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Review

Reaction to: "The Myth of Language Universals and cognitive science" On the choice between phrase structure and dependency structure☆

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Evans and Levinson (E&L) present an extremely strong case against the Chomskyan paradigm, but rather oddly retain without question one of its main pillars: phrase structure (their 'constituency'). They take it for granted that sentences have a phrase structure in languages like English, though not in languages where the order of words and phrases is much freer:

> "constituency is just one method, used by a subset of languages, to express constructions which in other languages may be coded as dependencies of other kinds" (p. 440)

They see this diversity as evidence against Universal Grammar, but their argument would be strengthened considerably by a complete rejection of phrase structure.

Consider first the oddity of phrase structure in relation to general non-linguistic cognition. Its distinctive claim is that only two relations are available for syntactic structure: the whole-part relation of dominance and the before–after relation of linear precedence. For instance, the phrase-structure assumption means that in (1) the only way to show how *John* is related to *loves* is by constructing at least one larger unit that includes both words.

(1) John loves Mary.

The 'subject–verb' relation can be read off this tree structure thanks to the linear order and the categories to which the various elements belong, but it is only shown indirectly. In contrast, the larger units (such as the VP *loves Mary* and, of course, the whole sentence) are recognised explicitly. Phrase structure crucially involves the claim that individual words CANNOT be related directly to one another: no direct link is possible between *loves* and either *John* or *Mary*.

This is a remarkable claim when seen in the context of general cognition. Where else do we find a body of knowledge where some otherwise available mental apparatus is disabled? It is true that optical illusions such as the Müller-Lyer illusion are insulated against conceptual knowledge, but syntactic structure is not a product of perception. It is deeply influenced by the conceptual thinking involved in disambiguation, so one would expect it to be able to use the full range of conceptual apparatus. Outside language we can certainly recognise direct relations without invoking whole-part relations as an intermediary; most obviously, in our social relations we know how our community works in terms of relations such as

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'mother', 'uncle', 'friend' and 'boss'. These are relations between one person and another, and although we can identify some larger groupings such as 'family' or 'company', the person-to-person relations do not depend on them. But if we can cope intellectually with direct relations between people, why cannot we do the same for words? Why cannot we recognise *John* as the subject of *loves*, and *Mary* as its object?

Now suppose the assumption behind phrase structure is wrong. Suppose our minds do in fact analyse sentence structure, at least in part, in terms of relations between individual words – the 'dependencies' that everyone mentions, even if they do not accept them as part of their theory of syntax. If this new assumption is right, it matters a great deal for our understanding not only of language structure but also of its relations to the rest of cognition. The idea that syntax is based on word–word dependencies rather than phrase structure is an ancient one, dating at least as far back as the mediaeval Arabic grammarians (Owens, 1988; Percival, 1990; Kruijff, 2006). As E&L point out, it is still popular among linguists concerned with free-order languages, but it is also popular among European linguists even when dealing with languages such as French and German (Heringer et al., 1980; Kunze, 1975; Kahane, 2000; Tesnière, 1959). The dependency idea has been developed into more or less ambitious theories of syntactic structure including the Meaning-Text Model (Mel'cuk, 1997), Tree-Adjoining Grammar (Joshi and Rambow, 2003) and the Prague-school Functional Generative Description (Sgall et al., 1986), and my own work on Word Grammar (Hudson, 1984, 1990, 2003a,b, 2007, 2008, 2010). Dependencies are at least implicit in several mainstream theories of grammar, notably Lexical Functional Grammar (which E&L mention: Bresnan, 2001) and Categorial Grammar (which they do not: Steedman, 2000). The debate has even reached mainstream American linguistics (Chametzky, 2003; Collins and Ura, 2004; Frank, 2002) and psycholinguistics (Gibson, 1998; Ninio, 1996).

But if sentence structure already shows word–word dependencies, does it also need the hierarchical structure of phrase structure? Contrary to what E&L assume, word order constraints in languages like English can be handled at least as well without phrases as with them. Standard versions of dependency grammar accept a constraint called 'projectivity' which eliminates tangled dependency arrows (Bröker, 2000; Dikovsky and Modina, 2000; Kunze, 1975; Robinson, 1970), and other theoretical options are available for keeping the words in a phrase together (Hudson, 2007:130–151). For example, take (2).

