Toward a Minimalist Theory of Syntactic Structure

David R. Dowty

Ohio State University

Paper prepared for the Tilburg Conference on
Discontinuous Constituency

January 25-27, 1989

[Corrected version February 24, 1992]

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1. Introduction.

No assumption is more fundamental in the theory (and practice) of syntax than that natural languages should always be described in terms of constituent structure, at least wherever possible. To be sure, certain kinds of cases are well-known where constituent structure of the familiar sort runs into problems, e.g.

(1) a. VSO languages
b. Cases for which "Wrapping" operations (Bach 1980, Pollard 1984) have been proposed
c. Free word order and free constituent order languages.
d. Various other instances of proposed "flat" structures
e. Clause unions
f. Extrapositions
g. Parenthetical phrases

But even here, the strategy has usually been to accommodate these matters while modifying the received notion of constituent structure as little as possible. Indeed, the most extreme and general theoretical proposal I know of for systematically departing from constituent structure, Zwicky's (1986) *direct liberation* framework, which incidentally was the inspiration for this paper, still takes the familiar hierarchical constituent structure as its point of departure, in an important sense, and derives "flat" structure from these (more on this below).

There are two things that worry me about the situation syntactic theory finds itself in 1990. Since hierarchical syntactic structure is so often assumed, syntacticians don't usually ask questions---at least beyond the elementary syntax course---as to what the nature of evidence for a constituent structure in a particular sentence in a particular language is: we just take whatever structure our favorite syntactic theory would predict as the expected one for the string of words in questions---by the current X-bar theory, etc.---unless and until that assumption is contradicted by some particular fact.

My second concern is closely related: I suspect syntacticians today have almost come to think of the "primary empirical datä of syntactic research as phrase structure trees, so firm are our convictions as to what the right S-structure tree for most any given sentence is. But speakers of natural languages do not speak trees, nor do they write trees on paper when they communicate. The primary data for syntax are of course only STRINGS of words, and everything in syntactic description beyond that is part of a theory, invented by a linguist.

What I want to do today is describe what I will call a ***minimalist theory of syntax***, that is, one in which the default assumption in syntactic description is that a clause or group of words is ***only*** a string; hierarchical structure is postulated only when there is direct evidence for it or when it is unavoidable in generating the data right. Unlike Zwicky's approach, which is really very similar in the class of phenomena that can be analyzed[1], this theory is deliberately formalized in such a

[1] Beyond differences of how the two formulations affect the methodology of the linguist, there are only two differences between Zwicky's formulations and mine that I can see: (i) my description of bounding requires one to list the "bounding categories" for the whole language; these then are treated as bounded by all rules (though, at present, I also allow additional rule-specific bounding as a marked option). Bounding (for which his corresponding concept is "concatenated daughter", as opposed to "liberated daughter") can be specified by Zwicky only rule by rule, so he cannot, e.g., directly describe a generalization (assuming there is such) that all rules of some language mentioning NP must treat it as bounded. (ii) Zwicky does not employ anything corresponding to syntactic "attachment" (see below).

way as to make linear relationships more salient and hierarchical ones less so.

As you might expect from the context in which I am presenting this paper, I am suggesting that this is also a theory which permits the description of various discontinuous syntactic phenomena, in fact descriptions which are simpler, I will argue, by virtue of it's taking linear structure as the norm; in the course of the discussion, I will treat examples of many of the problems in (1).

While not appealing so much to tree structure, I will on the other hand take much advantage of the idea of *Linear Precedence Principles* from GPSG (GKPS 1985), and also an idea which I think has been too little pursued: that some words and constituents are more tightly bound (or *attached*) to adjacent words than others are. This draws a parallel between syntax in general and the well-studied phenomenon of clitics.

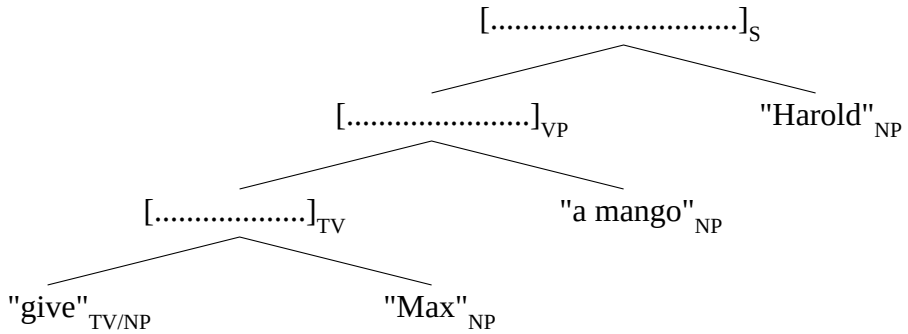
Though the theory as described here is in a very simple and embryonic form, and there are many aspects of the problems under discussion that I cannot yet give a satisfactory treatment of, I hope the reader can get some flavor of the possibilities and constraints from this presentation. One of the main interests that such a theory has for me is the way it challenges us to justify our assumptions about constituent structure at every step of the syntactic description of a natural language.

1.5 Two senses of "Constituent"

Now, there is one sense in which I am proposing to do away with much syntactic constituency and one sense in which I am not. I still assume that sentences of a language are described by rules of a recursive grammar which specify how words and phrases of some categories can be combined to form expressions of another category. And I assume that language is interpreted by semantic rules, corresponding one-to-one to these syntactic rules, that specify how the interpretation of a syntactically-derived phrase is determined by the interpretations of the inputs to the rule. All this implies syntactic constituents, in one sense. I am going to introduce a distinction which H. B. Curry drew in 1963 (Curry 1963) and which I have found it useful to appeal to before (Dowty 1982a): the sense of syntactic structure we have just been talking about is *tectogrammatical* structure---the steps by which a sentence is built up from its parts, but without regard to the actual form that these combinations of parts takes.

This notion may be best visualized by a Montague-style analysis tree as in (2), which you might imagine as illustrating the generation of a sentence, in an unknown language, meaning "Harold gave Max a mango", with lexical items only glossed:

(2)



Here we see the lexical expressions involved, the syntactic categories, the steps by which words and phrases are combined, and the implicit form of the compositional semantics. But the complex expressions at the nodes of the tree have been omitted. What is missing is, in Curry's term, the *phenogrammatical* structure: ***how*** the words and phrases are combined, in what order, whether word order is fixed or free, whether

inflectional morphology marks the syntactic organization or not, whether the tecto-grammatical groups in (2) come out continuously or discontinuously in the sentence itself, and so on. It is in phenogrammatical structure, not tectogrammatical structure, that I am suggesting natural language may be more string-less, less tree-like, than has been suspected.

One might ask at this point whether it really matters whether phenogrammatical structure is string-like or not, as long as tectogrammatical constituent structure exists; doesn't the latter do everything we want phrase-markers to do anyway? The answer is, it would not matter at all, if all languages had fixed word order and syntactic formation rules that invariably concatenated input expressions as undivided wholes: the phenogrammatical structure of every sentence like (2) would in that case be a straightforward mapping of the tree's leaves into a linear string. The problem, of course, is that languages do not always work this way: they have discontinuous word order, extraposition, and all the other phenomena in (1) that are problematic for the context-free phrase structure model. My claim is therefore that when one gets around to describing such phenomena, one may well find that they are better formulated in terms of syntactic operations applying to strings of words than to phrase markers.[2] Furthermore, I am questioning whether some of the familiar tree-based descriptions of apparently context-free phenomena (in languages like English) are really the best descriptions, so I'm suggesting the class of non-phrase-structural phenomena could be wider than is generally assumed.

The distinction between tectogrammatics and phenogrammatics is an important one if we are to seriously examine the basis for traditional constituent structure. Many arguments and lines of reasoning that are taken to show, inter alia, that surface structures are trees really establish only tectogrammatical constituency, not pheno-grammatical constituency.

Here is an example to illustrate. The sentences in (3a)-(3d) would constitute one good traditional argument that the English VP has a hierarchical "nested" VP structure:

(3) a. They said he could have been slicing the spinach, and have been slicing the spinach he could.

b. They said he could have been slicing the spinach, and been slicing the spinach he could have.

c. They said he could have been slicing the spinach, and slicing the spinach he could have been.

This conclusion, in particular, meant that (4) had at least three VP constituents:

(4) He could have been slicing the spinach.

However, (3) and other distributional facts about VPs show only that English has nested VPs tectogrammatically--that rules create various kinds of (fronted) VPs in (3), and that these rules derive all these kinds of VPs sequentially in the process of

[2] This might appear to have much in common with early transformational grammar, in which a context-free phrase-structural component generated strings which are operated on, in a purely string-based way, by transformations. Many differences exist, however, in the question of which phenomena are to be described by string-based operations (e.g. I assume here that Passive, Raising, etc. are not), differences in the restriction on how "structural descriptions" are stated, the ways "movement" is determined (e.g. here by LP and other general principles, etc.), the fact that here string-based operations are either tied to particular syntactic formative operations (i.e. like generalized transformations) or not a consequence of any one rule at all (LP principles). (WH-extraction is not treated in the present paper, but both a functional-composition analysis like that of Steedman (1985a, 1985b) and the "feature-passing" analysis of GKPS (l985) are compatible with my proposals.)

producing (4): It does not show that (4) itself has a phenogrammatical form that involves nested VP constituents; and I will argue below that the VP in (4) has no such constituent structure.[3]

For a second example consider co-reference conditions involving pronouns and reflexives in English. There is a long tradition that describes these in terms of tree structure. But in what sense is the tree structure necessary? In 1980, Emmon Bach and Barbara Partee (Bach -- Partee 1980) showed how to construct, for a reasonable fragment of English, an analysis of anaphora and pronominal expressions, in terms of the kind of compositional semantic interpretation I am assuming here. It was as adequate as the approach of Reinhart (1983), they argued, and superior in a few respects---namely, where there was an asymmetry in anaphoric behavior that would necessarily be paralleled by some asymmetry in semantic interpretation but was no well-motivated asymmetry in traditional constituent structure. Bach and Partee's compositional semantic interpretation had the same form as the tectogrammatical syntactic structure---as it does by definition in a "rule-to-rule" semantic interpretation. But the actual phenogrammatical form of the English sentences plays no role in their system.

In this paper, I will begin by describing this theoretical framework briefly, then illustrate it, first with a very small corpus of Finnish data, to indicate the treatment of relatively free word order, then turn to English, where I will address the "constituency" of the verb phrase, then turn to Extraposition data. English extraposition offers a very interesting challenge to someone who would postulate much less constituent structure but more reliance on LP principles: "extraposed" relative clauses and PPs end up at exactly that place in the clause where English LP principles say that subordinate clauses and PPs should end up anyway: at the right hand margin. The challenge is to see whether the phenomenon of extraposition can in fact be made to follow automatically from these LP rules simply by "loosening" the English constituent structure properly.

