning of (17a) can be paraphrased: "He can always avoid this problem in the following way. If he needs to assume that there are *n* distinct empty sets of possible worlds, then he hypothesizes that there are *n* protopropositions, whatever *n* is." And (17b) can be paraphrased: "He can always avoid this problem in the following way. If he needs the assumption that there are *n* distinct empty sets of possible worlds, then he hypothesizes that there are *n* protopropositions, whatever *n* is." I have found that speakers for whom the subject matter of (17a) is complete gobbledygook can nevertheless construe it perfectly well, judging it much more acceptable than (17b).

Examples (14)–(17) show that when the underscored compared constituents are separated by a complex noun phrase, the result is markedly worse than when they are not. Observe that the *a*- and the *b*-examples in each pair of sentences are separated by the same number of "cyclic nodes," in Chomsky's (1973) terms. Compare (18a) and (18b), for example:

- (18) a. ... [NP as many job applicants] [S as they claim [S to believe
[S that there are [NP — jobs]]]]]
b. ... [NP as many job applicants] [S as they believe [NP the claim
[S that there are [NP — jobs]]]]]

Chomsky (1973) assumes NP to be a cyclic node. Together with his Subadjacency Condition, this enables him to explain the Complex Noun Phrase Constraint as follows. Apparent unbounded movements are analyzed as iterative bounded movements through complementizer position. As shown in (19), *wh*-movement cannot apply in the NP-cycle, because NPs lack complementizers (COMPs):

- (19) *Who does Mary believe John saw pictures of?*
[S₁ COMP₁ Mary believes [S₂ COMP₂ John saw [NP pictures of who NP] S₂] S₁]

However, on the S₂ cycle in (19), *wh*-movement can move *who* into COMP₂, because S₂ and NP are adjacent cyclic nodes. On the S₁ cycle, *who* is moved again into COMP₁. Now compare (20), which contains a complex NP:

- (20) **Who does Mary believe the claim that John saw?*
[S₁ COMP₁ Mary believes [NP the claim [S₂ COMP₂ John saw who S₂ NP] S₁]

On the S₂ cycle in (20), *who* is moved into COMP₂. On the next cycle—the NP cycle—*who* cannot be removed, because NPs lack COMPs. But then on the S₁ cycle, *wh*-movement is prevented by the Subadjacency Condition from extracting *who* from S₂. S₁ and S₂ are not adjacent cyclic nodes because the cyclic NP node separates them. Consequently sentence (20) cannot be derived.¹

This is an ingenious solution, but it cannot be extended to account for Subdeletion without a significant loss of generalizations. For, as pointed out in Bresnan

(1975a), the measure-phrase modifiers removed by Subdeletion cannot in general be moved from the constituents they modify by known movement rules. Contrast (21) with (22)–(25).

- (21) *She has as many boyfriends as she has — books.*
(22) a. **How many did she send — books to you?*
b. *How many books did she send — to you?*
(23) a. **How many she sent — books to you!*
b. *How many books she sent — to you!*
(24) a. **So many does she have — books, that her garage is being converted into a library.*
b. *So many books does she have —, that her garage is being converted into a library.*
(25) a. **Many though she has — books, she wants more.*
b. *Many books though she has —, she wants more.*

Furthermore, there is no overt evidence that a constituent is moved in Subdeletion constructions, as was also pointed out in Higgins (1973). For example, the *wh*-movement rule can move phrases superordinate to the *wh*-pronoun, by the so-called "obligatory pied-piping" convention. We see this happening in (26):

- (26) *I asked [Q there was how large a percentage of men] —→
I asked how large a percentage of men there was.*

The entire noun phrase including *a percentage of men* is "pied-piped" along with *how large*, into interrogative position. But in (27) we see that the same constituent cannot be moved in Subdeletion constructions:

- (27) **There isn't even as large a number of women as — a percentage of men there was.*

The "Subdeleted" phrase in (27) is *x large*. If this phrase had undergone movement prior to its deletion, we would expect (27) to be derived by obligatory pied-piping. What we have instead is simply (28):

- (28) *There isn't even as large a number of women as there was — a percentage of men.*

In fact, no examples like (28) could be derived by *wh*-movement without losing the generalization in English that when a left-branch modifier of a phrase is affected by a movement rule, the entire phrase obligatorily "pied-pipes." The movement analysis can preserve this generalization only at the cost of systematically deriving examples like (29a) instead of (29b).

- (29) a. **She has more boyfriends than — books she has.*
b. *She has more boyfriends than she has — books.*

In short, Subdeletion cannot be analyzed as a movement rule without a significant loss of generalizations about movement rules. But if so, the applicability of

Subdeletion over unbounded contexts (e.g., (14)–(17)) then disconfirms a bounding condition on transformation.

By contrast, a simple deletion analysis of Subdeletion can preserve these generalizations (Bresnan: 1975b, 1976a,d). The “obligatory pied-piping” mentioned above is an interesting property of a number of movement rules in English, including the preposing rules involved in examples (22)–(25). As observed in Bresnan (1975a), these rules are “cross-categorical”: they can affect phrases of several different kinds, such as noun phrases, adjective phrases, and adverb phrases. Although the preposed phrases in the (b) examples of (22)–(25) were all noun phrases, we can just as easily construct examples like “How serenely he sits by the fire smoking his pipe!” or “How tall do you estimate that a ginkgo tree grows?” (with a preposed adverb phrase or adjective phrase). These sets of different kinds of phrases fall into natural classes in the X theory of categories of Chomsky (1970), Bresnan (1973), Selkirk (1976), and others. Further, it has been shown in Bresnan (1975b, 1976a) that if the movement transformations are formulated with natural class predicates in the X notation, the pied-piping effects are a consequence of a general maximality principle governing the application of transformations, the “Relativized A-over-A Principle.” Question Movement, for example must move the maximal interrogative phrase that satisfies the natural class predicate in its structural condition. Thus in example (30), *how many* is not the maximal interrogative phrase that satisfied the Question Movement transformation—

(30) [Q *she sent* [NP [QP *how many* QP] *books* NP] *to you*]

—but *how many books* is, and this accounts for the difference in grammaticality between (22a) and (22b):

- (22) a. **How many did she send — books to you?*
b. *How many books did she send — to you?*

Now Subdeletion is also a cross-categorical rule, as can be seen from examples like (31)–(33), where it applies to compared constituents that are NPs, APs, or AdvPs.

- (31) *She has* [NP *more boyfriends*] *than she has* [NP — *books*]
(32) *She seems* [AP *as happy*] *now as she seemed* [AP — *sad*] *before*
(33) *My sister drives* [AdvP *as carelessly*] *as I drive* [AdvP — *carefully*]

Furthermore, Subdeletion can remove phrases of these different kinds—an NP in (34), an AP in (35), an AdvP in (36):

- (34) *There isn't as large a number of women as there was — of men.*
[deletion of *x large a number*]
(35) *There isn't even as large a number of women as there was — a percentage of men.* [deletion of *x large*]
(36) *Your face, I judge, is more nearly oval than it is — oval.*
[deletion of *x nearly*]

Thus, if Subdeletion were a movement rule, as required by the Subjacency Condition, it would necessarily prepose the maximal (“largest”) NP, AP, or AdvP that satisfied its structural condition. As a deletion rule, however, Subdeletion can delete a modifier of the compared constituent in place, subject to recoverability. In cases where the entire compared constituent is not recoverable, Subdeletion must delete a proper subpart, the maximal one that satisfies its structural condition.² Therefore, given the relativized A-over-A principle and the X theory of categories as developed in Bresnan (1975b, 1976a), we can explain the contrast in the behavior of these cross-categorical rules (e.g., the contrast between Subdeletion and Question Movement in (21) and (22)) by hypothesizing that the missing subpart of the compared constituent is not moved, but simply deleted.

The preceding argument is quite independent of the issue of whether Subdeletion is a special case of the rule of Comparative Deletion (as suggested in Bresnan 1975a,b; 1976a) or not. There are several unexplained differences between Subdeletion and Comparative deletion. One is that Subdeletion into several tensed clauses “gets worse faster” than Comparative Deletion. (This is noted in Bresnan (1975a, note 10). Another is that Subdeletion into nonextraposed clauses can be nearly incomprehensible:

- (37) *More women than — men flunked, passed.*
(38) *I gave as many women as I had — men in my courses, As.*

(This fact was pointed out to me by Jessie Pinkham.)
On the other hand some cases are acceptable:

- (39) *I can tell you that fewer women than there are — fingers on my right hand, passed.*
(40) *He has as many women as he has — horses, in his stable.*

And when the comparative clauses of (37) and (38) are extraposed, the result is fully acceptable: *More women passed than men flunked; I gave as many women As as I had men in my courses.*

Involving a comparison of “contrasts,” Subdeletion constructions have, intuitively, a greater semantic complexity than corresponding Comparative Deletion constructions. It is also clear that strategies for parsing Subdeletion constructions will be harder to devise than for corresponding Comparative Deletion Constructions, because the deletion site is not as obviously marked syntactically in cases of Subdeletion. For these reasons I continue to assume that such differences between Subdeletion and Comparative Deletion as those I have just referred to may be attributable to “performance factors.” However, it is always possible that a revealing grammatical explanation will be found to require distinct rules of Subdeletion and Comparative Deletion. This would not weaken my argument. See Bresnan (1976d).

4. Summary

As remarked in the first section of Part I, transformational grammar has provided basically two options for describing unbounded syntactic dependencies: one makes essential use of syntactic variables, permitting unbounded domains of transformational application; the other makes essential use of the transformational cycle, permitting iterative transformational applications to the same constituent. A bounding condition on transformations like the Subjacency Condition presupposes the latter analytic option and eliminates the former. But the evidence for an unbounded deletion rule presented in the third section of this Part shows that the "iterative movement" option leads to a significant loss of generalizations in one area of English syntax.

As for the fact that this deletion rule is subject to the same 'island' constraints as movement rules, this shows that it is a mistake to regard such constraints as diagnostics for movements (as argued in Bresnan, 1975a). Instead, the constraints themselves should be revised or replaced by alternatives that apply equally to unbounded movements and unbounded deletions. One such alternative is given in Bresnan (1976d), where it is shown how the Subjacency Condition can be eliminated without losing any of the major theoretical results that have motivated it (assuming these results to be valid generalizations).

My conclusion is that unbounded transformations should remain as a descriptive option in transformational grammar. Whether the "iterative movement" optional should also remain, is an interesting question for further research.³ Part II of this study will corroborate this conclusion.

