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Susan U. Stucky

1 Introduction

Natural languages typically permit more than one order of words or phrases, though they differ with respect to both the amount of order variation allowed and the kind of information carried by these differences in order.[1] In some languages, linear order conveys information about the argument relations. In others, this role is performed by morphology alone. Linear order may otherwise bear information about the status of the content of an utterance in the discourse–whether it is new or expected, for instance. Even within a particular language, different orders may carry fundamentally disparate kinds of information.

Variation in order among syntactic constituents, which I shall refer to as *configurational variation*, has received a good deal of attention in the linguistic literature of late (e.g., Flynn [5], Gazdar and Pullum [10], Hale [13], and Uszkoreit [26]. [2] Much of that attention has been focused on languages other than English, because of the assumption (tacit, at least) that there is not enough *configurational variation* in English to be troublesome.

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[2]The terms *configurational variation* and *permutational variation* (both of which will be defined below) were introduced in the proposal for the grant under which this research was conducted. In this endeavor Jane Robinson, Stuart Shieber, and Hans Uszkoreit were central participants.

A moment's reflection (think of the placement of adverbs, for instance, or of stylistic variation and topicalization) ought to convince the reader that this assumption is at best somewhat shaky. Therefore, it would seem prudent to examine *configurational variation* in English. Two recent developments in theoretical linguistics make it particularly appropriate to do so at at this time. One is the advent of nontransformational grammar formalisms, which need to be tested against these data. The other is the increasing interest in natural-language processing. Since both of these developments involve changes in underlying assumptions, it might reasonably be expected that analyses will differ likewise.

Before launching into the analysis *per se*, it would seem profitable to outline the problems posed by such constructs as extraposition in the abstract. For this purpose, I introduce some terminology that will be useful not only for the discussion of order from a nontransformational point of view, but also from the perspective of language processing. *Configurational variants* are sentences that differ in syntactic form, but possess the same propositional content. Automatically excluded by this definition are variants that signal quantifier scope, such as *Not every variant will be included in this definition* and *Every variant will not be included in this definition.* Note also that scope ambiguities in theories in which the different readings of quantified sentences are represented by differences in the order of constituents in logical form are also excluded by the definition, since they involve a one-to-many mapping of syntactic to logical form. The constructs under investigation here are further constrained to fall into a class whose members are defined as *permutational variants*, a subset of *configurational variants. Permutational variation* is distinguished from *configurational variation* in that it is not lexically signaled. For instance, the passive construct in English is a lexically signaled *configurational variant*, and so does not fall under the definition of permutational variation. Extraposition, on the other hand, is a primary example of *permutational variation.* The relative freedom of adverbial placement is still another. Yet a third example is presented by the order variation of noun phrases in languages whose argument relations are signaled neither by the morphology nor by surface contiguity (as is sometimes the case in Makua, a Bantu language).

The foregoing terminology had its origin in research related to natural-language processing rather than in the pursuit of strictly grammatical issues–though this development is surely only a consequence of the way in which

the two disciplines have developed. In fact, it might appear at first glance that the divisions implied by the terms *configurational* and *permutational* are artificial ones, for it is not immediately apparent what, say, establishing argument relations in Makua has to do with extraposition in English. But it is the lack of lexical signals and structural cues, no cue (from the linear order, that is), that creates the problem for processing; for how, if there is no determinate order and no marking, do you determine what is what?

If, on the other hand, there is a lexical signal, we are faced with a different situation. In principle–and taken in the abstract–processing then raises fewer problems than are caused by order variation without such cues. To understand the reason for this intuitively, it is helpful to use the following distinctions (devised by Hans Uszkoreit). *Parent-bounded* permutations are those in which permutable categories turn out to be sisters in the assigned phrase-structure tree. Other permutations are *category-bounded*, often by S or NP. Still others are *unbounded* altogether, there being, in principle, no bound upon the distance at which the permuted constituents may be found. The complexity of the grammar is a function of the boundedness of the permutation and the number of possible variants. If, as is the case in English, different kinds of permutational variants can interact, e.g., alternative placements of adverbs and unbounded topicalization, the number of possible variants becomes increasingly large; indeed, in the worst case, it can become exponential in the number of permutable constituents. Now if this seems extreme, consider the Austrialian languages with flexible word order (as described initially by Hale[13] (1981); they evidently have this property.

I will not attempt an exploration of all permutational variants in English (for all the obvious practical reasons), though that is surely necessary if investigators are to understand the phenomenon in a comprehensive fashion;[3]

[3]It is an important point of method to note that to describe *configurational variation* in a given language, it is necessary that the number of categories in the language be finite, or, in a theory in which categories are made up of feature bundles, that the number of features be finite. For, to determine the scope of variation, one must check all the orders–and the number of orders is n-factorial, where n = the number of categories (or feature combinations). If that number is not finite in principle, then the test cannot be made. Note too what this means in practical terms: three items = six orders, four items = twenty-four orders, five items = one hundred twenty orders. And a mere six-item sentence would have seven hundred twenty orders. The analysis in this paper is likewise subject to these very real practical problems. In general, we linguists fall far short of even descriptive adequacy, but the degree to which we do so in investigations of this sort is sobering. The point is simply that our theoretical claims about *configurational*

I concentrate instead on one construct, which is known in the literature as extraposition. The example below is typical:

(1a) An analysis of extraposition *that is both uncomplicated and insightful* has not been forthcoming.

(1b) An analysis of extraposition has not been forthcoming *that is both uncomplicated and insightful.*

In spite of this limited domain, it will be possible to draw a number of conclusions. One will be that a number of time-honored assumptions regarding the facts are not tenable. In particular, I argue that there are fewer "syntactic" restrictions than are normally assumed, both on the number of extraposed consituents allowed (I maintain that there is no limit imposed by the grammar) and on the order of extraposed constituents. The generalization we arrive at is that categories that are not heads of phrases and do not ever linearly precede their respective heads (this excludes some adverbs and adjectives) may appear anywhere after their heads.

