

COGNITION AND THE SYMBOLIC PROCESSES

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THREE BATONS FOR COGNITIVE PSYCHOLOGY

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This chapter, written by a linguist, is primarily for cognitive psychologists. It describes three major research areas whose results, I hope, will suggest parallel avenues for psychologists to explore in their investigations of the full set of mental phenomena. The topics of Sections 1–3 are abstract syntax, islands, and non-discrete grammars, respectively.

ABSTRACT SYNTAX

1.1 Syntax, the study of the laws that govern the structure of sentences, which specifies which of the set of all possible sequences of words in a language actually can be used by speakers of the language to communicate, and which specifies how speakers group these words together into constituents—this branch of linguistics was, until the late 1940's, a relatively neglected area.

I think it is accurate to say that the enormous proliferation of syntactic studies in the past decade can ultimately be traced to the work of Zellig Harris, whose previously elaborated theoretical structures, consisting largely of hierarchical groups of such postulated elements as phonemes, morphemes, and constituents, underwent a radical change when Harris attacked the problem of discourse (cf. Harris, 1952, 1963).

The primary problems confronting one who wishes to study discourse are knotty questions like these: Why do some sequences of sentences form paragraphs, while other sequences do not? Why do some sequences of paragraphs form chapters, and others not? Why can only some sequences of chapters form books? And why can sentences and larger units only be formed into cohesive larger units when they occur in a certain order? What are the constraints on possible orders? What kind of formal account can be given of such concepts as “subordination of one idea to another in a given text”?

While attempting to provide answers to such questions, Harris came to the conclusion that the item and arrangement theories which had sufficed for the study

of lower units in the speech chain—up to the level of the word, essentially — would have to be enriched by the addition of laws of a fundamentally different type: *syntactic transformations* (cf. Harris, 1957). This type of rule, which provides a formal reconstruction of the notions “related sentence,” is typically exemplified by the Granddaddy of Them All, the rule of *Passive*.

- (1) a. Gordon reviled the committee members.
b. The committee members were reviled by Gordon.

By postulating that both of the sentences in (1) are variants of one canonical syntactic form, Harris was able to achieve important results in studying the problem of cohesion in discourse. Put in simple terms, what Harris proposed is stated in (2).

- (2) Big sentences are syntactically made up of little sentences.

These “little sentences” Harris called “kernel sentences.”

An example of the factoring of a big sentence into little ones (Harris calls this “kernelization”) may prove instructive.

- (3) Having been believed by many fans to have been reviled by Gordon caused the committee members to reconsider their decision not to block his nomination by the Chief.
- (4) K_1 : Something (K_2) caused something (K_5).
 K_2 : Many fans believed something (K_3).
 K_3 : Gordon reviled the members.
 K_4 : The members belong to a committee.
 K_5 : Something (K_6) happened again.
 K_6 : The members considered something (K_7).
 K_7 : The members decided on something (K_8).
 K_8 : The members would not block something (K_9).
 K_9 : The Chief will nominate Gordon.

These kernel sentences, in Harris’s view, are actually existing sentences of English. The kernels of a language are of a finite length — they are usually quite short — and therefore their number, though large, is also finite.

Since English is infinite, however — that is, since we cannot give an upper bound on the length of an English sentence — these kernels must be combined with one another by processes which can be applied to their own outputs an unbounded number of times — *recursive*, or *iterable*, processes. Such processes would allow the finite number of kernels of any language to be projected into the infinity of its complex, or *surface*, sentences. Harris refers to these processes as *transformations*.

To take an example of a recursive process, let us consider the derivation of the noun *committee member*, which Harris might analyze as proceeding somewhat as in (5).

- (5) a. Gordon reviled the members who belong to a committee.
b. Gordon reviled the members belonging to a committee.
c. (*) Gordon reviled the to-a-committee-belonging members.
d. (?*) Gordon reviled the committee-belonging members.
e. Gordon reviled the committee members.

The derivation would start from the combining of two of the kernels of (3), K_3 and K_4 , into the main clause-subordinate clause structure of (5a) by what Harris calls a noun-sharing transformation — both of these kernels contain the noun *member*. Having been formed, the modified noun phrase (NP) of (5a) is then grist for the mills of a number of reduction transformations, the first of which participializes the relative clause [yielding (5b)], the second of which preposes the non-finite modifier [yielding an ungrammatical intermediate step, (5c)], the third of which compresses this modifier still further, yielding the still-awkward (5d), and the last of which gets rid of the predicate of the subordinated kernel, *belonging*.

That such processes must be able to apply to their own outputs, to chase their syntactic tails, as it were, can be seen from the fact that the derived noun *committee member* can itself appear as the first member of a compound like that in (6a), presumably to be derived from something like (6b),

- (6) a. Committee member committee
b. Committee which is for committee members

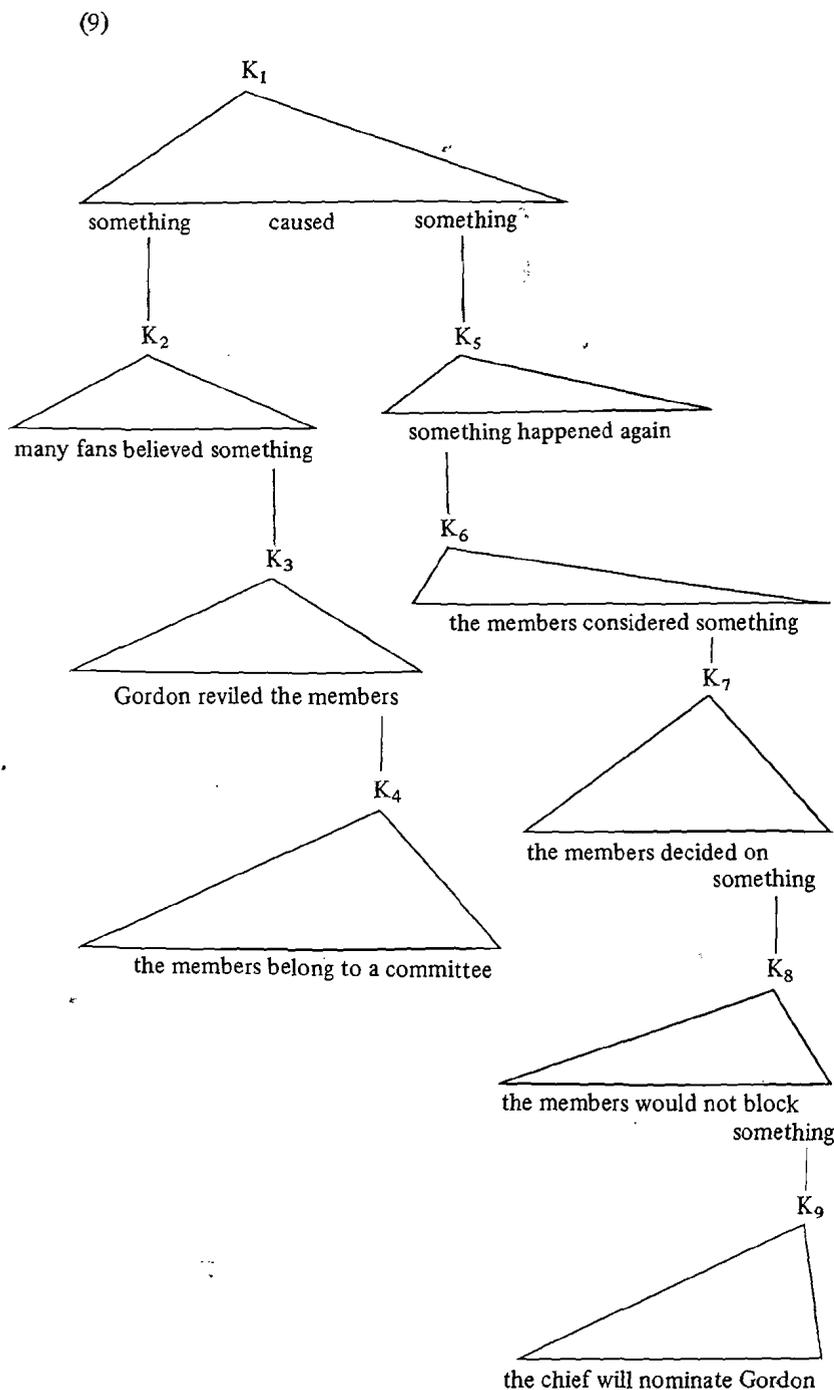
where (6a) can itself start a compound, as in (7a) [from (7b)],

- (7) a. Committee member committee member
b. Member who belongs to a committee member committee and onward and downward into the bureaucratic night.

It is clear that we need, in addition to the list of kernels given in (4), some means of indicating how they are to be combined, because often there are many combinations of the same set of kernels that will produce different grammatical surface sentences. For instance, if the two kernels underlying (5a) are combined in such a way that K_4 becomes the independent clause, and K_3 the dependent one, then sentence (8) would result.

- (8) The members who Gordon reviled belong to a committee.

I have indicated some of the subordinations which are necessary to convert the unordered set of kernels in (4) into (3) by the expository device of appending to each *something* which will become the site for the embedding of one of the other kernels a parenthesized appositive giving the number of the kernel to be embedded. The hierarchical tree structure of (9), in which triangles are abbreviations for the more detailed structures which could be provided for each individual kernel, is a graphically more perspicuous equivalent of this notation.



It is easy to adduce evidence for the syntactic correctness of the kernelization sketched in (4)/(9). One example is the fact that if an emphatic reflexive pronoun is inserted before *been reviled* in (3), the pronoun *themselves* produces a grammatical sentence, while the pronoun *himself* does not.

- (10) a. Having been believed by many fans to have $\left\{ \begin{array}{l} \text{themselves} \\ \text{*himself} \end{array} \right\}$ been reviled by Gordon caused the committee members to reconsider their decision not to block his nomination by the Chief.

This is easily explicable on the basis of the fact that in the course of deriving (3) from (4), one transformation would passivize K₃, converting (1a) into (1b). And the possibilities for the occurrence of emphatic reflexives in (1b), which are shown in (11), exactly mirror those of (3), the sentence whose derivation (1b) is a part of.

- (11) The committee members were $\left\{ \begin{array}{l} \text{themselves} \\ \text{*himself} \end{array} \right\}$ reviled by Gordon.

In other words, the kernelization of (3) is syntactically justified on the basis of the fact that simple syntactic laws ["emphatic reflexive pronouns follow the noun phrases (hereafter "NP's") they modify"] are statable only in terms of the "little sentences" [and their products – passives like (1b), middles like (12b), datives like (13b), flips like (14b), etc.] which are presupposed by the analysis.

- (12) a. Sophomores can easily translate sonatas.
b. Sonatas translate easily for sophomores.
(13) a. I read 2/3 of my thesis to Harold.
b. I read Harold 2/3 of my thesis.
(14) a. I was lucky that you forgot the password.
b. That you forgot the password was lucky for me.

Let us take the case of the distribution of emphatic reflexives as a down-payment on a full presentation of the evidence which could be given in support of the correctness of (2) and pass on to a second, closely related, insight of Harris's: (15).

- (15) Meanings of big sentences are semantically made up of meanings of little sentences.

In other words, kernelization, which is justified on syntactic grounds, provides a semantic, as well as a syntactic, decomposition. This is so obvious, even in the face of the tremendous difficulties posed by any attempt to arrive at a precise formal theory of meaning, as to require almost no comment. To give just one example, it is evident that in whatever kind of formal object one might choose to represent the meaning of (3), the entities designated by the NP *the committee members* must be characterized as bearing the semantic relation of *object* to the past participle *reviled*. But precisely this is also true of the kernelization in (4)/(9).

I will not review here the great strides that have been made in semantics in the past decade, all, I would argue, traceable to Harris's second pioneering insight, (15), but will instead pass on to a third profound insight, (16), which seems to me to be the clear source for the resurgence of interest in questions of universal grammar in recent years.

- (16) The grammars for the kernels of any two languages are far more similar than are the grammars of their surfaces.

That is, carrying out transformational analyses of widely divergent languages will yield kernelizations of corresponding sentences¹ whose differences are confined, largely to differences in the order of the elements in the kernels.

Investigation of this hypothesis has also revealed that the transformations needed in any single language to convert a kernelization into a surface sentence of that language will show great similarities to the transformations necessary to produce surface sentences from corresponding kernelizations in other languages. In other words, it is not merely the case that kernelizations of corresponding sentences are highly similar — the same is true of the derivations by which these proceed to their (dissimilar) surface structures. The method of transformational decomposition has led to the discovery of many new and hitherto unperceived axes of similarity among the languages of the world, and has made possible a much more restrictive characterization than could have been attempted before of the notion "possible human language."

1.2 In the renaissance of syntactic and semantic studies that have grown out of Harris's three fundamental insights, a new conception of the nature of language which emerged from the work of Noam Chomsky, a student of Harris', has had an equally potent impact. Chomsky's idea was to regard a natural language as an infinite set of strings on a finite alphabet (of phones, phonemes, morphemes, or words) and to regard a grammar of a language as a rewriting system, a formal device of a general type that was in the process of exploration by mathematicians and logicians, which would generate, or produce, all and only the members of this set in a totally explicit and algorithmic way. Chomsky's theory was, therefore, a kind of synthesis between Harris's transformational analyses and metamathematics. The degree of rigor and precision with which arguments could be framed and concepts defined in Chomsky's theory of generative grammar led to the framing of and discovery of many answers to questions that had not even been clearly formulable

¹By this term, I mean the following. Two synonymous sentences in different languages would be corresponding sentences only if they contained roughly equivalent lexical items. Thus (i) and (iii) would be corresponding sentences, but not (ii) and (iii).

- (i) Fritz is trying to find Michael.
 (ii) Fritz is looking for Michael.
 (iii) Fritz versucht, Michael zu finden.
 tries to find

Much more could be said about this notion, but I think its intent should be clear enough for the present discussion.

in linguistic discussion prior to the advent of generative grammar. It is impossible, in an article with the limited scope of the present one, to indicate adequately the size of the great leaps in our understanding of linguistic organization — not only in syntax, but also in phonology, semantics, and linguistic change — which were a consequence of this synthesis.

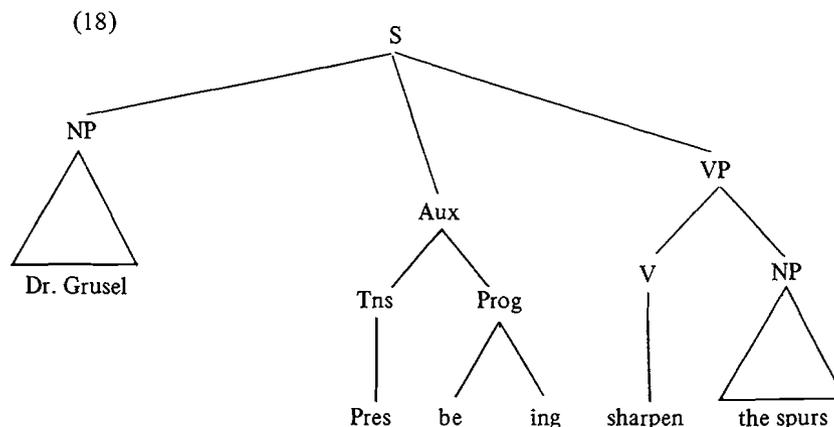
1.3 Of central importance both in Harris's transformational analysis and in Chomsky's generative grammar is the distinction between surface structure, which corresponds more or less directly to articulatory events, and an abstract level of representation, which Harris called the kernelization of a sentence, and which Chomsky called its *deep structure*, which is related to such articulatory events in a complex way. To take one concrete example, in the surface structure of (3), the phonetic sequence [membr], *member*, occurs only once, while the NP corresponding to this sequence occurs in K_3 , K_4 , K_6 , K_7 , and K_8 in the deep structure of (3). Clearly, then, these phonetically non-manifested occurrences have to be removed in the passage from deep structure to surface structure, by one or more deletion transformations.

The abstractness of the deep structure of any sentence is measured by the number of transformations in the derivation that starts with that deep structure and ends with the sentence in question. One result of the last 5–10 years of syntactic investigation has been the discovery of evidence for increasingly abstract deep structures. That is, as more research was done on the syntactic organization of classes of sentences, the derivations that had previously been thought adequate for these sentences seemed to require lengthening. Some examples may help to make this point clear.

Consider a causative sentence like (17).

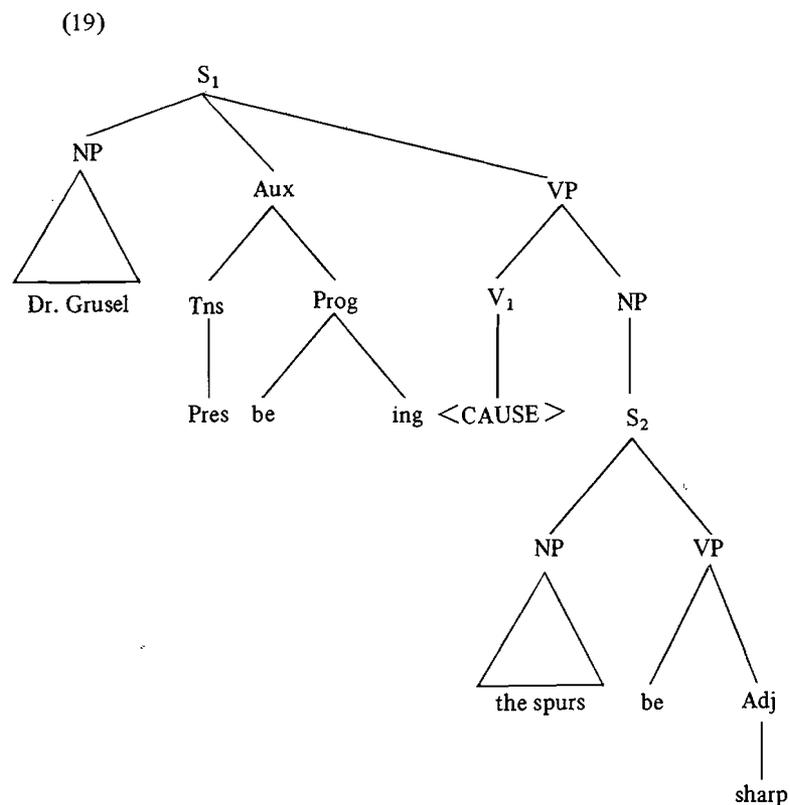
- (17) Dr. Grusel is sharpening the spurs.

The deep structure which would, around 1965, the time of Chomsky's *Aspects of the Theory of Syntax*, have generally been assumed to underlie (17) is shown in (18).



The derivation of (17) from (18) was extremely short – the only transformations were one of agreement, to inflect the tensed part of the sentence with a morpheme indicating the grammatical number of the subject, and one called *Affix Hopping*, which attached the participial suffix-*ing* to *sharpen*, and the present tense morpheme to the auxiliary *be*.