PART II: ON CONSTRAINING UNBOUNDED TRANSFORMATIONS

Part I provided evidence of the existence of one unbounded deletion rule in English grammar. Part II provides evidence for a generalization that shows an important class of English transformations to be unbounded, making essential use of variables.

1. A Generalization

It is a frequently observed fact of English that a subject noun phrase cannot be removed from a complement clause marked by the complementizer *that*. This is

illustrated by (2a), which is to be understood as deriving from a structure like (1):

- (1) *Jack claimed (that) one of his cats had eaten one of his birds.*
 (2) a. **Which one of his cats did Jack claim that ___ had eaten one of his birds?*
 b. *Which one of his cats did John claim ___ had eaten one of his birds?*

(' ___ ' indicates any position from which a phrase has been transformationally removed.) (2b) shows that in the absence of *that*, the subject can be successfully removed from the complement. But the removal of NPs other than subjects is not restricted by the presence of a complementizer; for example, with or without a *that*-complementizer, (3) is grammatical.

- (3) *Which one of his birds did Jack claim (that) one of his cats had eaten ___ ?*

Less well known is an observation of Ross's, that a subject NP cannot be removed from a complement clause marked by the complementizer *for* (Ross 1967, 6.3.2). He gives the following examples in illustration:

- (4) *It bothers me for her to wear that old fedora.*
 (5) a. **The only girl for whom it bothers me ___ to wear that old fedora fedora is Annabelle.*
 b. **The only girl who it bothers me (for) ___ to wear that old fedora is Annabelle.*

(5a) and (5b) contain relative clauses constructed on the pattern of (4) by relativizing the subject of *to wear*. (5a) shows that the complementizer *for* cannot "pipe" with the relative pronoun. (Contrast the mobility of the preposition *for* in *The only girl for whom I would buy a hat is Annabelle.*) (5b) shows that whether or not *for* remains in complementizer position, the subject NP cannot be extracted from the complement. But observe that the *object of to wear* can be relativized:

- (6) *The only hat which it bothers me for her to wear ___ is that old fedora.*
 To account for these facts, Ross proposed the following constraint (Ross 1967, example 6, p. 183):

- (7) *Ross's Generalization*
 No element in the environment [*for* ___ VP] can be chopped.

This means that "chopping" rules like Question Movement, Relativization, and the like, cannot remove the subject of a complement marked by *for*. It is easy to see why the bracketing in Ross's generalization is necessary: without it, (7) would wrongly prohibit the removal of objects of the preposition *for*, which happened to be adjacent to NPs, as in (8) and (9).

- (8) *It will be hardest [vp for the new students] [vp to follow the lectures]*

- (9) a. *For whom will it be hardest ___ to follow the lectures?*
 b. *Who(m) will it be hardest for ___ to follow the lectures?*

For is a preposition in these examples, as in *It will be hardest for the new students.* (Contrast the complementizer *for* in (4): **It bothers me for her.*) Other examples like (9) are (10) and (11).

- (10) *Who(m) would it be good for ___ to take dancing lessons?*
 (11) *For which one of them would it be dangerous ___ to be seen with me?*

The close relation between these two sets of facts involving *that* and *for* has been largely unrecognized. But Ross's generalization (7) can be naturally generalized to account for both sets of facts:

- (12) No element in the environment [COMP ___ VP] can be chopped.

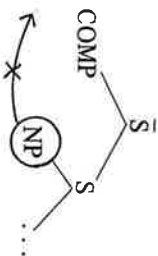
COMP is the category of complementizers. (12) is more general than Ross's statement (7) because (12) extends to the *that*-complementizer as well as the *for*-complementizer. Indeed, if *whether* is also a COMP (see Bresnan, 1974, and the references cited there), then (12) would automatically account for contrasts like the following (from Hudson, 1972):

- (13) *The book that the editor asked whether I'd review ___ for him was very long.*
 (14) **The book that the editor asked whether ___ could be reviewed by next month was far too long.*

Although, as Chomsky (1964) observed, the removal of any elements from 'wh-complements' is heavily restricted, linguists have given some relatively acceptable examples: in addition to Hudson (1972), see Kuno and Robinson (1972; examples 3-9, 3-10, 3-11), and Bresnan (1976d).

A version of the generalization stated in (12) was formulated in Bresnan (1972) as "The Fixed Subject Constraint":

- (15) No NP can be crossed over an adjacent COMP.

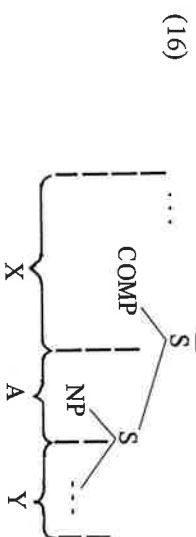


(15) is still more general than (12); it was intended to apply not only to chopping rules, but also to rules like Passive and Subject Raising (see Bresnan, 1972). However, as Ross (1967) pointed out, a constraint on variables would be inapplicable to transformations like Subject Raising, which involves no essential variables. There is interesting evidence that Ross's interpretation of the constraint is correct.

2. A Constraint on Variables

What is a constraint on variables? Given a proper analysis of a structure with respect to a transformation, we can distinguish between 'variable factors' and 'constant factors' of the proper analysis: a variable factor will correspond to a variable in the transformation and a constant factor, to a constant.⁴ For example, in Figure 2, the portions of structure described by 'X' and 'Y' are variable factors and the portions described by 'Q' and 'NP' are constant factors. A constraint on variables can be regarded as a condition on variable factors which limits the class of proper analyses.⁵

To formulate (12) more explicitly as a constraint on variables, observe that a chopping transformation that applied in violation of (12) would give rise to a proper analysis of the form shown schematically in (16), where X and Y are variable factors and A is a constant factor.



Thus we could restate (12) by saying that in any proper analysis (... X, A, Y, ...), if A is a constant factor to be chopped, and X and Y are variable factors, then X cannot end in a complementizer. Because rules that delete over a variable are subject to the same kinds of constraints as chopping rules (as argued in Bresnan, 1975a, and 1976d), and because the "chopping" of a phrase involves both copying and deleting it, I will state the constraint as in (17):

- (17) *The Complementizer Constraint on Variables*
 For any proper analysis (... X, A, Y, ...) such that X and Y are variable factors and A is a constant factor to be deleted, if X = ... COMP, then ... must be empty (of terminals).

This means that X can contain a COMP only if it contains nothing else, a condition that permits X to function as an 'end variable' when a transformation applies on \bar{S} . For example, imagine that a transformation applies on \bar{S} in (16) and postpones the NP adjacent to COMP; in this case, the variable factor X will contain nothing outside the COMP, and so (17) will not prevent the rule from applying.⁶

Perhaps a more intuitive way of putting this constraint is that factorization must respect clause marking, in the sense that variable factors cannot split off complementizers from the clauses they mark and lump them together with arbitrary material. Now we are in a position to ask how one can tell whether a generalization like that given is a constraint on variables or some other form of constraint or restriction.

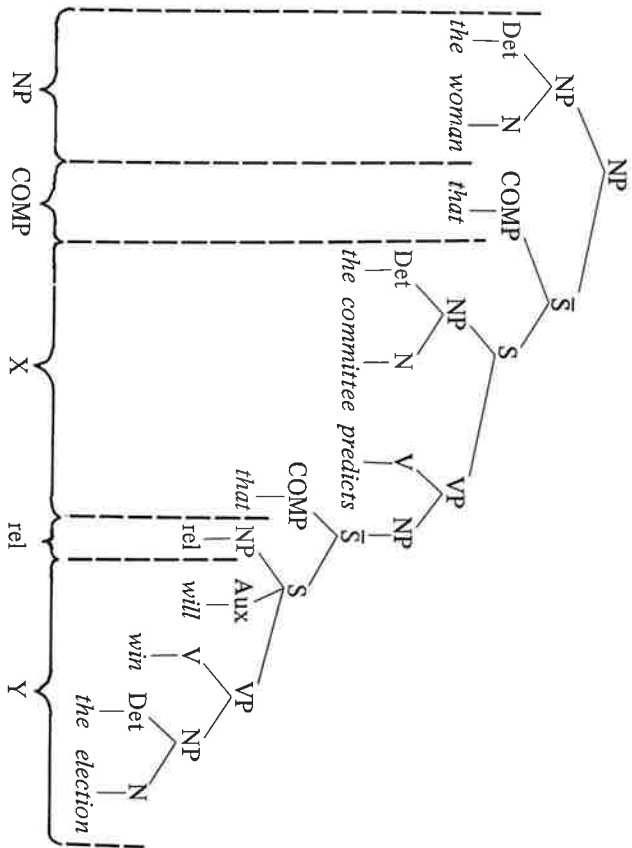


Figure 5: Proper Analysis Violating Constraint (17)

In Figure 5, "rel" is a constant factor to be deleted, but it lies between variable factors X and Y, where X ends in a COMP.

Now it is crucial to observe that the constraint (17) does allow removal of a relativized item adjacent to the initial COMP of the relative clause (term 2 in (23)), because the latter does not lie in the variable factor, but is analyzed by a constant in the rule; see Figure 6.

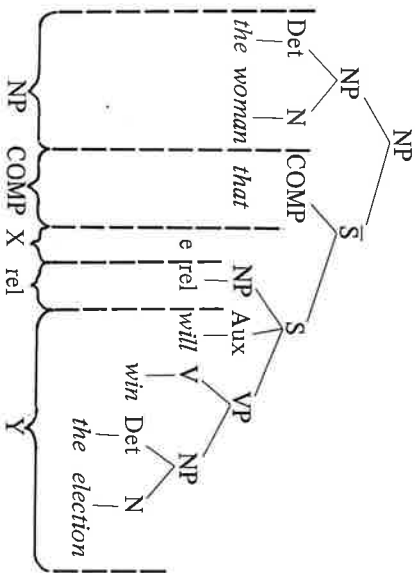


Figure 6: Proper Analysis Not Violating Constraint (17)

Therefore there is no violation entailed in treating the relative-clause marker *that* as a COMP in the well-formed phrase (26):

(26) *the woman that will win the election*

The motivation for mentioning the COMP in the relativization rule is that the relative pronoun supplants this marker. However, it is natural to question whether in cases of simple deletion the COMP need be mentioned at all. Could a rule of Relativization-by-Deletion not be formulated as in (27)?

(27) *Relativization-by-Deletion*
 NP [\bar{S} X rel Y]
 1 2 3 4 →
 1 2 ϕ 4

The answer is that it could be. Formulation (27) will produce exactly the same pattern of violations and nonviolations with respect to the Complementizer Constraint on Variables as (23). For example, the analysis of (24) would be like that shown in Figure 5, except that the second factor (COMP) and the third factor (X) would not be distinguished. Since the variable factor X would still end in a COMP on the right, a violation would still occur. But now compare Figure 7.