2. What would a "minimalist" syntactic theory look like?

The components of the theory I have in mind are as follows:

a. ***A Categorial Grammar*** with compositional semantics; syntactic operations build up expressions from words to larger expressions.

b. The ***"default operation"*** for combining two expressions syntactically is to merge their words into a single (unordered) multiset.

c. However, ***Linear Precedence Principles***, as in Generalized Phrase Structure Grammar (or GPSG) (Gazdar, Klein, Pullum, and Sag 1985 --- henceforth GKPS 1985) and Head-Driven Phrase Structure Grammar (or HPSG) (Pollard 1984, Pollard and Sag 1987), which apply to the output of the whole grammar, limit the orders in which expressions may appear relative to others, either partially (leaving

[3] Zwicky, coincidentally, uses the same example to illustrate his system of direct generation, noting that phonological phrasing does not motivate the nested VP structure in English (Zwicky 1986: 67). One reason that I prefer the present forumlation to Zwicky's is that his system does not clearly distinguish between phenogrammatical and tectogrammatical structure, as it comes from a tradition that presumes these are the same: the phrase markers his rules generate are, presumably, phenogrammatical, and if there are any "flattened nodes" (corresponding to my tectogrammatical constituents which are not phenogrammatical ones), these do not appear in his trees at all and are like "phantom categories" in early GPSG (though they must be "reconstructed", in effect, in the compositional semantic interpretation). An auxiliary notation might be added to his system to remedy this, but I prefer one based on tectogrammatical analysis trees, permiting phenogrammatical trees (in bracketed form) as well, when needed.

some word order variation) or entirely (leaving none). Specifications like "must appear in second position" are to be allowed. But LP principles are actually defaults, not absolute rules, as they can be overridden by rule-particular syntactic operations (Zwicky 1986, Powers 1988); see below.

d. For each language, there is a list of ***Bounding Categories***: parts of expressions of these categories cannot mingle with expressions outside the bounding category expression and vice-versa; these are "constituents" in the traditional sense. The list of bounding categories is regarded as a language-specific parameter. For (probably) every language, "Sentence" is a bounding category, since even in very free word order languages, words do not stray outside their own clause. For some languages, NP is a bounding category (so-called "free constituent order languages" are of this type, e.g. Makua (Stucky 1981)), for others it is not (these are so-called "free word order languages"), where an adjective may stray away from its head noun. A language in which all categories were bounded would of course be completely "constituentized," as normal phrase structure theory assumes all languages to be.

e. Constituent-formation **can** be specified as a rule-specific syntactic operation, but a marked one: there are two other kinds of possible syntactic operations besides the default one: (i) ***ordering*** one expression[4] to the left or right (13) of the head[5] of another, and (ii) ***attaching*** one expression to the left or right of the head of another. The difference is that two expressions connected by attachment cannot be subsequently separated by other expressions, while ordering allows this.

f. Finally, since categorial grammar is the basis of this theory, it is important to emphasize that agreement and government morphology would still be treated either as in Bach (1983), or in a unification-based system as in Karttunen (1989) or Zeevat, Klein and Calder (1987); both of these allow one to observe the so-called "Keenan principle" that in a functor-argument pair, agreement morphology is "copied" from the argument to the functor, while the functor determines what government morphology appears on the argument (Keenan 1974).

Needless to say, the details of this proposal are provisional (or absent at present) and might well be modified; some will in fact be modified as we proceed.

3. A simple "free word order" example: Finnish

I will begin with a very brief illustration of how a relatively free word order language would be described in this method. Fortunately, Karttunen (1989) describes a small

[4]I assume for the moment that ordering one expression before (after) the head of another is only meaningful if the first is bounded. Thus, options the theory could take at this point are (i) that such ordering is only to be well-defined for bounded expressions, and (ii) that if the first expression is not bounded, this operation has the effect of ordering the head of the first before (after) the head of the second. The latter will be adopted below: cf. (81), (82).

[5]I assume *head* is defined as more or less customary in categorial grammar: in a complex expression formed from one expression of category A/B and a second of category B, where A ≠ B, the first is the head; if A = B, then the second is the head (i.e. the functor A/A is a modifier). Below, we will have occasion to refer to the *lexical head* of an expression, the simplest definition of which is that it is both a head and a lexical expression (i.e. is not a syntactically derived phrase). Some expressions would not have a lexical head by this definition, of course. If it turns out that we are to assume lexical heads for all expressions, the intuitive way to proceed is by a recursive definition: one seeks the (non-modifier) functor of the expression, and if that head is not lexical, then one seeks the head of the head, and so on. However, the problem with this kind of definition is that it indirectly makes reference to the derivational history of an expression and therefore to its tectogrammatical "constituent structure", thereby defeating my goal of avoiding reference to constituency in syntactic operations. But the data treated in this paper do not suffice to determine what sort of notion of "head" is needed; the experience of Pollard (1984) and Pollard and Sag (1987) should be relevant, but I am not sure how to apply it here. Cases of attachment in this paper involve attachment to a (first-order) lexical head, or attachment to a group of attached words, of which the group is the (first-order) head and which also includes the (ultimate) lexical head.

part of the grammar of Finnish that is just right for my purposes, so I will borrow his data (but not his analysis). First, we will need some notation.

3.1 Basic Notation

Since a set is a familiar mathematical construct that has members with no inherent ordering on them, I will use the set notation to represent expressions that have been produced by grammatical operations but not linearly ordered by the LP (Linear Precedence) principles, as for example (5) is:

(5) {*a, b, c, d*}

Suppose the language has the LP principles in (6),

(6) A < B , C < D

which are interpreted as saying that expressions of category A (to which we assume *a* belongs) must precede those of category B (to which *b* belongs), and those of C (etc.) must precede those of D. This will then authorize the following as well-formed linearly ordered sentences of the language:

(7)

a b c d	*c d a b*
a c b d	*c a d b*
a c d b	*c a b d*

(This is taken over from GPSG, as in Gazdar and Pullum (1981).

To indicate a bounded constituent, a set "inside" (represented as a member of) an expression will be used. For example, if in the derivation of the expression in (5) the combination of *c* and *d* had been of a bounded category, then the whole expression produced would have been (8):

(8) {*a, b,* {*c, d*}}

and since bounded expressions cannot be separated by expressions outside, the linear phrases allowed by the same LP rules would now be only:

(9)

a b c d
a c d b
c d a b

For grammatical rules, I will adopt a Montague-style notation (since phrase-structure rules will obviously not be suitable), and the default combination operation will be represented by set union:

(10) (Default syntactic operation)

S1. If $\alpha \in A/B$, $\beta \in B$, then $F_1(\alpha,\beta) \in A$, where
$F_1(\alpha,\beta) = \alpha \cup \beta$.

Lexical items themselves will be singleton sets; therefore all expressions, lexical and complex will be sets, so set union is always well-defined on them.

The two "marked" operations will be symbolized as in (11)

(11) a. $F_2(\alpha,\beta) = \alpha << \beta$ ("α ordered to left of β")

b. $F_3(\alpha,\beta) = \alpha + \beta$ ("β attached to the head of α")

3.2 Finnish Data

Karttunen is concerned with four statements about Finnish grammar:

(12) a. In declarative sentences, subjects and objects may occur in any order with respect to the verb and to one another.

b. In yes-no questions and imperatives, the finite verb comes first.

c. The negative auxiliary (*e-*) precedes the temporal one (*ole-*) and both precede the main verb, but the three types of verbs need not be adjacent.

d. Elements of participial and infinitival clauses can be interspersed among the constituents of a superordinate clause.

(Karttunen 1989: 48)

Assume that Finnish has at least these operations for combining subjects and objects for verbs:[6]

(13) a. If $\alpha \in$ S/NP, $\beta \in$ NP, then $F4(\alpha,\beta) \in$ S, where
$F_4(\alpha,\beta) = \alpha \cup \text{NOM}(\beta)$.

b. If $\alpha \in$ TV, $\beta \in$ NP, then $F_5(\alpha,\beta) \in$ VP, where
$F_5(\alpha,\beta) = \alpha \cup \text{ACC}(\beta)$.

(I give only a very rudimentary treatment of morphology here, merely to point out at what point in the derivation case government is determined; see Bach (1983) or Karttunen (1989) or Zeevat, Klein and Calder (1987) for fully-developed theories.)

And if Finnish has **no** LP principles affecting NPs and verbs, then the following kinds of sentences will be generated, all of which mean "John loved Lisä:

(14) a. Jussi rakasti Liisaa.
b. Jussi Liisaa rakasti.
c. Liisaa Jussi rakasti.
d. Liisaa rakasti Jussi.
e. Rakasti Jussi Liisaa.
f. Rakasti Liisaa Jussi.

For Karttunen's second condition, we need simply a Linear Precedence Condition for

[6]Since under the convention we have adopted β is here a set, "NOM(β)" would be more properly understood as applying the nominative morphological operation to the expression ***in*** the set β; the same applies to attachment and rule-specified precedence in the rules below. The unification-based treatment of Karttunen 1989, or Bach's (1983) "lexical implementation", is actually preferable here, since we do not want to take rules like (a) and (b) to imply that a syntactically *analysed* version of the phrase β is necessary at this point (to apply the morphological operation correctly to the appropriate words within β), but only that a *derivation* of a nominative (or accusative, etc.) phrase β is well-defined elsewhere by the grammar.

Finnish that specifies that certain kinds of words, namely interrogative auxiliaries[7], must be first in their clause.

(15) $\underset{[+Q]}{V} < X$

Here "X" is understood as a variable over categories, i.e. an interrogative verb precedes anything. I assume a syntactic rule derives interrogative verbs from ordinary verbs, by suffixing *-ko*, and performing the necessary semantic operation. This will allow (16a) but not (16b):

(16) a. Rakastiko Jussi Liisaa?
"Did John love Lisa?"
b. *Jussi rakastiko Liisaa?

Karttunen's third condition, restricting the order of two kinds of auxiliaries and main verb is only a slightly more complicated LP condition,

(17)

V	<	V	<	V
[+Aux]		[+Aux]		[-Aux]
[+Neg]		[+Tem]		

permitting four (but only four) ways of saying that Lisa has not slept. Here, *ei* is the negative auxiliary and *ole* the past auxiliary:

(18) a. Liisa ei ole nukkunut. "Lisa has not slept"
b. Ei Liisa ole nukkunut.
c. Ei ole Liisa nukkunut.
d. Ei ole nukkunut Liisa.

The more interesting case, for our concerns, is the fourth one, for Finnish is rather unusual in permitting words from a subordinate infinitive complement to "escape" into a main clause. Below is some data. We will have an infinitive meaning "play tennis in these (clothes)" embedded as complement to the verb "start" (*ruveta*), all of which is then embedded as complement to "intend" (*aikoa*), along with negative and tense auxiliary verbs:

(19) En minä ole aikonut ruveta pelaamaan näissä tennistä
not I have intend start play these-in tennis
"I did not intend to start to play tennis in these."

(*ruveta* takes infinitive complements with the verb in the 3rd infinitive in the illative case; *aikoa* requires the 1st infinitive.) In this example, of course, the infinitives appear in contiguous groups. But the object *tennistä* and adverbial *näissä* can "scramble" to any of six possible positions in the superordinate clause. Karttunen says that it is not clear that all of the 42 possible "free" word orderings are acceptable, but it is not clear that any are ungrammatical either. Some clearly acceptable ones are in (20), where the "discontinuous constituents" are in boldface:

[7] To save time, I will ignore the other ways of forming questions that Karttunen mentions, namely by suffixing *-ko* to a NP or by using a WH-word such as *keta*. Thus the LP principle should order any word with some feature corresponding to *-ko* at the beginning of the sentence. The syntax and semantics of deriving these other questions is more complex.

