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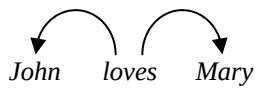
DEPENDENCY STRUCTURE AND CLAUSE STRUCTURE: COMMENTS ON THE TREATMENT OF WORD ORDER IN WORD GRAMMAR*

1 INTRODUCTION

Most syntactic theories have adopted phrase structure as the basis for sentence structure. This includes information that individual words combine to form constituents. In contrast, there is a family of approaches known as "dependency grammars" which employs the notion of dependency, i.e., the head-dependent relation, as the basis for sentence structure. Dependencies and phrases are alternative ways of representing word-word relationships. Indeed, it has been widely believed that dependency structure and phrase structure are merely notational variants and virtually interchangeable (Gaifman 1965; Robinson 1970). There are, however, significant differences between the two. (1) is the notation for dependency structure used in Word Grammar (Hudson 1984, 1990, 2003a, 2007), one of dependency-based frameworks.

(1)



Dependency structure is a pure representation of head-dependent relations. The head, called "parent" in Word Grammar, is represented as the tail of an arrow, and the dependent is at the point. The notable characteristic of this notation is that the number of nodes is in a one-to-one correspondence to the number of words in the sentence: (1) has three nodes and the sentence which it represents has three words. Consider the corresponding phrase structure in (2).

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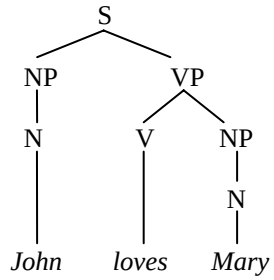
(2)



This structure has seven nodes: S, two NPs, two Ns, VP and V. This clearly means that dependency structures are simpler than phrase structures. Furthermore, Hudson has noted that phrases are implicit in the dependency structure: "each word that has at least one dependent is the head of a phrase which consists of that word plus (the phrases of) all its dependents" (Hudson 2007: 118). Phrase structures can be derived from dependency structures, so they are redundant.

Being simpler and less redundant, dependency structure should probably be chosen as a basis for syntactic representation. A question then arises: can all work really be done with just dependency structure? The purpose of this paper is to take a critical look at the treatment of word order within Word Grammar. We will particularly focus on the new version of the theory which Hudson (2007: xii) calls "the new Word Grammar" (henceforth: NWG).

2 WORD ORDER IN NWG

Word Grammar is characterised as a monostratal and thus nonderivational grammatical framework; it dispenses entirely with multiple levels of syntactic representations and transformations that mediate among them. Word Grammar is an instance of dependency grammar, where words relate directly to one another via dependency links. Thus, Word Grammar does not use phrase structure, and hence does not recognise any unit larger than a word. Phrases are only implicit in the dependency structure. Grammatical relations or functions are shown by explicit labels, such as "subject" and "complement".

In this section we will provide theoretical assumptions of the NWG framework of Word Grammar. Some important concepts and notations, particularly those concerned with representing word order, will be introduced.

2.1 Landmarks

In NWG the positioning of a word is controlled in relation to other word(s): its landmark(s) (Hudson 2007: 132ff). In simple cases a word's landmark is its parent: the word it depends on.

(3) Parents are landmarks (Hudson 2007: 132)
A word's parent is its landmark.

Let us consider a simple example. In an NWG notation, *John loves Mary* is represented as in (4).

(4)

John is the subject and *Mary* is the complement of the verb *loves*, and therefore they both depend on *loves*. These dependencies are represented with the solid lines. The dotted lines designate landmark relations, showing that the landmark of both *John* and *Mary* is *loves*. *John* and *Mary* take their position from their parent. In NWG, the landmark relation is classified into two sub-types: Before and After. In the above example, *John* is in the Before relation to its landmark *loves*, and *Mary* is in the After relation to its landmark *loves*.[1]

Landmark relations are transitive: "a landmark relation applies not only to the object that has that relation in its own right, but also to any other object that takes this object as its own landmark" (Hudson 2007: 135). This is stated in the following principle.

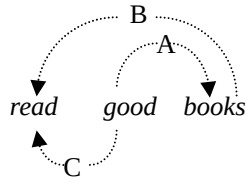
(5) Landmark Transitivity (Hudson 2007: 139)
If A is a landmark, of sub-type L, for B, and:
(a) B is a landmark for C, then A is also a type L landmark for C. (subordinate transitivity)
(b) A is also a landmark for C, then B is also some type of landmark for C. (sister transitivity)

Subordinate transitivity plays an important role in determining the positioning of *good* in (6).

(6) Read good books.

The landmark relations in (6) are shown in (7).

(7)



The dotted arrow labelled A indicates that *books* is the landmark of *good*. The

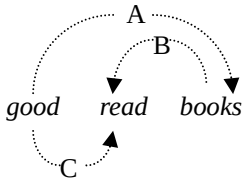
[1] In the rest of the paper, dependency relations and landmark relations which are irrelevant to the discussion will be omitted in the representations.

adjective *good* is in the Before relation to its landmark. The dotted arrow B shows that *read* is the landmark of *books*, which is in the After relation to its landmark. Now, subordinate transitivity requires that *read* should be a landmark for *good*, as the dotted arrow C shows. Subordinate transitivity also requires that *good* should be in the After relation to its landmark. Now compare (6) with (8), which is ungrammatical.