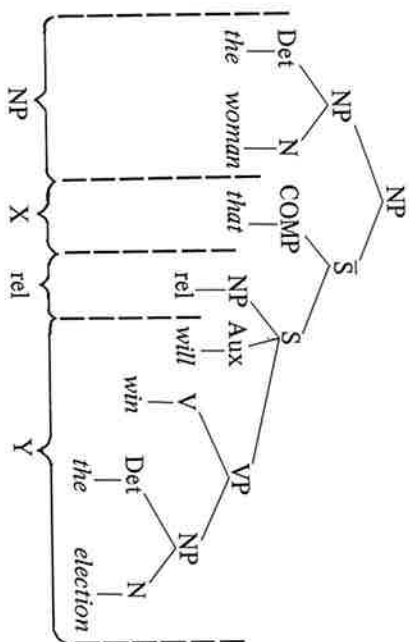


Figure 7: Proper Analysis Not Violating Constraint (17)

Here X functions like an 'end variable' (see the comments following (17) above): the X variable factor contains nothing outside of the \bar{S} clause that the COMP is a marker of, so there is no violation of the constraint (17).

Thus we see that there are two ways in which an element can be removed next to an adjacent COMP without violating the constraint (17): either the COMP is a clause-marker mentioned by the transformation in its structural condition and so does not lie in a variable factor at all, or the variable factor does contain the COMP but does not extend beyond the clause the COMP marks. In either case the exceptional COMP has the distinguishing function of marking part of the characteristic domain of the transformation—the relative clause, in the case just considered.

The view that the relative marker *that* is a pronoun is so entrenched (from school grammar, if not theory), that it may be worthwhile to introduce evidence from a different type of relative clause, the *as*-relative, to support this point. Among its many uses, *as* can serve as the marker of relative clauses like those in (28).

- (28) a. *Such women as Tom was able to speak to* ___ were very unfriendly.
 b. *Such women as there were* ___ on the playing field were unfriendly to Tom.
 c. *Such women as* ___ were on the playing field were unfriendly to Tom.

It is quite natural to regard *as* here as a nonpronominal, "conjunctive" clause marker—a complementizer, in our terms. Relative pronouns (*who*, *which*, etc.) do not appear at all in *as*-relatives, so we can assume that simple deletion applies (as in (27), for example). As (28c) already shows, the subject of the *as*-clause itself can be deleted; this does not violate the Complementizer Constraint on Variables for the reasons given above. However, when the deletion applies in a complement clause within the *as*-relative, a violation can be produced:

- (29) a. *... to give such particulars of Edward as she feared that ___ would ruin him forever
 b. ... to give such particulars of Edward as she feared ___ would ruin him forever

((29b) is cited by Jespersen (1927: p. 201).) This is in accordance with the Complementizer Constraint on Variables. In connection with the analysis of *as* as a COMP, it is interesting to note that *as* also appears in dialectal examples like (30), which is cited in the *Oxford English Dictionary*:

- (30) *I don't know as you'll like the appearance of our place.*

The Complementizer Constraint on Variables would therefore predict contrasts like the following for dialects with (30):

- (31) a. ... *someone (that) I don't know as I would like to talk to*
 b. *... *someone (that) I don't know as* ___ would like to talk to me

To conclude this brief discussion of relativization, I have shown that relativization cannot remove a phrase adjacent to a clause marker except when the clause marker serves to mark the relative clause itself, and this is precisely what is predicted by the analysis of relativization assumed here together with the formulation of the complementizer constraint as a constraint on variables.

3.2 Clefting

The same points can be made with the cleft construction, illustrated in (32).

- (32) a. *It's her Alfa that she was driving* ___.
 b. *It's her Alfa that she's likely to have been driving* ___.
 c. *It's her Alfa that the police believe that she is likely to have been driving* ___.

Relative pronouns may appear in this construction:

- (33) *It's her Alfa which she told us* ___ was stolen.

But when a relative pronoun appears, it is positioned initially in the cleft clause, where it supplants the *that*-complementizer. The relative pronoun cannot be stranded in some other COMP position:

- (34) **It's her Alfa that she told us which* ___ was stolen.

Now if we assume that, like relativization, clefting makes essential use of variables, moving (or deleting) an element into (or from) a specified position at the extreme of the cleft clause, the Complementizer Constraint on Variables accounts for all contrasts like (35) and (36):

- (35) a. *It's her Alfa that she told us* ___ was stolen.
 b. **It's her Alfa that she told us that* ___ was stolen.
 (36) *It's her Alfa that* ___ was stolen.

The complementizer *that* in (36) marks the cleft clause itself, part of the characteristic domain of the clefting transformation; the second complementizer *that* in (35b) lies in a variable factor with respect to the clefting rule.

Again, the question may arise whether the initial *that* in cleft constructions is truly a COMP and not a relative pronoun. Here we can appeal to a special peculiarity of the English cleft construction: not only NPs but PPs can be "clefted," as in (37).

- (37) *It's with Mary that I was sitting.*

And when a PP is clefted, a relative pronoun cannot appear in place of *that*:

- (38) a. **It's with Mary who(m) I was sitting (with).*
 b. **It's with Mary with whom I was sitting.*

((38a,b) are to be construed as clefts; there is a different, grammatical, but irrelevant construction which can be paraphrased "It (namely, my umbrella) is with Mary, with whom I was sitting.") But if relative pronouns cannot have a cleft PP as antecedent, then *that* in examples like (37) must not be a relative pronoun. It is a complementizer.

Now consider the fact that some PPs can participate in subject-verb inversions, such as (39):

- (39) *In these villages can be found the best examples of this cuisine.*

Here the initial PP has inverted with the subject NP, now in postverbal position. We can exploit this fact to derive the following examples:

- (40) *It's in these villages that* ___ *are found the best examples of this cuisine.*

- (41) a. *It's in these villages that we all believe ___ can be found the best examples of this cuisine.*
 b. **It's in these villages that we all believe that ___ can be found the best examples of this cuisine.*

Here we find that the PP can be clefted when it is adjacent to the initial COMP marking the cleft clause (40), but not when it is adjacent to some other COMP (41b). This is striking confirmation of the constraint on variables (17).⁷

In Summary, Clefting conforms our previous findings with relativization. The fact that a phrase adjacent to the *that* complementizer that marks the cleft clause can "exceptionally" be removed, as in (36) and (40), follows from the Complementizer Constraint on Variables, together with the hypothesis that Clefting makes essential use of variables.

3.3 Comparative Deletion

Comparative Deletion is another transformation that can be assumed to make essential use of variables:

- (42) a. *Jack cooked more pancakes than we could eat ___.*
 b. *Jack cooked more pancakes than we believed that we could eat ___.*
 c. *Jack cooked more pancakes than we'd been led to believe that we could eat ___.*

It also obeys the Complementizer Constraint on Variables:

- (43) a. **I solved even more problems than I'd predicted that ___ would be solved by all of us.*
 b. *I solved even more problems than I'd predicted ___ would be solved by all of us.*
 (44) *I solved even more problems than I'd predicted (that) I would solve ___.*
 (45) a. **I solved exactly as many problems as I had claimed that ___ could be solved by someone with my background.*
 b. *I solved exactly as many problems as I had claimed ___ could be solved by someone with my background.*
 (46) *I solved exactly as many problems as I had claimed (that) I could solve ___.*

These facts follow, given a formulation of Comparative Deletion like that proposed in Bresnan (1976a).⁸

3.4 'Across-the-Board' Deletions

Jespersen (1927) argued that *than* and *as* in examples like (42), (43b), (44), (45b), (46) should be classed as clause marking particles or conjunctions, along with the

relative marker *that* and what we call the complementizer *that*. We can use this analysis to construct a further test of the Complementizer Constraint on Variables. I will assume here for convenience of exposition that *than*, *as* are members of COMP, but the basic point holds even if they are analyzed as "conjunctive" prepositions: see notes 6, 11.

We begin by noting that on this analysis, the deletion of phrases adjacent to *than* and *as*, as in (47) and (48), is consistent with the Complementizer Constraint on Variables:

- (47) *I solved only as many problems as ___ could be solved without a slide rule.*
 (48) *I saw more people than ___ saw me.*

For if Comparative Deletion is formulated as shown schematically in (49) or (50), then *than* and *as* mark part of the characteristic domain of the transformation—the comparative clause (S).

- (49) A [\bar{S} COMP X A Y], where COMP = $\left. \begin{array}{l} \text{than} \\ \text{as} \end{array} \right\}$
 +F +F
 1 2 3 4 5 →
 1 2 3 φ 5
 (50) A [\bar{S} X A Y]
 1 2 3 4 →
 1 2 φ 4

(For a more exact formulation of Comparative Deletion, see Bresnan, 1976a.) Consequently, either *than* and *as* will not lie in a variable factor of a proper analysis with respect to Comparative Deletion (49), or they will be the sole terminal elements in the variable factor (50). In either case, no violation of the Complementizer Constraint on Variables ensues.

Given the analysis of *than* and *as* as members of COMP, we would predict that if another rule could extract something from a comparative clause "over a variable," it would be prohibited from removing an element adjacent to *than* or *as*. Now this prediction is difficult to test, for the following reason. Comparative constructions are like Complex NPs, in that they resist extraction from any position in the clause:

- (51) a. *Q Freddy is taller than which one of his sisters is.* →
 b. **Which one of his sisters is Freddy taller than ___ is?*⁹
 (52) a. *Q Freddy is taller than you found which one of his sisters to be.* →
 b. **Which one of his sisters is Freddy taller than you found ___ to be?*
 (53) a. *Q Freddy is taller than you were believed to be by which one of his sisters.* →
 b. **Which one of his sisters is Freddy taller than you were believed to be by ___?*

Question Movement yields ungrammatical results not only where the subject of the *than*-clause is removed, as in (51b), but also where other phrases not adjacent to *than* are removed (52b), (53b).