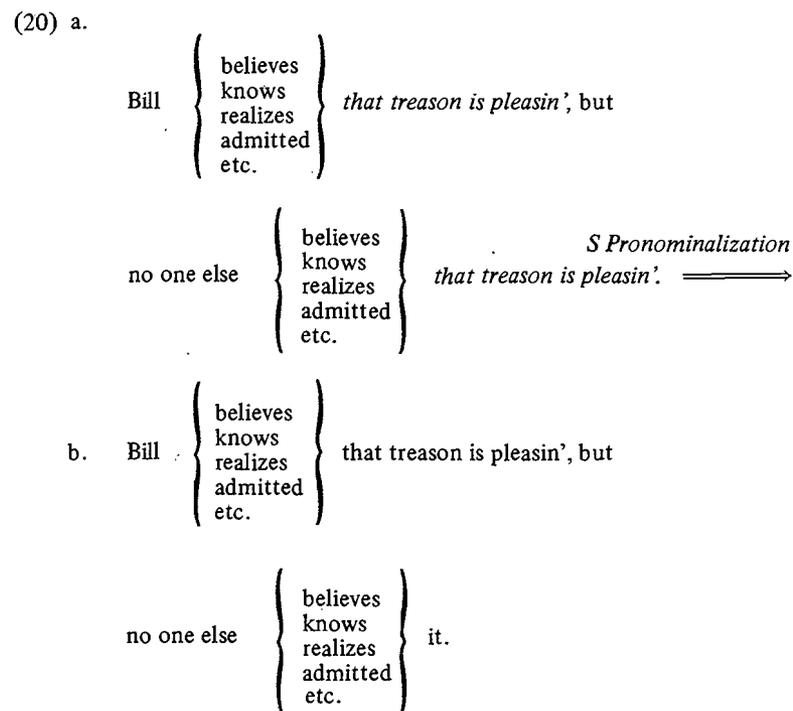
The first step away from surface structure was the reanalysis of causative verbs proposed by Lakoff (cf. Lakoff 1971) shortly after the completion of *Aspects*. Lakoff argued that verbs like *sharpen*, *harden*, *reddden*, *break*, etc. had to be syntactically decomposed into (at least) a causative matrix verb and an embedded kernel which contained the non-causative core of the causative verb's meaning². Thus (18) would be split into the two clauses of (19).



²Lakoff also argued that many causatives have to be factored into yet another clause, one whose main verb is an inchoative, with a meaning akin to "come about." That is, a more complete factorization of *sharpenX* would be CAUSE (COME ABOUT (SHARP X)). For our purposes, however, this refinement can be omitted.

The deep structure in (19) would be converted into the now intermediate structure of (18) by a rule Lakoff referred to as *Plugging-In*, which would adjoin the embedded predicate *sharp* to the left of the abstract predicate CAUSE in (19) obliterating all traces of the embedded clause *S*₂ (by pruning), and making the NP *the spurs* the derived object of the new compound predicate. This compound predicate would later, by morphophonemic rules, be realized as *sharpen*.³

One piece of evidence for the correctness of Lakoff's causative analysis concerns the behavior of the pro-form *it*, when it functions as a pro-sentence, as in (20b), which derives from (20a) by the operation of a rule of *S Prenominalization*.⁴



This rule operates to replace the complement objects (or subjects) of certain predicates by *it*, when these complements are identical to a sentence elsewhere in

³In McCawley (1968), an improved formulation of the rule of *Plugging-In* is given. This rule, rechristened *Predicate Raising*, is also discussed at some length in Postal (1970a).

⁴For a formulation of this rule, cf. Ross (1972b).

the text. Thus, since the italicized object complements in (20a) are identical, this rule can convert the second one to *it*.

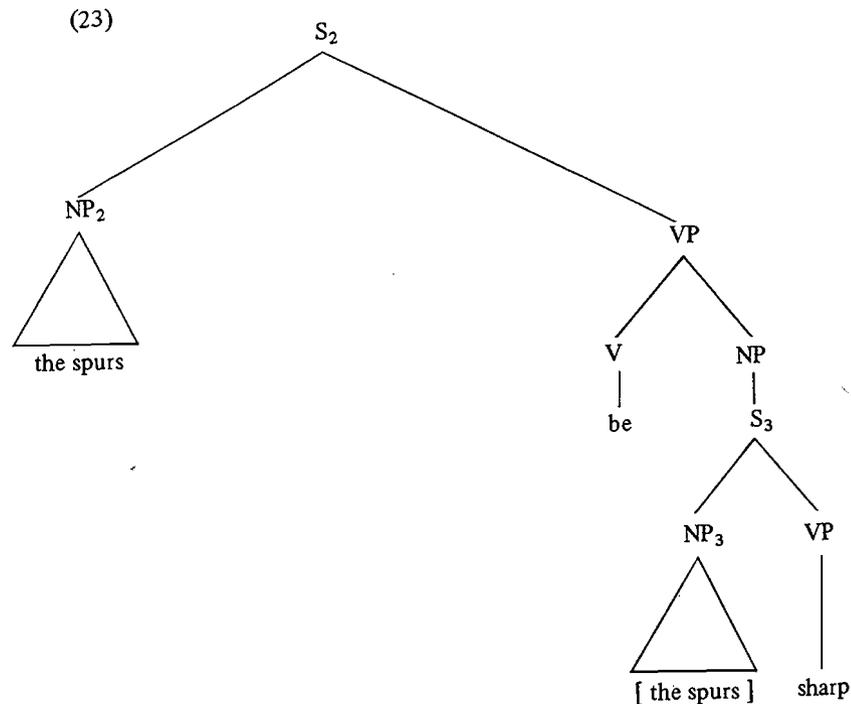
Now let us examine how this rule applies to such sentences as (17). Consider (21).

- (21) Dr. Grusel is sharpening the spurs, but it may take him hours to bring it about.

What is the antecedent of the *it* in (21)? Evidently, it must be some clause like (22),

- (22) The spurs are sharp.

not the whole of (17). But if this *it* is to result from an application of the rule of *S Pronominalization*, the structure underlying (17) must contain a clausal structure like (22). Since such a clause is not available if (18) is the deepest structure underlying (17), but is if the more abstract (19) is assumed, the *it* of (21) provides support for Lakoff's causative analysis.⁵



⁵This analysis is not uncontroversial. Cf. Chomsky (1972) and Fodor (1970) for some critical comments, and Lakoff and Ross (1972) and McCawley (1973) for some replies.

The next increase in abstractness was proposed in Ross (1969a). I argued that in deep structures, all adjectives should be analyzed as being the nominal complement objects of a main verb *be*, as suggested in the diagram in (23).

Since the *be* in (23) is an equi-subject verb⁶, the rule of *Equi*⁷ will obligatorily delete NP₃, under identity with NP₂, and other trivial rules will convert the resulting structure into the structure underlying (22).

Two of the reasons cited in Ross (op. cit.) for assuming that adjectival sentences like S₂ in (19) must be given the more abstract analyses of (23) are the following. First, *S Pronominalization*, and closely related rule, *So Pronominalization*, which also replaces a complement in non-subject position by a pro-form, *so*, under conditions of identity,⁸ both treat adjectives as if they were derived from clauses, as can be seen from the conversion of (24a) to (24b).

- (24) a. Parents want one to be *polite*, but being *polite* is often very difficult.
 b. Parents want one to be polite, but being $\left. \begin{array}{c} \text{so} \\ \text{it} \end{array} \right\}$ is often very difficult.

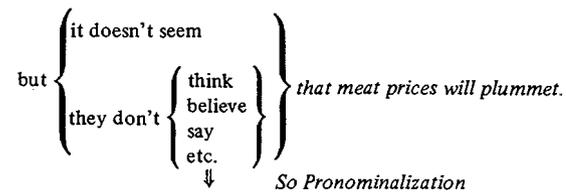
It is still a mystery as to why these processes of proadjectivization are so limited in English. In German and French, for instance, such sentences as those in (25), which have been produced by the operation of *S Pronominalization*,

⁶Cf. Perlmutter (1971) for discussion of this term.

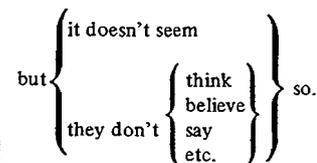
⁷This rule is discussed in great detail in Postal (1970b).

⁸This latter rule would thus convert any of the sentences in (i) below the corresponding shortened sentence in (ii).

- (i) It is possible that meat prices will plummet.



- (ii) It is possible that meat prices will plummet,



The operation of this rule is mysterious in various ways (After what predicates can it operate? Why can this *so* not appear in subject position? What relation does this *so* bear to the various other more adverbial *so*'s which English abounds with? And so on.), but these need not concern us here.

- (25) a. Hans ist fleissig, aber ich bin es nicht.
 Hans is diligent but I am it not.
 'Hans is diligent, but I'm not.'
- b. Jean est paresseux et elles le sont aussi.
 John is lazy and they (fem) it are also.
 'John is lazy, and they are too.'

are flawless, but the corresponding sentences in English, whether involving *S Prenominalization* or *So Prenominalization*, are hopeless: Cf. (26).

- (26) a. *Hans is diligent, but I'm not $\left\{ \begin{array}{l} \text{it} \\ \text{so} \end{array} \right\}$.
- b. *Jean is lazy, and I'm $\left\{ \begin{array}{l} \text{it} \\ \text{so} \end{array} \right\}$ too.

Apparently, these pro-forms can never appear after finite forms of *be*, and not even after all non-finite forms, either. Cf. (27).

- (27) a. He's not tall now, but he must have been $\left\{ \begin{array}{l} \text{so} \\ \text{*it} \end{array} \right\}$ earlier.
- b. I'm not rich, but I will be $\left\{ \begin{array}{l} \text{?*so} \\ \text{**it} \end{array} \right\}$ some day.

Also unexplained is the fact that *it* is so much worse than *so* as a pro-adjective.

Nonetheless, whatever the answers to these questions may turn out to be, the fact that such sentences as (24) exist lends support to the abstract analysis of (23), because only under such an analysis could a maximally general formulation of the two pronominalization rules discussed above be retained.

A second argument for postulating the abstract structure in (23) as the source of adjectival clauses can be derived from the syntactic behavior of appositive clauses. As can be seen from (28), these can be adjoined to NP's,

- (28) a. [The fourth plant]_{NP}, which was carnivorous, swayed seductively.
- b. [That martial law will be declared]_{NP}, which is a distinct possibility, is very disquieting

and as (29) suggests, they cannot be adjoined to such obviously non-nominal constituents as verbs, prepositions, and *not*.⁹

- (29) a. *Tom may resemble, which I ϕ Janet, your geometry teacher.
- b. *BMW's are from, which Datsuns are ϕ Japan, the Federal Republic of Germany.
- c. *Not, which I did ϕ read your letter, many people like fleas.

Now note that one can find appositive clauses modifying adjective phrases. Cf. (30).

- (30) a. Marcel is [fond of eating], which Sally is not.
- b. These facts are [inconsistent with my theory], which I wish they weren't.

It should be emphasized that appositives can only modify whole adjective phrases, not their adjectival heads by themselves. Cf. *(31).

- (31) a. *Marcel is fond, which Sally is ϕ of drinking, of eating.
- b. *These facts are inconsistent, which I wish they were ϕ with your theory, with my theory.

Thus I conclude from such sentences as those in (30) that it is necessary that adjective phrases be dominated in deep structure by an NP for the appositive clause to modify, as is the case in the abstract analyses shown in (23).

Thus far, I have given two sets of arguments which suggest that (18) should be replaced by a structure which is more abstract in that it would contain two clauses which are subordinate to the main verb *sharpen*, or rather to the causative abstract verb which is contained in *sharpen*. Speaking pictorially, we could say that (32), which gives the approximate replacement for (18), has been made more abstract "below" *sharpen*.¹⁰

(32) [See page 76.]

In the four sets of arguments to follow, I will attempt to demonstrate that (18) must also be made more abstract "above" *sharpen*.

To this end, consider the behavior of the verb *do* in (33).

- (33) Dr. Grusel is sharpening the spurs, and he is panting heavily while he is doing $\left\{ \begin{array}{l} \text{it} \\ \text{so} \end{array} \right\}$.

The fact that *do* can be followed by both the pro-form *it* and the pro-form *so* suggests that it might be a verb with a complement object, which object had been pronominalized either by the rule of *S Prenominalization* or by the rule of *So*

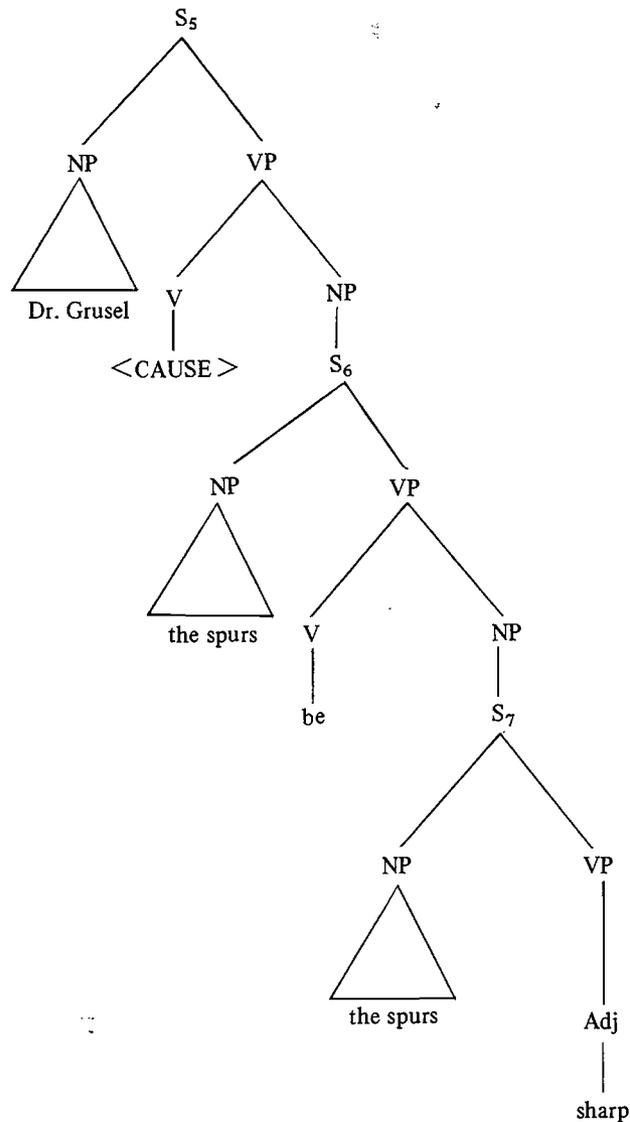
⁹The ' ϕ ' symbols in (29) are to indicate where the words *resemble*, *from*, and *not* would have stood in the sources of the appositive clauses in which these symbols appear.

¹⁰The reason for the particular choice of subscripts in (32) will become clear by the end of Section I.

pronominalization If so, *do* would be like such verbs as *believe*, *guess*, *expect*, *say*, *imagine*, etc., which also allow either pro-form to replace their objects.

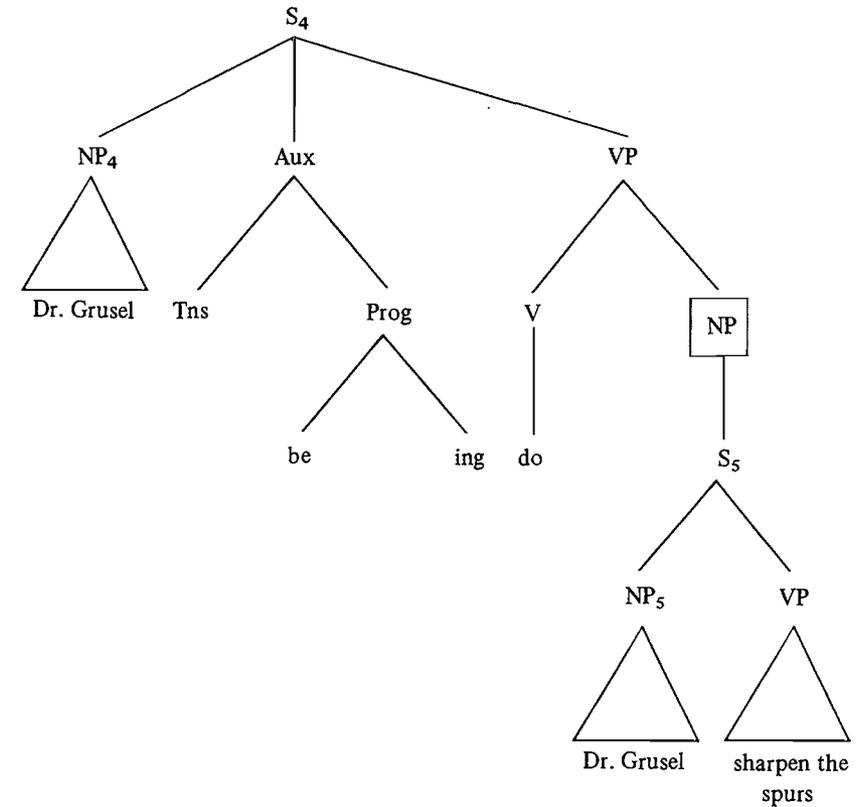
But if these pro-forms in (33) have been produced by a pronominalization transformation, what was the structure of the *while*-clause of (33) before the

(32)



pronominalization took place? Evidently, it must have contained something like the structure shown in (34).

(34)



If S_5 in (34) is replaced by *it* or *so*, under identity with a preceding clause, structures like the *while*-clause of (33) will emerge. But what will happen to (34) if no pronominalization can take place?

Obviously, if *do* is a verb which can appear in deep structure with a complement, it will be necessary to specify that it, like the *be* of (23), is an equi-subject verb. Thus *Equi* will always apply to delete the NP in the position of

NP₅ under identity with the one in the position of NP₄. The structure that would result would, depending on what complementizer had been chosen, be one of the strings in (35).

- (35) a. *Dr. Grusel is doing [sharpening the spurs]_{NP}
 b. *Dr. Grusel is doing [(to) sharpen the spurs]_{NP}

While none of these are grammatical, there are independent indications that some such structure is necessary. First of all, the boxed NP of (34) could be the NP to which the appositive clause of (36) has been adjoined.

- (36) Dr. Grusel is sharpening the spurs, which he shouldn't be doing.

Secondly, there is a process in English called *Topicalization* which has the effect of moving to the front of a sentence an NP which is being focused on. Thus "regular" NP's, *that*-clauses, and adjective phrases, which I have argued above are all dominated by NP, can all be topicalized, as in the conversion of the sentences in (37) to the corresponding ones in (38).

- (37) a. I've never liked chawing on [Benson and Hedges]_{NP}.
 b. We never realized [that Riley was a Rigellian anthroflant in disguise]_{NP}.
 c. Proust was never considered to be [outgoing]_{NP}.
 (38) a. [Benson and Hedges]_{NP} I've never liked chawing on.
 b. [That Riley was a Rigellian anthroflant in disguise]_{NP} we never realized.
 c. [Outgoing]_{NP} Proust was never considered to be.

As we would expect, the nominal object complement of *do* can also, in some dialects, be topicalized, producing such sentences as those in (39).

- (39) a. [Sharpening those spurs]_{NP} I just will not do!
 b. [Writing thank-you notes]_{NP} most children don't like doing.

One final piece of evidence for the postulation of such structures as (34) is provided by passive sentences like (40a), which would be derived from such

ill-formed strings as (40b), which is ungrammatical in the same way as the sentences in (35) are.

- (40) a. Sharpening the spurs should not be done by someone as easily excitable as Dr. Grusel.
 b. *Someone as easily excitable as Dr. Grusel should not do [sharpening the spurs]_{NP}.

Thus we see that there are a number of reasons for postulating that *sharpening the spurs* in (17) derives from the complex verbal structure shown in (34). But how are the structures in (35) converted into the well-formed (17)?

In Ross (1972a), where the above arguments for the existence of a higher *do* are developed more fully, it is suggested that the rule which effects the deletion of this *do* is to be identified with *Predicate Raising*. Whether or not this independently motivated rule can be made use of in converting (35) to (17), the point which is of relevance for the present context is that the syntactic behavior of the verb *do* also requires a more abstract representation of (17) than (18).

The next verb above *do* is *happen*. This is argued for by such pseudo-cleft sentences as (41).