(20) En minä **näissä** ole **tennistä** aikonut ruveta **pelaamaan**
not I these-in have tennis intend start play

En minä **tennistä näissä** ole aikonut ruveta **pelaamaan**
not I tennis these-in have intend start play

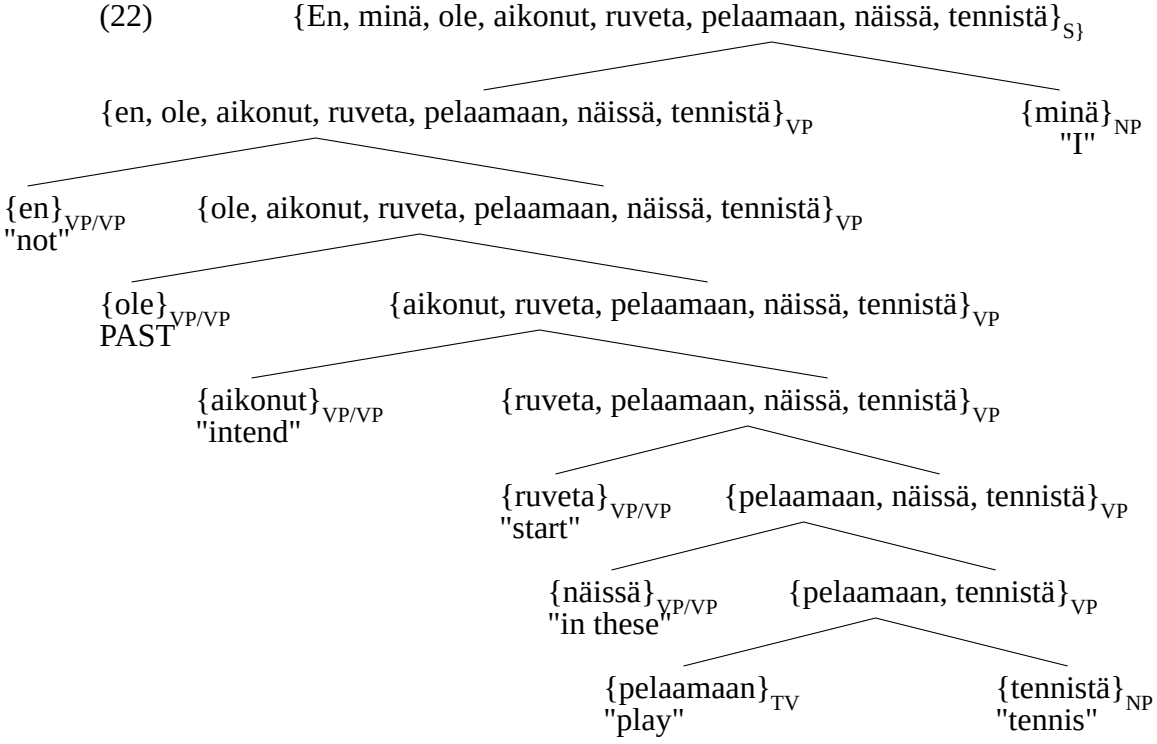
En minä **tennistä** ole aikonut **näissä** ruveta **pelaamaan**
not I tennis have intend these-in start play

In the present theory, Karttunen's property (6d), that elements of an infinitival clause can escape into a superordinate clause, which is responsible for this data, reflects simply that infinitival VP is not a bounding category in Finnish, as it is in many other languages. The syntactic rule combining the verbal subcategory to which *aikoa* ("intend") belongs with its complement is approximately as in (21), morphology again simplified:

(21) If $\alpha \in$ VP/VP, $\beta \in$ $VP_{[-fin]}$, then $F_6(\alpha,\beta) \in$ VP, where $F_6(\alpha,\beta) = \alpha \cup$ [3rd-Inf](β).

And assume a parallel rule for *ruveta* ("start"). The analysis tree responsible for (19)-(20) is then (22):

(22)



As the only LP principles we have used for Finnish relate to the order of the first two auxiliaries and as VP is not a bounding node, the sentences in (20), and many others, are all permissible linearizations of (22).[8]

[8] Actually, this grammar may be inadequate for this or slightly larger fragments of Finnish because it permits the order of complement-taking verbs to be too unrestricted (once the morphological restrictions on these particular complement verb forms no longer disambiguate); if so, restrictions like those suggested below for English auxiliaries might be needed, which order the head of a VP before (for Finnish, non-NP) elements of the VP.

With this brief illustration, I turn to a language which is not traditionally thought to have any free word order phenomena of this sort, namely English, and will first discuss verb phrase word order, then turn to extraposition.

4. English: Verb Phrase Order and Constituency

4.1 English Bounding Nodes

With regard to bounding categories for English, surely "sentence" is one. One can see this not only from, e.g. the fact that NPs do not float freely from one clause to another but, as will turn out to be very relevant to this paper, from the familiar fact that extrapositions from NP also do not escape the clause of their host NP, the so-called "right roof constraint" (Ross 1967). The bounding status of NP itself is complicated and will be delayed until we talk about extraposition. Is VP a bounding category in English? It seems to me that we have no choice but to treat infinitives as bounding categories, where by "infinitive" I mean a nonfinite VP introduced by *to*. As for other kinds of English VPs, one might think there is a good argument that they too are bounding nodes, from that fact that, as show by Baltin (1982), Extraposition seems not to be able to escape from VP in examples like (23), where a VP in fronted position permits us to visibly demonstrate that an extraposed PP (or relative clause) cannot move outside it.

(23) a. They said he would call people from Boston up, and call people from Boston up he did.
b. *They said he would call people from Boston up, and call people up he did from Boston.

However, I believe this not really the correct conclusion to draw from (23). Example (23) is one of a more general class of focus sentences, which include not only VP focus sentences but NP focus sentences such as (24):

(24) a. She said she would hire a good syntactician, and by golly, a good syntactician she hired!

b. We expected him to catch a big one, and a whopper he caught.

c. They said he would pick out a nice one, and a nice one it was.

These of course can include PP or relative clause modifiers, and just as with Baltin's examples, we see that extraposition from the fronted constituent is prohibited (whereas relative classes and PPs can of course be extraposed from non-preposed NPs):

(24') a. She said she would hire a syntactician with a PhD, and by golly, a syntactician with a PhD she hired!

a'. *She said she would hire a syntactician with a PhD, and by golly, a syntactician she hired with a PhD!

b. We expected him to catch a big one with red scales, and a big one with red scales he caught.

b'. *We expected him to catch a big one with red scales, and a big one

he caught with red scales.

c. They said he would pick out a nice one that fit her, and a nice one that fit her it was.

c' *They said he would pick out a nice one that fit her, and a nice one it was that fit her.[9]

Since the fronted NPs in (24') cannot possibly be dominated by VP, Baltin's constraint cannot apply to them. The more general way to formulate a constraint which covers both kinds of examples is (25):

(25) Elements may not be extraposed out of a focussed constituent (and perhaps not out of any non-WH fronted constituent?)

Here are some further kinds of examples of frontings of various kinds: in some of these the fronted element is a VP (or can be analyzed that way, anyway) and so are not relevant to demonstrating Baltin's conclusion insufficient. But once examples like (24') have done that, these show the generality of the phenomenon. A third sentence is added in each case showing that extraposition is possible in a different structure:

(26) a. A student who excelled at math is what he wanted to become.
b. *A student is what he wanted to become who excelled at math.
c. A student visited us yesterday who excelled at math.

e. A mile from the spring where we got our water there appeared a big cloud of dust.
f. *A mile from the spring there appeared a big cloud of dust where we got out water. (If not *, then not synonymous with (26e).)
g. We rode about a mile from the spring almost every day where we got our water.

h. Under the bed which we put in the attic is a good place to hide.
i. *Under the bed is a good place to hide which we put in the attic.
j. I put it under the bed one day last week which we put in the attic.

Thus I will assume that the syntactic rules for focus and inversion (which I will not treat here) must mark their pre-verbal constituents as bounded, but I believe VPs in general are not bounded.

4.2 Grammatical Categories

I will assume at least the following syntactic categories for English, shown with a few exemplary members of each:

[9] This sentence actually has a grammatical reading, but not one that is synonymous with (25c); it is rather a focussed version of the cleft sentence *It was a nice one that fit her*.

(27)

a. NP	(*John, Mary,* etc.)
b. VP (= S/NP)	(*walk, talk*)
c. TV (= VP/NP)	(*eat, love*)
d. TV/NP	(*ask, give*)
e. $TV/PP_{[to]}$	(*give, offer*)
f. $IV/VP_{[inf]}$	(*try, want*)
g. $TV/VP_{[inf]}$	(*persuade, convince*)
h. $(VP/VP_{[inf]})/NP$	(*promise*)
i. (VP/VP)	(*slowly, carefully*)
j. S/S	(*today, obviously,* also parenthetical phrases like *on the other hand, she suggested,* etc.)
k. PP (= XP/XP)	(*in the garden*, etc.)
l. P (= PP/NP)	(*to, for, in*)
m. CN	(*dog, cat*, etc.)
n. NP/CN	(*a, the, many*)
n. $CN/CN_{[atr]}$	(*former, imitation, etc.*)
o. $CN/CN_{[prd]}$	(prd. adjectives, *asleep* etc., PPs *on the sofa,* etc., Relative clauses *who loves Mary*)

This is intended to be a fairly uncontroversial category system for a categorial grammar for English, though of course much detail, especially in morphology, is omitted from the category descriptions in order to save space. Prepositional Phrase is treated as a category schema, XP/XP where X ranges over (at least) VP, S, and CN. One things to note is parentheticals, which I have assigned to category S/S (to get their compositional semantics right) and of which I will have nothing to say about the internal syntax, though I will return to their external syntax below. Also note that I have divided noun modifiers into attributive adjectives, versus predicative modifiers--the latter including predicating adjectives, prepositional phrases, and relative clauses; I believe this distinction can be justified both syntactically and semantically.

In order for LP principles to work properly, certain further distinctions in category must be introduced beyond the usual categorial ones. VP/VP includes both adverbs and prepositional phrases, but the latter must be distinguished, possibly with a feature, from adverbs. Complement sentences are often treated categorially as NPs, with their complementizer of category NP/S, but their sentential nature must be specified somehow. And so on. For convenience, I will refer to traditional categories like PP below without spelling out any one of the several ways these might be defined with features on the category system above.

4.3 English LP Principles

For the purposes of this paper, I will work with the LP principles (28):

(28) V,N,Adj < NP < Prt < PP < $VP_{[inf]}$ < S

These are based loosely on the LP principles worked out in GPSG (Gazdar and Pullum 1981, GKPS 1985). Here, the complement structure of verbs like *persuade* is treated in the now-traditional way for categorial grammar (Bach 1980), in which they combine

with their infinitive complements before their NP complements[10]. By the use of LP principles and a "flat" structure, the correct word order (e.g. *persuade Mary to leave*) results without any wrapping operation (in much the same way as in GPSG, though here with a categorial syntax).