These facts make it difficult to test our prediction, but not impossible. For, as Ross (1967) observed, there exist what have been called "across-the-board" applications of rules like Question Movement or relativization into coordinate clauses, as in (54):

(54) ... *a man who Mary called* — *an idiot and June called* — *a cretin*

It is an interesting feature of comparative clauses that they, too, appear to permit such across-the-board applications:

(55) ... *a man who Mary called* — *an idiot as often as June called* — *a cretin*

In these cases, we can extract elements from comparative clauses without creating the ungrammatical effects of violations of "island" constraints.¹⁰

Now compare (56) with (57):

(56) ... *someone that I believe Freddy has visited* — *as many times as my brother has visited* —
 *... *someone that I believe* — *has visited Freddy as many times as* — *has visited my brother*

In (56), the object of *visit* in both matrix and subordinate clause is deleted, yielding a grammatical example. In (57), the subject of *visit* in both clauses is deleted, but the second deletion site is adjacent to a clause marker (*as*) which is not distinguished in the relativization rule, and the result is ungrammatical. (Cf. "someone that I believe has visited Freddy as many times as he has visited my brother.") Thus we find that *as* prevents deletion of an adjacent phrase by across-the-board relativization in the same way that does:

(58) a. ... *someone that I believe* — *hates me as much as you believe*
 — *hates you*
 b. *... *someone that I believe* — *hates me as much as you believe*
 that — *hates you*

Similar examples can be constructed with *than*.

To sum up this argument, where a clause marker (such as *as* or *than*) marks part of the characteristic domain of a transformation (such as the comparative clause for Comparative Deletion), it permits deletion by that transformation of an adjacent phrase. This is illustrated by (47) and (48). But where the same clause marker lies properly within a variable factor with respect to a transformation, it prohibits the deletion of an adjacent phrase. This is illustrated by (57). The predicted contrast between examples like (47) and (57) thus provides striking confirmation of the Complementizer Constraint on Variables.

3.5 Summary

To conclude this section on evidence, I have now reviewed properties of relativization, clefting, and Comparative Deletion to show that they are subject to the Complementizer Constraint on Variables. By making essential use of variables in these transformations and formulating the constraint as a constraint on variables, we can systematically account for exceptions to the generalization that phrases cannot be removed from clauses by a transformation if they are adjacent to the clause markers. The exceptions are just those complementizers that mark the characteristic domain of the transformation itself and therefore do not lie properly within its variable factors.

The rules that I have discussed are only a small sample of the rules affected by the constraint, but I believe that they sufficiently illustrate the principles involved in my hypothesis. In the next section, I will compare alternative accounts of some of the same phenomena.

4. Alternatives and Counterarguments

4.1 The False-Parsing Hypothesis

Langendoen (1970) makes the following proposal, which I will refer to as the False-Parsing Hypothesis:

We can account, on similar grounds, for the fact that when the relative pronoun stands for the subject of a subordinate clause inside the relative clause, the subordinating conjunction *that* introducing that subordinate clause must be deleted. Thus the following sentence is grammatical:

(20) The committee which I understand investigated the accident has not yet made its report public.

but not:

(21) *The committee which I understand that investigated the accident has not yet made its report public.

The subordinating conjunction may, however, be retained in case the relative pronoun stands for some other noun phrase in the subordinate clause. Thus both of the following sentences are grammatical:

(22) The accident which I understand the committee investigated was the worst in the state's history.

The ungrammaticality of (21) stems presumably from the fact that the retention of *that* would lead to a false parsing of the sentence, in which *that* is taken to be the subject of the subordinate clause. This means, of course, that (21) fails to provide access to the deep structure underlying both it and sentence (20): the obligatory deletion of the subordinating conjunction may be understood as a means of rendering grammatical certain surface structures which do not provide ready access to their deep structures.

The False-Parsing Hypothesis is clearly limited to *that*, the only one of the subordinating conjunctions which, because it is homophonous with a pronoun (*that*), could give rise to "false parsing" as a subject. *For, whether, as, and than* could not be parsed as subjects; hence, the propensity they share with *that* to protect adjacent phrases in their clauses from deletion would have to have a different explanation, on Langendoen's account. The Complementizer Constraint on Variables therefore captures a generalization that the False-Parsing Hypothesis cannot in principle express.

We should also note that the False-Parsing Hypothesis presupposes that relative *that* is a pronoun; even if this explanation holds in relatives, it does not extend to the PP-clefting examples discussed above ((40)-(41)).¹¹

4.2 The Missing-Subject Hypothesis

Another type of explanation that has been offered to account for the ungrammaticality of examples like **Who do you think that is coming to town?* is based on the idea that an English clause without its subject is ungrammatical. One version of this Missing-Subject Hypothesis is Perlmutter's (1971, p. 100):

- (59) Any sentence other than an Imperative in which there is an S that does not contain a subject in surface structure is ungrammatical.

In order to avoid questionable assumptions about pruning (Perlmutter, 1971, Ch. 4, note 16), let us consider instead of (59) the version given in (60):

- (60) *Missing-Subject Hypothesis*
Every clause beginning with a clause marker must have a subject in surface structure.

As a consequence of (60) (and of (59) as well), the *that* in examples like (61) must be analyzed not as a COMP (i.e., a clause marker), but as a relative pronoun:

- (61) ... *the women that were on the playing field*

Indeed, one of the reasons for which grammarians have distinguished a relative pronoun *that* from the "conjunction" *that* has been precisely to uphold the generalization that every English clause must have a subject.

Jespersen considered false the generalization that every English clause has a subject; he argued in effect that the true generalization is that English clauses, whether they are complements, relatives, or comparatives, are syntactically alike. His view of relative *that* is summed up as follows (1927, sec. 8.7₅):

We have thus brought together a great many phenomena, which traditional grammar puts into various separate pigeon holes, though they are in reality identical means of connecting a clause with the rest of the sentence, either without any form word or with the empty and therefore in many cases superfluous particle *that*. We may even say that in *I know you mentioned the man*,

and in *I know the man you mentioned* we have clauses with direct contact, and in *I know that you mentioned the man*, and in *I know the man that you mentioned*, we have the same kind of clauses with mediate contact, *that* being used to cement the two closely connected parts of the sentence.

To Jespersen we owe the following counterargument to the view that relative *that* serves as the subject of clauses in cases like (61). Jespersen observes (1927, sec. 9.1), "The conjunction of comparison *as* often serves to introduce clauses which must be termed relative. Many grammarians then call *as* a relative pronoun . . ." He then shows by parallel examples that if *that* and *as* are to be analyzed as relative pronouns, so must *than* and *but* be. The relative use of *but* occurs in such (now non-standard) examples as *I see none but are shipwrecked*, meaning, approximately, "I see only ones that are shipwrecked." The examples Jespersen gives include the following:

- (62) *such women as knew Tom*
such women as Tom knew
such women as Tom dreamt of
more women than ever came here
more women than he had seen there
more women than he dreamt of

Jespersen concludes:

It seems, however, hardly natural to extend the name of pronoun to all these cases. After what was said above (8.7₅) [quoted above—JWB] on *that* it will not surprise my readers if I prefer using the term particle or conjunction in speaking of *as, than, and but* in these employments, exactly as in other uses of the same words. This puts all the clauses here mentioned on the same footing and also approximates them to contact clauses [see the above quotation—JWB]. If it is asked what then is the subject of the verb in "such women as knew Tom" and "more women than ever came here" and "there are no women but *admire* him", the answer must be that there is no subject in these clauses, and that there is the same lack of a subject in "all the women that *admire* him" and in "there's a man below *wants* to speak to you". In the same way there is no object in the other clauses. Nothing is gained in such cases by putting up fictitious subjects and objects [i.e., treating *as, than, but, that* as relative pronoun subjects and objects—JWB]: it is much better to face the simple truth that there are clauses without a subject and others without an object, just as there are sentences without either.

Jespersen's argument, then, is that to preserve the generalization that English clauses must have (surface structure) subjects, one is forced to treat *that, as, than, and but* as relative pronouns. One thereby loses the generalization over "relative" and "conjunction" uses of these particles. For example, if *as* and *than* are the missing subjects in comparative clauses like (63),

(63) a. *As many students were flunked as were passed.*
 b. *Fewer students were passed than were flunked.*

—then they must certainly have a different function in (64), where subjects are supplied:

(64) a. *As many boys were flunked as girls were passed.*
 b. *More boys were flunked than girls were passed.*

I think Jespersen's argument alone is a compelling reason for rejecting the Missing-Subject Hypothesis, but there are others. One is the contrast between sentences like (41a) and (41b), in which the subject of *be found* and PP have exchanged positions:

(41) a. *It's in these villages that we all believe — can be found the best examples of this cuisine.*

b. **It's in these villages that we all believe that can be found the best examples of this cuisine.*

I assume that (41a) is derived from a source something like that in (65):

(65) *It's Δ that we all believe in these villages can be found the best examples of this cuisine.*

After it has inverted with the subject of *be found*, the PP is clefted. Note that the subject of *be found* is still present in the complement clause in (41b): it is not actually missing, but has merely exchanged places with the PP. But then the ungrammaticality of (41b) must be caused by something other than a missing subject. (I assume that the PP in (65) is not a subject, on the ground that subjects can induce number agreement of the verb: cf. *Near that town were situated two old castles* and *Near these towns is situated an old castle*.) Further reasons for rejecting the Missing-Subject Hypothesis in favor of the Complementizer Constraint on Variables are given in the next section.

4.3 Surface Structure Constraints

Although the previously proposed Missing-Subject constraint on surface structures does not adequately express the generalizations captured by the Complementizer Constraint on Variables, there have been (to my knowledge) two arguments offered in favor of defining the constraint on surface structure. Neither of them establishes this conclusion, however, and there is counterevidence against any surface structure constraint approach, as I will show below.

The first argument, suggested by Chomsky (personal communication), is based on the grammaticality of examples like (66a,b).

(66) a. *He's the one that they still want very much to go to Harvard.*
 b. *You're someone whom we have wanted for a long time to visit us.*

The argument assumes that with *want* (and similar verbs—see Bresnan, 1972), a post-verbal adverb requires the presence of the complementizer *for*, as in (67) and (68):

(67) a. *They still want very much for him to go to Harvard.*
 b. **They still want very much [him to go to Harvard S]*

(68) a. *We have wanted for a long time for someone to visit us.*
 b. **We have wanted for a long time [someone to visit us_S]*

Now, so the argument goes, given a constraint like the Complementizer Constraint on Variables, which affects transformational applications, the obligatory presence of the complementizer *for* should prevent relativization of the adjacent subject, and therefore (66a,b) should be ungrammatical, like their sources (69a,b):

(69) a. **He's the one that they still want very much for — to go to Harvard.*
 b. **You're someone whom we have wanted for a long time for — to visit us.*

But contrary to this prediction (66a,b) are grammatical. On the other hand, if the constraint is defined as a surface structure constraint (like (60), for example), then (66a,b) would have ungrammatical *for* — 'sequences, subsequent deletion of *for* before *to* yields structures to which the surface structure constraint can no longer apply.