- (41) What is happening is [that Dr. Grusel is sharpening the spurs]_{NP}

The general regularity to be noted about pseudo-cleft sentences is that the clefted constituent, i.e., that constituent which follows the verb *be*, is an NP which would yield a sentence if it were put into the *wh*-clause that is the subject of the pseudo-cleft sentence in the same place that the *wh*-word occupied in deep structure. That is, if we represent the structure of pseudo-cleft sentences by the formula shown in (42),

$$(42) \left[\begin{array}{c} wh \\ \text{pro-Y} \end{array} \right] X \phi Z \text{ be } Y$$

then it must be the case that Y is an NP, and that XYZ would form a sentence.¹¹

¹¹There is a fascinating and little-studied class of counterexamples to this latter claim – so-called amnesties, like the sentences in (i) and (ii) [note the ungrammaticality of the XYZ counterparts in (iii) and (iv)].

- (i) What I want is that he be tickled mercilessly.
 (ii) What he achieved was doubling the voter participation in 3 years.
 (iii)* I want that he be tickled mercilessly.
 (iv)* He achieved doubling the voter participation in 3 years.

These cases, in which a complementizer selection that would star a string in isolation can be "amnestied" under clefting, do not detract from the importance of the generalization that XYZ in (42) normally constitute a well-formed clause.

That Y can be any of the types of NP that we have investigated thus far – namely, “regular” NP’s, *that*-clauses, adjective phrases, and activity VP’s – can be seen by inspection of the examples in (43), and of their respective XYZ forms in (44).

- (43) a. What he is peering into is [a cored onion]_{NP}.
 b. What he forgot is [that his creepy-peepy was on when he went to the sandbox]_{NP}.
 c. What Mr. Milquetoast never was was [arrogant]_{NP}.
 d. What you should be doing is [shoeing your horse]_{NP}.
- (44) a. He is peering into a cored onion.
 b. He forgot that his creepy-peepy was on when he went to the sandbox.
 c. Mr. Milquetoast never was arrogant.
 d. *You should be doing shoeing your horse.¹²

Now let us return to the pseudo-cleft sentence in (41). By what I have said above, its XYZ form, (45), should be grammatical.

- (45) *That Dr. Grusel is sharpening the spurs is happening.

Since it is not, we must conclude either that the XYZ generalization above must be abandoned, or that some process applies to get rid of the *that* and *is happening* in (45), converting it into (17).

It seems to me that in this case, the latter conclusion is the correct one, because there is an additional class of sentences that confirms the necessity of postulating a higher *happen* above all verbs that denote events. These are what I have called¹³ “equative” sentences – such sentences as those in (46).

- (46) He tossed something interesting to them:
 X NP₁ Y
 he tossed a New Hampshire pineapple to them.
 X NP₂ Y

As suggested by the symbols under the words of (46), such equative sentences may have the form shown in (47).

- (47) X NP₁ Y: X NP₂ Y

Where NP₂ must be “more specific” (whatever formal sense can be given to this intuitively obvious characterization) than NP₁.

In any equative sentence of the form of (47), an optional rule of *Equative Deletion* can delete those parts of the post-colon clause which are identical to parts of the pre-colon clause, namely X and Y. That is, this rule can convert sentences of the form (47) to those of the form shown in (48).

- (48) X NP₁ Y: NP₂

For example, applying this rule to (46) would cause *he tossed* (= X) and *to them* (= Y) to be deleted, producing (49) as an output.

- (49) He tossed something interesting to them: a New Hampshire pineapple.

When we examine the other types of NP₂ that can follow the colon in sentences of the form of (48), we again find the same class of constituents that we have encountered before. Cf. (50).

- (50) a. He said something interesting to us: [that mangoes were tart]_{NP}.
 b. He turned out to be something quite unexpected: [so generous to his subordinates that they loved him]_{NP}.
 c. We may do something quite dangerous: [fry eggs on the Autobahn]_{NP}.

Turning our attention now to *happen*-sentences, consider (51).

- (51) Something creepy is happening: [(?*that) Dr. Grusel is sharpening the spurs].

¹² As discussed above, this structure would obligatorily be converted into (i) by either the rule of *Predicate Raising* or some equivalent process.

(i) You should be shoeing your horse.

¹³ Cf. Ross (1969a) and Ross (1972b).

I am at present unable to account for the badness of (51) if *that* appears, but there are structures in which the colon is followed by such adverbs as *namely* or *for example*, which I take to have an analysis that is identical in all important respects to that of the equative sentences considered so far,¹⁴ and these structures can manifest a *that*-clause after the colon. Cf. (52).

(52) Something creepy is happening: namely, (that) Dr. Grusel is sharpening the spurs.

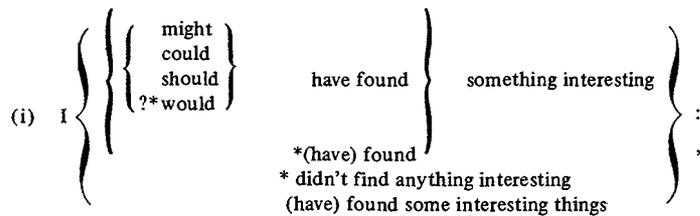
The feature of this sentence that makes it of interest in the present context is the fact that *that* can appear in the second clause. Note that this is by no means always true in all two-clause sentences whose clauses are separated by a colon, as (53) shows.

- (53) a. Prices shot up: (*that) the depression began.
- b. Plants must be watered: (*that) they can't survive on love alone.

Nor is it the case that all sentences of the form (48) can have a *that* inserted after the colon, as (49') and (50') show.

(49') *He tossed something interesting to them: that a New Hampshire pineapple.

¹⁴Note, for instance, the fact that all of the sentences of the form (48) – namely, those in (49) and (50) – can have a *namely* inserted immediately to the right of the colon. The same is true, by and large, for adverbs like *for example*, except that with this adverb, some mysterious (semantic?) conditions must be met. Thus observed the contrasts in (i)



for example, a pre-Cambrian walnut.

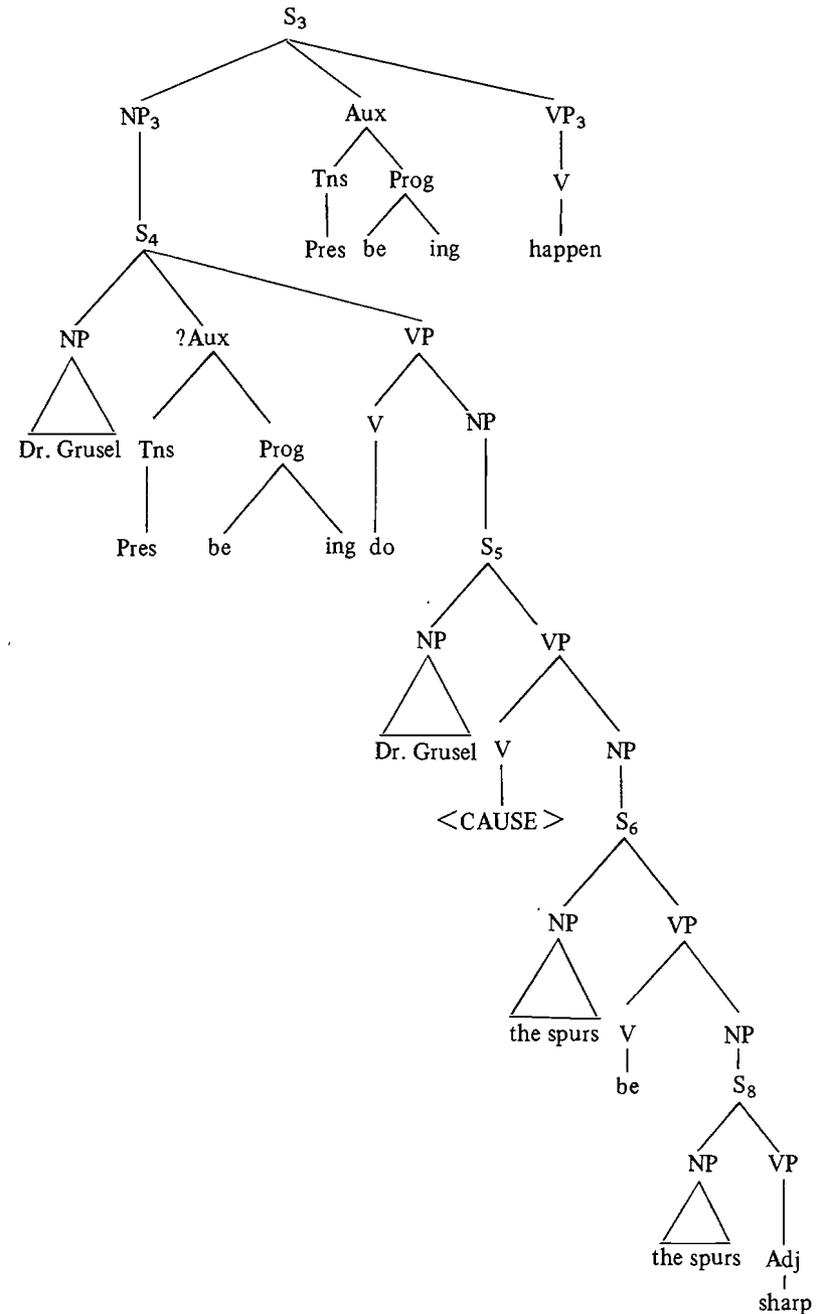
All sentences of the full form (49) which include either *namely* or *for example* [cf. (ii)],

(ii) ?? He might find something interesting:

{ namely
for example }, he might find some used water.

have, to my ear, a distinctly low-faluting ring.

(54)



- (50') a. *He said something interesting to us: that that mangoes were tart.
 b. *He turned out to be something quite unexpected: that so generous to his subordinates that they loved him.
 c. *We may do something quite dangerous: that fry eggs on the Autobahn.

The generalization that governs sentences of the form of (48) which contain the complementizer *that* is quite simple: NP₂ in (48) can only start with this complementizer if it is the complement of some predicate in X or Y which takes *that*-clauses.¹⁵ Thus NP₂ in (50a) can start with *that* because this NP is the complement of the verb *said*, which takes this type of complement.

The force of this generalization is quite clear: In order to account for the *that* in (52), we must assume that the predicate in Y of (52), namely *is happening*, can take *that*-clauses, i.e., that such structures as (45) are underlyingly well-formed, as was suggested by the grammaticality of the pseudo-cleft sentence in (41). But if it is underlyingly well-formed, some process must exist which converts it into a well-formed surface structure. I will assume, for the present, that this is a simple rule of deletion, which gets rid of *that* and *is happening*, converting (54), the structure which incorporates all of the abstractness arguments that I have presented to date, into (eventually) (17).

It may turn out that no special deletion rule is necessary – that the rule of *Predicate Raising* can be stated in such a way as to effect the merger of *happen* and *do*. Alternatively, it may turn out that there is no deletion rule at all, but that there is instead a global filter¹⁶ which stars any surface structure in which the node that corresponds to the deep subject to *happen*, NP₃ in (54), for instance, is still a highly sentential¹⁷ complement. If this suggestion proves superior to the postulation of a deletion rule,¹⁸ then, while it would still be correct to claim that such structures as (54) are underlyingly well-formed, it would not be necessary to postulate the existence of a higher *happen* above every event predicate. Given our present limited understanding of the extremely complex syntax of *happen*, we may continue to regard this as an open question, perhaps, despite the extreme difficulties that the examples discussed in footnote 18 above pose for any deletion analysis.

¹⁵As with pseudo-cleft sentences, this claim must be stated with somewhat greater care, to make allowances for amnesty cases like (i), for those dialects that accept such strings.

(i) ? I want something quite simple: that he be tickled mercilessly.

The general point at issue is unaffected by such sentences, however.

¹⁶The necessity of expanding linguistic theory to include global, or non-local, processes was first argued for in Lakoff (1970b). For further refinements, cf. Postal (1972).

¹⁷The need for referring to various types of complements as being ordered with respect to a quantifiable predicate of sententiality (or non-nouniness) is argued for in Ross (in press). Cf. also Section 3 below.

¹⁸One reason for thinking that a deletion rule may prove to be unfeasible is the possibility of its environment being destroyed by some number of applications of the rule of *Raising* which could have the effect of moving NP₃ and VP₃ in (54) indefinitely far apart, producing
 (This footnote continued on page 85.)

I now move to a brief scrutiny of the status of the auxiliary. In Ross (1969b), I presented a number of arguments that suggest that the node *Aux* is not a necessary member of the set of non-terminal phrase nodes admitted in the theory of universal grammar, and that what had previously been classified as auxiliaries should instead be regarded as being main verbs which were defective in a variety of ways (e.g., in that they could not all appear in non-finite contexts, or did not exhibit the full range of verbal inflections). In Ross (1972a), I presented another argument which reinforced this conclusion, especially with respect to the status of the progressive auxiliary *be*.

The evidence in this latter argument turns on the fact that in some cases, a doubling sequence – i.e., one of the form X + V₁ing + V₂ing + Y – is ungrammatical. In (55), some ungrammatical doubling sequences are shown, and in (56), some grammatical ones.

- (55) a. Fritz { keeps / *is keeping } looking at you.
 b. When { will you stop / ??* are you stopping } seeing him?
 c. We { continued / ??are continuing } having problems with the equine lead.
- (56) a. I can't imagine people who are *sleeping biting* me.
 b. Your *having quitting* classes to justify is a problem.
 c. I tried *drinking, running* five miles, and then studying. but nothing cheered me up.

The hypothesis that I advanced for the cause of the ungrammaticalities of (55), in the face of the grammatical sentences of (56) is that *doubling sequences only*

such sentences as (i), which are ungrammatical, but which cannot be deleted into grammaticality.

- (i) [That Dr. Grusel is sharpening the spur] NP₃
 is expected [to be happening] VP₃
 seems
 etc.

These could not be avoided by making the *Happen-Deletion* rule cyclic or pre-cyclic, for the *happen* must remain present until the rule of *Equative Deletion*. This latter rule could not itself be made precyclical, because of the necessity of applying it to cyclically produced sentences, such as passives, so that the passive *by* can appear after the colon in such sentences as (ii).

- (ii) The crown was fondled by someone avaricious: by Greta Mingle.

And if *Equative Deletion* is cyclical, a cyclical rule deleting *happen* would apply to the right-hand clause of (52), a cycle before the former rule could apply to save the complementizer *that*.

cause violation when V_2 is the main verb of the complement of V_1 .¹⁹ If this hypothesis is correct, and I know of no counterexamples to it, then the fact that (57b) is ungrammatical

- (57) a. That he is goofing off is reprehensible.
- b. *His *being* goofing off is reprehensible.

implies that the doubling sequence contained in this sentence must be an instance of a verb and its complement both appearing as present participles. That is, *be* must be a main verb. And if it is a main verb here, then it is also one in the source of (17), which would then have to be derived from (58).²⁰

(58) [See page 87.]

The final layer of abstraction that I will argue for in this paper is the performative verb, which I proposed should be at the top of all syntactic deep structures (cf. Ross, 1970). Basically, performative verbs are activity verbs which, when occurring in a first-person non-progressive, non-negative, present tense sentence, can be taken as constituting an instance of the type of speech act that they denote.

For example, the sentences in (59), when uttered in the appropriate circumstances [that is (59a) by a judge to a convicted criminal, (59b) by someone who has the floor in a meeting in which there are no other motions being discussed, (59c) by someone authorized to confer knighthood, etc.],

¹⁹In Milsark (1972), a refinement of this condition is suggested, one with which I am basically in agreement, but one which is irrelevant to the conclusions reached here with respect to the main verb status of the progressive *be*.

²⁰Note that in (58), I have analyzed the progressive *be* as an intransitive verb with a subject complement, rather than as a transitive verb with an object complement. The reasons for this decision are gone into some detail in the final section of Ross (1972a), and I will not repeat them here. Actually, I am not sure as to whether it is sufficient to postulate only one occurrence of the progressive *be* in the source of (17). Note that in (41), we find both *happen* and the verb of its complement in the progressive tense. This is not accidental – there is a kind of tense and auxiliary agreement, which has not been studied in the literature, as far as I know, between the matrix and the complement verbs in such constructions. Thus compare (41) with the less than perfect sentences in (i) – (v).

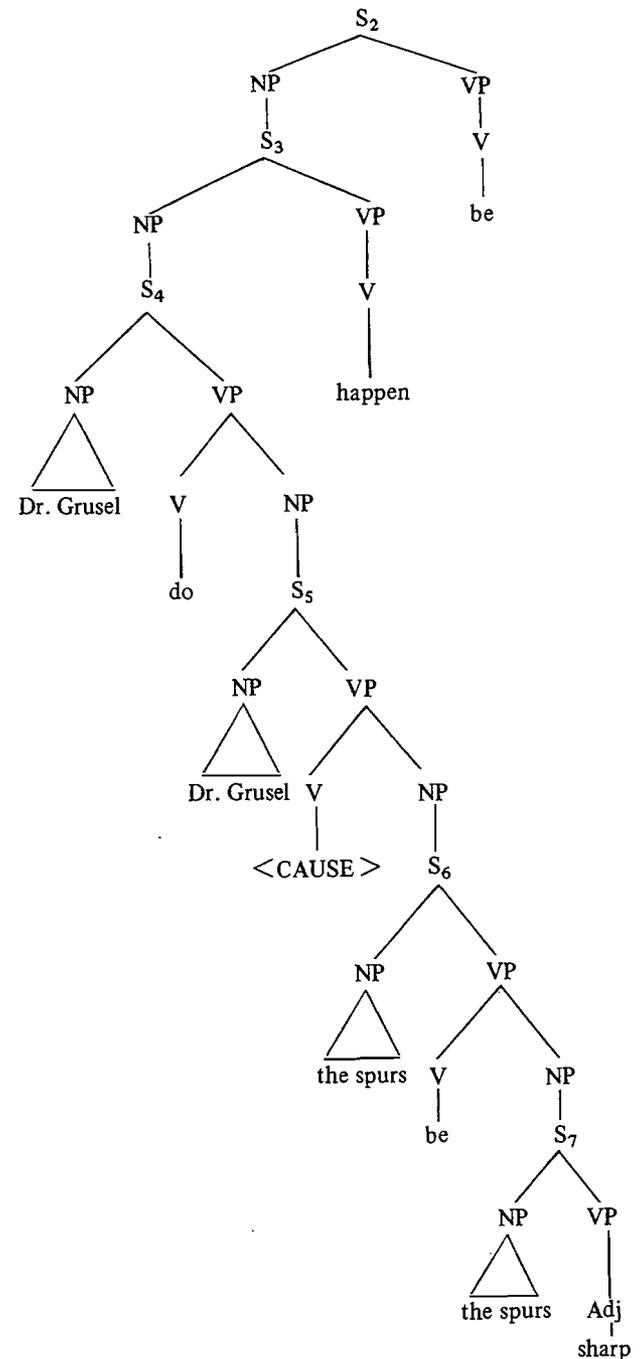
- (i) ??What is happening is that Dr. Grusel has sharpened the spurs.
- (ii) ??What has happened is that Dr. Grusel is sharpening the spurs.
- (iii) ?*What will happen is that Dr. Grusel is sharpening the spurs.
- (iv) *What happens is that Dr. Grusel is sharpening the spurs.

- (v) What

}	** happened	}	is that Dr. Grusel sharpening the spurs.
	** was happening		
	?* must have happened		
	** had been happening		
	must have been happening		

(This footnote continued on page 88.)