One thing that should be noticed about (28) is that it seems to order constituents according to their length. That is, I think it is fairly likely (though I have not attempted a statistical study) that an average English NP is longer than an average verb; that an average PP is longer than an average NP; an average infinitive is longer than an average PP, and an average clause longer than an average infinitive. As is known, and as we shall have occasion to see later on, violations of this ordering are often acceptable when the particular instance of a constituent placed on the right is significantly longer than whatever (28) says should instead be on the right of it. This raises the question whether (28), or part of it, should be replaced by a general rule sensitive to the length of particular phrases and saying "heavier constituents to the right".[11] I don't have an answer to this question, but I think one should keep it in mind.

4.4 The Double NP Construction and Attachment

How should we insure the correct word order when there are two NPs following the verb, as in (29)?

(29) a. Mary gave Harold a book.
b. Richard asked Sue a question.

Here the order of NPs is rigidly fixed, unlike the order of two PPs, which the LP rule (28) correctly predicts to be free (e.g. *talk to Bill about John, talk to John about Bill*). We could, as in the GPSG treatment, introduce via the syntactic combinatory rule a syntactic feature [+F] on the NP that we want to appear to the left, then add the LP principle:

$$NP_{[+F]} < NP_{[-F]}$$

It has been objected that this step is ad hoc and is at odds with the spirit of the LP program. There is, however, a more interesting way to account for this ordering.

It has often been observed (e.g. Postal 1974) that adverbs can intervene almost anywhere in an English VP except between the verb and immediately following NP:

(30) a. I believe very strongly that Tony is honest.
b. *I believe very strongly Tony to be honest. *(Postal 1974)*
c. I persuaded George quite easily to leave the party.
d. I persuaded George to leave the party quite easily.
e. *I persuaded quite easily George to leave the party.

[10] However, the motivation for the category $TV/VP_{[inf]}$ (as opposed to the category $(VP/VP_{[inf}$)/NP), and therefore the motivation for (some effect of) wrapping in this construction, does not really seem to me to be on firm ground; see Dowty (1982a) and Dowty (1982b). English almost surely requires wrapping (or the equivalent) in other cases, however, such as *too hot to eat* and *easy man to please*.

[11] A related idea was proposed by Ross (1967, sec. 3.1), though not in an LP-framework but as an output filter on a transformational grammar. Another perhaps relevant fact (if not one observed already) is that constituents containing a verb are placed at the end of the clause; this could have a disambiguating effect, as NPs or PPs placed after such a verb-containing constituent could sometimes be ambiguously parsed as belonging to the constituent in question or to the main clause.

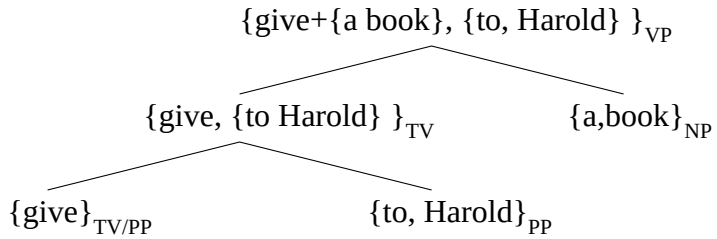
f. I easily could have been passing the note to her.
g. I could easily have been passing the note to her.
h. I could have easily been passing the note to her.
j. I could have been easily passing the note to her.
k. *I could have been passing easily the note to her.
l. ?I could have been passing the note easily to her.
m. I could have been passing the note to her easily.

With parentheticals (*however, I think, George, on the other hand,* etc.), the same prohibition against separating a verb from its object obtains. This suggests to me that this is one point in the English verb phrase where a tighter connection exists between adjacent elements than at other points, and it is this kind of case for which I included the syntactic operation of *attachment* (cf. (11b) above). Thus, the syntactic rule for combining verb with direct object is to be revised from the default operation to that in (31). (This will be revised slightly below.)

(31) S5. If $\alpha \in$ TV, $\beta \in$ NP, then $F_3(\alpha,\beta) \in$ VP, where $F_3(\alpha,\beta) = \alpha + \beta$ (β attached to the head of α).

A derivation of the VP *give a book to Harold,* for example, would proceed as in (32):

(32)



That is, the attachment of the NP *a book* to the verb is by the special "marked" syntactic operation introduced earlier and cannot be interrupted by adverbs. The PP *to Harold*, necessarily follows afterward (but cf. below).

A phenomenon which may correlate with this one in an interesting way is that unstressed personal pronoun objects are unacceptable when they do not appear immediately to the right of their verbs, necessarily preceding even a verb particle (Zwicky 1986):

(33) a. We took in the unhappy little mutt right away.
b. *We took in it right away.
c. We took it in right away.

(34) a. Martha told Noel the plot of *Gravity's Rainbow.*
b. *Martha told Noel it.
c. Martha told it to Noel.

After surveying the range of syntactic environments where unstressed personal pronouns *are* acceptable in English, Zwicky offers the following two-part solution to this problem. Unstressed personal pronouns are *leaners* (in the sense of Zwicky (1982), what have been called *clitics* in other, less fine-grained analyses), and must form a prosodic unit with adjacent material, either preceding or following, in order to be acceptable. (Stressed personal pronouns, on the other hand, have a freer distribution.) The first part of his solution is the Unaccented Pronoun Constraint:

(35) A personal pronoun cannot constitute a prosodic phrase by itself unless it bears accent.

Connection of a subject or possessive pronoun to a following prosodic host is relatively unconstrained. For object cases, Zwicky proposes the constraint (36):

(36) A personal pronoun can form a prosodic phrase with a preceding prosodic host only if:

a. the prosodic host and NP constituted by the pronoun are sisters.
c. the prosodic host is a lexical category
d. the prosodic host is a category that governs case marking.

The second two conditions generalize the condition from verb + object cases to preposition + object and adjective + object cases (as in *I'm nearer her than you are*).

The interesting question here is whether the cases in which prosodic combination of a pronoun with its functor are "obligatory" are the same as the ones in which, in our framework, the syntactic operation of attachment is motivated. If so, syntactic attachment may offer a way of describing this constraint, or even a motivation for it. Zwicky points out a number of other kinds of cases besides (33)-(34) where the effect can be observed. A subject pronoun can appear after an auxiliary when the latter is inverted (examples below from Zwicky (1986a)), but in this situation it may not be separated from that verb:[12]

(37) a. Was he posing on the couch?
b. *Was apparently he posing on the couch?

(38) a. When did she learn that pigs can't fly?
b. *When did supposedly she learn that pigs can't fly.

(39) a. He isn't dangerous, is he?
b. *He isn't dangerous, is conceivably he?

[12]Zwicky also deals with another class of sentences where an unstressed subject pronoun is prohibited, namely inversions:

Across the plane came the 20th Century Limited.
*Across the plane came it.
"Gee whillikers!" exclaimed Ona, with great feeling.
*"Gee whillikers!" exclaimed she, with great feeling.

and argues that their ill-formedness is due to their having a somewhat different structure from that in (37)-(41), though one that his condition applies to nonetheless. These sentences, unlike the ones discussed above, permit adverbial material, or, for that matter, further auxiliary and main verbs to separate the subject from the main verb, as in (Zwicky's examples):

"Gee whillikers!" *suddenly exclaimed* Ona with great feeling.
Across the plains *would come* the train every few days.

However, I think there is reason to wonder whether the pronoun unacceptability here is due to the fact that these are presentational sentences (at least the second), whose function is to introduce a new discourse referent. Personal pronouns by their meaning, on the other hand, cannot introduce a new referent. And in fact, I find even a stressed pronoun rather strange here, though Zwicky's analysis assume that stressed pronouns should always be acceptable:

(*) Around the corner came SHE, of all people!
(*) And now "Gee whillikers!" exclaimed SHE, as well.

(40) a. Were she prime minister, she would dissolve parliament.
b. *Were, I suspect, she prime minister, she would dissolve parliament.

(41) a. Not only would he eat the snails, he also enjoyed the brains in black butter.
b. *Not only would, however, he eat the snails, he also enjoyed the brains in black butter.

But in fact this effect is not peculiar to pronouns; *no* NP in these positions can be separated by an adverb from its auxiliary, (in contrast to the its uninverted form of the same sentence):

(37') *Was apparently Henry Kissinger posing on the couch?
Henry Kissinger apparently was posing on the couch

(38') *When did supposedly Aunt Susan learn that pigs can't fly.
Aunt Susan supposedly did learn that pigs can't fly.

(39') *He isn't dangerous, is conceivably Bad Bart?
He isn't dangerous, is Bad Bart?
Bad Bart conceivably is dangerous, isn't he?

(40') *Were, I suspect, Mrs. Gardmore prime minister, she would dissolve parliament.
If Mrs. Gardmore, I suspect, were prime minister, she would dissolve parliament.

(41') *Not only would, however, Henry eat the snails, he also enjoyed the brains in black butter.
Henry, however, would eat the snails, and he even enjoyed the brains in black butter.[13]

To finish out the range of English cases, we note the familiar facts that prepositions cannot be separated from their objects:

(42) *We put the fertilizer on, probably, the table.
*The president of, he remarked, Brazil will be there.

Nor adjectival objects from their adjectives:

(43) *The dog was near, I thought, the vase.

Thus the generalization that is apparently true of English syntax is (44):[14]

[13]I find the judgments in the following example a bit clearer than in Zwicky's, for reasons I am not sure of:

John obviously has never lied.
John has obviously never lied.
Never has John obviously lied.
*Never has obviously John lied.

[14] We will deal with Heavy-NP Shift below, which is an exception to this principle.

(44) Whenever a functor combines with a NP argument to its right in English, they combine via the operation of syntactic attachment.

And the corresponding prosodic principle is (45), giving us an analysis somewhat similar to Zwicky's but stated in terms of attachment rather than tree structure, is (45):

(45) An unstressed personal pronoun which has been combined with its functor by the operation of syntactic attachment is only acceptable if it can form a phonological phrase with the lexical head of that functor.

Note that there is a naturalness about this: a tighter syntactic binding requires, for certain unstressed items, a tighter phonological binding as well. If this is right for English, one would like to know if the combination is found in other languages. Unfortunately, I do not know of any research investigating a possible connection between cliticization conditions and syntactic "intervention constraints" in other languages.