The flaw in this argument is the implicit and unwarranted assumption that (69a,b) are the only sources for (66a,b). It is assumed that in the derivation of (66a,b) the postverbal adverbs are positioned prior to relativization between the verb and its *for*-complement, as in (67a) and (68a). However, it could be just as well assumed that the adverbs are positioned postcyclically (after relativization), or that they are positioned as in (70a,b):

(70) a. *?They still want him very much to go to Harvard.*
 b. *?We have wanted someone for a long time to visit us.*

As they stand, these examples are relatively unacceptable. (For discussion of possible explanations, compare Postal, 1974, pp. 134–154, and Bresnan, 1976c.) However, it turns out that removal of a NP from between a verb and its adverbial modifier greatly improves examples like (70a,b), and that this effect holds even in *believe*-complement constructions that give no evidence of an underlying *for* (see Kiparsky and Kiparsky, 1970; Bresnan, 1972):

(71) *?You believe these things so strongly to be true.*
 (72) *The things which you believe so strongly to be true are not true.*

(71), like (70), is relatively unacceptable, where the adverb modifies the main verb; but (72) is fine. What these facts show is that however the contrasts between (71) and (72), (70) and (66) are ultimately to be accounted for (whether by a surface structure constraint on adverb positions or by late [postcyclic] reorderings of adverbs), there exist possible sources for examples like (66a,b) which entail no violation of the Complementizer Constraint on Variables. Thus this argument for a surface structure constraint is invalid.

Furthermore, the surface structure filtering approach to examples like (66) can be shown to be inadequate. Observe that the claim that (66a,b) derive from (69a,b)

requires that a rule deleting *for* before *to* be applicable after relativization. It is the application of this rule—call it “*for*-before-*to* deletion”—that “saves” (66) from the hypothesized surface structure constraint. But then *for*-before-*to* deletion should likewise “save” examples like (73) and (74):

- (73) **This is the dress that it is required for ___ to be worn on these occasions.*
 (Cf. *This is the dress that it is required for us to wear ___ on these occasions.*)
- (74) **This is one game that it wouldn't matter for ___ to be lost.*
 (Cf. *This is one game that it wouldn't matter for us to lose ___.*)

But after *for*-before-*to* deletion, the examples are still ungrammatical:

- (75) **This is the dress that it is required to be worn on these occasions.*
- (76) **This is one game that it wouldn't matter to be lost.*

The Complementizer Constraint on Variables can explain these facts, for the only sources for (73) and (74) involve violations of the constraint (17): cf. **It is required this dress to be worn* versus *It is required for this dress to be worn*, and **It wouldn't matter one game to be lost* versus *It wouldn't matter for one game to be lost*. Similarly, the Complementizer Constraint on Variables automatically accounts for the contrast between (75) and (76):

- (75) **It's John that I wouldn't be eager to see me here.*
- (76) *It's John that I wouldn't be eager to have see me here.*

The sources of the cleft clauses in (75) and (76) are similar to (77) and (78) respectively:

- (77) *I wouldn't be eager for John to see me here.*
- (78) *I wouldn't be eager to have John see me here.*

The clefted element *John* is adjacent to the underlying complementizer *for* in (77), but not in (78). Thus the evidence from *for*-complements actually supports the Complementizer Constraint on Variables and disconfirms the surface structure constraint approach.¹²

The second argument for a surface structure constraint is given by Perlmutter (1971, pp. 111–112). Consider (79):

- (79) a. **John is anxious for someone to visit him, but I don't know who John is anxious (for) to visit him.*
 b. *John is anxious for someone to visit him, but I don't know who.*

Assuming that (79b) derives from (79a) by means of Sluicing (Ross, 1969), Perlmutter argues, essentially, that if (79a) is ruled out by a constraint on transformations rather than a surface structure constraint, (79b) should also be ungrammatical. However, it is well known that other violations of constraints on transformations appear to be mitigated by the Sluicing transformation—indeed, this was one of

Ross's points, used to justify reanalyzing such constraints as constraints on derivations. Consider (80):

- (80) a. **Press aides revealed that the President would make a surprise proposal to disband a certain corporation—which corporation the President would make a surprise proposal to disband they didn't say.*
 b. *Press aides revealed that the President would make a surprise proposal to disband a certain corporation—which corporation they didn't say.*

In (80a) a violation of the complex NP constraint occurs, but it is not reflected in (80b). Thus the argument from Sluicing does not show that the complementizer constraint should be formulated as a constraint on surface structures.¹³

Observe finally that any finite, or “local,” surface structure constraint would be incapable in principle of discriminating between examples like (81) and (82):

- (81) *This food is still cooked in the same way that ___ is prescribed in ancient books.*
- (82) **One food that ___ is cooked by the French in the same way that ___ is cooked by the Italians is this.*
 (Cf. *One food that is cooked by the French in the same way that it is cooked by the Italians is this.*)

(82) is a case of “across-the-board” relativization, as was discussed in section 3.4. When this rule removes the second relative item adjacent to *that*, the result is ungrammatical, as (82) shows; but when the second relative item is not adjacent to the complementizer, the result is grammatical:

- (83) *One food that the French cook ___ in the same way that the Italians cook ___ is this.*

Notice also that removal of the second object depends upon the relativization of the first object:

- (84) **The French cook one food in the same way that the Italians cook ___.*
 (Cf. *The French cook one food in the same way that the Italians cook it.*)

The reason that a local surface structure constraint would fail to discriminate between such examples as (81) and (82) is that the same sequences, having the same structures, occur in both examples—the *same way that* ϕ is *V-ed*; yet they contrast in grammaticality. As observed in section 3.4, the Complementizer Constraint on Variables can explain such examples, since in (81) *that* marks the characteristic domain of the unbounded rule of relativization, but in (82), the same *that* lies in a variable factor with respect to relativization.

Let me add in conclusion that very little work has been done to make precise exactly what it is that surface structure constraints cannot do. Clearly it would

mean nothing to "drastically restrict" the expressive power of transformations while tacitly permitting surface structure constraints to be formulated with labelled brackets, with essential variables, with traces, and with trace binding (in the sense of Chomsky, 1976). In Bresnan (1976d), I have proposed one strong but very natural restriction on surface structure constraints (and transformations as well)—the requirement that they may not refer to traces or trace binding. This would restrict idiosyncratic, language-particular rules from access to "global" information, greatly simplifying the task of the language learner.

In any case, it appears that enriching the surface-structure filtering component with traces and labelled brackets can provide at best only a piecemeal account of the range of evidence explained by the Complementizer Constraint on Variables. 14

4.4 The Syntactic Nature of the Constraint

Although the Complementizer Constraint clearly affects syntactic movements and deletions of the kinds I have illustrated, it appears to exert no effect on rules for determining quantifier scope and variable-binding. For example, the rule that would give (optional) widest scope to *someone* in the "transparent" reading of (85)—

- (85) *Everyone believes that someone loves Mary.*
(Ex) (Ay) (y believes that x loves Mary)

—is unaffected by the adjacent COMP *that*. This is in sharp contrast to (86), where a syntactic deletion is involved:

- (86) **There is someone that everyone believes that ___ loves Mary.*
Cf. There is someone that everyone believes ___ loves Mary.)

Similarly, the rule which binds *he* to the quantifier in (87) is indifferent to the adjacent COMP.

- (87) *Everyone thinks that he is right.*
(Ax) (x thinks that x is right)

Again this contrasts with a deletion (though the element deleted is also bound to a quantifier):

- (88) **someone that everyone thinks that ___ is right*

Further, we can find examples that contrast with respect to the complementizer constraint but have identical logical forms:

- (89) **someone that ___ has visited Mary as many times as ___ has visited June*
someone that ___ has visited Mary as many times as he has visited June

The logical form for (89) would presumably be identical to that for (90), with *he* bound by *someone*; the contrast between the two cannot therefore be expressed as

a condition on logical form itself. Finally, there do exist grammatical nonecho questions like (91):

- (91) a. *Who recommends that who be fired?*
 b. *Which man ordered that which woman be fired?*

((91a,b) are counterexamples to Kuno and Robinson, 1972, but I find them perfectly grammatical; cf. Hankamer, 1975.) If these are interpreted along the lines suggested by Chomsky (1973)—e.g., "For which x, for which y, x recommends that y be fired"—then ungrammatical examples like (92) would have the same kind of interpretations—"For which x, you recommend that x be fired"—providing further evidence of the syntactic nature of the constraint.¹⁵

- (92) **Who do you recommend that ___ be fired?*

Thus the Complementizer Constraint on Variables provides some support for a theoretical distinction between syntactic transformations and interpretive rules.

5. Conclusion

We have now reached by a different route the same conclusion that was arrived at in Part I: that by making essential use of syntactic variables in transformations, we can capture linguistic generalizations that would otherwise be lost.

It should be remarked that the Complementizer Constraint on Variables appears not to be universal: in particular it appears not to hold in languages which have subject pronoun deletion (e.g., Portuguese and Spanish; see Perlmutter, 1971, for some discussion). Although this poses the empirical problem of discovering which properties of given languages determine the presence or absence of the constraint, it does not seem to me to pose a problem in theory. It is known that languages vary in whether they allow prepositions to be "stranded" by transformations under certain conditions (see, e.g. Grimshaw, 1975); and so languages vary in whether they allow clause markers to be stranded by transformations under certain conditions. I see no reason why grammars for these languages might not vary with respect to admissibility conditions on proper analyses. Perhaps the assumption that applicability conditions on transformations could vary among languages or language types will seem more plausible when the problem of incorporating grammars within performance models is considered. In a sentence recognition model in which (unbounded) transformations correspond directly to sentence-processing operations, these operations would be actively used to extract an underlying structure from a surface structure. (See Bresnan, 1976b and 1977, for a discussion of the realization problem for transformational grammars.) General conditions governing the applicability of these operations within a language could well depend upon particular, nonuniversal structural properties of the language.

It is also important to recognize that because the effects of the Complementizer Constraint on Variables vary with the form of the transformation (i.e., with respect

to the sequence of variables and constants in its structural condition), the constraint presupposes certain universal formal limitations on transformations. To see this, note that we could "get around" the constraint simply by reformulating all transformations that delete 'A' between variables, as in (93).

(93)	A	X	A	Y	
	1	2	3	4	-->
	1	2	φ	4	

with an extra variable, as in (94),

(94)	A	X	Z	A	Y
	1	2	3	4	5
	1	2	3	φ	5

or with an extra constant, as in (95).

(95)	A	X	(COMP)	A	Y
	1	2	3	4	5
	1	2	3	φ	5

This is because the proper analyses shown in (96) would be permitted by the constraint:

(96)	a.	A	...	COMP	-A	...
		A	X	.	Z	.A.Y
	b.	A	...	COMP	-A	...
		A	X	-(COMP)	A	Y

Thus the formulation of the constraint in (17) tacitly presupposes that (94) and (95) are not available transformations, while (93) is.