(2) I like short examples.

Why does *short* has to stick next to *examples*, rather than separating from it as in (3)?

(3) *I short like examples.

Phrase structure rests on the assumption that the only way to explain this is to assume larger units of syntax such as *short examples*, but this assumption is simply wrong. Given that *short* depends on *examples*, and *examples* depends on *like*, general principles can be formulated which prevent *short* from being separated from *examples* by *like*. Moreover, these principles guarantee that if *short* depends on *examples*, then *short* will always take its position from *examples*; so whatever rules fix the position of *examples* will also affect the position of *short*. The phrase *short examples* plays no role, as such, in these rules. To draw a non-linguistic comparison, if Mary has her small son John by her side, and we know that Mary is at the front door, we can easily work out where her son is, without the benefit of a larger 'group' consisting of Mary and John. The case for phrases in syntax is no stronger than that for groups in thinking about people.

But what about all the other syntactic phenomena that have been explained in terms of phrase structure? Supporters of phrase structure will no doubt argue that the long history of research in phrase structure has shown a great many other properties of sentence structure that follow from configurations in phrase structure. The trouble with these arguments is that phrase structure is virtually always taken for granted, and alternative analyses in terms of dependency structure are rarely considered (though there are exceptions: Tallerman, 2009). One of the most productive areas of syntactic research has been the detailed analysis of extraction, where phrase structure has played a prominent part; but here too dependency structure provides a satisfactory basis for analysis, provided we allow sufficiently rich structures. Consider (4), for example:

(4) What do you think that we should eat?

A rich dependency structure for this example shows that *what* depends on both *do* and *eat*; its link to *do* explains its position, while the link to *eat* explains how it satisfies the latter's need for an object. But how does our internal grammar allow a word depending on *do* also to depend on *eat*? A 'hopping' mechanism is available in dependency structure very much like the one in phrase structure, so *what* depends on a succession of words in the dependency chain from *do* to *eat*: on *do*, then on *think*, then on *that*, then on *should* and finally on *eat*. The structure is shown in Fig. 1, where each arrow points from one word to its dependent.

The point of this rather complicated diagram is precisely to show that dependency analyses can be complex and abstract. The word–word dependencies are not limited to just one per word, and since every dependency carries at least one generalisation, a word's properties can be inherited via different dependencies. In the case of *what*, its position is fixed by the link to *do* and its meaning by the link to *eat*, and the connection between these two words is managed by the intermediate links. Similarly, *you* belongs to *think* as well as to *do*, and *we* to *eat* as well as to *should*. This is not the place to explain the details, let alone to justify them (Hudson, 1990:354–403, 2007:119–121); the main point is simply that this kind of analysis is possible without any phrase structure.

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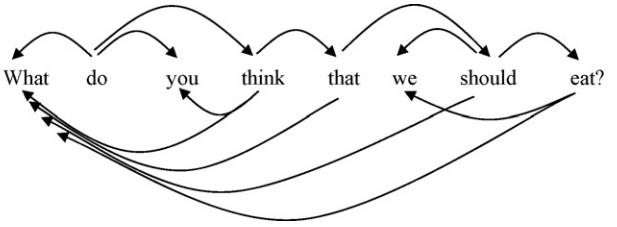

Fig. 1. Recursive extraction and subject-sharing in dependency structure.

A more subtle point is that humans are good at classifying relations. This skill is particularly obvious in our social life, where we have a rich vocabulary for different social relations. It would be surprising if we did not apply the same skill to syntactic relations, and the existence of established grammatical relations such as 'subject' and 'adjunct' suggests that this is precisely what we do. Each of the arrows in Fig. 1 can bear a label showing a more or less traditional grammatical relation. This means that categories such as 'complement' and 'adjunct' can be defined in dependency grammar even more easily than in phrase structure (where a very limited number of configurational contrasts can be made), and are available for explaining, for example, why adjuncts are so much harder than complements to extract (Rizzi in comment:467) and why they break the dependency chain between the extracted item and its (otherwise) possible source, as in (5):

(5) *Which book did you meet the man who wrote?