Consider first the verb-particle examples. I assume that verb-particle combinations are single lexical entries which can consist of more than one word; this step is motivated semantically by the fact that many such combinations are not compositional in meaning at all (*egg on, buzz off*, etc.) or are not completely predictable(e.g. *try out, try on*, but not try in, *try up*, etc.). I also assume that lexical entries can consist of more than one word; see Dowty (1979) for discussion. In fact, I will propose that verb-particle constructions each have two kinds of lexical entries, one which consists of a verbal functor and a particle complement, as in (46),

(46) Cat TV: $\{look_{TV/Prt}, up_{Prt}\}$

and one which consists of the same two words, but in which they are somehow "glued together", either by means of a bound, or by means of attachment: for my purposes here, it doesn't matter:

(47) Cat TV: $\{\{look_{TV/Prt}, up_{Prt}\}\}$

These two forms will result in the familiar two forms of verb-particle VPs, the first in (48) (cf. LP principles above), the second in (49):

(48) {look+{the, answer}, up}

(49) {{look, up}+{the, answer}}

Consider what happens in the case of an object pronoun. For the first kind of lexical entry there is not a problem, as the pronominal argument is syntactically attached to the lexical head of its functor and can form a phonological phrase:

(50) {look+{it}, up}

but in the second the attachment (or bounding) that keeps the particle next to the verbal head keeps the pronoun away from it (and thus violates (45), if we assume with Zwicky that pronouns cannot form phonological phrases with particles, prepositions or parentheticals to the left):

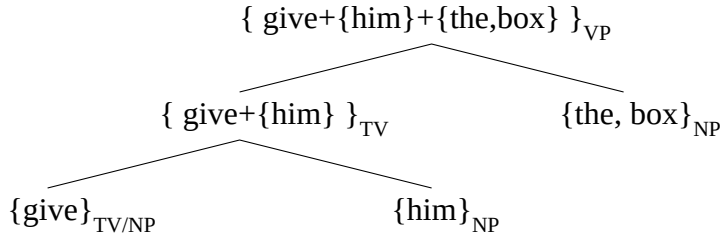
(51) {{look, up}+it}

For the double-NP constructions, I must make it explicit that I am assuming that in a VP *give Harold the oyster*, the verb *give* combines (tectogrammatically) first with its immediately adjacent NP *Harold*, then with the other object *the oyster*: this is not the same order as in most other works dealing with grammatical relations and categorial grammar (e.g. Bach 1980, Dowty, 1982a), but grammatical relations can still be defined in terms of the categories of this system, nonetheless, as pointed out in Dowty (1982b).[15] (It would in fact still be possible to treat the pronoun data assuming the NPs to combine the other way, but with a more complicated analysis.[16]) And since the principle (44) clearly applies to both objects of a two-object verb, we must assume that syntactic attachment is used for both objects of a double-object verb to maintain its full generality. And indeed, separation of either object from the verb by an adverb sounds pretty bad, even though the first object separation sounds worse:

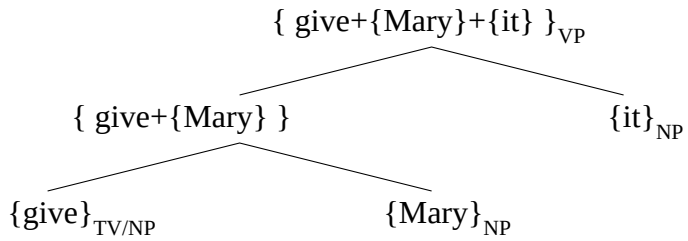
(52) a. Harry had undoubtedly slipped Roger the Kiwi sauce.
b. *Harry had slipped undoubtedly Roger the Kiwi sauce.
c. ?*Harry had slipped Roger undoubtedly the Kiwi sauce.
d. Harry had slipped Roger the Kiwi sauce, undoubtedly.

If so, the difference between the acceptable and unacceptable derivations is as in (53) (good) and (54) (bad):

(53)



(54)



In the latter case, (54), the pronoun cannot form a phonological phrase with the lexical head of its functor, because the attached NP *Mary* intervenes; (53) has no such problem.

[15] That is, *direct object* is redefined as the "first NP argument" that a verb combines with, while *subject* is the "last NP argument". Rules like Passive, which apply to direct objects (or to direct objects only) can be given a schematized definition that permits "first NP argument" to be affected, over a variety of verbal types. This schematic form for relation-changing rules is motivated by the need to give parameterized definitions of relation-changing rules, as explained in Dowty (1982a).

[16] The other method would require us to suppose that the first NP to combine with a ditransitive verb is attached to it: {give} and {a, book} combine to give {give+{a, book}}. Then when the second NP is added, the syntactic operation again being attachment, and requiring us to attach the new NP to the head of the TV, the result is that this new NP "displaces" the old one: {give+{a, book}} plus {Harold} gives {give+{Harold}+{a,book}}. A question for this approach is what happens to the original attachment that is broken: is {a, book} reattached to {Harold}? Some requirement of a link is needed to explain the badness of **I gave Harold it.*

4.5 Heavy NP Shift

Of course, the English direct object need not always appear adjacent to the verb but can, in a process known traditionally as "Heavy NP Shift", move to the right of the clause if it is long or otherwise lengthy ("heavy"):

(55) Susan gave to Ellen for her birthday a large purple ceramic tureen with lavender handles.

I do not have a great deal to say about this but can suggest two possibilities: (i) syntactic attachment is optional for the TV + NP rule in the case of "heavy" objects, and the LP principles should be understood in such a way as to allow a very heavy constituent to gravitate to the right of the clause, no matter what its category, or (ii) an alternative operation for the TV + NP rule is to bound all the words within the TV and order the object NP after it, i.e. if α is the TV and β is the NP, the phrase produced is $\{ \{\alpha\} << \beta \}$. One interesting argument for bpth forumulations is that they, together with the syntactic category assignment to verbs given earlier, predict the observation (Bach 1980) that Heavy-NP Shift is possible for sentences with *persuade* but not *promise*:

(56) a. I persuaded to go to the game all those nutheads who were afraid of a little rain.
b. *I promised to go to the party all the people who were afraid I would stay home.

This is because Heavy-NP Shift would be tied to the operation for a particular syntactic category, TV, and as sentences with *promise* never involve this category, (56b) would not be produced.

By the same token, the left-most NP in double-object sentences would be predicted not to undergo Heavy-NP shift under either of these analyses,

(57) *I gave a copy of the book everyone I saw today in the office or on the street.

since that NP does not participate in the TV + NP rule. It does predict, however, that the ***second*** of the two NPs should be shiftable (it ***is*** combined via the TV + NP rule), and this seems to be so:

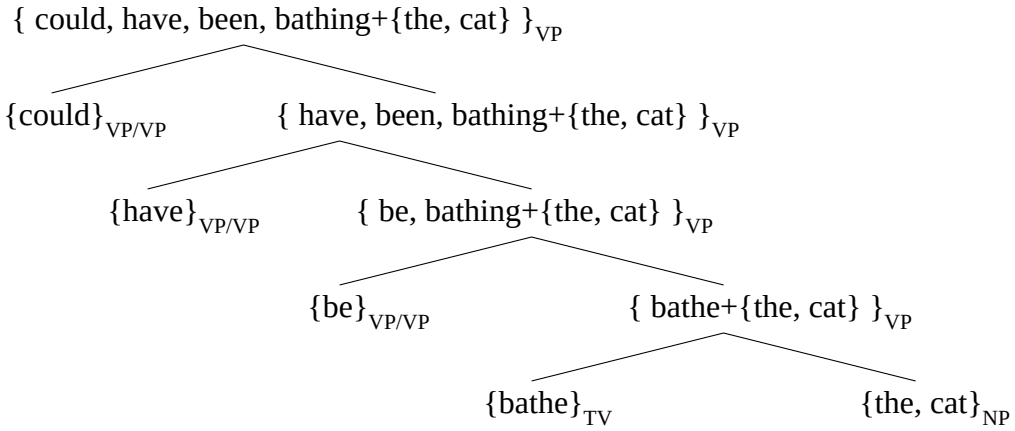
(58) I gave Mary yesterday for her birthday the old book I had bought in the used bookstore on 17th Street.

(The configurational analysis of Zwicky (1986) shares these same predictions, incidentally.)

4.6 Ordering of Auxiliary Verbs

Here, again, I am not so much defending a particular analysis as pointing out various alternatives which exist in a linear-oriented theory. One thing I would like to assume is that a VP with several auxiliary verbs has a flat structure, not a hierarchical one. As is well-known, English auxiliaries appear in one order (Modal, Perfective, Progressive, Main Verb) and in one order only. So we will have derivations roughly like (59):

(59)



In a flat-structured VP, the most obvious alternative would be to build this into the LP principles:

(60) [+V,+M] < [+V,+Perf] < [+V, +Prog] < [+V, -Aux]

Note that we cannot thereby dispense with a system of subcategorization and agreement features among the auxiliaries, both because of morphology and semantics: having auxiliaries in the proper order would do little good if the wrong interpretation were assigned. There is a bit of redundancy in (60), therefore.

A more interesting method would be to try to order each successive auxiliary verb added in the course of a derivation at the beginning of its phrase, as the LP principle (61):

(61) V < X

might (at first) seem to do, where *X* is a variable over syntactic categories. But this is not enough. In a flat VP containing several auxiliaries, (61) would apply to all such verbs equally, once they have been introduced.

Could one save (61) by adopting a kind of "freezing principle"? That is, LP principles wouuld be applied, as it were, "immediately", not at the end of the derivation, and once two constituents were ordered with respect to each other, their order could not change? The intent would be that the variable *X* above stands for everything already ordered by LP principles, and the *V* the new auxiliary.

This however is still not inadequate. The previously added auxiliary verbs would still be indistinguishable in syntactic *category* from the newly added one, yet LP principles are traditionally understood as depending only on category.

What one needs is an LP principle that orders the lexical functor of the *current* phrase being produced before the rest of the phrase, something like (62):

(62) VP/X < Y where VP/X is any verbal category, and VP/X is the lexical head of the current phrase.

And this has to be understood in such a way that it can be applied recursively, repeatedly ordering "new" functors before "old" functors.

"Current lexical head" is however a very different notion from the other categories we

have used in LP rules: what is current at one stage of the derivation is not current later on, so we are admitting in a roundabout way a feature of tectogrammatical structure---which is hierarchical structure---into the determination of word order, even if the phrase we are building is not to be hierarchical. Is this undesirable? I am not sure. Since both GPSG and HPSG (Pollard and Sag 1987) have found "(lexical) head" to play such an important role, it seems possible that one should admit just this derivational notion without admitting others.

The only other way I can see of handling auxiliary order in a flat structure is to make ordering specific to each auxiliary rule, i.e. all such rules are of the form of (63):

(63) If $\alpha \in$ VP/VP$_{[+aux]}$, $\beta \in$ VP, then $F_2(\alpha, \beta) \in$ VP, where $F_2(\alpha, \beta) = \alpha << \beta$.

(Note the operation actually orders α only before the head of β.) This is a less general statement.

4.7 Subject-Predicate Rule

I really have nothing to say about this, except that I want to assume that it, like the verbal auxiliary rules, does not introduce bounding. Since English otherwise has functors before arguments, I suppose this rule will involve rule-specific ordering of the argument (or at least its head---see below) to the left of the functor.

4.8 Sentence Adverbs and Parentheticals

As mentioned, I have assumed that both sentence adverbs and parentheticals are of category S/S and are thus sentence modifiers semantically, which is appropriate. I will not deal with how parenthetical expressions such as *I think, on the other hand, if you don't mind, George, please*, etc. are generated. The syntactic operation for combining such an expression with a sentence is the default one[17], i.e. "union", or merging. As there are no LP principles applying to adverbs or parentheticals, an adverb is free to "settle" anywhere as long it (i) does not cross a bounding category boundary or (ii) separate attached words. Since the (finite) VP is not bounded, this predicts such adverbs can appear just about anywhere in the VP, except between a verb or preposition and its object, or in a subordinate VP or S (see examples throughout this paper). This is more or less correct, and it is a natural virtue of this kind of theory to deal with this traditionally knotty problem in this simple way. (See below on adverbs and parentheticals in NPs.)