Now it is easy to see that without the Complementizer Constraint, (94) and (95) are *descriptively equivalent* to (93): the set of structures immediately derivable by (93) is the same as the set of structures derivable by (94) or by (95). (For every structure s which has a proper analysis $p = (p_1, p_2, p_3, p_4)$ with respect to (93), there is a proper analysis p' of s with respect to (94) or (95) which yields the same derived structure as (93): namely, $p' = (p_1, p_2, e, p_3, p_4)$, where e is the labelled bracketing of length 0. Conversely, for a proper analysis $(p_1, p_2, p_3, p_4, p_5)$ of any s with respect to (94) or (95), there is a proper analysis of s with respect to (93) that yields the same derived structure: $(p_1, p_2, p_3, p_4, p_5)$. For the definitions assumed here, see Bresnan, 1976a.) Thus apart from the effects of the Complementizer Constraint, we would lose no descriptive power by eliminating (94) and (95) from the realm of possible transformations, and retaining (93). One way of restricting the class of possible transformations appropriately would be to take equivalence classes of transformations under a relation of descriptive equivalence and to select from each class one representative transformation (say the shortest), eliminating the

others. In defining the relation of descriptive equivalence, only *universal* conditions on transformations would apply. In this way (93)-(95) would belong to the same equivalence class, and (94) and (95) would be eliminated as possible transformations.

The determination of universal formal constraints on transformations is one of the most important and interesting in syntactic theory, but as I hope to have shown in this study, the study of nonuniversal constraints can also shed light on the formal properties of transformations.

Acknowledgments

I would like to thank my fellow participants in the Irvine Conference on Formal Syntax, June, 1976, and especially Noam Chomsky, for very stimulating discussion of the material in this article. I am grateful to the John Simon Guggenheim Memorial Foundation for the Fellowship that made it possible for me to pursue the research of which this study is a part. The illustrative material in part I of this study is drawn from Bresnan (1976d) with permission.

Notes

1. What is produced instead is **Does Mary believe the claim who John saw?*, which is ruled ungrammatical by a surface-structure constraint that requires *claim* to have a *that*-complement.
2. I have given two slightly different formulations of Subdeletion in Bresnan (1975a) and Bresnan (1976a). Both of them are governed by the relativized A-over-A principle, and both of them automatically "collapse" with Comparative Deletion (in which the entire compared constituent is deleted, e.g. *Bill is taller than John is*). However, under the relativized A-over-A principle as given in Bresnan (1976a), the earlier formulation of Subdeletion also derives, as an option, all examples like *Bill is taller than John is tall*, where the compared constituent contains repeated material. In his contribution to this volume, Chomsky argues that such examples are grammatical, but mistakenly claims that it is a "crucial requirement" of the analysis of Subdeletion in Bresnan (1975a) that such sentences "must be marked ungrammatical, as a violation of [the Relativized A-over-A Principle]." Chomsky's objections to my analysis are therefore inapplicable. The interested reader is referred to Bresnan (1976d) for a full discussion of this issue, as well as a more detailed exposition of properties of Subdeletion that Chomsky's (1976) analysis fails to account for.
3. An interesting alternative to eliminating unbounded transformations would be to eliminate iterative cyclic transformational applications to the same constituent. Although cases like the passive transformation (which applies iteratively to *John in John is believed to have been awarded the prize*) seem at first to be obvious counterexamples to such a proposal, a cyclic passive transformation is not necessary to account for these examples, and there is some evidence that a restriction of the transformational cycle will yield a more realistic model of transformational grammar (see Bresnan, 1976b, 1977). It is interesting to note in this connection that within the theory of Bresnan (1976b, 1977), in which deep structures much more closely resemble surface structures, the Passive and Raising rules meet the criteria for *lexical* rules given by Wasow in his contribution to this volume, where he argues

- that the Passive must be a transformation. This goes to show that 'criteria' for interpreting phenomena are dependent on theories of the phenomena and cannot be treated as theory-independent diagnostics. I hope to provide a full discussion of this issue in another study.
4. A proper analysis of a structure *s* with respect to a transformation *T* is a factorization (P_1, \dots, P_n) of *s* which satisfies the structural condition of *T* and on which the transformational mapping (structural change) of *T* is defined. (See Peters and Ritchie, 1973.) In terms of the Peters and Ritchie definitions, which do not use variable symbols in structural conditions, we can define a factor *p* to be a constant factor if there is a basic predicate *P* in the structural condition of *T* such that *P* holds of *p*, and to be a variable factor otherwise.
 5. —or, conceivably, as one which limits the class of derivations; cf. note 13.
 6. As it is formulated in (17), the constraint permits all examples like *Who did she say that tomorrow — would regret his words?, an amendment which they say that next year — will be law, Which doctor did you tell me that during an operation — had had a heart attack?* in which an adverb intervenes between the deleted phrase and the COMP. If it is considered desirable to rule out these (mildly awkward) examples, (17) could be appropriately modified, for example by having, instead of adjacency of COMP to A, adjacency of COMP to the S which immediately dominates A. Note also that although (17) is formulated in terms of 'COMPs', it could be generalized to include other subordinating conjunctions; cf. note 11.
 7. Note that *all in* (41a) can bear heavy stress, suggesting that *we all believe* is not a parenthetical insert. This suggestion is reinforced by the existence of examples like 'It's precisely in X's writings that I do not believe will be found any evidence for your hypothesis.' Negative parentheticals cannot occur in affirmative sentences: *'In X's writings, I do not believe, will be found any evidence for your hypothesis.'
 8. As formulated, constraint (17) predicts contrasts between Subdeletion examples like (a) *As many men were hired as you had predicted — women would be*, and (b) *As many men were hired as you had predicted that — women would be*, even though (c) *There were as many men as you had predicted that there would be — women*, and (d) *There were as many men as you had predicted there would be — women* do not contrast. As I have remarked elsewhere (Bresnan, 1975a), I do find a contrast between (a) and (b) — with (b) worse — but it is slight enough that I do not wish to base too much upon it. Let me note, therefore, that the deleted constant factor in cases of Subdeletion is never immediately dominated by the S that the adjacent COMP marks, although it is in the other cases discussed here, so that (17) could be appropriately modified to permit (b), if desired.
 9. On the status of examples like *Which one of his sisters is Freddy taller than?, Who wasn't he as tall as?*, see Hankamer (1973), who argues that the structure of these seemingly truncated clauses is not COMP S.
 10. It is worth pointing out that Right Node Raising does not provide a plausible source for many examples like (54) and (55). The reason is that Right Node Raising affects only phrases at the right periphery of their clauses. Thus Right Node Raising can derive 'I go out with, more often than I stay home with, that kind of friend' from a source like 'I go out with that kind of friend more often than I stay home with that kind of friend.' But where *that kind of friend* is not the rightmost phrase in the clauses, the result is ungrammatical: 'I meet that kind of friend at restaurants for lunch more often than I invite that kind of friend to my home for supper' cannot be converted into *'I meet at restaurants for lunch, more often than I invite to my home for supper, that kind of friend.' Nevertheless, I find examples like the following perfectly grammatical: 'the kind of friend that I meet — at restaurants for lunch more often than I invite — to my home for supper.' This suggests that the latter is not derived by applying Right Node Raising prior to relativization.
 11. See Hudson (1972) for other criticisms of Langendoen's proposal. Hudson offers a proposal of his own: "If a clause contains among its immediate constituents both a conjunction

(which must be overt) and a grammatical subject, then they must come in that order, even if the subject has been 'raised' into the structure of the matrix clause." The reliance on reordering biases this proposal toward movements; it would not provide an explanation for the contrasts created by deletion rules, such as Comparative Reduction (on which cf. Vergnaud, 1975 and Hankamer, 1971) — *He ran faster than I'd thought* (**that*) *was possible* — and Comparative Deletion — *He ate more than I had believed* (**that*) *was in the refrigerator*. Nor would this proposal distinguish correctly between the PP-clifting examples (40)–(41). Nevertheless, in its emphasis on "conjunctions," Hudson's proposal is similar in spirit to mine.

One interesting feature of Hudson's analysis is that he extends it to subordinating conjunctions (e.g., *though, if*). Although I argued in Bresnan (1972) that the evidence he gives for this extension is not sufficient, it would be quite possible to generalize (17) further to subordinating conjunctions as well as complementizers: what these have in common is that they are "particles" (members of closed classes) that can be generated as sisters to S. (I presuppose here an analysis of subordinating conjunctions like that given in Emonds, 1976, together with the analysis of complementizers of Bresnan, 1974.) And there is in fact other evidence for such a generalized formulation, as Alex Grosu has pointed out to me. It would explain, for example, contrasts like the following:

- (i) *This is a delicate matter that, quite frankly, I would be surprised if he were to resolve — effectively.*
- (ii) **This is a delicate matter that, quite frankly, I would be surprised if — were to be resolved effectively.*

12. It is important to notice that the Complementizer Constraint on Variables is not disconfirmed by the occurrence in some dialects of constructions like *Who does she long for to visit her?* A number of verbs select the preposition *for*, which, as I have already noted, is not subject to the Complementizer Constraint (see (8)–(11)). *Want*-type verbs, in particular, may, in some dialects, select a complement construction in which the preposition *for* governs the entire complement clause (S). Because this preposition does not form a constituent with the clausal subject, it would not "pied-pipe" under *wh*-movement, but because it is not a complementizer, it would not prevent extraction of the subject. Thus we can attribute this dialectal variation to lexical selectional differences in a natural way.

13. Let me note that it would be possible to regard a constraint on variables as restricting derivations rather than proper analyses. However, I do not view the evidence from Sluicing as compelling, because the types of facts that Ross adduces to show that Sluicing must involve syntactic deletion can also be found in "discourse Sluicing." Compare, for example: **Someone's coming, but I don't know whom*, and A: *Someone's coming*. B: *Whom?* Since pragmatic principles rather than rules of sentence grammar may be required to account for "discourse Sluicing," and since they might also extend to sentence Sluicing, it could well turn out that (b) is not derived from (a) in either (102) or (103).

14. For example, in the course of discussion at the Irvine Conference on Formal Syntax, Chomsky suggested the following surface structure constraint:

- (i) * [COMP *t* X] *t*, where X = *that*, . . . , and *t* is a trace.