The generalization would appear to raise problems immediately in two ways. First, there are a great many examples one can think of (from the linguistic literature and simply off-the-cuff) that would appear to confute such a claim. The different classes these illustrations fall into are taken up individually in the paper. In particular, though, I note the now familiar decline in comprehension induced by seemingly minor modifications of examples, and it is my contention that they decay in interesting, principled ways. Second, if one were to offer the generalization as a bald statement on the linear precedence of categories (e.g., as a linear precedence rule in a generalized phrase-structure grammar (GPSG) [9], say, H $<$ α where α includes the allowable feature bundles), with no other abstract level of representation,.then the syntax would not provide the structures normally considered useful as guides to semantic interpretation. Now these objections might seem to be sufficient to reject the generalization out of hand. However, any return to the safer confines of syntactic constraints is also out of the question, for the examples discussed here are simply better than they ought to be if either the syntactic generalizations assumed in the literature to date are correct or, indeed, if there are any genuine syntactic constraints at all besides the one just mentioned. The old assumptions do not seem to stand

variation in a given language are valid only to the extent that we have have tested the possibilities.

up very well under the onslaught of facts about extraposition; it is apparently time to acknowledge this fact and begin to look for other explanations. Consequently, the present analysis is not formulated in any of the current formalisms. Moreover, in my own admittedly subjective opinion, to do so at this time would incur a high risk of missing the forest for the trees.

One caveat should be introduced here. In the present paper, I abstract away from the discourse constraints on the use of a particular order (which is a viable subject matter in its own right). I do this not because such a description would not be part of a full account of extraposition, but because what features mark such functions, or, for that matter, whether there should be any syntactic features in this role at all, is still an open question in the theoretical tradition (loosely speaking, the generative tradition) adhered to in this paper.

2 The Lingustic Domain of English Extraposition and Related Matters

In this section I build up an analysis of a subset of *permutational variants* under garden-variety assumptions about syntax. The points of this section are twofold. One is that a number of generalizations embodied in current syntactic analyses seem not to be valid; the other is that there is a pattern to the deviance in ill-formed or not easily comprehensible examples. I should like to state at the outset, that though I start out to investigate extraposition, I am profoundly skeptical about the existence of such a rule or more generally, such a structure. I shall continue to use the term, but it should be understood that it is used as though it were in quotes. I trust that it will be clear to the reader by the end of the paper that this skepticism is merited.

2.1 Delimitation of the Domain

To embark on a discussion of some phenomenon that already has a name would suggest that something is known about it. So what is extraposition? The answer, as usual, depends on the linguist you ask. To begin with, the

structures the term is used to cover in the traditional grammatical literature are not the same as in the modern theoretical literature. The word "extraposition" has been used in traditional grammar (e.g., Jespersen [15]) to include those patterns in which a word or phrase is outside the sentence proper (is, in Jespersen's view, an afterthought) and in which the extraposed item is replaced by a pronoun. This account does not specify whether the extraposed element is at the beginning (Jespersen [15] (p. 95), for example, takes *That priest who entered, do you know his name?* to be an instance of extraposition) or end of the sentence. Other modern grammarians, e.g., Quirk et al. [20] use the term for rightward dependencies only and also require the presence of a substitute (i.e., a pronoun) in the position in which the phrase normally occurs. In contrast, generative grammarians have taken to calling these latter cases dislocations of various sorts and have posited rules such as Right Dislocation and Left Dislocation to account for them. Nor do the traditional grammarians count as extraposition, those structures induced by the rules of Heavy NP Shift, or any of the kinds of extraposition from NP that generative grammarians have posited rules for–e.g., extraposition of relative clauses, PP's, comparative clauses, and result clauses. None of these latter rules, as commonly formulated, leaves a trace in the form of a surface resumptive pronoun, which is characteristic of what the traditional grammarians have called extraposition. But the lack of a resumptive pronoun is not an adequate criterion for defining extraposition in the generative paradigm either, since sentences that were formerly analyzed by a rule of topicalization involves displacement of words to the periphery of a clause without the presence of a resumptive pronoun. Besides, extraposition of a subject NP does involve a pronoun in subject position. The delineating difference between extraposition and topicalized structures is that topicalization is unbounded–i.e., the topicalized constituent can be arbitrarily far from the clause to which it belongs semantically, whereas extraposition (according to Ross [22]) is perceived to be a bounded rightward dependency. But we are getting ahead of ourselves.

The point of this excursion into the history of the term "extraposition" is that it has been employed to cover different cases at different times, so that intuitive inferences as to whether or not some construction is an instance outside a particular formulation are risky.

In summary, the term "extraposition" has been used in the generative tradition as the name of a rule which analyzes structures in which a phrase

or clause is displaced to the right end of some constituent (examples follow) except for structures induced by Complex-NP-Shift (also known as Heavy-NP-Shift). Structures induced by the rule of Right Dislocation (i.e. with a resumptive pronoun, rather than a dummy pronoun, as in "He is very capable, *the secretary who is being hired to move into the new office*" is generally not called extraposition in the generative tradition. That is to say, sentences like these have not been treated according to some general rule of extraposition. The cases which we are examining in the present paper are those defined in the generative tradition, because, as instances of *permutational variation* they provide a real challenge to natural-language processing (for the reasons cited above), even though it is by no means clear that rules similar to those developed in the generative paradigm will be equally well justified in other paradigms, say, in nontransformational ones.

2.2 Syntactic Facts

The following discussion of the range of facts to be covered relies on literature dealing with the transformational paradigm, even though it is based on assumptions that have been superseded in government-binding theory (GB).[4] Moreover, as I noted above, there is little precedent in the nontransformational paradigm. One quite crucial difference between that paradigm, on the one hand, and either the current transformational paradigm or the current nontransformational ones on the other, is that it is difficult to emulate formally the old transformational rules. In any case, there has traditionally been a distinction made between extraposition *of* an argument and extraposition *from* one. (The classic study of these matters in the now classical transformational paradigm was Rosenbaum's [21] 1965 thesis.) For instance, 'Extraposition-of-subject' is a term used to name a rule that related phrase-structure markers analyzing such sentences as the following:

(2a) *That I hadn't considered any of the important ramifications* struck us all.

[4]Unfortunately, much of the discussion of extraposition within GB concentrates on a detailed examination of one particular kind of extraposition in the theory rather than on viewing the phenomenon in its entirety and placing it within the context of related phenomena in English. It is the latter approach that I am interested in in the present paper.