(58)

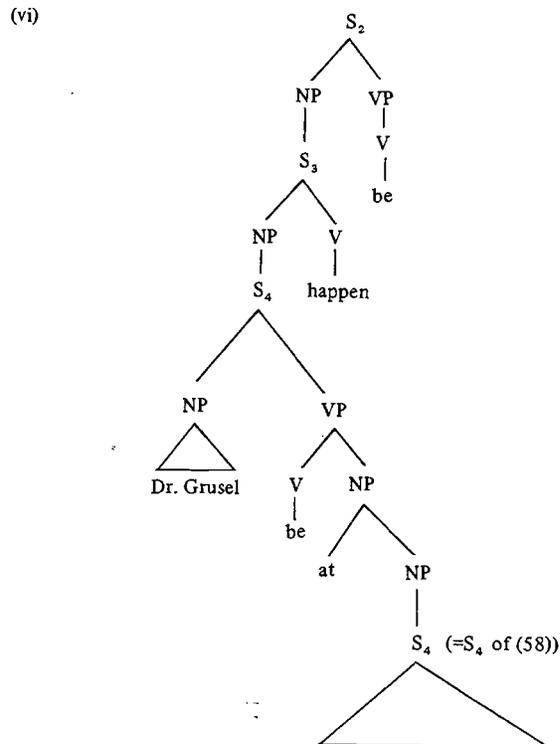


- (59) a. I sentence you to swim in the Rhine.
- b. I move that we treble our salaries.
- c. I dub thee Sir Godzilla.

can be taken as a sentencing, a motion, and a knighting, respectively; while the sentences in (60), which contain non-performative verbs, can only be taken as description of habitual activities on the part of the speaker.

Footnote 20 continued -

The facts seem to be quite complex here, and I have not been able to come to a decision as to whether this type of (approximate) agreement could be handled by some form of copying transformation, which I feel to be unlikely, or whether some complex semantic condition involving a matching between two compound auxiliary structures, both of which appear in underlying structure, must be imposed. If the latter is true, as I suspect, then (17) would have not merely one *be* in its source, but two, arrayed in the kind of configuration shown in (vi), which would replace (58).



Pending the resolution of the complicated issues surrounding (i) - (v), I have temporized by postulating the slightly less abstract (58) as the source of (17).

- (60) a. I insult you.
- b. I tickle you because you're such a gloom-pot.
- c. I visit the Ozarks.

The claim of Ross (1970) is that every declarative sentence, (17), in particular, comes from a structure containing as its highest predicate a performative verb of saying such as *say, tell, state, declare, assert*, etc. Thus (17) would be derived from (61).²¹

(61) [See page 90]

Though the performative analysis is not uncontroversial (cf. Anderson, 1970, and Fraser, 1970, for critiques of Ross, 1970), I believe that most of the criticisms of it can be met, and that the weight of the available evidence favors its adoption. Two arguments for it will be reviewed below.

Consider first the behavior of emphatic reflexives in constructions of the schematic form shown in (62).

(62) Det Adj + *er* N *than* Pro + *self*

One example is the sentence shown in (63).²²

(63) Marvin_i thought that your aunt might need a wiser man than himself_i to solve her problem.

The question at issue is this: What are the syntactic conditions which must be met on the NP which is the antecedent of the pronoun in the *than*-phrase in (62)?

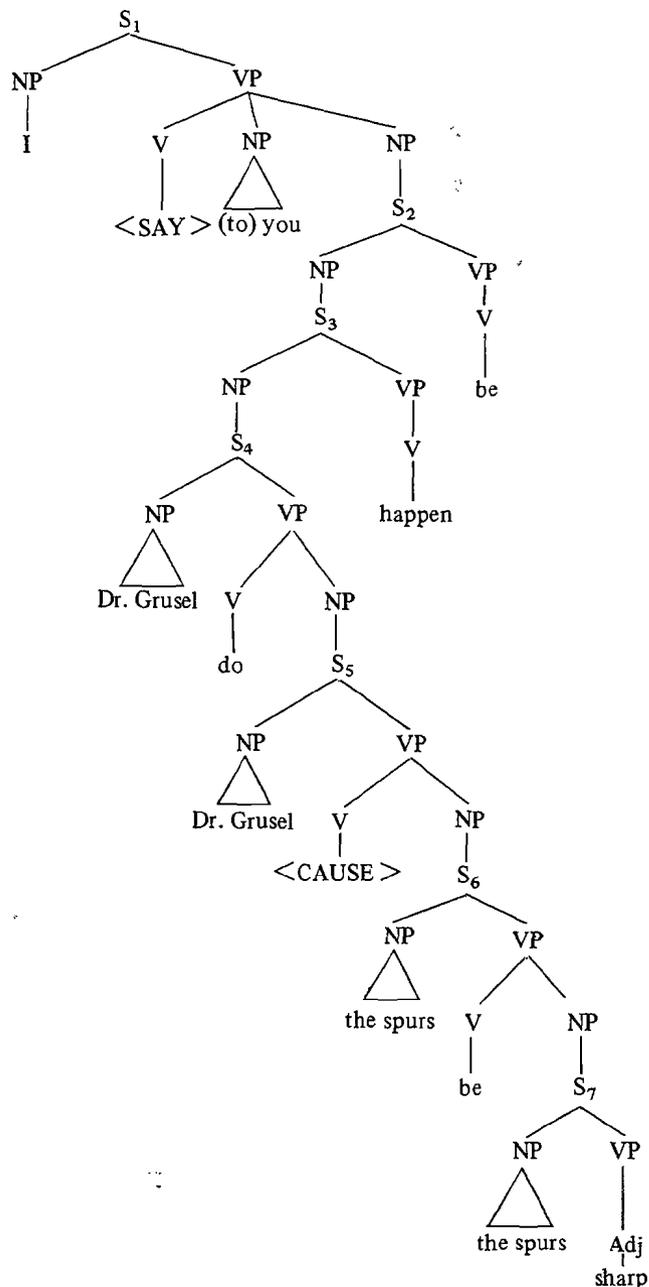
First, note that it is a necessary condition for well-formedness that the antecedent NP be in the same sentence as the reflexive pronoun. Such sequences of sentences as those in *(64), in my speech and that of all those I have checked, are ungrammatical: The anaphoric linkage involved in (62)-type constructions cannot extend across sentence boundaries.

(64)* Marvin_i is brilliant. Your aunt may, however, need a wiser man than himself_i to solve her problems.

²¹Note that I have not provided, in this structure, a place for representing the fact that (17) is in the present tense. I will not recapitulate the arguments here, but I would follow McCawley (1971) in hypothesizing that tense morphemes are reflexes of a higher time adverb. The present tense is essentially a copy of *now*, and the past tense is a copy of *then*. This analysis would, of course, entail an even more abstract source for (17).

²²Identical subscripts on two or more NP's indicate presupposed identity of reference, as discussed in Postal (1970b).

(61)



Second, note that while the reflexive pronoun can precede the NP to which it refers, as in (65a), that NP must command the pronoun.²³ In (65b), in which this command condition is not met, no linkage is possible.

- (65) a. That your aunt might need a wiser man than himself_i to solve her problems was distressing to Marvin_i,
- b. *That your aunt might need a wiser man than himself_i to solve her problems was distressing to the nurse who was looking after Marvin_i.

In (66a) and (66b), I have drawn skeletal diagrams of the sentences in (65a) and (65b), respectively, in order to make the command relationships clearer.

(66) a and b. [See page 92.]

In (66a), since the first S node above *Marvin* is S₁, the top of the tree, *Marvin* commands all the nodes of the tree. But in (66b), the first S node above *Marvin* is S₃, so *Marvin* commands only the elements of that clause.

The situation is exactly similar with respect to the contrast between (63) and *(67).

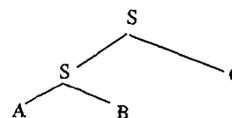
- (67)* The nurse [_Swho is looking after Marvin_i]_S thinks that your aunt might need a wiser man than himself_i to solve her problems.

Again, since *Marvin* is the subject of the main clause in (63), it commands all other nodes in the tree underlying this sentence, in particular *himself*. In *(67), on the other hand, *Marvin* commands only the elements of the bracketed relative clause, so no anaphoric link is possible between *Marvin* and *himself*.

Assuming, thus, that it is only possible to have constructions of the form of (62) when the reflexive form is commanded by the NP which it refers to,²⁴ what are we to conclude from the grammaticality of (68)?

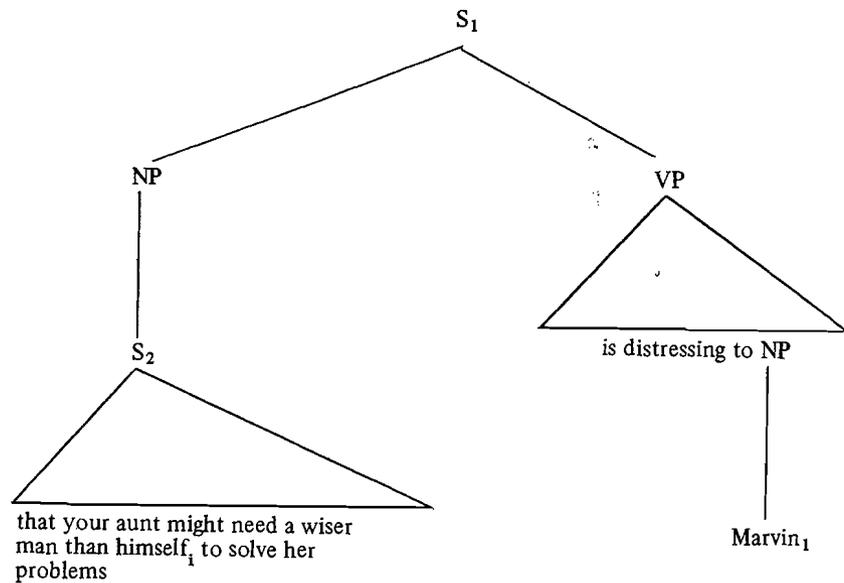
²³ The important notion of command derives from Langacker (1969). Basically, one node commands a second if the first is a clause-mate of the second or is an element of a clause that dominates the second element. Put in other words, if A commands B in a tree T, then the first S node above A in T will dominate B. For instance, in (i), A and B command each other, and C commands each of them, but is commanded by neither.

(i)

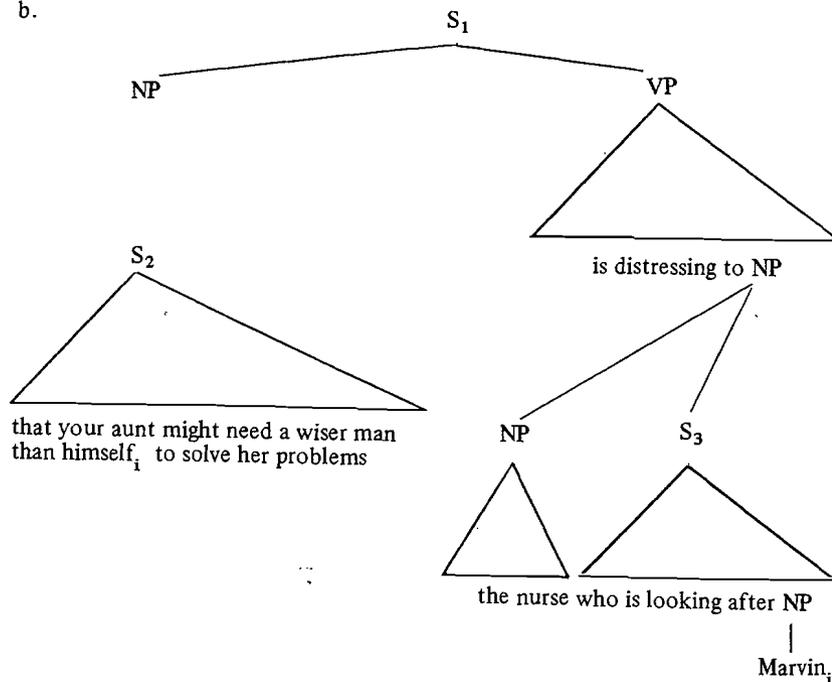


²⁴ See page 93.

(66) a.



b.



(68) Your aunt may need a wiser man than myself to solve her problems.

The answer is obvious: (68) must derive from some structure which contains another occurrence of *I*, so that the command law which governs (62)-type constructions is satisfied. Since the performative analysis asserts that all declaratives are embedded as the objects of a higher performative clause of saying, as in (61), the first-person subject of this clause could be the antecedent of the *myself* in (68). Thus this *myself* provides partial support for the performative analysis.

I say "partial" here, because the command condition on (62)-type constructions does not provide any information about how high up in the tree the reflexive antecedent can be — it cannot require it to be a member of the immediately superordinate clause, for we find such grammatical sentences as (69), in which the antecedent is several clauses up.

(69) Marvin_i thinks [_Sthat many people feel [_Sthat we are of the opinion [_Sthat you should deny the claim [_Sthat your aunt might need a wiser man than himself_i to solve her problems_S]_S]_S].

Nor does this command condition specify that the antecedent NP must be a higher subject — if it did, it would incorrectly rule out (70).

(70) We told Marvin_i that your aunt might need a wiser man than himself_i to solve her problems.

Thus while the *myself* in (68) would be compatible with the source provided by the performative analysis, it does not *require* precisely this source, since the command condition would also be met by any of the following schematically shown sources;

(71) See page number 94.

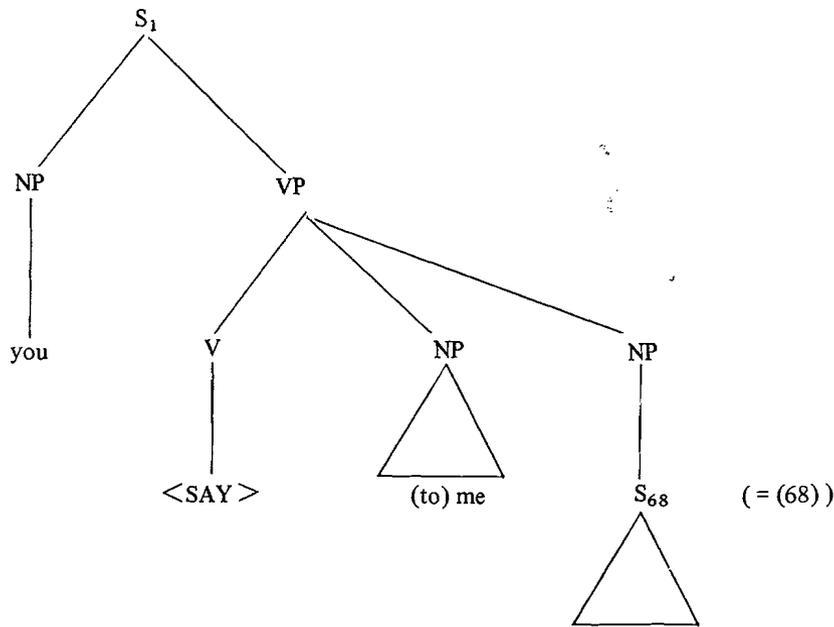
(72) See page number 95.

and indefinitely many others.

²⁴ Note that it is of no consequences how this reflexive pronoun is generated — whether it appears in deep structure in its surface structure form, whether it is derived by a rule of pronominalization from a fully specified NP (like *Marvin*, in the examples discussed above), or whether, a seems most likely to me (though I emphasize that I have no evidence for this opinion), it is derived from a reduction rule that deletes a coreferential pronoun which is followed by an intensifying reflexive, as in the derivations suggested in (i).

- (i) $\left. \begin{array}{l} \text{he} \\ \text{him} \end{array} \right\} \text{himself} = \text{himself}$
 $\left. \begin{array}{l} \text{she} \\ \text{her} \end{array} \right\} \text{herself} = \text{herself} \text{ etc.}$

(71)



In short, the command condition is a first step along the way, in that it indicates that *something* must be “up there,” but it is not specific enough in its requirements to tell us that only the topmost clause of (61) could be the missing something.

The next argument to which we will turn will provide much more detailed information about this “something.”

Consider such sentences as (73), in which the verb *believe* occurs with an unstressed direct object, where the combination of verb plus object is used to refer to a clause elsewhere in the discourse.

(73) Sheila_i said to Jeff_j that termites made great pets, but he_j didn't believe her_i.

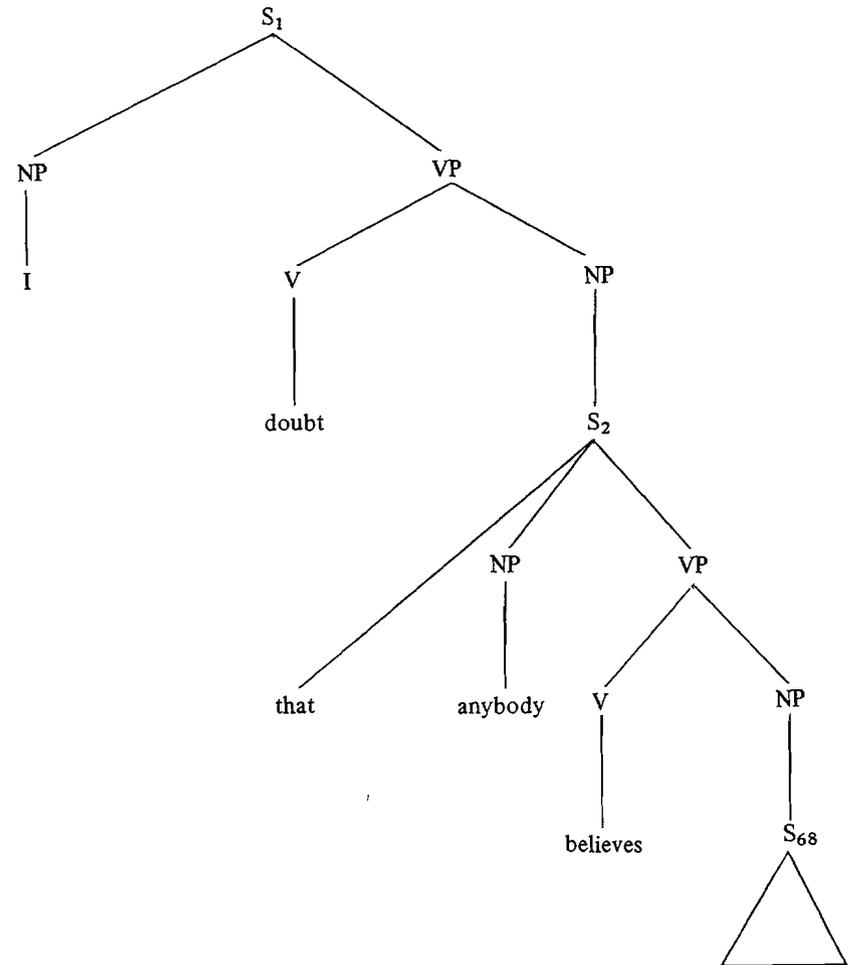
Here, the clause referred to is *that termites made great pets*. What is of interest is a precise characterization of the conditions under which this particular type of anaphoric linkage is possible.²⁵

Notice first that the class of verb that the clausal antecedent functions as the complement of is crucial – cf. (74).

²⁵Let us exclude from consideration such cases as (i), in which the pronoun following *believe* is anaphoric, but not the verb-object combination as a whole.

(Footnote 25 continued on page 95.)

(72)



(i) You may believe Senator Quark_i, but I don't believe him_i.
and such cases as (ii), in which, though the combination is anaphoric, it is not anaphoric to a clause, but rather to a noun like *story*, *testimony*, etc.

(ii) Bill believed Tom_i's

{	story testimony claim accusation etc.	}
---	---	---

, but we didn't believe him_i.

The cases that are relevant for the performative analysis are exclusively cases in which the verb-plus-object combination is anaphoric to a clause.

- (74) Sheila_i $\left\{ \begin{array}{l} \text{said} \\ \text{whispered} \\ \text{wrote} \\ \text{wigwagged} \\ \text{made it plain without saying a word} \\ \text{*hoped} \\ \text{*doubts} \\ \text{*knew} \\ \text{*thought} \end{array} \right\} \text{ to Jeff}_j$

that termites made great pets, but he_j didn't believe her_i.