5. Extraposition and the Bounding of NPs

As I said at the beginning, an important attraction of this kind of theory is to be able to describe extraposition by the same LP principles that determine the position of complement S's and PP's in the VP. But in order to determine just how we want to

[17] Since S is a bounding category, this raises the question what exactly happens to its bound when an S/S combines with it. Clearly, we want to make an exception, so that the "outer" S created by this combination is bounded, but the "inner" S is not, to get the right adverb positions. Cf. the similar discussion about modifiers of NP below, so maybe there is a cross-categorial principle about modifiers of bounded categories. Other than just stipulating this exception, another option would be to postulate something like an S-bar node and make it, not S, the bounded category. However, S-bar has no natural definition (and possibly no need) in categorial grammar, at least in the positions where we would need it. Another possibility is general type-raising for adverbs, i.e. S/S ==> VP/VP (==> TV/TV, etc.), which has a number of independent motivations. This would bring S-adverbs inside the S-bound. Possibly *Obviously, John hasn't left yet* has an S/S adverb (outside the bound) and *John obviously hasn't left yet* has its adverb in VP/VP.

permit NP modifiers to "break away" from NPs and extrapose, and therefore the nature of NP bounding in this theory, we will want to look at some extraposition data.

5.1 What extraposes?

First of all, I will ***not*** discuss sentences like (64) in this paper:

(64) a. That John is asleep is obvious.
b. It is obvious that John is asleep.

In accord with GKPS (1985), as well as Dowty (1982b), I will assume that the clause *that John is asleep* in (64b) is an argument of the verb itself, with a "dummy" subject being an independent argument, and thus these examples do not involve anything peculiar in word order or constituency.

Here are, instead, the kinds of things I assume to "extrapose":

(65) *Relative clauses from subject and objects*

a. Someone arrived who I have never met before.
b. We met a student yesterday at lunch who only recently arrived in this country.

(66) *Non-Restictive relative clauses*

a. The President appeared shortly at the party, who had just come from an important meeting.

(67) *Prepositional phrases from subjects and objects*

a. Two people were there from Alaska.
b. I called some doctors up with late office hours.

(68) *PPs from nominalizations*

a. My appointment was at 2 PM with Dr. Smith
b. She gave me a picture at that time of Mr. Howard.

(69) *Predicative Adjectives*

a. I want to see someone at every window armed and alert.
b. Nothing ever shows up on her table even remotely palatable.
(both examples from Stucky 1987: 388)

(70) *Infinitival relative clauses*

The person didn't arrive to fix the plumbing?

5.2 How are NPs bounded?

Were the above examples the extent of the extraposed phrases (and these are certainly the majority), the generalization would be clear: one can extrapose a predicative modifier (i.e. a $CN/CN_{[+prd]}$) from a NP. It is even observable that non-predicative

adjectives (which appear exclusively in pre-nominal position in a NP) cannot extrapose:

(71) a. *I saw some senators at the party former and future.

b. *It appear I have given the assignment to a fool after all complete and utter. (Stucky)

At this point, let's consider how the NP bounding might be described. Since extraposable phrases appear both within their "host" NP and in separated position, I assume NPs will have to have two syntactic analyses, one in which these phrases are somehow connected to the rest of the NP, and one in which they are not (and therefore appear at the end of the clause in accord with LP principles).

If one followed Bach and Cooper (1978) in treating restrictive relative clauses (and, shall we suppose, all the above predicative modifiers as well) as of category NP/NP, then a simple analysis of NP bounding is at hand. In the Bach-Cooper analysis, there are two expressions of category NP whenever there is such a modifier, an "inner" and an "outer" one, as in (72):

(72) $\{ \{\text{someone}\}_{NP} \{\text{whom I have never met}\}_{NP/NP} \}_{NP}$

If we stipulate that in such cases ***either*** one ***or*** the other of these NPs can be bounded, but not both, we have the result we need: if the bound is taken to be the outermost NP, the relative clause remains immediately adjacent to the head noun of the NP (as in (73a); but if the bound is taken to be the inner NP, and if subject-predicate and verb-object operations order (or attach) only the **head** of the NP, then the remaining parts, namely the modifying relative clause, will, like all other parts of the clause not specifically attached, appear in whatever position the LP rules specify. In the case of a clausal constituent, this is clause-final position, as in (73b):

(73) a.$\{\{\text{someone}\}_{NP} \{\text{whom I have never met}\}_{NP/NP} \}_{NP}$ arrived}

b.$\{\{\text{someone}\}_{NP}$ arrived $\{\text{whom I have never met}\}_{NP/NP}\}$

However, the NP/NP analysis of restrictive relative clauses is not the most semantically appropriate one. If instead the more familiar CN/CN analysis is chosen, then some way must be found of making all CN/CN modifiers of the CN within a NP "optionally free" from the bound part of the NP at the point at which the NP combines with its functor.

For example, one might propose that anything to the right of the CN in a NP is extraposable, anything to the left is not, regardless of category.

One interesting argument (or a possible argument) that the distinction between CN/CN and other NP constituents is the right one to invoke here comes from a fact noticed by Ross (1967): when a PP modifiers a CN, the object of the preposition can be extracted if the PP remains adjacent to its head (74a), but not if the PP has been extraposed (74b):

(74) a. Who did Bill give Harry a picture of yesterday?
b.*Who did Bill give Harry a picture yesterday of?
(cf. Bill gave Harry a picture yesterday of his brother wearing a rabbit suit.)

c. Who did you witness the arrest of at the station?
d.*Who did you witness the arrest at the station of?
(cf. I witnessed the arrest at the station of the entire group of demonstrators that had gathered there.)

I argued in Dowty (1989) that prepositional NPs attached to nominals should be analyzed as modifiers rather than arguments; even if not as widely true as suggested there, I believe this is sometimes valid. On the other hand, these PPs are in some respects like arguments. It has been suggested a number of times in various theoretical frameworks that a fundamental difference in extractability exists between arguments and adjuncts (or modifiers): one can extract from arguments but not from adjuncts. (Different theories have different ways of capturing such a constraint of course; compare for example Kaplan and Zaenen l989 with Steedman 1985a, 1985b.)

Thus, if the PPs accompanying event-nominals and picture-nominals are in principle either adjuncts or arguments of the nominals ambiguously, but if they are only extraposable on their adjunct (i.e. NP/NP) analysis, not when they are arguments then the difference in extractability Ross observed will follow.

5.3 More kinds of extraposition

However, there are still more kinds of extraposition we have not yet considered:

(75) *Noun-complements*

a. Sue denied the charge vehemently that she had been in the study at midnight.

b. The idea appalled Bill that anyone would have considered him appropriate.

(76) *Too- and enough infinitival complements*

a. Mary was too tired after all that work to take another step.
b. His examples were clear enough to everyone to make it obvious that he had researched the subject.

(77) *Comparative than- clauses*

She was wiser when it was all over than anyone would have expected her to be.

(78) *So and too result clauses*

a. So many people came to the lecture that I couldn't find a place to sit down.

b. He put too much chlorine in the pool for us to swim in it without our eyes burning.

Now I can imagine a CN/CN (or NP/NP) analysis being given to the noun complement clauses in (75), though it is not the first analysis that comes to mind. But I cannot envision any modifier analysis at all for the complements of *too* and *enough* in (76) or for the *than*-clauses in (77). But I cannot say such analyses are impossible, either. (I will return to (78) later.) Pending the development of such modifier analyses, I will tentatively conclude that the distinction between extraposable and non-extraposable complements on the basis of predicative modifier status is to be ruled out. (In addition, there are extrapositions which are not from NPs at all: see below.)

The alternative I will pursue here is to see if there is evidence that the rest of the NP---the (pre-) determiner, adjective(s) and CN--might all be syntactically attached. And in fact, it seems that such constituents are not separable by parentheticals:

(79) a. *The, however, big Dalmatian may take the prize.
b. *The judge picked several, he said, collies that were quite impressive.
c. *We looked at some large, in any event, dark houses.
d. *I talked to almost, apparently, all the students.
e. *A very, in my opinion, absurd judgment was rendered.
f. *We drank too, possibly, much wine to give a reliable judgment.
g. *We drank too much, possibly, wine to give a reliable judgment.

Is there a contrast with the post-noun modifiers as to interruptability? While not all examples below are totally felicitous, I think there is a clear difference between those of (79) and those of (80), where something intervenes between the CN and a non-extraposed post-nominal modifier:

(80) a. He invited the vice-chairman, I think it was, of the nominating committee to come to the party.
b. An undergraduate student, supposedly, who had witnessed the event reported it to him.
c. ?Someone, apparently, asleep at the wheel must have caused the accident.
d. They dismissed the suggestion, she said, that anyone would protest the action as unrealistic.
e. A taller person, if that's possible, than they had ever encountered was coming up the walk.
f. Too much wine, possibly, to permit a reliable judgment was consumed on that occasion.

This indicates that even where these phrases are NOT extraposed, some sort of syntactic difference exists between them and the pre-CN constituents of the NP.[18]

Though the other alternatives should perhaps not be completely ruled out, I will adopt at present the hypothesis that an attributive adjective is syntactically attached to its

[18] Coordinated adjectives within NPs are an exception to these general principles, as one can sometimes felicitously insert parenthetical material after the *and*:

A handsome and, if I'm not mistaken, expensive overcoat was lying on the sofa.

But if coordinated conjuncts are each bounded expressions (as we would need to say in this approach for several reasons, such as producing the right word order within coordinated VP's and in non-constituent coordinations), then there is no contradiction in saying that a coordinated attributive adjective expression is attached to its CN (and the determiner subsequently attached to it), even though there are unattached expressions within the coordinated adjective expression; that is, the coordination construction itself can be assumed not to involve attachment but only ordering.

CN and that a determiner is syntactically attached to its following material (i.e. lexical or phrasal CN)---as one might expect it to be, in this approach, because of the phonological status of determiners as clitics dependent on following material. We have thus motivated this situation:

(81) The pre-CN elements of a NP are syntactically attached to each other and to the CN; the post-CN elements (both CN-modifiers and others) are not syntactically attached.

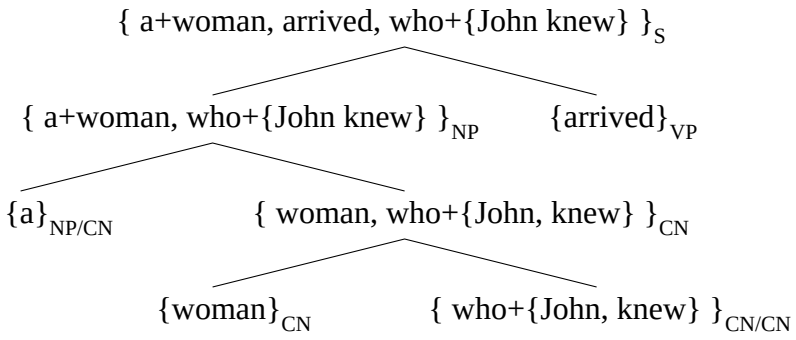
Because of this linking of the pre-CN elements, the group will inevitably behave like a traditional "constituent", whether the category NP itself is a bounded category or not.[19]

This makes possible a straightforward treatment of the bounding problem for NP and therefore for extraposition (from NP):

(82) The category NP in English is optionally bounded: both derivations in which NP expressions are treated as bounded and those in which they are treated as unbounded are well-formed.