This constraint would account for the contrast between (ii) and (iii) —

- (ii) *the man [COMP that] t was there*
- (iii) *the man that I said [COMP t that] t was there*

—if we assume that *wh*-movement occurs in both these examples, leaving a trace in COMP to the left of *that* in both, and the subsequent *wh*-deletion in relative-clause initial position leaves no trace. However, (i) fails to account for the difference between (82) and (83). For the same way *that* . . . is a "wh-island" in Chomsky's (1976) terms:

- (iv) *The French cook this in the same way in which the Italians cook that food.*

This means that once *wh*-movement moves in which in (iv), no other *wh*-word can move into COMP position. By hypothesis, when *in which* is deleted by *wh*-movement, no trace of it remains. Thus a trace can never be left in the lower COMP of (82), shown in (v):

- (v) *One food that t is cooked by the French in the same way* [COMP *that*] *the wh-food is cooked by the Italians is this.*

In this respect, (82) would not differ from (83), shown in (vi):

- (vi) *One food that the French cook t in the same way* [COMP *that*] *the Italians cook wh-food is this.*

Thus, even if we increase the expressive power of surface structure constraints in this undesirable way, we obtain a less general account than the explanation provided by the Complementizer Constraint on Variables.

Obviously, (i) also fails to account for the *for*-deletion examples (75) and (76), since the crucial complementizer has been deleted.

15. Fiengo and Lasnik (1973) suggest that a rule of Reciprocal Interpretation would be constrained by the complementizer constraint, but examples recorded by Postal (1974: pp. 76-77, n. 24) argue against this: *They arranged for each other to live in comfort, They prayed for each other to prosper.*

COMMENTS ON THE PAPER BY BRESNAN

Barbara Hall Partee

*Departments of Linguistics and Philosophy
University of Massachusetts
Amherst, Massachusetts*

The main aim of Bresnan's paper is to define the existence of a class of syntactic rules whose existence was not thought until recently to need any defense. Ever since Ross (1967), the class of unbounded movement rules making essential use of variables has been the focus of a great deal of study of constraints on rules, on rule applications, and on derivations, and Bresnan (1975) argues persuasively that there are unbounded deletion rules as well as unbounded movement rules, and that they share the same constraints. The challenge to the existence of unbounded rules came from Chomsky (1973): *wh*-movement when formulated as an unbounded movement rule violates at least two of the constraints there proposed, the Tensed-S Condition and the Specified Subject Condition, but Chomsky argued for a reformulation of the rule as a successive-cyclic movement into COMP, and proposed the Subjacency Condition that rules out unbounded movement (and deletion) rules altogether. Bresnan's present paper, as well as Bresnan (1975), provides arguments in support of the existence of unbounded deletion rules and hence against Chomsky's Subjacency Condition, and since parts of Chomsky's present paper are directed specifically against Bresnan's arguments, I will direct my own comments as much to the relevant parts of Chomsky's paper as to Bresnan's.

My remarks will fall into three sections. The first section contains some general observations that can be made about the semantics of unbounded rules. The second addresses Chomsky's suggested alternative treatments of the rule of Subdeletion and in particular the question of what Subdeletion deletes; the third takes up the problem raised for Bresnan's analysis by sentences like *John is taller than Bill is tall*, discussed by Chomsky. I am raising problems of detail because I do not believe that the nature of the rule of Subdeletion is yet fully understood, particularly those cases that in Bresnan's analysis involve deletion of a constituent larger than *X much* or *X many* but less than the whole compared constituent. I will argue in section 2 that such cases, if admitted, would provide the strongest counterarguments to Chomsky's reanalysis of Subdeletion as *wh*-movement, but in section 3 I suggest that the same cases seem to be counterexamples to the best account I can think of for sentences like *John is taller than Bill is tall* within Bresnan's framework. In

general, I find Bresnan's arguments quite compelling; but further research remains to be done before the issues will be resolved.

1. Unbounded Rules and Variable Binding

Within a theory in which semantic interpretation is based on syntactic derivation in such a way that for each syntactic rule there is a unique corresponding semantic rule, one place to look for constraints is on the form of the interpretation rules that correspond to syntactic rules of a given form. It is not my place to argue for such a theory here (see Partee, 1975); I only want to remark that it appears that one general constraint of this sort might be that all and only unbounded syntactic rules are interpreted semantically by rules that bind variables (either by quantification or by lambda abstraction.) This holds of relative clause formation (Montague, 1973, and later extensions by Rodman, 1976, and by Thomason, 1976), *wh*-question formation (Karttunen, 1975), Comparative Deletion and Subdeletion (Davis and Hellan, 1975); it holds equally of unbounded rules that have been formulated within alternative frameworks, such as Quantifier Lowering (Lakoff, 1971b), and the Derived Verb Phrase Rule (Partee, 1975c); I hypothesize that the constraint holds quite generally and can be maintained over a considerable range of alternative formulations of syntactic-semantic theory.¹

If Chomsky (this volume) is able to reformulate successfully all of the traditionally unbounded rules as rules involving *wh*-movement, then it might be possible to formulate an equivalent constraint relating *wh*-movement and variable-binding, except that within his framework the semantic interpretation operates on almost-surface structures rather than in any direct correspondence to syntactic rule applications. It should be noted that among the rules that map the almost-surface structures onto logical form, there are unbounded rules, e.g., his rule (38) that interprets a *wh*-phrase as a quantifier and inserts a matching variable in the corresponding trace, which may be arbitrarily far away. Hence a likely candidate for the corresponding constraint within Chomsky's theory might well be that all and only the unbounded interpretive rules are variable-binding rules.²

As a potentially relevant aside, let me note that there is apparently a theorem, though I have never seen proof of it, to the effect that the set of closed sentences of first-order predicate calculus is not context-free, and it is clearly the "unboundedness" of variable-binding that is the only potentially non-context-free aspect of that language. Variable-binding is obviously a very powerful device, and it would not surprise me if our competence in coping with it were reflected in a syntactically powerful device such as unbounded rules as well as in the semantically powerful devices needed to interpret it. Tying two such powerful devices together by a universal constraint on the syntax-semantics connection might be a fruitful step toward limiting the places where such power is to be expected.

2. What Subdeletion Deletes

The first section of Bresnan's paper is devoted to a demonstration that Subdeletion, whether or not it is collapsible with Comparative Deletion, is an unbounded deletion rule and cannot without significant loss of generalization be reformulated as a successive-cyclic movement rule followed by a local deletion rule. Chomsky (this volume) proposes two alternatives to Bresnan's formulation of Subdeletion, the choice between them resting on whether Subdeletion does in fact obey the Complex Noun Phrase constraint as Bresnan (1975) argued (and as she further argues in the present paper). Both of Chomsky's alternatives result ultimately in the removal just of the special representative of QP which he calls X, which corresponds to Bresnan's "X much" and "X many." If Subdeletion does obey the CNPC, then X is to be identified with or have the feature *wh*-, and is to count as a "bare" *wh*-, so that the Relativized A-over-A Condition does not apply to it; then Subdeletion will be treated as another case of *wh*-Movement and will obey all of the associated constraints without violating the relativized A-over-A condition. If Subdeletion does *not* obey the CNPC but is sensitive to some not yet understood conditions regarding complexity and parallelism of structure, then the designated element X is to be freely deleted (locally, in place) and the conditions of complexity and parallelism are to be built into the rules of interpretation. Let me call the first proposal "Bare *wh*-movement" and the second "free X-deletion in place." In the present paper Bresnan gives further evidence that Subdeletion obeys the CNPC, so that the "free X-deletion in place" proposal is not an appropriate alternative, and I will not discuss it further.

The other proposal, bare *wh*-movement, which Chomsky discusses in more detail, seems to me to rest on an unsuitable analysis of the deleted (or moved) element. Bresnan's analysis of comparatives treats the phrases *X much* and *X many* as phrases of the category QP (or Q triple-bar); the X is the specifier of the QP, as are *as*, *-er*, *so*, *that*, and *too*. Subdeletion always deletes at least *X much* or *X many* (I will return below to the cases where it apparently deletes more besides); it never leaves the *much* or *many* stranded. Now if *wh*- is attached to *X much* or *X many*, the result should be *how much* or *how many*. But Chomsky's bare *wh*-movement analysis depends on the unpronounceability of the bare *wh*-. Both Chomsky and Bresnan refer to the fact that the dialect that allows (1) below does not allow (2).

(1) *John is more courageous than what Bill is* (=Chomsky's (256))

(2) *John is more courageous than how Bill is intelligent*. (=Chomsky's (255)).

Bresnan (1975) suggests that such facts argue for the simultaneous existence within a grammar of closely related deletion and movement rules; the dialect in question permits a movement construction in place of Comparative Deletion but no movement construction, only a deletion, for Subdeletion. Chomsky attempts to account for the impossibility of (2) within a movement analysis on the basis of the lack of phonetic realization for a bare *wh*-. But if what must be moved is *wh*-*X many* or

wh-X much, what we really should expect to find in this dialect is not (2), but (3) or (4), depending on the formulation of *much*-deletion.

- (3) *John is more courageous than how much Bill is intelligent*
 (4) *John is more courageous than how Bill is intelligent.*

What is a reasonable form for the full adjective phrase, given the similarities of APs and NPs pointed out, for instance, in Ross (1969). The absence of a direct interrogative form for adjectives is unexplained, but the existence of interrogative *how much*, *how many* would certainly seem to argue against the unpronounceability of *wh-X much*, *many* as the explanation for the absence of any surface form to corroborate a movement alternative to Subdeletion.

I would like to know what has been found out about acquisition of comparatives, since I am fairly certain I have heard children use sentences like (5) and (6), which would further confirm the claim that if there were a movement alternative to Subdeletion, it should show up as (3) or (4), and that the absence of such forms confirms Bresnan's use of the Relativized A-over-A Condition to rule them out.

- (5) *I want more cookies than how many Sarah got.*
 (6) *I'm bigger now than how big I was last year.*

Whether there is relevant data from acquisition or not, the main point here is that Subdeletion deletes at least *X much* or *X many*, and that adding a *wh-* to them gives *how much* and *how many*, not an unpronounceable abstract form. To suggest that Subdeletion deletes something else, such as a bare *wh-* or *wh-* combined with some different abstract element, would require explaining away both syntactic evidence (such as the partitive remnants like *of the women* from *X many*) and semantic evidence, since Davis and Hellan (1975) provide an elegant semantics that operates on a syntactic structure exactly like Bresnan's in all relevant respects³ in which Comparative Deletion and Subdeletion are a single rule as in Bresnan (1975).