In general, the only verbs whose objects can be anaphorically linked to *believe* + NP constructions are verbs of linguistic communication – even wigwagging is a little peculiar, for me. Yet as Anderson has pointed out,²⁶ the object of *make plain* is a viable antecedent. Since, however, such derived nominals as those in (75), which, like the objects of (76), denote emotions, seem unable to function as antecedents,

- (75) *Sheila_i made plain her_i $\left\{ \begin{array}{l} \text{disgust} \\ \text{resentment} \\ \text{enthusiasm} \\ \text{aversion} \\ \text{etc.} \end{array} \right\}$, but no one believed her_i.
- (76) *Sheila_i $\left\{ \begin{array}{l} \text{shrugged her}_i \text{ indifference} \\ \text{snorted her}_i \text{ impatience} \\ \text{nodded her}_i \text{ assent} \\ \text{glowered her}_i \text{ rage} \end{array} \right\}$, but no one believed her_i.

it seems necessary to impose the condition that this type of anaphora is not only dependent on the semantic properties of the verb whose object is being referred to, but also on the surface clausehood of the antecedent proposition.

The next point to emphasize is that this type of linkage depends on a particular coreference relation obtaining in the sentence. Namely, the object NP in the *believe* + NP construction must be coreferential with the subject of the verb whose complement is being referred to.²⁷ Thus if her_i in (73) and (74) is replaced by *me*, *Ted*, *us*, *you*, etc, the sentences become ungrammatical.

²⁶ Cf. Anderson (*op. cit.*).

²⁷ That this characterization is not quite accurate can be seen from such examples as (i), which were pointed out in Anderson (*op. cit.*)

(i) Jeff_j heard from Sheila_i that termites made great pets, but he_j didn't believe her_i.
Examples of this type suggest that the coreference condition should not be stated in terms of the grammatical subject of the antecedent verb, but rather in terms of the actant in its clause which fills the semantic role of agent or source. I will, however, disregard this refinement in the simplified exposition of this paper.

Keeping in mind the two restrictions discussed above, we can see how such sentences as those in (77) support the postulation of a higher verb.

- (77) [Dr. Grusel is sharpening the spurs]_{S₁}, but if you don't

believe $\left\{ \begin{array}{l} \text{me} \\ \text{*Ted} \\ \text{*her} \\ \text{us} \end{array} \right\}$, observe him through the peephole yourself.

The fact that this occurrence of *believe me* can be used to refer back to the bracketed clause S₁ of (77) argues that S₁ is the complement of a verb of linguistic communication, and the fact that only *me* (or *us*) can follow *believe* suggests that this verb must have a first-person agent (or source).

Thus (77) provides information of a much more specific nature about what is "up there" than does (68), but both support the postulation of the higher performative clause in (61).

Similar arguments can be developed for postulating a higher performative clause for other types of speech acts as well, but I will not develop them here, for the general conclusion should be clear: Underlying semantactic representations must be inferred to be orders of magnitude more remote from surface structures than was believed to be the case a decade ago.

Though space limitations preclude more than a passing mention of this point here, the type of abstractness arguments I have been outlining here can in fact be pursued much further – so far, in fact, that the line between syntactic deep structure and semantic structure vanishes – hence Georgia Green's term *semantax*. The surface structures of any language are then the result of the repeated application to a universal set of semantic structures of a rather small, largely universal, set of transformations like the ones that have, in the discussion above, been postulated to play a role in the derivation of (17) from (61). The diversity of the surface structures of the world's languages appears not to derive from deep differences, but rather from a number of language-particular restrictions on these general transformations, and in part from the effects of certain language-particular transformations and output conditions.

Under this conception of grammar, which has come to be known as *generative semantics*,²⁸ we could recode the three basic insights of Zellig Harris which were discussed above in Section 1.1 in the following abbreviated form:

- (78) Big sentences are (semantactically) made up of little meanings – the propositions and open sentences which correspond roughly to the S₁ of such structures as (61). And there is one "kernel grammar" for all languages – the rules that specify the set of well-formed semantic structures.

²⁸ For a more detailed exposition of this theoretical framework, cf. Postal (1970a), Lakoff (1972), and McCawley (1967, 1973) and the works cited there.

2. ISLANDS

2.1. The results I will report on in this section concern general constraints on the functioning of transformations. In Section 2.2, I will introduce the notion of *islands*, and show how a particular phrase-structure configuration allows the deduction of a large number of constraints that can be found on various rules in grammars of various languages of the world. And in Section 2.3, I will define and briefly discuss the important notion of *primacy*.

2.2 In Ross (1967), I proposed that the ungrammaticality of the results of topicalizing the NP *these points* in the sentences in (79) [cf. the corresponding bad sentences in *(80)]

- (79) a. She will execute [[anyone]_{NP}[who mentions these points]_S]_{NP}
 b. We will take up _{NP}[either [his proposals_{NP}] or [these points_{NP}]]_{NP} next
 c. [[For her to talk about these points]_S]_{NP} was unexpected.
- (80) a. *These points she will execute anyone who mentions ϕ .
 b. *These points we will take up either his proposals or ϕ next.
 c. *These points for her to talk about ϕ was unexpected.

should be accounted for by adding to linguistic theory the following three constraints:

- (81) a. *The Complex NP Constraint*
 No constituent can be chopped²⁹ out of a sentence modifying a lexical head noun.
 b. *The Coordinate Structure Constraint*
 No constituent can be chopped out of a coordinate node.
 c. *The Sentential Subject Constraint*
 No constituent can be chopped out of a clausal subject.

Schematically, what is excluded is moving any constituent along the arrows shown in (82a-c) – therefore, I have x-ed these arrows.

²⁹In Ross (*op. cit.*), Ch. 6, a distinction is made between “chopping” rules—rules like *Topicalization*, which move a constituent from its original position in a sentence, leaving no trace of where it came from – and “copying” rules – rules which move a constituent, but which leave behind a pro-form to mark the point of departure. One copying rule is *Left Dislocation*, which converts (i) into (ii).

(i) I wish he had soaked the bread longer.

(ii) The bread, I wish he had soaked it longer.

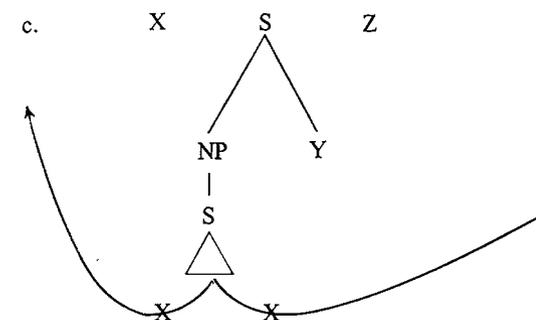
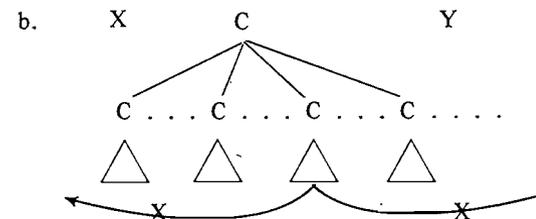
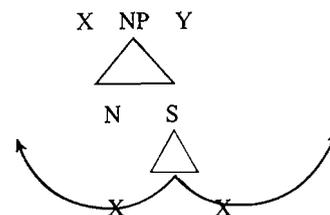
As the sentences in (iii)–(v) show, the rule of *Left Dislocation* is not subject to the three constraints of (81).

(iii) These points, she will execute anyone who mentions them.

(iv) These points, we will take up either his proposals or them next.

(v) These points, for her to talk about them was unexpected.

(82) a.



It should be noted that the constraints in (81) are not restricted to the particular rule of *Topicalization* in English – as the examples in (83) suggest, many other chopping rules are affected –

- (83) a. *Tall though I am dating [[a girl] [who is ϕ]_{NP}],
 NP
 I am really a midget-head.
- b. *Not my sock you can't throw [either [his sock_{NP}] or ϕ _{NP}]
 into the soup
- c. *Carefully [[for him to slice the banana ϕ _S]_{NP}] would be
 expensive

rules which, in happier circumstances can prepose adjective phrases to the front of *though*-clauses, cf. (84a), a copied *not* and an emphasized constituent to the beginning of a sentence, cf. (84b), or an adverb, cf. (84c).

- (84) a. Tall though she is ϕ , I'm a midget-head.
 b. Not my sock you can't throw into the soup.³⁰
 c. Carefully, he sliced the banana.

Nor are the constraints intended to be restricted to English. In Ross (*op. cit.*), data from other languages is cited which tends to support the claim that these constraints are universally valid.³¹

Assuming now, with the restrictions noted in footnote 31, that the three constraints of (81) are indeed roughly correct, the question that immediately arises is, *why these three?* Why is it that elements are forbidden from leaving the sentence of a complex NP, but not the S of a complex VP? And why should it be that elements are forbidden from leaving coordinated elements when they are not forbidden from leaving subordinated ones? And why should it be harder to chop elements out of sentential subjects than out of sentential objects?

While I know of no approach to the last of these three questions that seems promising, it does seem likely that the first two questions might be answered along the following lines.

³⁰No thanks are due to John Lawler for calling my attention to this ugly class of facts.

³¹Since this work appeared, however, a number of other studies have been made which show that the actual situation with respect to the universality of the constraints is not nearly as simple as I had supposed. In particular, what seems necessary is the postulation of a universal implicational hierarchy of island types, one part of which is shown in (i)

(i) CNPC \supset CSC

That is, any language which has the CNPC will also have the CSC, but not necessarily the reverse. Some languages which appear to have only the CSC are Korean and – notwithstanding what was claimed in Ross (*op. cit.*) – Japanese. In addition, Brazilian Portuguese appears to have a form of the CNPC that is not as general as the version stated in (81a). However, the main point here is not to argue for the particular set of constraints shown in (81), for these are only a first approximation, but rather to call attention to the necessity of attempting to establish some such universal set.

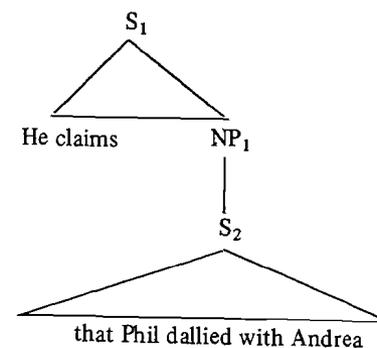
Some important research along these lines is contained in Postal (1971, 1973), Chung (1973), Lakoff (1970a), Witten (1972), Bolinger (1972), Grosu (1972), Neeld (1973), Erteschik (1973), and Chomsky (1973).

Bruce Fraser has pointed out that the word *even*, when attached to a *that*-clause, as in (85b),³² makes it difficult, if not impossible, to remove elements from the clause. Compare (86a) and *(86b).

- (85) a. He claims that Phil dallied with Andrea.
 b. He claims even that Phil dallied with Andrea.
 (86) a. Andrea he claims that Phil dallied with.
 b. ?? Andrea he claims even that Phil dallied with.³³

If we assume that *even* is Chomsky-adjoined³⁴ to the term it modifies, then the two sentences of (85) would differ from one another in structure as shown in (87).

(87) a.

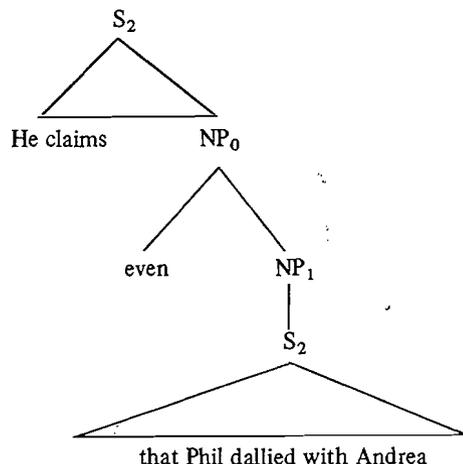


³²Cf. Fraser (1971), in which Fraser uses the term "protected environment" for such *even-ed* clauses.

³³This sentence is better when *dallied* is contrastively stressed than when it is read with no extra emphasis on this word, which is the reading that I am starring. I have no explanation for this difference.

³⁴Cf. Ross (1967) for discussion of this type of adjunction operation.

b.



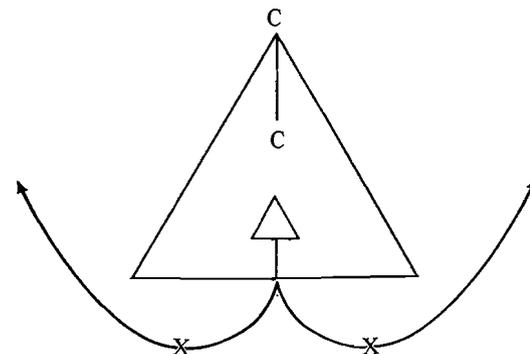
I suggest that the reason that *Andrea* can be topicalized in (87a), but not in (87b), is that in the latter structure, the node NP₀, which was created as a result of the Chomsky-adjunction of *even* to NP₁, is a self-dominating node, that is, a node which immediately dominates another node of the same type³⁵. In (88), I propose a principle which would predict the ungrammaticality of *(86b) as a consequence.

(88). *The Immediate Self-Domination Principle (ISP)*

- a. No element may be chopped out of a node which immediately dominates another node of the same type.

³⁵Note that the ungrammaticality of *(86b) remains if *even* is replaced by *only* or *also*, a fact which suggests the need for the kind of parallel explanation attempted immediately below in the text.

(88) b.



Note that the ISP would subsume as subcases the CNPC³⁶ and the CSC. In addition, the ISP could be used to provide an explanation of the fact that when a constituent is postposed by *NP Shift*, the rule that converts (89a) to (89b),

- (89) a. She will send a picture of the Waco Post Office to Inspector Smithers

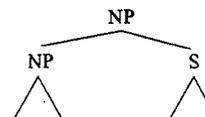
↓ *NP Shift*

- b. She will send ϕ to Inspector Smithers a picture of the Waco Post Office.

it is more difficult to chop constituents from the shifted constituent than it is to chop them from an unshifted one [compare (90a) and *(90b)].

³⁶Only if we assume that the constituent structures of both modified N + relative clause constructions (*the fact which they uncovered*) and sentential N + complement clause constructions (*the fact that they uncovered it*) are to be represented as in (i).

(i)



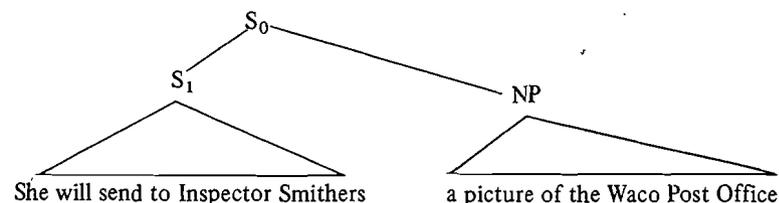
Since relative clauses and noun complements do not conjoin, however, cf. *(ii),

(ii) *The fact(s) which they uncovered and that she uncovered it upset me. and since there is a systematic difference between the strength of the prohibition on chopping elements inside relative clauses and noun complements, as suggested by the facts from Brazilian Portuguese that were alluded to in footnote 31, this may be an incorrect assumption. If so, then the ISP could only be used to explain the existence of the relative clause part of the CNPC.

- (90) a. The Waco Post Office she will send a picture of ϕ to Inspector Smithers.
 b. ??The Waco Post Office she will send to Inspector Smithers a picture of.

Under the assumption that *NP Shift* Chomsky-adjoins the shifted NP to the right of the clause [thus the structure of (89b) would be roughly that of (91)],

(91)



an assumption lent support by the fact that the most natural place for parenthetical inserts like *as you know, he felt, to my knowledge*, etc. in (89b) is immediately after *Inspector Smithers*,³⁷ the awkwardness of ??(90b) would also follow as a consequence from the ISP.

One other process which lends additional support to the ISP is the rule of *Right Node Raising* (cf. Postal, 1974), for details), which optionally converts such coordinate structures as (92a), in which each conjunct contains an occurrence of a coreferential NP (here italicized), into such reduced structures as (92b), in which one copy of this repeated NP has been Chomsky-adjoined to the right of the coordinate node, producing the type of structure indicated schematically in (92c).

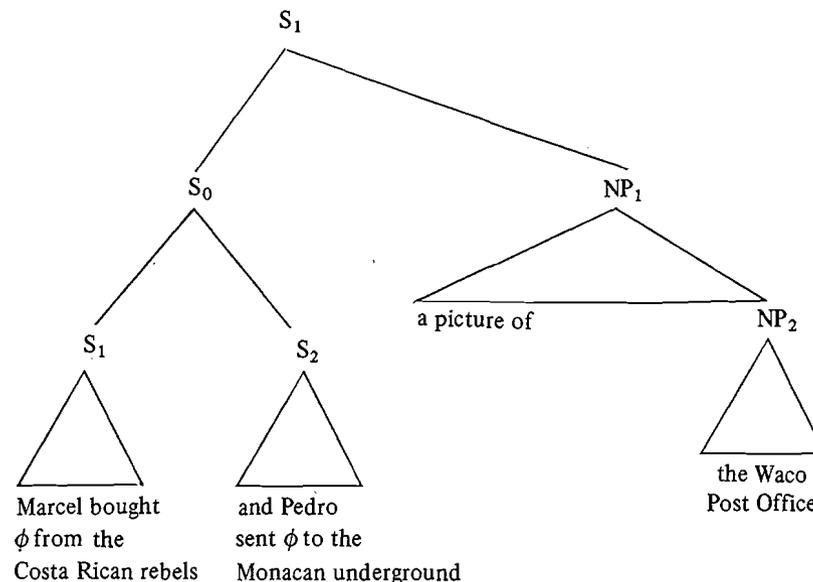
- (92) a. [_{S₀} [_{S₁} Marcel bought *a picture of the Waco Post Office* from the Costa Rican rebels_{S₁}] and [_{S₂} Pedro sent *a picture of the Waco Post Office* to the Monacan underground_{S₂}]_{S₀}].

↓ *Right Node Raising*

- b. [_{S₁} [_{S₀} [_{S₁} Marcel bought ϕ from the Costa Rican rebels_{S₁}] and [_{S₂} Pedro sent ϕ to the Monacan underground_{S₂}]_{S₀}] [*a picture of the Waco Post Office*]_{NP}]_{S₁}

³⁷In Ross (in preparation a), I argue that the basic generalization governing the location of parenthetical inserts like the above is that they do not interrupt constituents, but appear with the greatest naturalness between major constituents of unembedded clauses.

(92) c.



Again, the claim that Chomsky-adjunction is involved in this process can be supported by the observation that the most natural place for parentheticals to be inserted into (92b) is right after *underground*, as would be predicted from the structure shown in (92c) and the generalization of footnote 37.

What is of interest about (92c) for the ISP is the fact that NP₂ is difficult to topicalize out of NP₁, the NP that has been Chomsky-adjoined to S₀, as the awkwardness of ??(93) shows.

- (93) ??The Waco Post Office Marcel bought from the Costa Rican rebels and Pedro sent to the Monacan rebels a picture of ϕ .

Since the ISP would not only subsume (?part of – cf. footnote 36) the CNPC and the CSC as special cases, but would also explain the fact that items may not leave protected environments [cf. ??(86)], and may only leave shifted or right-node-raised NP's with difficulty [cf. ??(90b) and ??(93)], I conclude tentatively that it should be included as a part of the theory of universal grammar.

Of course, if we propose the ISP as a partial explanation for the existence of such constraints as the CNPC and the CSC, we must now deal with a host of thorny questions that sweep in with it. Such as: Why should self-dominating nodes be hard to get things out of, rather than self-non-dominating nodes? Why should some self-dominating nodes be harder to get things out of than others (i.e., why should the CSC be harder to violate than the CNPC, as was pointed out above in footnote

31)? Why should the rules of *NP Shift* and *Right Node Raising*, which Chomsky-adjoin to the right, produce less restricted self-dominating nodes than the process which forms protected environments by Chomsky-adjointing *even, only*, and *also* to the left of a clause? And so on.

Regardless of the answers which future research may provide to these questions, I feel that the ISP can fairly be characterized as an advance over the unhomogeneous set of constraints that were recapitulated in (81).