If a NP is taken to be bounded, an unextraposed sentence is derived; if the NP is taken to be unbounded, the extraposed version is produced, and produced automatically.[20] Since the VP, as I have tried to show above, with which a subject NP combines is not bounded, the unattached modifying PP, AdjP or relative clause of the NP become "constituents" of the clause itself by the default "union" operation, as in (83):

(83)



Consequently, the LP principles which order the rest of the clause will also be responsible for the linear order of the "extraposed" relative clause, PP or AdjP: in

[19] Though I will not discuss them in detail, it can be noted briefly that this treatment produces a "wrapping" effect in several other CN and Adj modifier constructions, e.g.

(i) taller than Susan ==> taller woman than Susan
(ii) easy to please ==> easy man to please
(iii) too to enter ==> too tall to enter

I assume the attachment operation that attaches attributive modifiers to nouns (adjectives) is really head-attachment. Thus if the adjective (or Adj/Adj) is a phrasal one, the head is attached to the left of the CN (or Adj) by syntactic head attachment, and the rest of the adjective phrase is unattached and appears whereever the LP principles order it. In the above examples, the phrases are PPs or infinitive VPs, so they follow it. This treatment also predicts the possibility of extraposing these phrases. (Why the complements of *easy*-adjectives do not extrapose, I cannot explain presently.)

[20] The present account makes no provision for NPs in which one modifier has been extraposed and another left behind (remaining with the NP). If such sentences exist, and they apparently do, a more sophisticated definition of "optionally bounded" must be worked out.

general, these will be at or near the end of the clause.

Since direct objects are not part of a bounded TV constituent in English, nor are objects of prepositions so confined (I assume a preposition is united to its NP object via syntactic attachment), choosing the unbounded option for these NPs will likewise free their post-nominal constituents to be positioned within the clause as a whole by the LP principles.

It's time to make revisions to bring a couple of formal definitions up to date. Above, I have mentioned the category NP as if it were always a bounded category, when discussing attachment, ordering and LP principles. The syntactic operation of attachment has already been defined so that when an unbounded functor attaches to an argument, it is actually the head of the functor that "attaches" (becomes linearly inseparable). Now we must do the same thing for the argument:

(84) Attachment (redefined): the operation $\alpha + \beta$ is defined as specifying that the expression α (if α is bounded), or the lexical head of α (if α is unbounded), or α and any material already attached to α, is ordered to the left of, and is subsequently inseparable from, β (if β is bounded) or the head of β, or β and any material already attached to β.

A parallel change must be made in the syntactic ordering operation "<<" to linearly order only the lexical heads of unbounded expressions (without thereby ordering their attachments), as well as ordering bounded expressions in the way already described.

A similar change must be made in the interpretation of LP principles:

(85) If an LP principle mentions a category A, and A is not a bounded category, then the interpretation of the principle is that only the head of an expressions of category A, together with any material syntactically attached, is to be ordered as the LP principle specifies for A itself.

Two final comments for this section: extraposition also occurs from adjective phrases, for example:

(86) a. I am anxious to meet someone from there right away.
b. I am anxious to meet someone right away from there.

As far as I can see, these can be treated satisfactorily just by making the category adjective phrase, as well as NP, optionally bounded.

The second comment is that at least one class of potentially extraposable complements exists which does not extrapose: the complements of pre-nominal "tough"-adjectives:

(87) a. He seemed to be an easy person to talk to when I met him.
b. ?*He seemed to be an easy person when I met him to talk to.

Yet the complement seems quite interruptible by parentheticals:

(88) a. He was an easy person, I thought, to talk to.

Possibly the difference relates to the fact that here the extraposed phrase is a complement to an attributive adjective, not to the CN itself. Yet *too* Adj and Adj

enough complements and comparative *than*-clauses are arguably complements of attributive adjectives, and they extrapose. I have no solution to propose to this at the moment.

6. Where do extraposed phrases end up?

The matter of the resulting position of extraposed phrases is the main point of comparison I want to make between the present theory and other linguistic theories of extraposition.

First of all, however, notice that in this theory one cannot raise the question whether an extraposed phrase is (phrase-structurally) attached to the VP node or the S node of a clause, though this is a matter which has been much disputed in the literature. If the category VP is not bounded, as I have argued, membership in the VP ***is*** membership in the S and vice-versa. (I personally suspect this particular simplification of theoretical options is a fortunate one.)

Second, note that the "upward boundedness" of extraposition (Ross 1967) is captured, since we obviously need for S to be a bounded category in English for various reasons.[21]

6.1 Multiple Extrapositions

Extraposition of multiple modifiers from the same NP is possible (Stucky 1987, 390-395), though such examples are usually awkward. If one is a PP and the other a relative clause, usually only the extraposed order PP - S is acceptable:

(89) a. And then, a man suddenly appeared at the door from the CIA who I had seen the previous week.
b. ??And then, a man suddenly appeared at the door who I had seen the previous week from the CIA .

(90) a. Surprisingly enough, several books have appeared over the years by that author that had fewer that 300 pages.
b. ??Surprisingly enough, several books have appeared over the years that had fewer that 300 pages by that author. *[NB: avoid irrelevant reading where author writes less than whole book].*

(91) a. Can you give me the names of any newcomers as soon as possible from Finland who may have programming experience?
b. *Can you give me the names of any newcomers as soon as possible who may have programming experience from Finland?

(examples from Stucky 1987: 391-392)

The appeal to LP rules in describing extraposition predicts this, as English has the LP rule PP < S.

It is not clear to me how a "landing site" theory of extraposition (Baltin 1982) or other movement theory could predict this effect. Note that an appeal to a preference for nesting in multiple dependencies is not possible: if these modifiers were adjacent to their head NPs, their order would likewise be PP before relative clause, so the

[21] As already mentioned, I do not attempt to deal with leftward extraction in this paper, though some other theories of leftward extraction are not incompatible with what I am proposing here: cf. footnote 2.

hypothesized relationships between "fillers" and "gaps" in such a movement analysis would have to be the unnested ones, not the nested ones, for the acceptable examples.

If however the PP is made especially long or "heavy", then the ordering in which the PP is on the right can be acceptable:

(92) a. And then a man suddenly appeared at the door whom I had seen last week from that organization that we all know but which will go unnamed here.

b. Surprisingly enough, several books have appeared over the years that had fewer than 300 pages by that author whom we all know to be especially long-winded.

c. Can you give me the names of any newcomers as soon as possible who know LISP from any of the countries on our list of overseas development targets?

But this too is just the effect one finds in PPs and S's that originate in the VP:

(93) a. We announced to the students that the exam was over.
b. ?We announced that the exam was over to the students.
c. We announced that the treaty had been signed to all the dignitaries and reporters who were waiting in the outer hall.

The point is not to delve into the well-known but mysterious trade-off between grammatical category and length ("heaviness") in the ordering principles for the English VP. I don't know the solution to this problem, whether there is a "basic" versus "heavy" order, nor even whether there are actually any order principles based on categories, but it doesn't matter here. The point is rather that whatever solution is found to this problem, this theory will allow us to describe the ordering of extraposed complements by the same principles as those for VP-original clause elements, which looks as if it is the right thing to do.

6.2 Multiple Extrapositions and Nesting

As Stucky (1987: 393) points out, extrapositions from two different noun phrases in the same clause are awkward at best and then only acceptable when they are (i) in a "nested" relationship to their hosts[22], and (ii) preferably of different categories. Her nested example, (modified to remove an ambiguity she did not intend) is (94):

(94) Improbable as it may seem, an impeccably dressed man struck up a conversation with me on the plane last month about 'Situations and Attitudes *who was going to Missoula, Montana.* [PP, Relative clause]

Example (95) (from Stucky, likewise modified), is the same except for "unnested" host-modifier relationships;

[22] Note the difference between the hypothetical "nesting" explanation rejected for (89)-(91) above and those discussed here (and in the following section): in (89)-(91) we were talking about two predicative modifiers of the same NP. Even if it made sense to talk about the "original" vs. "final" order of the modifiers (which I am claiming it doesn't, since no movement is involved), "nesting" could not make any difference, since the semantic interpretation would be the same no matter in which order the two modifiers were combined. In this example, we are dealing with modifiers of two different NPs (or later, of an NP vs. of a complement of a verb), so getting the right element with the right head is crucial for the right semantic interpretation.

(95) *Improbable as in may seem, an impeccably dressed man struck up a conversation with me on the plane last month *who was going to Missoula, Montana* about 'Situations and Attitudes [Relative clause, PP]

it is worse, and for me, completely ungrammatical.

The following, adapted from Stucky's example, is about the best I can construct with extraposed relative clauses from different NPs (nested order):

(96) ??Improbable as in may seem, an impeccably dressed man struck up a conversation with me on the plane last month that was about 'Situations and Attitudes' *who was going to Missoula, Montana*.

Why relative clause extrapositions from two NPs should be impossible while two extrapositions from the same NP are at least marginally acceptable, I have no idea, unless this is entirely due to parsing difficulties; there is no obvious way to block the former at all in this approach.

6.3 Extraposition and VP Constituents

Stucky also offers, from Henry Thompson and Mark Liberman, an example in which the extraposed relative clause does not make it all the way to the end of the clause, appearing instead before a (very heavy) PP that modifiers the verb:

(97) A man arrived that I had been expecting *at the time he had said he would come.* (Relative, PP)

This particular example is dubious, as the phrase *at the time...* can be parsed as an S-modifier as well as a VP-modifiers (cf. *The man's arrival occurred at the time he had said...*) and therefore not necessarily an element of the clause. But because of the theoretical significance of this kind of example (cf. below) it is relevant to try to construct others: (For clarity, the first extraposed phrase is underlined, the second marked in italics.)

(98) a. Some guy was hired that Sue knows *to fix the plumbing and the air conditioning.* [Relative clause, infinitival purpose clause]

b. George actually convinced somebody this morning who neither of us had ever seen before *to buy 600 shares of stock in our new company for $5 a share.* [Relative, subcategorized infinitival]

c. Lois told a woman today from Finland *about the great weather in Central Ohio.* [PP, subcategorized PP]

d. This event is harder right now than anyone would have imagined *for him to just accept as if nothing had happened.* [*than*-S, *tough*-complement]

(99) By the way, that fellow cabled headquarters whom none of us had ever met *that he would be arriving in Paris on Tuesday.* (Stucky 1987: 396, from Stuart Shieber.) [Relative, subcategorized *that*-clause]

I find such examples to be of ***reduced*** acceptability, but definitely ***not*** ungrammatical. But there is a good reason for this reduced acceptability: these are examples of a kind

of double dependencies. Though there is no second instance of a "filler-gap dependency" in the traditional sense here, the meaning of the verb (or adjective) would, in the categorial analysis, have to combine compositionally with that of the italicized complement before the whole verbal meaning combined with the meaning of the subject (or object), but the latter must have combined with its italicized modifying phrase before it does this. To the extent that one can categorize, the dependency is "nested" in (98b,c) and "unnested" in (98a,d) and (99). I suspect it is because the categories of the two nested pairs are different from each other here that their unacceptability here is not as great as that of (96) above or the more familiar unnested double leftward NP extractions examples, where the parser has to fight ambiguity as well.