The problem in (5) is that *who* is an adjunct of *man*, so its dependency does not provide a suitable stepping-stone for *which book* to hop down to *wrote*.

This combination of a rich dependency structure with classification of dependencies offers a very powerful analytical vocabulary, but unlike phrase structure it is rooted in general cognition. Indeed, we find a very similar combination of rich structures and classification in our social world; for instance, the recursive element in extraction can be matched in the social world where we deal with relations such as 'ancestor' (defined recursively as the parent of a parent of...). Moreover these relations are not simply associations, but are 'typed' so that different relations carry different rights and obligations. Unlike the very simple structures of phrase structure, the dependency analysis of syntax confirms the claim of Penn et al. (comments:463) that the distinctive characteristic of human cognition is our capacity for 'relational complexity'.

Where, then, does this leave the choice between phrase structure and dependency structure? For some, even free-order languages "do not fundamentally differ from others in basic constituent structure," (comments, Pesetsky:464). For E&L, "the most realistic view of the world's languages is that some yield completely to one representational system, some to the other, most to a mix." In this view, there are phrase-structure languages like English and dependency-structure languages like Latin or Thalanyji, but most languages use some combination of the two. In contrast, I suggest that every language uses dependency structure, and even languages like English have at best a minor role for phrase structure. (I argue elsewhere that we need phrase-like word strings in order to accommodate quotations and coordination — Hudson, 1990:404–422.) But my view does not reintroduce Universal Grammar with a slightly different content. Recognising dependencies between words is simply a domain-general cognitive ability to recognise abstract relations and to classify them, with no specific implications at all for how these relations might be used in grammar. It does not exclude the possibility of recognising phrases as well, but it certainly does not predict, for example, that every language must use a VP node. This is not to deny that objects tend to combine with verbs before subjects do (as in the Verb-Object Constraint of Baker, comments:448); indeed, as Baker says, "presumably this tells us something contingent and potentially profound about how humans mentally represent events." But an innate VP node is only one possible explanation alongside more cognitive explanations. Dependency grammar offers a promising framework for this research because each dependent modifies the meaning of the head word, so nothing prevents the object from modifying the verb's meaning before the subject does. As Baker says, the question is why this should be so.

One of the attractions of the dependency framework lies in research on processing costs, which Haspelmath sees as a major influence on language structure (p. 457). When deciding how costly a word is to process, one important factor is how long it has to be kept active in working memory while other words are being processed. For example, sentence (6) is hard to process because the head of the subordinate clause, i.e. the word *that*, has to stay active until it can be integrated semantically with the word *is*.

(6) That it often rains in London even in the summer is well known.

In contrast, its extraposed equivalent (7) is much easier because *that* is almost next to *is*.

(7) It is well known that it often rains in London even in the summer.

In these sentences, *that* has to stay active until the reader finds the word on which it depends, and more generally, a word stays active until its dependency needs are satisfied. The cost of keeping it alive can be measured in terms of the number of

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other words encountered during this time – in short, in terms of the word's 'dependency distance', the number of words separating the words at either end of the dependency (Hudson, 2007:124–129). This measure gives *that* a dependency distance of nine in (6), but only two in (7). In this light, it is easy to see why so many languages favour syntactic structures such as SVO which minimize dependency distance by putting one dependent on either side of the head; but of course dependency distance measures only one of the competing processing costs, which is why languages do not all opt for the same engineering solution.

In conclusion, phrase structure has two major drawbacks in syntactic research compared with dependency structure. It assumes from the outset that language uses a very limited range of relational skills compared with ordinary cognition, thereby guaranteeing analyses which make language structure look very different from other parts of cognition. In contrast, dependency structure uses much richer relations which can be matched elsewhere in cognition. And secondly, phrase structure fits some languages (such as English) much more comfortably than others, whereas dependency structure has the flexibility to fit every type of language and, indeed, to predict the full range of diversity that E&L celebrate. This makes it a better theoretical foundation for explaining the diversity of language which E&L see as "the central explicandum for a theory of human communication." (p. 446).

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