2.3 The notion of *primacy* is an extension of the important notion of *accessibility*, which was proposed in Keenan and Comrie (1972) and Keenan (1972).³⁸ Keenan and Comrie show that the various strategies for forming relative clauses which are employed in the widely diverse selection of languages that they survey are all governed by the following hierarchy:

- (94) *The Accessibility Hierarchy*
 Subjects \geq Direct Objects \geq Indirect Objects \geq
 Oblique constituents \geq Possessors \geq Objects of comparative constructions

The interpretation of the inequality sign is as follows: In any language, if some strategy exists for forming relative clauses in which the shared NP in the constituent sentence is a NP at some given point B on (94), then this strategy will also work for NP's at any other point A on (94), as long as $A \geq B$. Thus any language which can relativize direct objects will also be able to relativize subjects, but there are languages, like Malagasy, which can only relativize subjects. In Keenan and Comrie's terminology, subjects are *more accessible than* direct objects.

The notion of *primacy* is roughly explained in (95).

- (95) *Primacy*
 Node A of a tree has primacy over node B ('A \rightarrow B') if
 (i) A and B are clause-mates, and A is to the left of B, or
 (ii) A is an element of a clause which dominates B.³⁹

This definition is coupled with the following constraint:

- (96) *The Primacy Constraint*
 If some process P can operate in a language in such a way as to affect or be triggered by some node B, then P will also be able to operate in the language in such a way as to affect or be triggered by any node A which has primacy over B.

³⁸ An extremely important application of the Keenan-Comrie accessibility hierarchy to the analyses of causative constructions in universal grammar is presented in Comrie (1972).

³⁹ The notion of primacy is thus closely related to, though not identical with, Langacker's notion of command (cf. footnote 23).

Thus since subjects have primacy over objects, any language which is like English in allowing reflexive pronouns to refer to objects, as in (97a), must also allow reflexives to refer to subjects, as in (97b).

- (97) a. Pete_i talked to Jack_j about himself_j.
 b. Pete_i talked to Jack_j about himself_i.

However, there are languages, such as German, in which only subjects can be referred to by reflexives. Thus while the German translation of (97b) can make use of the German reflexive pronoun *sich*, as in (98),

- (98) Peter_i sprach mit Hans_j über sich_i.
 Peter spoke with Jack about self.

the translation of (97a) must use the non-reflexive pronoun *ihn* [cf. (99)].

- (99) Peter_i sprach mit Hans_j über $\left\{ \begin{array}{l} \text{ihn}_j \\ *sich_j \end{array} \right\}$.

German thus provides an example of a language which shows that the process of reflexivization is in conformity with (96) and (95i) – the clause-mate part of the definition of primacy. What (95i) – (96) predict is that no language will be found in which only sentences which correspond to (97a) are grammatical.

To see what (95ii) and (96) imply, let us compare the processes of *Reflexivization* in English and Japanese. As is well-known, by and large, English reflexive pronouns can only refer back to an antecedent in the same clause. Thus while (100a) is grammatical in English, *(100b) is not.

- (100) a. Bill_i criticized himself_i.
 b. *Bill_i knows [_Sthat himself_i is sick_S].

However, in Japanese, sentences corresponding to both of these are grammatical – Japanese has no clause-mate condition on the antecedents of its reflexive pronoun *zibun*.

- (101) a. Biru wa zibun o hihan sita
 Bill (topic) self (acc) criticism did
 'Bill_i criticized himself_i'
 b. Biru_i wa [_Szibun_i ga byooki da to iu_S] koto o sitte iru.
 Bill (topic) self (nom) sick is that say fact (acc) knowing is
 "Bill_i knows that he_i is sick"

What (95ii) – (96) predict is that no language will be found which exhibits *only* cross-clause reflexivization.

Another process which conforms with (95) – (96) is *Equi*. While English allows this rule to delete the subjects of lower clauses under identity with either higher subjects [cf. (102a)] or higher objects [cf. (102b)],

- (102) a. I_i want [_S for me_i to go]_S
 \downarrow *Equi*
 ϕ
- b. He forced me_i [_S for me_i to go]
 \downarrow *Equi*
 ϕ

Serbo-Croatian only permits the former type of deletion [cf. the sentences in (103), which are drawn from Perlmutter (1971)].

- (103) a. Ja_i zelim [da ja_i idem]_S
 I want that I go
 \downarrow *Equi*
 ϕ
- b. Zelim ici
 I want to go
- c. Prisilio me je_i [da ja_i idem]_S
 forced he me that I go
 \downarrow *Equi*
 ϕ
- d. *Prisilio me je ici.
- e. Prisilio me je da idem.
 he forced me that I go (=to go)

He forced me that I go (= to go)

Thus the Serbo-Croatian process of *Equi* can apply to (193a), deleting the second occurrence of *ja* 'I' under identity with the first.⁴⁰ Subsequently, a general rule deleting unstressed pronouns applies to delete the subject *ja* of *zelim*, yielding the well-formed string (103b).

However, as the ungrammaticality of (103d) indicates, this process is not applicable in the object of *prisilio*. *Equi* cannot apply to delete the *ja* of (103c) and cause *idem* to be infinitivized. In this case, all that can happen is for the above-mentioned rule of *Pronoun Deletion* to delete this *ja*, leaving the verb *idem* unchanged in the output string (103e).

⁴⁰Whether the complementizer *da* 'that' is deleted as a part of this process or by a separate one is not germane to the present discussion. Nor is the question as to what process causes the change of the inflected verb *idem* 'I go' to the uninflected infinitive *ici* 'to go.'

Thus we see that Serbo-Croatian provides us with a case that supports (95i) – (96). Essentially, what is excluded is a language which would exhibit the reverse of Serbo-Croatian, as in (104).

- (104) a. I want that I go.
 b. He forced me to go.

To the best of my knowledge, no such language exists.

The process of *Equi* can also be used to support (95ii), if we assume, following Grinder (1970), that the process which converts (105a) to (105b), which Grinder refers to as *Super Equi*, is to be identified with *Equi*.

- (105) a. [Fred_i knows [that [his_i getting himself_i into trouble]_{S₂} would be inconvenient for me_{S₂}]]_{S₁}.
 b. Fred_i knows that getting himself_i into trouble would be inconvenient for me.

In this case, the subject of *getting* has been deleted not by any element of *S₂*, the clause immediately above it, but rather by *Fred_i*, the subject of *S₁*. Schematically, the deletion has proceeded as in (106).

(106) [See page 110.]

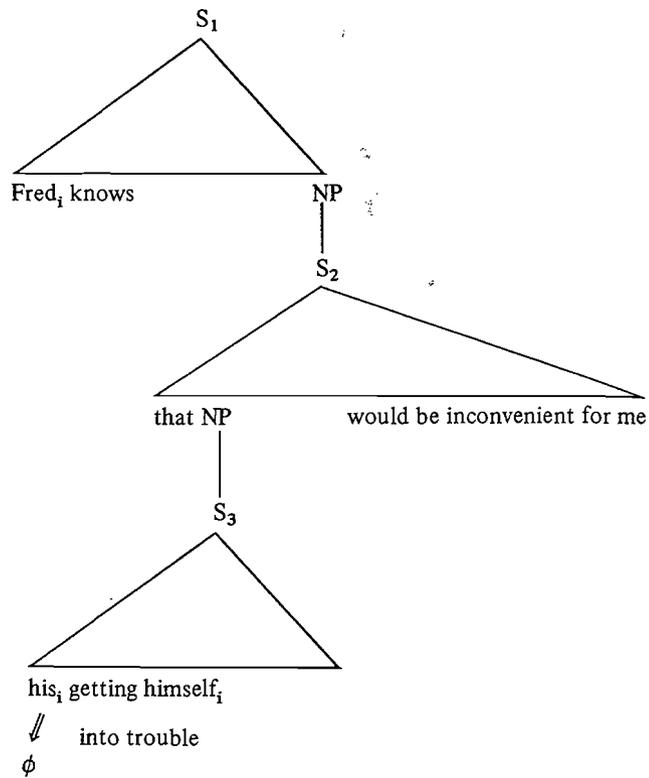
Under the assumption that the deletions involved in (105) and (102) are in fact parts of the same rule, the Primary Constraint would predict that while a language might exist which exhibited only *Equi*, no language could exist which exhibited only *Super Equi*. In other words, (95)–(96) predicts that while we may find a language which has only sentences produced by *Equi*, like those of (102), and none produced by *Super Equi*, like (105b), we will find no language which has the latter type of sentences unless it also has the former type.⁴¹

⁴¹I have thus far been unable to find a clear case of a language which has *Equi* but not *Super Equi*, though Japanese may be such a language. Kazuko Inoue has informed me that the following sentence is slightly more acceptable with the reflexive pronoun *zibun* than without it,

- (i) Biru_i wa $\left[\left[\left\{ \begin{array}{l} zibun_i \\ ? \end{array} \right\} \right] \right]_{S_1 S_2}$ ga hayaku kaeru $\left. \right]_{S_2}$ koto ga
 Bill (topic) self (nom.) early return fact (noun)
 Ann mo okoraseru daroo to $\left. \right]_{S_1}$ omotta

This footnote continued on page 110.

(106)



Many other processes could be cited whose operation is in conformance with (95)–(96), but for the present brief survey of the notion of primacy, the ones discussed above should prove sufficient to indicate that the Accessibility Hierarchy must be extended to constrain the operations of other types of rules than those that form relative clauses.

Footnote 41 continued –

Ann even infuriate would that thought

“Bill_i thought that $\left\{ \begin{array}{l} \text{his} \\ \text{—} \end{array} \right\}$ returning early would infuriate Ann.”

which may indicate that Japanese only has a weak rule of *Super Equi*. On the other hand, Japanese, like Serbo-Croatian, has a rule of *Pronoun Deletion*, and at present, I cannot demonstrate that the deletion of *zibun* in (i) would have to be accomplished by the former rule and not by the latter one. The only other languages that I have been able to check even cursorily – namely German, French, Spanish, Italian, Russian and Czech – all seem to have both kinds of *Equi*. If further investigation should reveal that no language exists which has only *Equi*, then this fact, while not disconfirming (95), could not be explained by it.

3. NON-DISCRETE GRAMMARS

The remaining research I will report on seems to necessitate the introduction into linguistic theory of a formally quite different type of conceptual underpinning than either the theory of generative semantics of Section 1 above or the theory underlying the type of constraints discussed in Section 2. Basically, this research indicates the need for changing the theory of grammar from a discrete theory to a non-discrete one. The logic of the theories discussed in Sections 1–2 contains basically only discrete predicates. For instance, this logic would lead to such claims as the claims that sentences are either well-formed or not; that constituents are either NP's or not; that NP's are either plural or not; that a sentence either does have a certain reading or does not have it; that elements either are or are not elements of different clauses; that groups of morphemes either are or are not idioms; that sentences are or are not related; etc., etc., etc. In other words, the Law of the Excluded Middle has, within the broad framework of generative grammar, always been assumed to hold for most of the predicates used in this theory.

I believe, however, that there are at present extremely cogent reasons for rejecting this law in all of the above disjunctions, and indeed, almost universally within linguistics. That is, I would argue that instead of being viewed as a device for partitioning the set of all strings of words into well-formed and ill-formed strings, a grammar should merely impose a partial ordering upon this set: For example, with respect to grammaticality, the grammar should merely assert that one string A is better than another string B; similarly, that one constituent C is more NP-like than another constituent D; that one constituent E is more plural than another constituent F; that one string M is better on reading Q than another string N is, etc., etc., etc.

While it is beyond the scope of this paper to demonstrate the necessity of such a sweeping reconceptualization of the logic of generative grammar, it is possible to give some indication of the kinds of evidence now available which have led me to this set of conclusions.

In Ross (1972b), I give evidence that suggests that rather than being discrete entities, such categories as N, A, and V are to be arranged in an implicational hierarchy, or cline, or gradient, as shown in (107).

(107)

V > Present > Perfect > Passive > A >
participle participle participle

Adjectival > N
noun

That is, adjectives are “between” verbs and nouns, as various sorts of participles are “between” verbs and adjectives, and adjectival nouns like *fun* and *snap* are “between” adjectives and nouns. The evidence on which this claim is based is largely of the following form: Some syntactic process applies more to V than to A, and more to A than to N. One example is the rule which allows the epenthesis of

the pronoun *it* before the factive complements of certain predicates. There are a fair number of verbs for which this process is possible [cf. (108a)], only one adjective, to the best of my knowledge [cf. (108b)], and no nouns [cf. *(108c)].

- (108) a. I $\left\{ \begin{array}{l} \text{resent} \\ \text{regret} \\ \text{hate} \\ \text{dislike} \\ \text{appreciate} \\ \text{etc.} \end{array} \right\}$ it that you used a-hanky.
- b. I am aware (of it) that you didn't have to.
- c. Her regret (*of it) that you did was feigned.

Such facts suggest that rather than being assigned to one of some number of discrete categories, words should be given some value (for the present, we can think of the values as being real numbers in the interval [0, 1]) of the feature [α Nouny], (equivalently, [α Verby]), and that syntactic processes, such as the rule that inserts *it*, should be assigned threshold values of this feature, above which they will not operate.

In Ross (1973a), I present a range of arguments to the effect that such constituents as the subjects of the sentences in (109) are less than full NP's.

- (109) a. Some headway was made on this amendment.
 b. There exists a contract.
 c. Accurate tabs were kept on Bingo's expenses.

When we compare the behavior of such subjects with that of such dyed-in-the-wool NP's as *euphoria*, we find that some are more like "true" NP's like *euphoria* than others: They "pass" more of the NP tests than these others do. We can rank them on their "noun-phrasiness," as is done for some of them in (110).

- (110) $\xleftarrow{\text{'More noun-phrasiness'}}$
euphoria > *headway* > *there* > *tabs*

The inequality sign in (110) is to be interpreted as an implication. For any two items, A and B, if $A > B$, then if B "passes" some test, A will also pass it. In other words, I am asserting that the mystery items under discussion are *fake* NP's; they only do a subset of what NP's like *euphoria* do. I know of no syntactic processes which are applicable to *fake* NP's, but not to standard-brand NP's like *euphoria*.

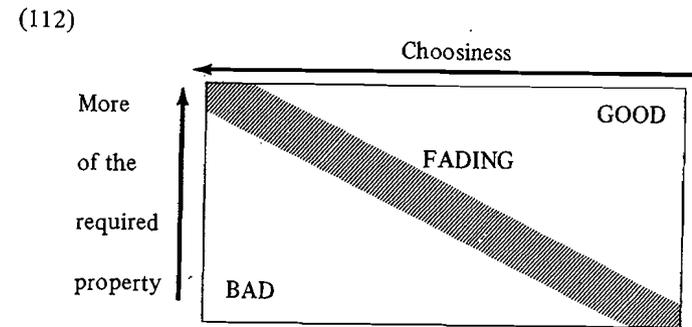
The "tests" for NP-hood - i.e., those syntactic processes which only apply to NP's - can also be hierarchically ordered. An example of the hierarchy formed by three such tests is given in (111).

- (111) $\xrightarrow{\text{Choosier}}$
 Tag Formation > Tough Movement > Left Dislocation

Again, the inequality sign has an implicational interpretation: For any two syntactic processes A and B, if $A > B$ [read: 'A is stronger than B' or 'B is choosier than A'], then whenever B can apply to a given item, A will also be able to.

The direction of the inequality sign is purposely chosen to be the same in (110) and (111): Just as NP's like *euphoria* are found in a wider range of syntactic contexts than NP's like *tabs*, so *Tag Formation* is applicable to a wider class of structures than is *Left Dislocation*.

The two hierarchies above interact to mutually define each other. They form the type of matrix shown schematically in (112), which I will refer to as a *squish*.



To give a concrete example, the hierarchies in (110) and (111) form the squish shown in (113).

(113)

	<i>Left Dislocation</i>	<i>Tough Movement</i>	<i>Tag Formation</i>
<i>euphoria</i>	ok	ok	ok
<i>headway</i>	*	?	ok
<i>there</i>	*	*	ok
<i>tabs</i>	*	*	?

[cf. (114)] [cf. (115)] [cf. (116)]

- 114 a. Euphoria, it's greatly overrated.
 b. *Some headway, it was made on this amendment.
 *There $\left\{ \begin{array}{l} \text{there} \\ \text{it} \end{array} \right\}$ exists ~~on~~ a contract.
 *Accurate tabs, they were kept on Bingo's expenses.
- (115) a. Euphoria is tough to arrange for.
 b. ?Significant headway is tough to make on complex amendments, like this one.
 c. *There is tough to imagine existing a contract.
 d. *Accurate tabs will be tough to keep on Bingo's expenses.
- (116) a. Euphoria should be legalized, shouldn't it?
 b. Significant headway was made on this amendment, wasn't it?
 c. There exists a contract, doesn't there?
 d. ?Accurate tabs were kept on Bingo's expenses, weren't they?

To claim that fake NP's form a squish is to make a quite precise empirical claim. It is to claim that when *all* other fake NP's are "blended into" (113), with as many rows being added as the facts necessitate, and when *all* other processes are "blended into" (113), with as many extra columns being added as there are processes that distinguish themselves, the resulting supermatrix will be well-behaved, as defined in (117).

- (117) A matrix whose cells contain indications of degree of grammaticality is *horizontally well-behaved* if the degrees of grammaticality indicated in the cells of a row increase monotonically (i.e., without changes in direction of increment), or decrease monotonically. If one row has decreasing values, all must; if one row has increasing values, all must. A matrix is *vertically well-behaved* if the degrees of grammaticality indicated in the cells of its columns increase or decrease monotonically in the manner specified above.
 A matrix that is both horizontally and vertically well-behaved is "*well-behaved*."

To claim that a body of data forms a squish is to claim that two varying parameters can be found whose pattern of interaction is given by a well-behaved matrix.

In Ross (1973b) I argue that there is a squish of nouniness which has the hierarchy of (117) as one axis.

- (117) a. *that S (that he gave the skunk to me)*
 b. *for NP to V X (for him to give the skunk to me)*

- c. Q ($\left\{ \begin{array}{l} \text{where} \\ \text{when} \\ \text{how} \\ \text{how quickly} \\ \text{etc.} \end{array} \right\}$ *he gave the skunk to me*)
- d. $\left[\begin{array}{l} \text{NP} \\ +\text{Acc} \end{array} \right]$ *Ving X* (*him giving the skunk to me*)
- e. NP's *Ving X* (*his giving the skunk to me*)
 f. Action Nominal (*his giving of the skunk to me*)
 g. Derived Nominal (*his gift of the skunk to me*)
 h. Noun *panda*

Except for (117h), the elements of this hierarchy are all complement types. To claim the existence of a squish here is to claim that while there may be syntactic processes that affect just (117a), or just (117a-b) or just (117a-c) or just (117a-d) etc., there will be no processes which affect just (117 a, c, d, g), or any discontinuous range of (117). ~~Some~~ examples of processes which support this claim are the rule of *Preposition Deletion* and the output condition which excludes headless sentence-internal nominal complements. Cf. (118) and (119). TWE

- (118) a. I'm amazed (*at) that he gave the skunk to me.
 b. I would be amazed (*at) for him to give the skunk to me.
 c. I was amazed (at) how quickly he gave the skunk to me.
 d. I was amazed *(at) $\left\{ \begin{array}{l} \text{him} \\ \text{his} \end{array} \right\}$ giving the skunk to me.
 e. I was amazed *(at) $\left\{ \begin{array}{l} \text{his} \\ \text{the panda} \end{array} \right\}$ $\left\{ \begin{array}{l} \text{giving} \\ \text{gift} \end{array} \right\}$ of the skunk to me.
- (119) a. *Did that he gave the skunk to me amaze you?
 b. *Would for him to give the skunk to me amaze you?
 c. ??Did how quickly he gave the skunk to me amaze you?
 d. ??Did him giving the skunk to me amaze you?
 e. ?Did his giving the skunk to me amaze you?
 f. Did $\left\{ \begin{array}{l} \text{his} \\ \text{the panda} \end{array} \right\}$ $\left\{ \begin{array}{l} \text{giving} \\ \text{gift} \end{array} \right\}$ of the skunk to me } amaze you?