(2b) It struck us all *that I hadn't considered any of the important ramifications*

In the interest of completeness, one does well to ask whether the parallel case, extraposition of an object NP is attested. Sentences such as the one below could at first glance be analyzed as object extraposition parallel to subject extraposition in that there is a pronoun in place of the object.

(3a) He told it to the teaching assistant at least ten times before yesterday *that the book would be in by the end of the week.*

(3b) He actually believed it for years, *that his best friend was incapable of such action.*

I do not find the example in 3a a very likely one. 3b, on the other hand, does seem more felicitous, but rather than seeing this example as a case of extraposition, it is equally plausible that "it" is pronominal for the subcategorized-for NPs such as "the fact" or "the claim". Stockwell et al. [24]) reject exactly this analysis first proposed by Kiparsky and Kiparsky [16]. Stockwell et al. proceed to point out that there are lexical exceptions, both positive and negative, to such an account of 3b. There are lexical exceptions (as there are exceptions to extraposition of "subject" NPs); "hate", for example, requires object extraposition, while "grasp" disallows it.

(4a) He hates it that the project is almost over.

(4b) *He hates that the project is almost over. (Stockwell et al.) 76a and 76b)

(5a) He grasped (the fact) that the project was almost over.

(5b) *He grasped it that the project was almost over. (Stockwell et al. 75a and 75 b; p. 553)

A third analysis suggested by the generative tradition, but not discussed by Stockwell et al. is that the structures with pronouns are produced by a rule of Right Dislocation, which does license a a dummy (or resumptive, depending on the analysis) pronoun. Most accounts of these rules are not specific enough to rule out this double analysis. Further complicating matters is the fact that a pronoun is not required, as shown by the examples below.

(6a) He repeated ten times yesterday that I would get the books I ordered by the end of the week.

(6b) Report to the higher-ups that you are displeased with the decision.

Such examples, in the standard transformational paradigm, could have been analyzed by a rule of Heavy-NP-Shift, which licensed the appearance of nonsubject "heavy" NPs at the end of their own clause. In fact, the above examples are not as egregious without the complementizer as they have been claimed to be (see Postal [19](p. 140)). What is clear and, moreover, seems reasonable to say about the distribution is that a postverbal complement does not have to be adjacent to the verb. And further that there may or may not be a resumptive pronoun in its place. With the verb taking "the fact that" complements, the analysis is a bit murkier in that the status of the pronoun needs to be clarified.

Now, these cases of extraposition lie, strictly speaking, outside the purview of *permutational variation* for two reasons. One is that a pronoun appears in surface "subject position." The other is that the possibility of such variants depends on the lexical verb in any actual sentence. Some verbs (e.g., seem, happen, chance) have only the extraposed form, while true permutational variation allows no such lexical cues. For processing, two cues not present in the simple extraposition **from** an argument, are present in extraposition **of** an argument; namely, a pronoun and a verb (which latter comes along with requirements for some determined number of arguments). [5]

Nevertheless, extraposition **of** an argument might be taken as a special instance of a more general case. If the "it" of extraposition is considered to have no referent (as it does not in some Montagovian treatments (cf. the recent treatment in Gazdar et al. [9]), there is then no difference in propositional content between the extraposed and nonextraposed counterparts. Extraposition of this sort then looks very much like the "**from** an argument" type. The sole distinction would be found in the more general difference between NP positions that must have lexical material in them

[5] Whether these cues can be of use in processing in anything like a straightforward fashion is extremely dubious. The "it" of extraposition must be distinguished from the real pronominal "it", for instance, a task that will require some work in itself. It might be, as is often assumed, that the reason for the dummy elements is a constraint to the effect that some argument positions must have lexical material in English.

from modifiers which are neither syntactically or semantically required. According to this view the extraposition **from** NP cases would not need any dummy element, since the only requirement is that argument positions be filled with lexical material.

Before coming to any conclusion concerning this matter, I take up the question of extraposition **from** an argument. Because these constructions are inherently more complicated in that they involve extraposition of numerous kinds of categories, I shall divide up the descriptive problem into five parts:

1. What kinds of constituents can be extraposed from?
2. What kinds of constituent types can be extraposed?
3. Are there limits on the number of extraposed constituents in a single clause?
4. Where can the extraposed constituent be found?
5. How do extraposed and nonextraposed constituents interact with other patterns in the language, e.g., wh-type phenomena and quantification?

2.2.1 What Kinds of Constituents Can Be Extraposed From?

In subsequent sections, the reader will encounter examples that are sometimes better when read aloud (especially by someone else!), or when there is a comma/pause setting off the extraposed phrase or clause, or when the extraposed item is especially long. It has also been my experience in reading other articles on extraposition that some examples seem absolutely uninterpretable, until I get accustomed to them. No doubt this has been shared by some readers here. But this is not a plea for tolerance; rather, I think that this phenomenon raises a matter of some concern. How do we know we are not dealing with parentheticals and not, in fact, with extraposition at all? How do we know they are separate phenomena? Does it matter? How do we know that these examples are not due to the Labov effect, or Zimmer's law (the longer the better). In my opinion, the answer is quite simple: we don't know. Some readers may feel that many of these examples are interpretable but ungrammatical. But the position I take here is that

the grammaticality judgments made with regard to these examples are not a matter for introspection. They are consistent neither for a broad range of examples of a given type nor for numerous iterations of the same example.[6] The point is that, when one takes as core phenomena *permutational variants*, we cannot afford to ignore the fact that grammaticality seems to shade into interpretability (discussed in Section 3). Note that this would be just the sort of effect one would expect if the grammar itself were not the sole repository of constraints.

The easy part of the answer to the question above is that, basically, nonhead categories that do not precede their respective heads linearly can be extraposed from any of three major categories (NP, AP, and PP), though I stress again that particular examples may not be interpretable.

Extraposition from NP (of various kinds of constituents) has received by far the most attention in the literature. Here is a typical example:

(7) The claim has not, to my knowledge, been demonstrated to anyone's satisfaction *that extraposition is easy to explain.*

Examples of extraposition from an adjective phrase (AP) are also attested. Here are various examples:

(8a) I was *sorry* for only a few minutes *about what happened.*

(8b) The analysis of extraposition is more devastating for everyone's theory *than you would have thought.*[7]

Examples of extraposition from a prepositional phrase (PP) can likewise be found, though it is often less clear that what is being modified is the preposition itself and not the noun in the PP. This potential ambiguity seems true of these examples in general. However, in the one below at least, "the market" can be omitted without jeopardy.