These examples, even with their reduced acceptability, are significant for theories which postulate a fixed site for extraposition to move to, and particularly for those that assume extraposed clauses from subject position (as (97) and (98a) are) are attached to S; in these examples, constituents which cannot possibly be dominated by S follow the extraposed element. Again, if extraposed elements are free among VP and S constituents to be ordered only by their heaviness and/or category, such examples are just what we expect to find.

One possible objection to such examples is that here the constituent to the right of the extraposed one has been moved there by some kind of Heavy Constituent Shift. This is not an option of course in accounts that claim that subject relatives are attached to S and Heavy Shift keeps elements within the VP. But it is implausible in any movement theory because the putatively shifted constituent need not really be heavier than what it moves over:

(98c') Lois told a woman today <u>from Finland</u> *about the news*.

Still, this possibility deserves more study.

6.3 So....that... Result Clause Constructions

All that has been said above about nesting and multiple extrapositions is apparently contradicted by combinations of relative clause extraposition with (what I will call) *so...that... Result Clause Constructions*, exemplified in this much-discussed example of Williams' (1974):

(100) Everybody is so strange whom I like that I can't go out in public with them.

First of all, there seem to be two extraposed clauses, originating from different hosts, yet the sentence has none of the awkwardness of the multiple clausal extrapositions we saw earlier (94, 98d, 99). More striking, the order of the extraposed clauses in (97) is the unnested order (the "host" of the WH-clause is the subject, that of the *that*-clause is *so*); the opposite, "properly nested" order is abysmally bad:

(100') *Everybody is so strange that I can't go out in public with them whom I like.

This then is a considerable problem for the hypothesis that extraposition in English can be viewed as a consequence of LP-principles, unbounded NPs, and "flat" clausal structure.

Gueron and May (1984) have studied the *so...that...* result clause construction in detail and have observed several properties relevant to us (among other properties). First, pronouns in the main clause can have their antecedents in the *that*-result clause (101a), while this is not possible in a superficially similar extraposed relative clause (101b):

(101) a. I told her_i that so many people attended last year's concert that I made $Mary_i$ nervous.

b. *I told her_i that many people attended last year's concert who made $Mary_i$ nervous. (Gueron and May, 1984, 14)

Second, it has been known since Ross (1967) that extraposition is upward-bounded by S (cf. 102b); this appears not to be the case for the *that*-result clause in (102a): In fact, the result-clause has "moved" out of a syntactic island here:

(102) a. Critics who have reviewed so many books were at the party that I didn't have time to speak to them all.

b. *Critics who have reviewed many books were at the party which I've enjoyed reading. (Gueron and May 1984, 18).

Third, and perhaps most revealing for our purposes, it has been noted by a number of investigators (Hankamer and Sag 1975, Andrews 1975, Libermann 1974, Baltin 1982), result clause can have more than one antecedent *so*-phrase in the host clause:

(103) So many people liked so many paintings at the gallery that the exhibition was held over for two weeks.

And the number of *so*-phrases need not stop at two; the following is fanciful but in no way ungrammatical or uninterpretable:

(104) So many football fans brought so much beer and so much popcorn in so many knapsacks with so many rips in them in such drunken stupors that a bulldozer had to be brought in to clear the parking lot.

Consider the semantics of such examples, e.g. (105):

(105) John ate so much caviar in 10 minutes that he got sick.

They express a causal relationship, but not a causal relationship that can being described as holding between the host NP's referent and the event described in the result clause: (105) doesn't really say that some quantity of caviar made John sick, or even that his eating that quantity made him sick, but rather it was his eating it in this period of time that made him sick. In other words, the quantity of caviar such that John ate it in ten minutes caused, or brought it about, that he became sick. The causal relation is between the extent(s) to which something or other obtained *in the event described by the first clause*, and the event described by the second. (Note on the other hand that the compositional semantic effect of a relative clause on its matrix clause is, in a sense, confined to the denotation of its host NP.)

Consider a double-host example like (103): not only can the causal relation *not* be described without reference to the event reported in the entire first clause, the relevant extents cannot be separated from one another: (103) does not assert that the number of people that liked many paintings caused the exhibition to be held over, nor that the number of paintings liked by many people caused this; rather the *combined* extents *x*

and *y* such that *x* people liked *y* paintings caused the extension.[23]

What this indicates, briefly, is that a compositional semantics must involve multiple variable-binding over the first clause, then a causal relation between this and the (event expressed by) the second clause is asserted. Thus (following a series of predecessors) I claim that no "extraposition" in the sense of this paper is involved in *that*-result clauses.

The analysis I am proposing actually has much in common with Gueron and May's (1984) (but see note 22), though as it is proposed within a very different theory, it looks superficially quite unlike it. The idea, basically is that *so*-phrases have unbound variables in them which must be bound at a higher level, specifically a sentential level. The result clause rule then takes a first clause with one or more of these variables, binds it/them semantically, combines it syntactically with a result clause, and semantically has the interpretation that there is a causal relation between the two events.

Assuming we don't want to just permit the result-clause rule to apply vacuously, i.e. when there are no *so*'s in the first clause as well as when there are,[24] we will need something like a feature [+*so*] to be passed up from the *so*-phrase to the sentence containing it; I will assume some mechanism of this sort. The syntactic rule is then (106):

(106) *So...That...*Result Clause Rule

$$\text{If } \phi \in S_{[+so]}, \text{ then } F_i(\phi) \in S/S_{[that]}, \text{ where } F_i(\phi) = \phi$$

That is, the initial clause in a result construction becomes a subordinate clause, though one that takes a *that*-clause as its argument to form a complete sentence;[25] Also, I will assume a lexical expression *so*, probably a determiner modifier, i.e. of category Det/Det (but with restrictions I won't attempt to go into here), and a translation involving a variable x_i over "extents".

I will indicate the semantic interpretation rule informally:

(107) If ϕ translates into ϕ' then $F_{10}(\phi)$ translates into that function on sentence meanings $\Pi\Sigma I$ such that:

the extent x_0 and....and the extent x_n to which ϕ' causes it to be the case that ψ'.

Now, let us return to the properties of result clauses observed by Gueron and May. The fact that the rule permits multiple *so*-phrases is of course captured by introducing *so*-phrases independently of the result-clause in the syntax; the right

[23] Note, therefore, that analyses which treat multiple *so*-sentences simply as having multiple, independent *so*-operators in semantic interpretation or in their logical form, without summing the extents somehow to get the relevant causal force, would not get the meanings of the sentences right. This would apprear to be a problem with Gueron and May's (1984) analysis, for example.

[24] The only reason I can think of that we *would* want this is to capture sentences, known to me only in (King James) biblical English, such as *She brought us bread, that we might eat*, which looks suspiciously like a result clause (in the subjunctive) without the preceeding *so* phrase. But I have not had a chance to check the history of the construction.

[25] The only reason I have given the syntax in this form is because of the anaphora data in (98); otherwise, the syntactic rule could, more simply, take two sentences δ and ψ to form { δ *that*+ψ }. For all I know, anternative accounts of the anaphora data could be given which are compatible with this structure. See Gueron and May (1984), who also use a structure somewhat like that in (103), for some discussion.

interpretation is derived because it is the result-clause rule which binds the (one or more) variables and supplies the causal relationship.

The observed fact that result-clauses "escape" syntactic islands and fail to be upward bounded follows here because there is no "movement" of result clauses at all (as in a traditional analysis), hence no movement out of syntactic islands. Rather, only the binding of variables connects the result-clause with its *so*-phrase(s), so there is nothing to prohibit the *so*-variable from being inside an island. Ordinary extraposed relative clauses, by contrast, are generated as part of their "host" NP, and cannot appear any farther away from that NP than the clause the NP belongs to.

Third, the antecedent of an (definite) embedded pronoun can appear in a result clause in (101a), repeated here,

(101) a. I told *her* that so many people attended last year's concert that I made *Mary* nervous.
b. *I told *her* that many people attended last year's concert who made *Mary* nervous. (Gueron and May, 1984)

because if the result clause construction is generated by (106), the first clause becomes a kind of subordinate clause to the second, and as the pronoun is in the familiar precede-and-command position that permits coreference, just as it is in, e.g.*Because I told her that so many people attended the concert, I made Mary nervous.*

Finally, this analysis, which I have now tried to motivate on other counts, explains why extraposed relative clauses must appear before result clauses, as in Williams's example, repeated here:

(100) Everybody is so strange whom I like that I can't go out in public with them.

(100') *Everybody is so strange that I can't go out in public with them whom I like.

The result "clause" is indeed an independent clause, outside the bound of the clause in which the *so*-phrase originates. As the relative clause on the other hand is not independent of its host's clause and cannot cross its boundary, the relative clause appears first. As result clauses are not extrapositions, it is not surprising that they should not be subject to the same limits on multiple extrapositions as are ordinary extrapositions.

Of course, this analysis predicts that *that*-result clauses should never appear adjacent to their hosts, since they do not "originate" there; in fact, the absence of sentences where they*do* appear there (or just past the CN anyway):

(108) So many books have been published lately that I haven't been able to read them all.

*So many books that I haven't been able to read them all have been published lately.

I persuaded so many students to come to the lecture that we couldn't all fit in the lecture hall .

*I persuaded so many students that we couldn't all fit in the lecture hall to come to the lecture.

has in fact traditionally been viewed as an embarrassment for the extraposition analysis (Stucky 1987: 388). I find these quite clearly bad, but some may accept them and find them only awkward; Stucky accepts the second sentence in (108).[26]

This analysis also appears to predict that result constructions could be nested by reapplying the result rule, binding one *so*-phrase the first time, another the second. Though it is often said in the literature said such examples do not exist, the following kind of example has been pointed out too. Everyone finds it somewhat awkward, and a few claim it isn't possible at all, though I find it not very bad:

(109) So many mothers complained that their children ate so much of the candy that they got sick that the manufacturers took it off the market.

(Note the relationship of *so*-phrases here, which contrasts with the "multiply-headed" result clauses discussed earlier: the outer result clause is a quantification of the sentence *x complained that x's child ate so much of the candy that it got sick* which contains an internal result clause that is semantically independent of the outer one.)

7. Conclusions

It is hard to convincingly present and motivate a new theory and a novel analysis of a well-known language in a single paper, and I won't pretend I have done so. But I hope I have shown there might be some interest in exploring the idea that a familiar language could have much less constituent structure than supposed, if one simultaneously admits the possibility that some words and phrases could be more tightly connected than others, and that LP-principles apply across a languages in GPSG fashion. Of more interest to me than persuading linguists of all this, however, is to getting linguists to question our automatic assumptions about constituents and our basis for assuming as a methodological principle that languages must always have a phenogrammatical syntactic structure describable by phrase structure trees.

[26] Stucky suggests (p. 388) that this sentence is also accepted by May and Gueron, but they exhibit it only as a D-structure (p. 3, 8b); there seem to be no non-extraposed (S-structure) examples in their paper.

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