Again, what seems to be called for here is some variable feature like [α Nouny] (or [α Sentential]) with threshold values indicated on various rules. *Preposition Deletion* must be made obligatory before complements of low nouniness, optional

for embedded questions, and must block before any sufficiently nouny complement. And the output condition which is responsible for the decreasing awkwardness of the sentences in (119) is obviously sensitive to the value of the feature [α Nouny] possessed by the internal complement. For low values of α , strings violating the condition are totally excluded, while for high values, no violations are produced. And for intermediate values, while speakers may disagree on absolute judgements of such strings as (119c-e), to the best of my knowledge, speakers will by and large agree on the relative acceptabilities of such strings.

Thus here we see two slightly differing manifestations of the nouniness squish: The valency of the rule of *Preposition Deletion* assumes the fairly discrete, categorial, values of OBLIG, OPT, and DNA in accordance with the squish, while the output condition occasions, for many speakers, no abrupt, categorial, discrete judgements. It is at present a mystery as to why some manifestations of such squishes are more categorial than others.

In Ross (in preparation b), I argue that discrete treatments of constraints on variables, such as the presentation in Section 2.2 above, must be abandoned in favor of a non-discrete treatment. Basically, what I assert is that it is possible to find a hierarchy of rule strength [the horizontal dimension of (120)] and a hierarchy of environment restrictiveness [the vertical dimension of (120)] which interact in the way shown in the assignment of values to the cells of the matrix.

(120)

		Rule Strength \rightarrow			
		<i>(English)</i> Reflexivization	<i>Tough</i> Movement	<i>Adverb</i> Preposing	<i>Topicali-</i> zation
Restrictive- ness of environment \downarrow	Within clauses	✓	✓	✓	✓
	Into non- finite clauses	x	✓	✓	✓
	Into non- factive <i>that</i> - clauses	x	x	✓	✓
	Into fac- tive <i>that</i> clauses	x	x	x	✓

As was pointed out in Section 2.3 above English Reflexivization cannot "go down into" even non-finite clauses [cf. (121)].

(121) Harry promised Mary_i [_Sto give her_i (*self) some port_S].

And the rule of *Tough Movement*, while it can extract elements from non-finite clauses [thus (122a) can become (122b)],

(122) a. It was tough for Jeff to begin $\left\{ \begin{array}{l} \text{to read} \\ \text{-reading} \end{array} \right\}$ this issue of *Zap*.

b. This issue of *Zap* was tough for Jeff to begin $\left\{ \begin{array}{l} \text{to read} \\ \text{reading} \end{array} \right\}$

cannot extract elements from any kind of *that*-clauses, even nonfactive ones, cf. *(123b).

(123) a. It was tough for Jeff to believe that *Zap* comics could have prurient interest for Judge Fendersnozz.

b. *Judge Fendersnozz was tough for Jeff to believe that *Zap* comics could have prurient interest for.

The rule of *Adverb Preposing*, while it is strong enough to extract adverbs from *that*-clauses in the object of non-factive predicates like *believe*, cf. (124),

(124) a. They believe that Pancho will be tilting this windmill tomorrow.

b. Tomorrow they believe that Pancho will be tilting this windmill.

is not strong enough to extract them from factive *that*-clauses, cf. *(125b).

(125) a. I'm glad that Pancho will be tilting this windmill tomorrow.

b. *Tomorrow I'm glad that Pancho will be tilting this windmill.

The fact that *Topicalization* can extract the NP *this windmill* from the object of *be glad* in (125a) [cf. (126)] shows that *Topicalization* is the strongest of all the rules in (120).

(126) This windmill I'm glad that Pancho will be tilting tomorrow.

What is of particular interest about the two hierarchies of (120) is that they appear to be in part universal. That is, for any rule of any grammar, if it cannot work "into" (or "out of") a non-factive *that*-clause, then it will not be able to work "into" (or "out of") a factive clause. Similarly, non-finite clauses are less restrictive than *that*-clauses, for all known languages. And the fact that the possibility of interclausal operations is always implied by the possibility of intraclausal operations is a consequence of (95) and (96). Thus in a way (120) would seem to be a kind of further refinement of the notion of primacy.

In Ross (in preparation c) I show that the hierarchy of rule strengths which was elucidated in connection with (120) implicitly defines a hierarchy of types of open sentences, and that there is a corresponding hierarchy of quantifier strengths, such that they intersect to form a squish highly similar to, and directly related to, the one in (120). Although the complexity of the argument precludes a full discussion here, the submatrix in (127) will give a rough idea of the central idea of this research.

(127)

		More restricted →		
	Quantifier			
	Type of open S	<i>several</i>	<i>many</i>	<i>no</i>
More inclusive ↑	Quantified NP lower than coref. pronoun	✓	x	x
	Coref. pronoun inside factive complement	✓	✓	?
	Coref. pronoun inside non-factive complement	✓	✓	✓

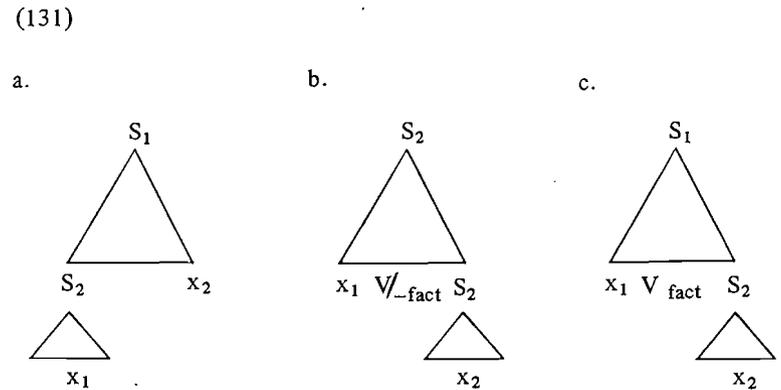
To see that *several* is “stronger than” *many* and *no*, compare (128a) with (128b).

- (128) a. That several people_i were snubbed angered them_i.
 b. *That $\left\{ \begin{matrix} \text{many} \\ \text{no} \end{matrix} \right\}$ people_i were snubbed angered them_i.

To see that *several* and *many* are “stronger than” *no*, compare (129) with (130).

- (129) a. $\left\{ \begin{matrix} \text{Several} \\ \text{Many} \end{matrix} \right\}$ people_i believed that they_i were unpopular.
 b. Nobody_i believed that he_i was unpopular.
 (130) a. $\left\{ \begin{matrix} \text{Several} \\ \text{Many} \end{matrix} \right\}$ people_i were surprised (at the fact) that they_i were unpopular.
 b. ?Nobody_i was surprised (*at the fact) that he_i was unpopular.⁴²

That is, the schematic phrase structures shown in (131a), (131b), and (131c), which correspond to the rows of (127), are arranged in the following subset relations: (131a), (131b), (131c).



Any quantifier which can, in surface structure, modify x_1 in (131c), with x_2 being a coreferential pronoun, can also modify x_1 in (131a) or (131b), with coreferential pronouns appearing for x_2 . And similarly, any quantifier which can appear as a modifier of x_1 in (131b) could also do so in (131a), again with it understood that x_2 contains a coreferential pronoun. The converse is not possible, however, as the sentences of (128)–(130) show. If we view the diagrams in (131) as schematic representations of open sentences, we find that there are syntactic reasons for thinking that some open sentences are more “open” to quantification than others.

Finally, in Ross (in preparation d), I show that there are certain syntactic phenomena which are limited to what we might call “treetops”—the highest islands of trees. All noncyclic fronting rules—rules such as *Adverb Preposing* and *Topicalization*—are limited to occurring in treetops. Thus note that while both (132a) and (132b), which represent the outputs of *Adverb Preposing* and

⁴²Most speakers that I have checked with do not find that there is any difference in grammaticality between the long and the short versions of (130) – for them, the addition of *at the fact* does not worsen the sentence. However, some speakers share my intuitions, and I have found none with the opposite feelings.

Topicalization, respectively, can appear in isolation, (i.e., in treetops), embedding them in subject clauses, as in (133a) and (133b), respectively, produces rottenness.

- (132) a. Tomorrow we will hire a minority group member.
 b. The overdose of alkaseltzer the DA will probably not even mention.
- (133) a. ??That tomorrow we will hire a minority group member is unlikely.
 b. *That the overdose of alkaseltzer the DA will probably not even mention is unlikely.

Significantly, from the point of view of non-discrete grammar, the embedding of sentences starting with constituents which were preposed by a weak fronting rule produces less ungrammaticality than that which is occasioned by the embedding of sentences starting with constituents that have been preposed by a strong fronting rule. Thus (133a), whose derivation involves *Adverb Preposing*, a relatively weak rule [cf. (125) above], is better than (133b), whose derivation involves the relatively strong [cf. (126)] rule of *Topicalization*. Also significant is the fact that sentences with fronted constituents embed more successfully after non-factive predicates than after factives [cf. (134) and (135)].

(134) They believe that { tomorrow we will hire a minority group member }
 { ?the overdose of alkaseltzer the DA will probably not even mention }

(135) They are surprised that { ??tomorrow we will hire a minority group member }
 { ?the overdose of alkaseltzer the DA will probably not even mention. }

To sum up, while it is true that research on developing a precise formal theory which would be adequate to the task of describing the many squishes and the intricate interactions among them which can be observed in natural languages is barely underway, it seems to me that the rejection of the Law of the Excluded Middle in favor of some nondiscrete logic, as I have proposed in the works reported on above, has already led to a significant deepening of the understanding of many complex areas of semantax, and is likely to prove to be a fruitful avenue for further explorations in the future.

4. SUMMARY

The three batons of the title of this paper should now have become clear.

In Section 1, a number of arguments were given which pointed to the

conclusion that the underlying structures which previous researchers had assumed to be adequate were too concrete, by orders of magnitude. The question that this suggests for cognitive psychology is this: Does a similar situation obtain with respect to the models that have been proposed for cognitive processes? As an outsider, I cannot point to any areas in which I know existing models to be under-abstract, but it would strike me as odd if two fields as close to one another in content as linguistics and cognitive psychology were to differ markedly in the abstractness of the relations between data and model.

In Section 2, I sketched some preliminary formulations of putatively universal constraints. The questions that I as a linguist have for researchers in cognition are these: Are there analogs to the Immediate Self-Domination Principle or to the Primacy Constraint within psychology? In what areas of psychology must hierarchically ordered structures be assumed? Can the idea of self-dominating nodes be exported from linguistics to be used in describing facets of the types of behavior that are described in such terms? And is the notion of primacy generalizable to such structures? As far as I can see, the prospects for explaining either of the two constraints explored in Section 2 within the bounds of linguistics are not bright. Why, for instance, shouldn't it be precisely those nodes which *do not* immediately dominate other nodes of the same type that prohibit the chopping out of one of their dominees? Or why shouldn't lower elements in a hierarchical structure have primacy over higher ones? While it may yet prove possible to find explanations for some of the particular facets of the universal constraints discussed in Section 2 within linguistics, this seems unlikely to me. Sooner or later, we linguists must hope that it will be demonstrable that the laws of universal grammar that we unearth are special cases of general laws of behavior.

Finally, in Section 3, I have given some indication of the breadth of the range of evidence that suggests that many metalinguistic predicates, such as *is grammatical*, *is an adjective*, *is an NP*, etc., etc., should not be thought of as being binary, discrete predicates, but rather as being quantifiable. I have not been able, within the confines of this short paper, to support adequately my contention that this "squishification" of linguistic predicates is necessary almost everywhere, but that is my belief. The question for cognitive psychology is: How's by you? Are there areas of investigation for which discrete systems have traditionally been assumed but for which non-discrete treatment would make more sense? For instance, would it make sense to talk about one subject as having solved a chess problem "more" than another subject? Or of one subject using one scheme for memorization "more" (i.e., more fully, not merely more frequent use) than another subject?

In linguistics, it would seem wise for future researchers to approach any phenomenon under investigation with the beautiful question of Lloyd Anderson — not "Is the phenomenon in question discrete or non-discrete?" but rather "How discrete is the phenomenon?" It may be that this question is as timely for psychology as it is for linguistics.

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I would also like to thank Albert Anonymously, the by now hundreds of students and colleagues who have listened to me talk about the material in Section 1 — abstract syntax — and have then patiently helped me to see that what I did not think was chaff was after all, and whose fault it isn't that so much of it still remains.

And very special thanks go to Jim McCawley, not for any particular comments on this paper, but for being able to be so cheerful at the task of sweeping out the Augean Stables of Meaning, and for just plain being; and to George Lakoff, who and I ([improbably] forthcoming) are said to be writing a book about abstract syntax, and who has taken these first steps towards meaning much farther than I would ever have been able to.

And most specially I am grateful to Paul Postal, whose teaching in the early 60's was the basis of most of abstract syntax and generative semantics.

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5

ON WHAT IS DEEP ABOUT DEEP STRUCTURES

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I'll begin by commenting on the moral that Haj Ross presented at the end of his first section: "We linguists have to have these wildly complicated underlying structures to account for our facts; do you cognitive psychologists need the same sort of machinery to account for your facts?" Personally, I doubt that cognitive psychologists will be able to utilize underlying structures which are abstract in Ross's sense in anything other than the cognitive psychology of language (or more generally, of communication). I note parenthetically that Ross, like most linguists, uses "abstract" in a rather untraditional sense, namely that of "non-patent; far removed from the *surface*"; this is quite distinct from the traditional sense of "abstracted from the specific instances by weeding out inessential characteristics." A surface structure or a phonemic transcription is abstract in the traditional sense but not in Ross's sense.

The underlying structures that Haj talked about do not have the status that transformational grammarians generally ascribe to them. The classical literature (e.g. Chomsky's *Aspects*) and most popularizations state as official doctrine that underlying structures are postulated to explain distributional facts, i.e., the fact that such-and-such a word can occur in such-and-such environments but not others, etc. As he pointed out, the position that Ross and I take is that these underlying structures are not just supposed to explain distributions of words but are intended as some kind of approximation to the meanings of sentences. Sentences have meanings independently of the linguist's desire to account for surface distributions of morphemes, and those surface distributions are heavily influenced by restrictions on how semantic elements can combine into meanings of sentences and how the language allows semantic structures to be expressed; the "intermediate stages" of our derivations are simply our way of representing the interactions of the various linguistic mechanisms that are involved in relating meanings to possible expressions. I thus think that it is only because of a very special property of sentences, namely that they are used to express meanings, that they are amenable to an analysis in terms of underlying structures that are abstract in Ross's sense.

Is there any other kind of linguistic analysis that provides a potentially more fruitful model for possible cognitive psychological analyses? Regardless of its merits in linguistics (where I think it has been pretty well discredited), *structuralism* would seem to me to be more relevant than the approach that Ross talked about today. While there is a wide variety of structuralist conceptions of “phoneme” (for example, those of Saussure, Bloomfield, Sapir, Bloch, and Jakobson), they all constitute attempts to analyze utterances by decomposing them into pieces and identifying those pieces. Structuralist analyses yield things-like phonemic representations and surface structures, and my feeling is that it makes more sense for psychologists to look for things like phonemic representations and surface structures manifested in cognitive data than for things like deep structures. To take one concrete example, in the celebrated experiment in which subjects who need string to perform a task fail to perceive as string the string that is holding up a picture, it makes sense to hypothesize some kind of “cognitive map” in which the string is perceived not as string but as some kind of excrescence of the picture, but that cognitive map is related to the physical world as an identification of the pieces of the physical world, albeit an identification in terms of functions and thus more analogous to Sapir’s conception of phoneme than to Bloch’s.

I should add one point here about structuralist linguistics, namely that among structuralists there is widespread confusion about two distinct questions: that of what is relevant to identifying the units that are postulated and that of what characteristics of the units are distinctive, as opposed to redundant. Many physical phenomena relevant to the identification of some unit are not “distinctive” in the linguist’s sense of the term. Let me illustrate this by describing my experience in learning to read and write Chinese characters, which I have been attempting to do since I started studying Japanese 12 years ago. Japanese has a really screwed-up writing system that includes an ungodly number of Chinese characters. I often write characters that to me are perfectly intelligible but which a native writer of Japanese can’t decipher. In many cases the thing that I’ve done wrong is non-distinctive, that is, my mistake doesn’t serve as the distinction between some character and another real or imaginable character but still somehow plays a role in the identification of the character. On the other hand, there are enormous differences between ways of writing the same character that native Chinese or Japanese don’t notice. (Incidentally, I think that handwriting deserves much more study by linguists and cognitive psychologists than it has received; or is there perhaps work in this area by cognitive psychologists that I just don’t know about?)

One area that might constitute a counterexample to my words of pessimism concerning Haj’s moral, i.e., an area that might call for analyses that are abstract in Ross’s sense, is music. (Have cognitive psychologists done anything on music, for example, on the identification of melodies, harmonies, rhythms, etc.? Again, I don’t know.) This is the one area where I was able to come up with something that might fulfill Haj’s request (in previous correspondence) for examples of things outside of linguistics that exhibit some analogue to the coordinate structure constraint or the complex NP constraint. The following musical example (from Mozart’s C minor piano sonata, K. 457) may illustrate something like the coordinate structure constraint. The sonata begins with a 4-bar phrase that leads



from the tonic to the dominant, followed by a 4-bar phrase that is roughly a repetition of the first 4-bar phrase but which leads from the dominant back to the tonic. Consider the turn that appears in the 2nd and 6th bars. If it were omitted in both bars, the result would still be a perfectly well-formed opening, but if it were present in only one place but absent in the other it would not be:



The coordinate structure constraint, stated in its full glory (which is fuller glory than in the statement of it that Ross gave today) says that a transformation may not move material into or out of a conjunct of a conjoined structure unless it does so to all the conjuncts. If it makes sense to regard these parallel 4-bar phrases as making up a conjoined structure (which I am not convinced makes sense), the requirement that the ornament be either present across the boards or absent across the boards might constitute an example of some analogue of the coordinate structure constraint.

Regarding Haj’s remarks about “primacy” and universals, he oversimplified the statement of the facts about reflexivization, but if you bring in something closer to the full hairy details you can still argue for something like his implicational hierarchy. Contrary to what Haj said, it is possible to reflexivize into subordinate clauses in English, though under not well-understood conditions, as in Jackendoff’s example “The fact that there is a picture of himself in the post office worries Fred.” Here *himself* is in a subordinate clause “that there is a picture of himself in the post office,” and its antecedent, *Fred*, is in the main clause. But here, contrary to the textbook cases of reflexivization, the use of the reflexive is optional: You can also say “The fact that there’s a picture of him hanging in the post office worries Fred,” with *him* referring to Fred. This is the same general kind of constraint or applicability which Ross was talking about, i.e., the rule basically applies to clause mates but can be extended to apply into a subordinate clause, with, however, a decrease in the obligatoriness of the rule: It is optional when it

applies into a subordinate clause. I would expect the following universal to be true. If a rule is applicable both within a clause and into a subordinate clause, it is possible for it to be obligatory within a clause and optional when it applies into a subordinate clause, but not vice versa.

Regarding the question of the scalarity or non-discreteness of category membership, a sobering question arises: If you accept the claim that there is a scale of membership in various categories, what sense can you make out of linguists' arguments for category membership of specific items, for example, the argument given by Ross (1968) that predicate adjectives (and adjective phrases) are dominated by a node labeled NP? Since the distinction between "sentence," "predicate," and "argument" (= "NP") in semantic structure seems to be absolute, I suspect that the various categorization arguments in existence, if examined critically, will turn out to be either (a) arguments as to the category of the node in semantic structure to which a particular node in surface structure can be traced back, or (b) arguments that show where a particular item fits on one of Ross's scales. Is there any relationship between the scales and the semantic categories? It would be nice if it turned out that there was a one-to-one match between the scales and the semantic categories, with each scale corresponding roughly to a measure of how closely the item in question approximates the "unmarked behavior" of items that are traceable back to the semantic category in question; however, at the moment I have no feeling as to how "nice" things really are.