[6]It is also my opinion that this is not unlike the experience of those investigating linear order in languages that are reputedly less rigid than English. My own firsthand experience with Makua was just like this.

[7]The status of examples with *for*-phrases is not altogether clear since it might be thought that *for*-phrases are arguments and that this is why they appear next to the head. Insofar as I am considering arguments as being required by the semantics of the head, these phrases do not count as arguments. See Dowty [4] for a discussion of a similar viewpoint.

(9) He liked living *near (the market)* last year *where they have a good selection of fish.*

Though one might try to argue that "near" in this case is functioning as a noun, that argument is flawed since, "live" does not equally well take a noun as its object–e.g., "living the market" is excluded.

It hasn't been customary to ask whether or not verb phrases allow extrapostion from themselves, since extraposition was never defined so generally. In spite of precedent, perhaps this is the way structures hitherto analyzed by the rule of Heavy NP Shift ought to be analyzed. If so, the generalization would be that all the major categories–NP, PP, AP, and VP–permit extraposition from them.

To begin with, I propose the following generalization: **nonheads can be extraposed.** Note that the generalization would account for "extraposed" object NPs, i.e. the complex NP shift examples (dummy "it" aside), since they too are nonheads.

2.2.2 Which Kinds of Categories Can Be Extraposed?

The answer to this question depends, of course, on the syntactic categories posited. Thus far in the discussion, I have been using the term "category' to imply that it is a monadic kind of object. This is not, in fact, the assumption underlying much of current syntactic theory, which views syntactic categories as being made up of feature bundles. In addition, once we move outside the domain of the major category features, there seems to be less agreement about what the features comprising these categories actually are. Many syntactic features have special distributions or are subject to diverse constraints (e.g., as in GPSG [9]). As the examples below attest, phrases of many common clusters of feature bundles can be extraposed, so many in fact, that the question becomes instead whether there are any nonhead categories that do not. Consider these examples:

(10a) *An analysis* has not been forthcoming *that is not uncomplicated.* (relative clause)

(10b) *The assumption* was questioned by only a few of those involved *that Mary would reject the offer.* (complement clause)

(10c) The analysis of extraposition is *more complicated* for everyone *than you would have thought.* (comparative clause)

(10d) Mary read *a book* over Christmas vacation *by Barwise and Perry.* (prepositional phrase)

(10e) *A man* sat down next to me on the plane *with three copies of* **Situations and Attitudes.** (prepositional phrase)

(10f) *Reviews* will appear shortly in all the major linguistics and philosophy journals *of that new book we have all been waiting for.* (prepositional phrase)

(10g) *Enough* people have responded *for us to go ahead with the decision.*

(10h) *Too many talks* have been given *for everyone to attend them.* (too-phrase)

(10i) It would be *surprising* to me, certainly, *for him to turn down the job.* (clausal complement)

(10j) They tried for many years *to force him to make a decision one way or the other*, but to no avail. (infinitival complement)

(10k) *So* many visitors have been giving talks *that it seems like a perpetual conference around here.* (result clause)[8]

Examples 10i and 10j, in particular, are problematic in that it is difficult to ascertain whether it is the complement that is extraposed or the adverb inserted. This need not be a problem in a nonmovement kind of analysis. In principle, the distribution can be characterized without making any one of the structures prior in any sense to the other. I regard this as one of the

[8]Since the nonextraposed forms for result clauses are seldom, if ever, used (and seem awkward), one might well question why they have ever figured in the discussions about extraposition in the first place. The arguments cited by Jackendoff [14] for degree clauses are relevant here: briefly, it was held that subcategorized-for complements must be adjacent to the heads they modify in order to drive interpretation from deep structure. Thus, a rule of obligatory extraposition would have to be invoked. What is relevant for purposes of the present paper is that these count as discontinuous constituents. The following, cited by Gueron and May [12] seem basically acceptable:

(10) So many books that I haven't been able to read them all have been published recently. (8a)

strongest advantages of the nonmovement accounts in general. [9]

Another category type that stands out as not being extraposable is that of the [strictly attributive] prenominal adjective. It is difficult, for instance, to imagine the following being acceptable in any circumstance, even as an afterthought.

(11) * It appears I have given the assignment to a fool after all(,) complete and utter.

There is a crucial difference in distribution between these prenominal adjective phrases and the other nonhead categories we have been considering. At first glance, this difference could be thought to reside at the very heart of the matter; namely, the fact that they precede their heads, whereas all the others I have been discussing follow. Perhaps the generalization should be that **all posthead categories are extraposable.** I would expect, under this hypothesis, that postnominal adjectives could be extraposed. In an early draft of this paper, I wrote that they could not; however, this appears to have been a hasty conclusion, since Geoffrey Nunberg has contributed the apparently impeccable examples below:

(12a) I want to see someone at every window armed and alert. ("reduced relative")

(12b) Nothing ever shows up on her table even remotely palatable. (-able adjective)[10]

Postnominal (i.e. posthead) adjectives themselves fall into several classes: those participating in compounds that have become quasi-lexemes. (e.g.,

[9] An analysis without movement or a mechanism that derives one form from another raises a question of no small import, but it is one that will not be addressed fully in the present paper. To wit, is it a problem if is there is no formal syntactic reflection of the conviction that in some cases one order is more basic or dominant (or normal) than another? Not necessarily; there are other equally plausible explanations. For instance, the notion of basic order may be an effect of the way in which the sentence is processed, or in the interaction of discourse functions defined by orders and the situation being described. Further discussion of this issue can be found in my thesis [25].

[10] Of course, it is well known that *even*-phrases offer challenges to many generalizations. One still has to explain why "even" would license this construction. Here, one seems to need only to have a phrase with "enough" content, which requires longer phrases than a single word in order to legitimize the extraposition.

court-martial, postmaster general), those that used to be considered "reduced relative clauses" (e.g., *I want to see someone armed and alert at every window*), and a group of -ible and -able adjectives (e.g., *Nothing even remotely palatable ever shows up on her table*). The compounds cannot be "extraposed", but this is not surprising; after all, if they function as single lexical items and English does not allow extraposition of parts of words (which I think it does not), then one would not expect them to be extraposable in any case.