On Bresnan's view of Subdeletion, an even stronger argument against bare *wh-* movement can be constructed, since Bresnan gives examples in which the deleted material is more than *X much*, while less than the entire compared constituent. In the present paper, there are examples of the deletion of *X (much) large* (35), *X (much) large a number* (34), and *X (much) nearly* (36) (Bresnan omits the *much*, but I assume that is merely abbreviatory); further examples such as *X (much) phony* can be found in Bresnan (1975). If such examples, like (7) below, are indeed instances of Subdeletion, it follows that Subdeletion cannot be reanalyzed as either movement or deletion of just a single designated element; real lexical items are crucially involved.

- (7) *There isn't even as large a number of women as there was ___ a percentage of men.* (= Bresnan's (35))

However I do not regard this last kind of evidence as conclusive, because the deletion of these additional lexical items by Subdeletion conflicts with the hypothesis that rules of sentence grammar do not delete full lexical items under identity,

a hypothesis that Chomsky mentions (cf. note 61 in this volume) and one that I find very attractive and will appeal to in the following section. Bresnan (1975) suggests in a note that it is a separate rule (from Andrews, 1975b), not Subdeletion, that deletes *nuggets* in (8); I do not know whether the same or a similar rule could delete the entire material in the examples cited above, but that possibility needs further discussion.

- (8) *There aren't as many nuggets of gold in that jar as there appear to be ___ of pyrite.*

3. John is taller than Bill is tall

If Subdeletion deletes only *X much* or *X many*, and Comparative Deletion always deletes the entire compared phrase, then some of Bresnan's arguments in both the present paper and Bresnan (1975) are somewhat weakened; Subdeletion becomes less of a cross-categorical rule, since although it deleted QPs from NPs, APs, and AdvPs, it no longer would remove phrases of those kinds, only QPs. And it could not be collapsed so neatly with Comparative Deletion by the use of the Relativized A-over-A Condition in combination with the identity condition.

Chomsky's strongest argument against Bresnan's analysis of Subdeletion, in my opinion, is the fact that the Relativized A-over-A Condition, which is crucial in blocking (9) and (10),

- (9) **How many did John read ___ books?*
 (10) **How (much) is John ___ tall?*

also predicts the ungrammaticality of (11), which is in fact grammatical with emphatic stress.

- (11) *John is taller than Bill is tall.* (= Chomsky's (243a)).

A rebuttal to this argument would require showing that the second *tall* in (11), or what underlies it, is not in fact identical to the first *tall*, or what underlies it. I can think of two possible arguments of this sort, although neither one is without problems.

A. *EMPH as a morpheme.* The first possibility is that the head contains just *tall*, while the compared constituent contains *EMPH tall*, with the emphatic morpheme *EMPH* blocking identity. The reality of *EMPH* has been widely used to block affix-hopping and trigger DO-support (or block DO-deletion) in sentences like (12).

- (12) *Susan does like Tom.*

Similarly, it appears that Chomsky's obligatory rule of non-coreference can be blocked by emphatic stress on either occurrence of *John* in (13), or on *me* in (14).

(13) *John shot John*(14) *I want me to hand him the prize.*

Note that stress on the first *tall* instead of the second, as in (15), similarly makes a sentence like (11) well formed.

(15) *John is taller than Bill is tall.*

One crucial problem with this proposal is that it cannot account for the well-formedness of (16), with both *talIs* stressed.

(16) *John is taller than Bill is tall.*

(Here the preceding discourse should contain something like (17).)

(17) *John is fatter than Bill is heavy.*

If two occurrences of *EMPH tall* counted as identical, as we would suppose they should on this proposal, the second would be deleted and we would get (18), and be unable to generate (16).

(18) *John is taller than Bill is.*

To generate both (18) and (16) while preserving the Relativized A-over-A Constraint, (18) and (16) would have to have distinct sources. And taking all the combinations of *tall* with or without *EMPH*, there are only four possible source configurations and five distinct grammatical sentences (all mutually nonsynonymous), (11), (15), (16), (18), and the normally unemphatic (19).

(19) *John is taller than Bill is.*

The problem can be summarized as in (20) below.

- (20)
- | | | | | | |
|----|-----------------------------------|-------------|--------------------------|---------|-------------------------|
| a. | <i>J is taller than B is</i> | : | <i>er much tall</i> | | <i>x much tall</i> |
| b. | <i>J is taller than B is TALL</i> | : | <i>er much tall</i> | | <i>x much EMPH tall</i> |
| c. | <i>J is TALLER than B is tall</i> | : | <i>er much EMPH tall</i> | | <i>x much tall</i> |
| d. | <i>J is TALLER than B is</i> | : | <i>er much EMPH tall</i> | | <i>x much</i> |
| e. | <i>J is TALLER than B is TALL</i> | } ? | <i>er much EMPH tall</i> | | <i>x much EMPH tall</i> |

Note that (18) would be normal when preceded by (21):

(21) *John is heavier than Bill is; what is more, —.*

The difference between (16) (=20e) and (18) (=20d) is that in (16), the first *tall* and the second *tall* are in contrast with two different adjectives, e.g., *fat* and *heavy*; in (18), both (underlying) occurrences of *tall* are in contrast with the same adjective, e.g., *heavy*. This leads to the second hypothesis.

B. *Variables over adjectives*. Just as those who support a transformational analysis of e.g., reflexivization, now generally hold that it applies to variables and not to full lexical phrases, one might argue that Comparative Deletion and Subdeletion also operate on structures with adjective variables rather than full adjectives. Full Comparative Deletion would apply to a structure of the shape (22), Subdeletion to (23) or (24) (the latter a possibility on the assumption that both lexical adjectives and variables can be inserted in the base.)

(22) *John is -er much A₁ than Bill is x much A₁.*(23) *John is -er much A₁ than Bill is x much A₂.*(24) *John is -er much tall than Bill is x much heavy.*

On this account full Comparative Deletion could not apply to (23), but subsequent “quantifying in” of adjectives might happen to insert the same adjective for both variables, thus leading to a sentence like (16). The chart (25) below shows a possible analysis of each of the five sentences of (20), omitting the alternatives with direct insertion of adjectives; A₁' and A₂' refer to variables in preceding discourse.

- (25)
- | | |
|----|--|
| a. | (A ₁ : tall) (. . . . er much A ₁ x much A ₁) |
| b. | (A ₁ : tall) (A ₂ : tall) (. . . . er much A ₁ x much A ₂)
(A ₁ = A ₁ ' ; A ₂ ≠ A ₂ ') |
| c. | (A ₁ : tall) (A ₂ : tall) (. . . . er much A ₁ x much A ₂)
(A ₁ ≠ A ₁ ' ; A ₂ = A ₂ ') |
| d. | (A ₁ : tall) (. . . . er much A ₁ x much A ₁) (A ₁ ≠ A ₁ ') |
| e. | (A ₁ : tall) (A ₂ : tall) (. . . . er much A ₁ x much A ₂)
(A ₁ ≠ A ₁ ' ; A ₂ ≠ A ₂ ') |

(An interpretive variant of the same proposal could presumably be devised; cf. Cooper and Parsons, 1976, for analogous translation of Quantifier-Lowering into an interpretive scheme.)

Independent evidence for positing variables for adjectives can be obtained from the data discussed in Ross (1969), which includes examples such as (26) and (27), to which can be added examples with comparatives such as (28).

- (26) *John says that Mary is pretty, which she is.*
- (27) *John said that Mary is pretty, and she is that.*
- (28) *John is still pretty hard to talk to, but he is less so than he used to be.*

This sort of analysis seems somewhat plausible to me, and it would further support the hypothesis that rules of sentence grammar do not perform deletion under lexical identity, a hypothesis on which there seems to be welcome convergence from a number of different theoretical frameworks. But unless there is independent evidence for a variable corresponding to *nearly* in (29), or to *large a number* in (30), this analysis raises problems for Bresnan's treatment of Subdeletion as a cross-categorical rule deleting constituents of various intermediate sizes, although it would preserve the unity of Subdeletion with Comparative Deletion.

(29) *Your face, I judge, is more nearly oval than it is —ogival.*
(= Bresnan's (36))(30) *There isn't as large a number of women as there was — of men.*
(= Bresnan's (34))

4. Conclusion

In general, I find Bresnan's arguments extremely persuasive, and Chomsky's counterarguments less so. But in both of the arguments that I have discussed in some detail, quite a lot turns out to depend on whether Subdeletion can delete a constituent larger than *X much* or *X many* but smaller than the entire compared constituent. In particular, the claims that Subdeletion obeys the RAOAC and is a cross-categorical rule with respect to what it deletes both seem to depend on these intermediate size applications of Subdeletion, and the claim that Subdeletion is an unbounded rule is certainly much stronger if it has both of those properties. Since the best proposal I could think of to answer Chomsky's RAOAC objection, namely the treatment of adjectives as variables, seemed in turn to lead to a new objection to intermediate size Subdeletion, that aspect of the Subdeletion rule stands particularly in need of further study. However, the evidence still seems to favor Subdeletion strongly as a deletion rule over a variable, and not as a movement rule.

In closing, I should note that my comments above were all concerned with the nature of the Subdeletion rule itself, which is the subject of Part I of Bresnan's paper. Part II gives a strong independent argument for the existence of unbounded transformations by showing that the Complementizer Constraint on Variables (a reformulation of the Fixed Subject Constraint of Bresnan, 1972) is an important generalization and that there is no adequate substitute for it in a system that does not include unbounded transformations. Unless an alternative to the Complementizer Constraint on Variables can be found within Chomsky's framework, that constraint provides strong support for the existence of unbounded transformations even if some modification of the particulars of the rule of Subdeletion should prove to be necessary.

Acknowledgments

I wish to thank Emmon Bach for a great deal of profitable and enjoyable discussion of Bresnan's and Chomsky's present papers and for example (14). I am also grateful to Edwin Williams for numerous fruitful discussions that have helped me appreciate the extent to which convergence on particular issues is possible within the quite different frameworks of Montague grammar and the Revised Extended Standard Theory, and to Lars Hellan for lengthy discussions of the semantics of comparatives that he and Charles Davis have worked out.

Notes

1. *Tough-movement* as formulated in Partee (1975) is an unbounded movement rule whose interpretation is the identity mapping (i.e., it preserves meaning) and is hence a counterexample to the hypothesis suggested here. A reformulation that combined the effect of

- Tough-movement* and the Derived Verb Phrase Rule would not be, nor would a reformulation involving *wh*-movement (cf. Chomsky, this volume) if *wh*-movement were unbounded.
- Chomsky stated during the discussion period that *all* of the rules of interpretation at that level are unbounded. In that case, of course, no such direct analog of the suggested constraint would be possible.
 - The only point of disagreement is that Davis and Hellan find it preferable to posit the deep structure [*a* [*how big*] *man*] where Bresnan posits [*how big*] [*a man*]].