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6

ROSS-McCAWLEY DISCUSSION

Ross: I think music is a good case to think about. At Bell Labs in New Jersey there is a melody generator. Researchers there have taken a Japanese folk song and a piece by Shubert (or somebody like that) and, using this melody generator, made a sequence of steps progressing gradually from pure Shubert to pure Japanese folk song with other "steps" being available if you want to make them. I don't know exactly what the constraints are, but they're like Gregorian chants. That is, there are some rules for generating possible sequences, and they can generate possible Japanese folk songs and impossible ones and mark them as impossible. The conclusions I would draw for squishiness here are again that it's like imprinting. That is, the concept of "Japanese folk song" is not an all or nothing, on-off predicate. This even holds for particular Japanese folk songs; that is "Is this particular melody which we have just heard a rendition of Japanese folk song x?"—is not going to be answered yes or no: The answer is going to be "sort of" or "not so much as last time," etc. Now, with respect to this, there's another musicologist whose work I know a tiny bit about. His name is Heinrich Schenker, who lived around the turn of the century in Austria. Schenker (1954) analyzed all tonal music up to roughly Strauss, to around 1900, in terms of what he called an *Ursatz*, which means something like a protoline and a set of rules that apply to expand it. So he would, for instance, derive the entire Jupiter symphony from an *Ursatz* which would be a very simple melody (perhaps with only ten notes in it) and then a set of rules which were supposed to apply to all tonal music or all of tonal music within a particular historical period. This man's work hasn't been studied by any other linguist, to the best of my knowledge. I just happened to know about it incidentally but I'm not enough of a musician to really do a study on it.

I want to say one final thing about the discussions of abstractness: Could it really be that something like that 22-sentence underlying structure for "Floyd broke the glass" is all there? How can it be psychologically real?

Let me stop speculating with this anecdote. We would be doing syntax and out would come this insane, crazy, vastly complicated unstateable fact about a language or language in general and we'd say "Oh, wow, how could that be learned?" I would say, "Look at this, it must be innate: It couldn't possibly be learned." Well, something that really changed my mind was the book by Luria (1968). Since I read

about Luria's subject *S*, I have ceased to say, "How could it be learned?" To be sure the mind of this man was rather like a laser beam trained in the wrong direction: He had a lot of difficulty coming to terms with the so-called real world, and what Luria did was to help him get into a career as a memory specialist. But if that much information can be represented over, in this case, 50 years of a man's life, then just a little bit of that vast amount of power could be used to learn anything. If *S* had the right kinds of principles, if he had more than associative rules, if we really had a learning theory with teeth in it, I think there's a great deal that we have found universal which *could* be learned. In particular, with respect to what McCawley said and to what has often been objected against these terrifically abstract underlying entities (that they are not psychologically plausible), I am not convinced. People say "well, how could somebody be thinking of all these 22 sentences and squish through all these derivations and pack it all into 'Floyd broke the glass' in something under two seconds?" I'm not convinced that we cannot do this, given the existence of this man and this sort of demonstrated power. Luria and his associates tried to find limits on his memory, but they couldn't. They just stopped—they found it was a hopeless undertaking. So now I am perfectly willing to listen to arguments which say that in particular, this linguistic analysis is wrong from a processing view. (That is, that big tree, which I gave you, is wrong.) I think the arguments have to be empirical ones, not arguments to the effect that "well, it couldn't be the case; you just don't have the brain power."

McCawley: Another thing about Schenker which gives further reason for people interested in the kind of structure we have been talking about to look at music is his notion of tonicization, which I think provides a musical analog to the linguist's notion of subordinate clause. In a lot of his musical analysis Schenker will talk about a certain section of the composition as involving subordinate tonality, which is somehow brought into being. Relative to that subordinate tonality, you've got dominant, subdominant, etc., but this is really a subordinate clause so you have to exit from it and get back to the basic tonality of that section of the composition.

Regarding the limits of human memory, and the structures such as Ross's simplified version of "Floyd broke the glass," his choice of words was, I think, unfortunate in a couple of places in talking about it, since it would suggest an extremely common error that turns up in writing about transformational grammar and the human mind and performance, namely the error of supposing that these kinds of underlying structures have to involve mental events of construction of this entire deep structure prior to production of this surface sentence, or even simultaneously with the production of the sentence. I think that an appropriate point of view to take is that you don't necessarily have to have any kind of psychological event or point in time when all of that stuff is simultaneously present in the mind of the speaker that's producing or hearing that sentence. But it makes sense to say that it's there as a representation of the sentence, in the sense that someone who said that sentence could perfectly well correct himself on the basis of his having said a sentence whose semantic structure doesn't correspond exactly to his intentions. Postulating a representation of the sentence is necessary to explain what would go on in a person's choice of sentences. You really have to talk about the interaction between his intentions and extremely complicated structures which

his language sets up in correspondence with sentences: the actual sequence of events could perfectly well be that he would say the sentence and only a few seconds later compute the actual total semantic structure which corresponds to it, but it still makes sense to say that that semantic structure is part of the psychological basis of what he does in speaking.

Halwes: First, concerning the business about generative semantics—and especially McCawley's comment that you couldn't expect to find that depth of abstractness in noncommunicative systems: I think that that is very likely *not* to be the case. It may very well be that McCawley's analysis is wrong. It seems to me to be an enormously good bet that whatever kinds of structure are involved in language are also involved in essentially everything that we do. I want to point to a few things which might make that intuitively clear; I don't think I can make the case in any kind of formal way, but I might make it plausible. One of the things that gets avoided in all of the linguistic work from M.I.T. (that I have seen) is what you might call an "aboutness relationship." We all know that communication is somehow supposed to refer to certain states of affairs in the world about which the person is presumably trying to communicate (to another organism). Now that aboutness relationship holds for essentially any kind of act, as far as I can see. Take, for example, walking. Bernstein's (1967) beautiful analysis of motor activity argues that there is what you might call a basic pattern of coordination which goes down any time a person is doing any skilled activity. There's a basic structure to my walking across the floor which you might consider to be analogous to a surface syntax, where you could analyze it into steps and the steps could be put into larger clauses where I have to turn and go this way because that's the way the aisle goes, etc. If you look at the movement as if the person were walking along in the air, you will get what Paul Weiss calls the basic pattern of coordination, which is analogous, I would suggest, to syntax in linguistics. But, in fact, the person's walking along on the ground, and there are various kinds of obstacles that he has to turn to avoid; he has to adjust his steps to the actual terrain so that in a very real sense, the walking is *about* the movement across the actual terrain. First it's about moving from here to there; secondly, at another level, it's about going along a particular pathway which has to be taken to get from here to there. And thirdly, it's about the particular fine adjustments of the basic stepping patterns which have to be made in order that I step *on* this rock instead of kicking it with my foot, etc. So I think that you're going to find that kind of aboutness relationship in any skilled motor activity, not just music and language. Also, you clearly will find that kind of aboutness relationship in perception. And when you start pushing these structures back up into semantics, it looks like what you're doing is pushing them back into an attempt to deal with what we call *knowledge*, that is, what the organism knows about the world, which is what (to use Gibson's term) *affords* all of these fancy things that we do. It seems like an enormously good bet that the knowledge which underlies our communicative acts is essentially the same knowledge which allows us to walk across the room without running into things and which allows us to see the things that we might otherwise run into.

Now about primacy. Somewhere in the middle of Ross's primacy talk the top of my head just blew open and I was ecstatic from then on. Certain things came to

me and I would like to point them out as examples. The first examples are not directly concerned with primacy, but rather give some ways of getting yourself into a frame suitable for looking at the implications of Ross's linguistic work for other aspects of psychology. First, when you're dealing with sentences, you're dealing with something like grammaticality and the rejection of non-sentences, and there are certain psychological phenomena which you can use as the same kind of indicator of failure to obey the rules in other domains of behavior. There's one phenomenon called the von Restorff effect where you see a list of words, which you're supposed to remember, and they're all printed in black ink except one that's red. If there's one that's red, then you notice it and you remember it better than the others. That *noticing* phenomenon indicates that the basic structure of your processing of that material has been interrupted by violation of something, which causes noticing. Here you're aware of the material at one level, and all of a sudden you jump down to an awareness of it at another level which, before the jump, was known tacitly. The shift in awareness from one level to another, the noticing, is caused by the violation.

As a second example, there's a beautiful phenomenon that was described to us, when I was a graduate student, by Zoffia Babska, a Polish psychologist who works with children. She told us a story about a time when she presented a kid with a carrot and he took the carrot and put it in his mouth. She presented the child with a plate and he ignored the plate and didn't care much about it. She presented him with a carrot on a plate and he took the plate and put it in his mouth. There's another phenomenon called the Ames room. If you look through that room, the people are seen as different sizes even though they're not. As a fourth example, there's a thing called the Honi phenomenon where essentially if there's somebody that you love put in the Ames room they *don't* change size.

Remember this thing in Fig. 1?

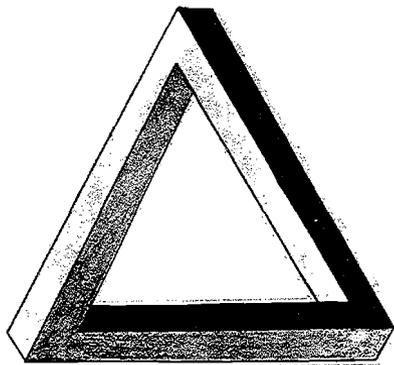


Fig. 1

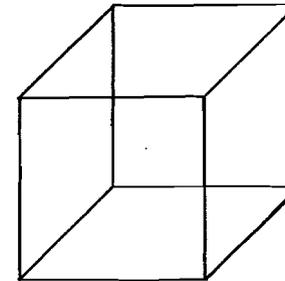


Fig. 2

That's another one. So is the Necker cube portrayed in Fig. 2. These are psychological phenomena you might look at in terms of responses that a subject may make—surprise and eating the plate, etc.—that would tell you that you were dealing with (or in this visual case the inability to construct an integrated experience of that thing which would tell you that you were dealing with) the kind of rule violations the linguists consider when they talk about grammaticality.

Now about squishiness. One of the nice things about music is that there is something analogous to linguistics in the study of music: theory. Theoreticians take Bach and decide what Bach was doing and what rules Bach was obeying when he made his music. So now you have all these rules and can show how Bach's work obeys them. Then you go look at Bach and you find that Bach violated all those rules. But when Bach violates one of these rules, it doesn't sound bad: It adds to the richness of the music. It makes a difference that he uses that particular violation. The presence of a basic structure, of a basic pattern of order in the music, makes it possible for Bach to make violations which do matter. Let me make a very bizarre speculation about the history of the development of language. One of the things that seems to be true about skilled motor acts is that, for example, if I'm going to hit a tennis ball over to the corner, there are essentially an infinite number of ways that I could do it. In fact, I will tend to do it with a certain *style*—my own personal idiosyncratic way. And the more I do it, the more I will drop into a particular style of doing it and the harder it will be for me to do it in one of the other ways that are in principle available to me. Now suppose you have monkeys talking to each other, making these noises, and they gradually drop into a certain style of making noises. You might think about that as the origins of surface syntax if you like. Now once you have a culture in which people have all gradually (through the fact that you learn from your mommy and you don't know whether this particular thing she's doing is crucial or not, as in the case of McCawley's Japanese figures, so you learn all of it that you can including her style) developed a situation wherein everybody in the community is using a particular style in certain

respects, then it becomes possible to put an information load on that style. Once you've got a basic pattern structure, you can *violate* it. You can do squishy things with it and use that squishiness, or those violations of that basic pattern of structure, as a way of communicating information.

Ross: Let me say one thing which has come up now in what Halwes said and came up in a comment that McCawley made to Dulany's talk; it's a conceptual idea which is a very good thing to export from linguistics into other fields: the idea of starring things. Ungrammatical sentences are indicated with asterisks or stars. For instance, in cultural anthropology we can view man as generating a set of possible cultures and as refusing to generate ill-formed cultures. The idea of generating an ungrammatical Bach sonata or an ungrammatical culture or an ungrammatical stimulus-response link or an ungrammatical behavior sequence seems very important. For me it's even more important than looking for deep structures and transformations and things like that. The idea of shooting for the stars is a good one.

McCawley: Just a comment on one of the things that Halwes was saying. The example of walking is beautiful and worth much thought, but I'm not convinced that it really leads into anything like the kinds of derivations underlying structures that Ross was talking about. The question is whether these modifications of the basic way of doing things would be analogs to transformations in Chomsky's sense or analogs to transformations in Harris' sense (if they're in fact analogs to either). To the extent that they're analogs to either, they would look to me more like analogs to Harris' transformations, i.e., a relationship between two classes of surface structures. The question I would like to ask is whether whatever you do in walking to avoid stubbing your toe on a rock is analogous to, say, the subject raising transformation or something like that, which is involved in converting Ross's underlying structures into surface structures, or is it analogous to whatever is involved in your, say, speaking in such a way that you don't use a word which would be likely to remind the person you're talking to of some money that you owe him. I think that there are things in the use of language which are analogous to the problem which Halwes was talking about there, but which really would involve some kind of mechanism distinct in nature from grammatical rules in the sense which we've been talking about them.

Brewer: One comment about Luria's *S*. He was clearly abnormal and not representative of human mental ability. Effectively he was a tape recorder and a three-dimensional color camera. This allowed him to do things like memorizing the surface structure of anything he ever heard. Now with all the rest of us poor human beings, when you go away from this conference and someone asks you what was said and you try to recall it, you will not be able to give back surface structure of everything that was said. You will be able to give back to some extent the meanings of some of the talks. *S* couldn't do that very well: He gave back surface structures and whenever he made an error, it was because something was visually similar or sounded the same. He never made mistakes of paraphrase when one word was similar to another in meaning. He was lousy at thinking basically and he couldn't read; he couldn't comprehend paragraphs or science lessons, etc. He could memorize everything, but he couldn't understand it. What is the circumstance of a

child who is trying to learn a language? Is he trying to memorize the surface of language? Or is he trying to dig up examples (just like Chomsky says), and he's got to somehow put all this together and come up with abstract structure? It seems to me that what the kid's circumstance requires of him is all those things that Luria's subject was bad at: trying to derive things and put them together and so on.

Ross: Briefly, I wasn't trying to use *S* for anything other than an existence proof for vast mental capacities, far in excess of what is usually discussed.

Brewer: Ross just mused that from the point of view of cognitive psychology it is hard to know what to do with material like "Floyd broke the glass." The things that look interesting are those places where the language apparatus interacts with the real world, and it does all the time when you really talk. In other words, you relate the knowledge that comes in your eyeball to what you say next. There are even examples in the language where the syntax is manipulated by those things, the classic *reference* phenomena, like "this" and "there" and pronouns—when I say "he left" I have to code it by what isn't there anymore. These kinds of phenomena are the things that look to me like ones that psycholinguists ought to be worried about. Another example occurs in "Floyd broke the glass." The thing that would be interesting would be for someone to give us an analysis, from the syntactic point of view, of a glass. Notice that when we get to glass, suddenly the analysis stops. We don't learn anything about glasses. What is it you know about glasses that makes them different than typewriters? I guess I'd like to have linguists respond to this and to Chafe's (1970) comment that this is all still fundamentally syntactic, even though the name makes it look perhaps another way.

Ross: I'll just say one very brief thing about why we don't analyze glass. The answer is we have to crawl before we can walk. I mean we will; we're getting at it, but so far it's very difficult. Here's the problem in semantic analyses. Some linguist says "Glass" has these four semantic features and they're structured like this: This one applies here, etc. Another guy says "Glass" has these seventeen features and these two apply . . . What are you going to do? Which one is right? The thing which I think is responsible for the large amount of interest in generative grammar on the part of both psychologists and philosophers is the structures which this kind of argumentation leads linguists to postulate. The first article on generative grammar really is arguably based on simple laws about distribution. "Hit Tom." That's really got a "you" in there: It means "you hit Tom." This is so obvious that it's very hard to distinguish, to point out to people, that generative grammar is really saying something new (because there's all this traditional stuff about the understood subject). Consider a sentence like this: "I wanted a bagel." Just like "I painted a bagel," one could say, and traditional grammarians, I believe, always have said "Wrong!" McCawley and I independently have worked out arguments that "wanted a bagel" really comes from "I wanted to have a bagel." And so "bagel" here is really declausal: It's the last fragment of the old object of want, which is really "I want" — "I have"—or "I will have"—or "I will get a bagel." And one of the syntactic arguments that this in fact is a correct analysis, which was noticed by a Japanese linguist by the name of Masaru Kajita, is this. You can say "by tomorrow" is a future adverb. But it seems to occur in a past-tense clause. Supposedly you can't have that. I mean normally that's impossible so "I wanted a bagel by

tomorrow" is started. But really, i.e., conceptually, what is "by tomorrow" modifying? Well, the thing that's *gone*: It's modifying "have." "I will have a bagel by tomorrow" or something like that. "I wanted—I will have a bagel by tomorrow." Now there are syntactic arguments here like the one I just flashed by in this analysis. My paper argues that really "I wanted a bagel" should differ in underlying structure from "I painted a bagel." In this case "bagel" should be desentential: the last item of a full clause. In "I painted a bagel," no such analysis holds. Now immediately, when a psychologist or a philosopher hears that, he perks up his ears and says "Ha Ha! I understand this simple stuff! This is easy, and it takes us back to structures which are very nice for meaning." Now suppose instead we could show that the following was what we had for "I wanted a bagel", that is, there were a lot of syntactic arguments for this analysis. Suppose there was in fact something *gone* in "I wanted a bagel," and that it was something like this: "I wanted a peanut, which you could put on a bagel." Suppose we could motivate such a structure (which is not logically impossible). Immediately all the philosophers and psychologists go to sleep, because the structures which we would be unearthing would be of no interest to anybody else in any other field. Now what's interesting—and why I would disagree very much with Chafe if you have presented him accurately—is, it seem to me, that syntax, these simple things which are very easy to understand in the basic cases, gives us a way of *justifying* particular semantic analyses for which otherwise there's no justification. As I said, one guy says "this" is a semantic analysis; the other guy says "that" is a semantic analysis; You can't even fight in that case. So as soon as we can find ways of proving what the correct way to unpack "glass" is we'll do it for you, but right now we don't know how.

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7

ECOLOGICALLY STIMULATING COGNITIVE PSYCHOLOGY: GIBSONIAN PERSPECTIVES¹

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STIMULATION AND COGNITIVE PROCESSES

On the face of it, James Gibson's approach to perception is not a likely candidate for concern in a volume devoted to problems in cognitive psychology. There is no need to argue for including perception itself under the heading of cognitive psychology, but Gibson's brand of perception is another matter. His most distinguished research efforts have focused on analyzing stimuli; and the data from his studies have been used to promulgate a theory of *direct* perception—two seemingly very uncognitive enterprises. Gibson, as anyone familiar with him knows, will never present testable processing proposals that could be recognized as normal cognitive psychology. Yet I shall offer his position, and some research on kinetic depth perception guided by it, as not only appropriate for cognitive psychologists to consider but featuring considerations without which cognitive psychology would be certainly incomplete and probably unsuccessful.

In current practice, it is the *processes* associated with a problem which tend to determine its assignment to a psychological category. Sensation, perception, and cognition are labels which suggest a scale of increasingly complex operations performed by the organism on stimuli as they journey from the peripheral receptors to the cortex, and are eventually transformed to a state of "knowledge." Ulric

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