Another class of modifiers, to be sure a functional rather than a syntactic one, is the adverb. Many adverbs are syntactically prepositional phrases or types of clauses. But there is a small class, which includes such adverbs as "usually", "slowly", and the like, that, as is well known, have a fairly flexible distribution. They do not fall strictly within the purview of this generalization either, since they both precede and follow the heads they modify. Prepositional phrases that fulfill an adverbial function are characterized by a freer distribution than postnominal categories. For instance, let us consider the prepositional phrase "in the park". If such a phrase is taken to modify a noun, it seldom precedes that noun (except in the phrase "an in-the-park kind of mood."[11] But if it is taken to modify a verb, i.e., its function is adverbial, it may well precede the verb (its head). Several strategems come to mind. One is to restrict the class of heads that supports extraposition, which may turn out not to be a natural class (i.e., NP, PP, AP, but not VP). A second is to restrict the class of "extraposable" items. This would seem problematic on the face of it, since it would require introducing essentially functional notions (i.e., adverbs) into the syntax. Yet a third alternative is to have three categories defined in terms of position. Here there are three cases: (1) prehead categories (i.e., prenominal adjectives), (2) posthead categories (which excludes prepositional phrases out of hand) 3) categories that are both prehead and posthead (which does include prepositional phrases). This third characterization also has a feature which doesn't recommend it initially, which is that it seems to miss the generalization that it is verbal heads that permit their nonhead categories to precede

[11]This example was contributed by Savel Kliachko, one of SRI's ablest editors. It actually calls into question the generalization arrived at by the end of the paper, if we look at distribution of categories sheerly in terms of linear order (as we are doing here). I don't quite know how neologisms (which is what I take this example to be an instance of) ought to fit into the system; nevertheless, it is a good idea to keep these sorts of examples in mind.

and follow. (Topicalized NPs, under this view, are nonheads belonging to a VP that can precede their heads.) As there is no clear preference yet, I will continue to state the generalization so as not to imply a choice.

So far, cases in which only a single phrase could be extraposed have been considered. But, as the next examples attest, there seems to be a possibility of extraposing more than one phrase or clause at once. By analogy with those arguments advanced for multiple embeddings and center embeddings, I will claim that the limits are not imposed by the grammar per se, but by human limitations on processing. This kind of argument always seems particularly weak, given that we researchers generally cannot process more than a couple of extraposed constituents at a time ourselves. Nevertheless, there seems to be no recourse other than the positing of an arbitrary upper bound, a solution I do not adopt.

There are a number of subcases to examine. First, consider examples in which more than one nonhead of a single head NP has been extraposed. Whether or not these can be taken to be instances of the extraposition of more than one constituent from a single phrase depends on our analysis of the structure of nonheads. Under standard assumptions, however, the following examples illustrate the extraposability of more than one nonhead. In general, one order is preferred to another in each example, but this apparently depends not on the syntactic category of the extraposed phrase or clause itself, but on its content.

(13a) (PP and RC) And then a man suddenly appeared at the door from the CIA whom I had seen the previous week.

(13b) And then a man suddenly appeared at the door whom I had seen the previous week from that organization that we all know well, but that will go unnamed here.

(14a) (PP and RC) Surprisingly enough, several books have appeared over the years by that author that had fewer than 300 pages.

(14b) Surprisingly enough, several books have appeared over the years that had fewer than 200 pages by that author whom we all know is especially long-winded.

(15a) (RC and RC) I'd like you to have dinner with some friends of mine tomorrow evening who came back from Paris who haven't been here in ages.

(15b) I'd like you to have dinner with some friends of mine tomorrow evening who haven't been here in ages who have just come back from Paris.[12]

(16a) (PP and RC) Can you give me the names of any newcomers as soon as possible from Finland who may have programming experience?

(16b) Can you give me the names of any newcomers as soon as possible who have programming experience who is from either Norway or Sweden?

In the next example, I find that one order seems quite uninterpretable, while the other is fairly good. Note too that, contrary to conventional wisdom, the "reduced relative" is not so bad. Indeed, the full relative seems stilted.

(17a) (complement clause and reduced relative) ??I have not yet demonstrated the claim either to my satisfaction or to anyone else's that free-word order phenomena are difficult to describe (that has been) made by several researchers.

(17b) I have not yet demonstrated the claim either to my satisfaction or to anyone else's (that has been) made by several researchers that free-word order phenomena require an inherently computationally intractable treatment.

Extraposition of nonheads from two different argument NPs in a clause is also possible. One interesting question to answer is whether or not both orders of modifiers are acceptable, for it is generally assumed that only nested dependencies are allowed in English (Frazier and Fodor [7], and that the head-modifier relationship, is arguably, a kind of dependency. It is also generally assumed that when there are modifiers of both a subject and an object, only the nesting order is good. There has been considerable theoretical debate in the literature on how this result can be obtained (e.g., the debates between Gueron [11]) and Baltin [2] and [1] , for example). The following examples with both orders are good, I submit, though not equally so.

[12]Example contributed by Hans Uszkoreit.

(18a) (Comparative and PP) Nesting - It turned out that more people read books over winter break by little-known authors than had been foreseen by even the wildest analysts.

(18b) Intersecting - It turned out that more people read books over winter break than even I had been able to forsee by both little-known and heretofore unpublished authors.

(19a) Nesting - Improbable as it may seem, an impeccably dressed man struck up a conversation with me on the plane last December on his way to Missoula, Montana carrying three copies of *Situations and Attitudes.*

(19b) Intersecting - Improbable as it may seem, an impeccably dressed man struck up a conversation with me on the plane last December carrying three copies of *Situations and Attitudes* on his way to Missoula, Montana.

Less satisfactory are examples in which the nonheads are of like category. Compare the following:

(20a) Nested - Only those students discussed articles in class yesterday that hadn't ever been assigned whom the professor likes and encourages.

(20b) Intersecting - ?? Only those students discussed articles in class yesterday whom the professor likes and encourages that hadn't ever been assigned.

A slightly different kind of example, one that makes the same point, is contributed by Henry Thompson, who reports that it came up in a conversation about such cases with Mark Liberman. In this case, there is a relative clause modifying a subject preceding a prepositional phrase, which, in turn, modifies the verb. It is particularly difficult to tell in this example whether the relative clause has been "interposed", or, alternatively, whether the prepositional phrase has been extraposed. The movement metaphors are unnecessarily misleading in this case. Nothing about this example violates the generalization that nonheads that do not ever linearly precede their heads therefore simply follow their heads. Indeed, this is just the sort of ordering we have come to expect.

(21) A man arrived that I had been expecting at the time he said he would come.

Now what can be going on? These examples are simply better than they should be, given standard assumptions. While it is surely going to be true that some readers will judge them to be ungrammatical but interpretable (a matter we take up in Section 3), I am certainly less sure of intuition in this regard. Rather than throw up our hands in despair at our inability to make judgments about these examples (which is the experience of most researchers who have probed deeply into extraposition), let's examine in some detail what makes the intersecting examples in 18a and 19a so easy to interpret. The suggestion will be that a number of factors play a role in making the particular examples in question interpretable (by which I mean understandable), factors that are not present in similar so-called ungrammatical examples cited in the literature.

One such factor is that the comparative "more" facilitates the inference that the than-phrase belongs to it. That this explanation is a plausible one is substantiated by the relatively less acceptable version (without the "more" phrase) in the following example:

(22) It turned out that many people read books over the winter break who are not our regular readers by both little-known and heretofore unpublished authors.

Also, the phrase "books by X" is a familiar enough one. Facilitation by lexical frequency is a well-known factor in other domains, so it is not surprising to find it relevant here. This hunch is rendered even more plausible by the deterioration the example suffers if a less familiar phrase is substituted.

(23) It turned out that more people read books over the winter break than even I had been able to foresee from East Asia and the Middle East.

Two other factors also appear to be relevant, the use of "even" together with the consequent natural stress on "we" and the length of the first extraposed phrase. If "even" is removed, the example seemingly becomes a little less natural.

(24) It turned out that more people read books over the winter break than they had been able to foresee by both little-known and little-publicized authors. [13]

Likewise, shortening the first extraposed clause has the effect of weakening example.

(25) It turned out that more people read books over the winter break than I had anticipated by both little-known and little-publicized authors.

It could be that what is happening is that the longer phrase allows the connection to be made, just because there is more time to figure out what's going on–which would be a kind of processing explanation for Zimmer's law. On the other hand, it may be that a longer phrase licenses the extraposition in the first place (much in the same way that Heavy-NP Shift is supposed to have done). Here too, there are a number of possibilities to be explored. However, there is enough evidence to conclude that the examples with intersecting dependencies are interpretable precisely because a number of factors conspire to make them so. The limits on the number of extraposed modifiers and the order they can appear in are, one could argue, not to be imposed by the grammar, but are artifacts of processing, much in the same way as the more familiar kinds of recursivity (e.g., "I said that Mary said that Bill reported that...") and center embedding have been treated in syntactic theory.

However, before abandoning totally an account with substantial grammatical constraints, there are two other types of facts that would need to be accounted for in any alternative model, because until now linguists have relied on a more constrained syntactic distribution in attempting to explain

[13]The facilitation by "even" is not surprising if, as has often been argued, focusing is related to the signaling of "new" information, since that fact, together with the assumption that "new" information follows the verb, provide the functional motivation for licensing the extraposition is in the first place. Hard as these notions are to define (and defend), they do have some intuitive appeal. Alternatively, focus may foreground the information in some way so that in some sense, it is "available" to be processed. There are quite a number of factors to sort out in this regard.

them. These include the putative restrictions on where various of the extraposed clause types could appear, and how, in general, extraposed clauses and phrases interact with other aspects of grammar.

2.3 Where Can the Extraposed Phrases or Clauses Be Found

Two aspects of the answer to this question are to be considered. First we want to know where in a clause extraposed phrases can be found, then whether there are any restrictions on linear order among the extraposed phrases or clauses themselves. Again I find examples that refute some of the claims made in the literature. As explained in the preceding section, it has generally been assumed under modern grammatical theory that extraposed phrases or clauses appear at the right periphery of their respective clauses. But the evidence is not so clear. What, for instance, in most accounts, determines the choice of analyzing an extraposed relative as 1) appearing in between two subcategorized-forcomplements or 2) being placed at the periphery of the clause with a heavy complement placed after it? On the face of it, the second analysis seems less preferable than the first since it requires superfluous movement (in a transformational account) or superfluous slots (in a nontransformational one).

(26) By the way, that fellow cabled headquarters whom none of us had ever met that he would be arriving in Paris on Tuesday.[14]

Of course, it is also difficult to tell whether or not these "interposed" clauses are parentheticals or not. Certainly, intonational breaks increase comprehension here. [15]

[14]This example was contributed by Stuart Shieber.

[15]One might well ask punctuation rules can help clarify the issue. Geoffrey Nunberg, the linguists' seer in matters regarding prescriptive grammar, has observed (personal communication) that the rules of punctuation rarely address such esoteric constructions as extraposition and that, in fact, while alive and well in the nineteenth century, extraposition is generally frowned on by present-day stylists. This latter fact may also explain why our intuition is often so unreliable and why, since it is marginal in English, it has been marginal in theoretical linguistics as well. Still, just for the record, some people do use commas (at least for obligatory extraposition), as in this example taken from an electronic message by John Perry: *Is anyone at CSLI interested in*

(27) John was unwilling to speculate how the range was arrived at, of students admitted to the program after the deadline.

However, it is worth noting that, with a verb that does not require lexical realization of a second argument as strongly as does "cable", the example deteriorates.

(28) By the way, that fellow telephoned headquarters that none of us had ever met that he would be arriving in Paris on Tuesday.

This suggests that the relative goodness of the example containing "cable" might have something to do with the fact that the second lexical argument is expected (in some sense); thus, when a lexical argument is not predicted in this way, there is more difficulty in recognizing whether some category does or does not count as the required material.

It has also been proposed that extraposition is bounded; that is, it is assumed that when the surface string is analyzed, the extraposed constituent cannot be arbitrarily far away. It is useful, in discussing this case, to distinguish two kinds of boundedness. One kind, which I will term *semantically bounded*, encompasses cases that are may be *syntactically unbounded*. These include, for example, cases in which there are arbitrarily many S nodes, each of which dominates material construed as belonging to the same clause. For instance, in some accounts of English syntax, sentential adverbs are "Chomsky-adjoined" to S. Thus, if we find an extraposed phrase or clause to the right of such a category (and if, in addition, we make the fairly standard assumption that there is no limit on the number of adverbs allowed in a given sentence), we may conclude that extraposition is *syntactically unbounded*. And, indeed, it appears that this is the case.

(29) The man had lived in the house all alone for many years that his father had bequeathed him in his last will.

issues like metaphorical meaning, analogy, and the like, who is willing to discuss such issues with this student? Or as reported in a newpaper article (contributed by Geoffrey Nunberg) *"I think everybody I know that's unemployed has put in for this job, that can read and write,"* said Vanessa Miller, a jobless San Francisco mother of two... (the **San Fransisco Chronicle**, March 1, 1985.) But then, other clear (and simple) instances of extraposition also lend themselves quite readily to comma intonation, so this cannot be a sufficient criterion for distinguishing parentheticals from extraposition.

On the other hand, extraposition may well be *semantically bounded* since examples in which a relative clause is "taken out of its own S" seem fairly uninterpretable.

(30) ??That the man left the book on the adjacent seat surprised me *that I had been wanting to read for a long time.*

Turning to the question of whether there is any order imposed among extraposed clauses, I find, once again, that the facts are not quite as explicit as they are purported to be. For instance, we have already ascertained that there is no rule-based restriction on the orders of nonheads extraposed from argument NPs. Yet another alleged restriction is the one noted first, I believe, by Williams [27] and subsequently remarked upon by Gueron and May [12]; according to this restriction, extraposed result clauses must follow extraposed prepositional phrases. Gueron and May [12] (p. 3) cite the following examples as evidence:

(31a) Everybody is so strange whom I like that I can't go out in public with them. (Gueron and May's 10a)

(31b) *Everybody is so strange that I can't go out in public with them whom I like. (Gueron and May's 10b)

Now I agree that the second is not "good English". But I would disagree that the reason must be that the grammar disallows it. For one thing, the following example is not as bad as it ought to be if it is truly ungrammatical.

(32a) So many books have been published recently, that I have lost count(,) by new authors on the topic of arms control.

For another there are compelling extragrammatical explanations. In general, to have short phrases or clauses follow long ones is stylistically vulnerable, and we linguists are not completely insensitive in this regard. Still, we should not allow the fear of prescriptive reproach to skew our grammaticality judgments (or whatever is left of them!). The fact is that, by and large, prepositional phrases are short, while result clauses are long.

In summary, we have seen that is difficult to establish either a unique site for the category of nonhead constituents we are considering or an internal

order among extraposed constituents. Taken together with the fact that there appears to be no bound on the number of extraposed modifiers, the conclusion is that there is a remarkably free distribution. The generalization is that **nonheads that do not ever linearly precede their heads can follow their respective heads, in any number and in any order.** We can therefore conclude that prenominal attributive adjectives and some "adverbials" are exempt from this generalization.

I have not yet returned to the cases of extraposed arguments. It is not altogether out of the question to consider the verb as the head for an "object" noun phrase, thereby subsuming "Heavy-NP-Shift" under the generalization too. But a subject NP does not fall under the licensing conditions of the generalization because it **does** precede its head and does require a "dummy" pronoun. And, by virtue of a "dummy" pronoun, extraposition of an "object" NP does not fall under the generalization. Thus, no simple extension of the latter generalization will explain either of these two cases, in any straightforward fashion.

2.4 How Do Extraposed Constituents Behave With Respect To The Grammar as a Whole?

In this section I explore the behavior of extraposed constituents with respect to other grammatical constructs. The central cases include interactions with wh-constructions, pronouns, and quantifiers. We take each of these up in turn.

As a first case, consider the frequent claim, attributed to Ross (1967), that one cannot create a question from an extraposed phrase or clause, whereas this is perfectly permissible with nonextraposed phrases. Typical of the examples cited is the following pair:

(33a) Who all did John read books by over Christmas vacation?

(33b) Who all did John read books over Christmas vacation by?

Admittedly, the second variant is awkward. But there are at least two kinds of explanations other than syntactic ones that could be given. Again, one is that it is generally considered bad style to end a sentence with a

preposition, and we linguists could be reacting to that essentially presecriptive fact. More plausible is the observation that information new to the discourse tends towards the end of the sentence. A prepositional phrase with a gap in it makes a very poor candidate for contributing new information to a discourse.[16] More importantly, it is not altogether impossible to find acceptable examples. Consider a situation in which one is trying to reopen a box. It seems that one can then say the following–if not altogether happily, at least quite grammatically–especially if the word "first" is given a little extra stress.

(34) Whatever did you open this the first time with anyway?

Ross has offered the following counterexample as well:[17]

(35) Which articles will summaries be given of reviews of?

Thus, it is not the case that questions formed out of extraposed phrases or clauses is disallowed.

Two other interactions central to grammatical descriptions are those with pronominal reference and with quantifiers. It is claimed that a pronoun followed by a noun in an extraposed phrase cannot be used to refer to the same individual. I have been unable to violate that constraint. Even if you imagine a situation in which pictures of John taken on holiday are being sent to him (=John), the following does not describe such a situation.

(36) Pictures are being sent to him posthaste of John on the boat.

[16]Of course, gaps in PPs are allowed (as in "whom are those books by?)", but this phrase is not "new information" just because it is postverbal. In this case there really isn't anywhere else it can go.

[17]This example was offered by Ross in oral comments to a paper on Mark Baltin ("Extraposition Rules and Discontinuous Constituents") at the 1982 LSA in San Diego. The example was reported to me by Ivan Sag.

The generalization, i.e., that only noncoreferential readings are allowed between a pronoun and a noun in an extraposed phrase, may well be true.[18]

It is also claimed (for example, in Gueron and May [12] that quantifiers have only wide scope over extraposed phrases. The best that I have been able to come up with in response to to this last claim are the following examples, which I take to have both wide-scope and narrow-scope of the quantifier 'every'. I have found less than perfect concurrence with these judgments, so I think it may well be that a first reading, however we decided to account for that, is not one in which the prepositional phrases are extraposed.

(37) The guardian has to be a male of every teenage boy in this place.

(38) We guarantee that the first novel will be a success by every German author who publishes with us.

Like the simple cases, the acceptability or nonacceptability of these more complicated ones depends on many specific features.

3 Conditions on Interpretability

The study of examples such as those undertaken in the present paper raises serious questions about the concept of grammaticality, a concept that is central to the autonomy of syntax hypothesis. In particular it raises questions about one facet of the intuitive conclusion that some sentences seem interpretable, but are just not grammatical. By "interpretable", for purposes of this discussion, I mean "understandable", rather than simply semantically coherent. For instance, "We believe that each other is wrong" is claimed to fall in this category. The converse is also taken to be true. The problem is that, for many people, intuitions of grammaticality are not reliable in the kinds of cases being discussed in the present paper. This is not a new dilemma, of course. But neither is it a matter of degrees of grammaticality, a now familiar route in attempts to escape this dilemma. Typically, appeals to this latter notion are of the kind in which examples differing in relative

[18] Such constraints have been handled in the syntax in recent treatments in GB, [12] (1984). We need not conclude, however, that the present generalization is wrong, since the facts on which the GB analysis was predicated have been shown to be faulty.

acceptability differ also in type of structure. In the cases at hand, there seems to be little in the way of identifiable structure that we can call upon to validate the examples. It has depended instead on the content of the examples in question, surely a notion outside the domain of grammar as it is currently conceived.

If we face up to this problem squarely, we arrive at one of two conclusions. Either the method underlying the whole of contemporary linguistic syntactic theory is faulty (and there are certainly those who would claim that) or there is some other factor at work here that must be considered. What might this something else be? Note that, in the foregoing statement on intuition, grammaticality is only half the picture, with interpretability as the other half. In this section I discuss some of the factors related to interpretability–factors that suggest, in my opinion, that extraposition will be better understood in terms of interpretability than in terms of grammaticality alone.

One factor that is surely relevant is adjacency. In fact, this exerts a fairly strong influence. Often the items in a posthead category are understood as modifying the item that figures as the nearest preceding head, if they can do so in a "semantically coherent" way. Presumably this is why, for instance, the next example is hard to interpret with one or more of the extraposed relatives modifying the "subject" NP:

(39) These people would like you to have dinner with some friends of theirs tomorrow evening who came back from Paris who haven't been here in ages.

Contrast this last example with the following ones, in which, according to the verb agreement, the second extraposed relative could only be taken to modify the subject NP. In this case, it seems that semantic coherence is unable to override the "syntactic" verb agreement failure.

(40) This fellow would like you to have dinner with some friends of his who have come back from Paris who hasn't been here in ages.

(41) A friend of mine wanted to talk to the administrators who feels wronged.

On the other hand, when the "failure" is dependent not on the form of the items in question, but on their content, an extraposed phrase or clause may be taken to modify nonadjacent material just in case the result is semantically coherent.

(42a) A woman climbed Anapurna last year who was pregnant.

(42b) The spy talked with the FBI who spoke with newscasters the next day. (Given world knowledge, there is little liklihood of the relative clause modifying the subject.)

(42c) The spy talked with the FBI who had leaked the information to the Russians. (Given world knowledge, there is greater likelihood of the relative clause modifying the subject.) [19]

The particular weighting of these factors may well be specifically characteristic of English. That fact alone, however, is suggestive of a view of the variation among languages in which they differ with respect to the definition, say, of available head, or or the strength of adjacency. In languages such as Warlpiri, the language most renowned for order variation, available heads seem not to be defined on linear order to the degree that they are in English. Rather, morphological encoding is what is relevant.

A better theory of interpretability, it appears would go some distance towards explaining the range of examples we have discussed. Certainly it appears that grammaticality alone will not.

4 Conclusion

Suppose one decides to accept the generalization that **nonheads that do not ever precede their heads can follow their respective heads in any number and in any order**. What can we conclude? Let's start with the most striking fact about this conclusion. If we were to embody this generalization in a formal grammar of the English syntax, we would not, without further amendments, have a standard constituent structure on which to base interpretation. There would be no NP that included the

[19] It has been called to my attention that there is a body of work by Judy Kornfeld of this sort, but I have not yet been able to obtain the relevent material.

head noun and any posthead categories belonging to it. One way to remedy this situation is to posit (as most generative grammarians have done) some abstract level(s) of representation, whether it is d-structure or s-structure etc. in GB [3], functional structures in lexical-functional grammar (LFG) [6], wrapping operations as in head grammars [18], metarules as in early versions of GPSG [8], or sequences in immediate dominance rules presented in later versions of GPSG–to name just a few current linguistic formalisms with strategies that provide a syntactic structure for interpretation. It is important to understand, however, that this approach is not the only one. Another possibility is to reject the more standard methods of interpretaton. One might, in this case, have syntactic objects that are more strongly typed, objects that enter into combinations on the basis of type and not according to syntactic constituent structure. The other obvious direction to take is, in processing, to create appropriate structures or descriptions of some other sort that are necessary for interpretation. There are two views regarding this strategy, it seems to me. One is to see the structure of language as more impoverished than generative linguists have thought, i.e., simply as having fewer syntactic constraints. There is precedence for this sort of approach in natural-language-processing systems that allow for over-generation. The most extreme position taken with respect to syntactic constraints was adopted by Schank (c.f. [23] and Abelson). But another way to view the move in the direction of processing is to consider the structure of language as being defined by the grammar together with a processor. The clearest exponent of this point of view is Marcus [17]. It is no accident, of course, that within the AI tradition the latter points of view have emerged, because it is primarily in that context that natural-language-processing research has been conducted. And linguists who, by and large, have mistakenly equated performance with processing have thought it unecessary, indeed undesirable, to explore processing models.

All of these possiblities have always been with us. The only difference now is that some syntactic sacred cows have mercifully been put out to pasture, so that it may well be worth revaluating our working assumptions in light of new evidence and more sophisticated research techniques.

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