(8) *Good read books.

The landmark relations in this example are shown in (9).

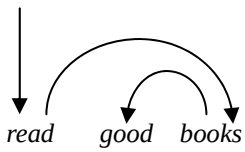
(9)



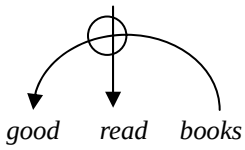
The dotted arrow labelled A indicates that books is the landmark of *good*. The adjective *good* is in the Before relation to its landmark. The dotted arrow B shows that *read* is the landmark of *books*, which is in the After relation to its landmark. Subordinate transitivity requires that *read* should be a landmark for *good*, as the dotted arrow C shows. Subordinate transitivity also requires that *good* should be in the After relation to its landmark. However, *good* precedes *read*. Thus, the contrast between (6) and (8) is correctly predicted in terms of subordinate transitivity.

In the earlier version Word Grammar, the same contrast was accounted for in terms of the No Tangling Principle (Hudson 2003a, b): every word should have at least one parent to which it is linked by an arrow which does not tangle with any other arrow. The dependency structures for (6) and (8) adopted in this version are the following.

(10)



(11)



The parent of sentences (i.e., root word) is marked with a vertical arrow in the notation employed in this version. In the structure in (11), the vertical arrow tangles with the arrow from *books* to *good*. The No Tangling Principle thus predicts the

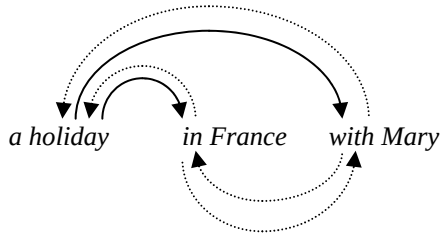
ungrammaticality of (8). (10) does not contain any tangling arrows. Hence (6) is grammatical. In the NWG framework, however, this principle has been abandoned because: (i) it does not generalise to general cognition; (ii) the vertical arrow pointing at the parent of the sentence is unmotivated; and (iii) it does not apply to coordinate structures (Hudson 2007: 140).

Let us turn to sister transitivity (5) (b), in which sister dependents take each other as landmark. In (12), in and with share holiday as their parent, so they are sisters.

(12) a holiday in France with Mary

Due to sister transitivity, *in* takes *with* as its "before" landmark, and *with* takes in as its "after" landmark.

(13)

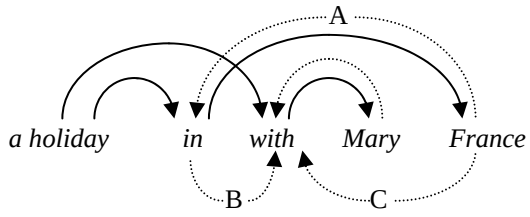


Sister and subordinate transitivity work together to block discontinuities as in (14), where the dependents of sisters are mixed up together.

(14) *a holiday in France with Mary

The relevant dependency and landmark relations are shown in (15).

(15)



The dotted arrow labelled A indicates that *in* is the landmark of *France*. The preposition *in* is in the Before relation to its landmark. *In* and *with* share *holiday* as their parent, so they are sisters. *In* can takes *with* as its "before" landmark, due to sister transitivity. Now, subordinate transitivity requires that *with* should be a landmark for *France*, as the dotted arrow C shows. Landmark transitivity also requires that *France* should be in the Before relation to its landmark. Note, however, *France* follows *with* in (15). Thus, the ungrammaticality of (14) is correctly predicted.

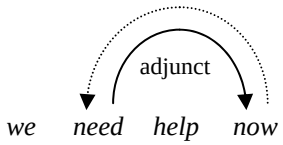
2.2 Extraction

We outline how extraction is dealt with in Word Grammar. Let us consider the examples in (16) and (17).

(16) Now we need help.
(17) We need help now.

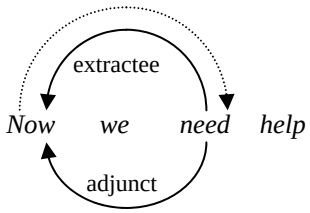
There is an adjunct in the sentence initial position in (16). The fronted adjunct *now* would otherwise follow its parent *need* as in (17), whose dependency structure is (18).

(18)



The precedence of *now* is represented in Word Grammar by adding an extra dependency "extractee" to the word.

(19)



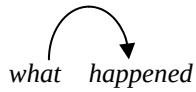
In (19) there are two dependency arrows from *need* to *now*, labelled "adjunct" and "extractee". This means that *now* is both an adjunct and an extractee of *need*. An adjunct would normally be to the right of its parent, as in (18), but in (19) *now* is to the left of its parent *need*. This is because English has a word order rule stating something like "an extractee is to the left of its parent".

2.3 Wh-*interrogatives*

We will outline how *wh*-interrogatives are dealt with in Word Grammar. Consider the dependency structure of *What happened?*, for example. The grammatical function of the *wh*-pronoun *what* to the verb *happened* is a subject. Therefore, *what* depends on *happened*. On the other hand, Hudson (1990: 361–382; 2003b) argues that the verb is a complement of the *wh*-pronoun and thus depends on it.

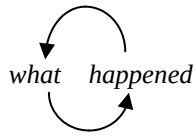
(20)

(21)

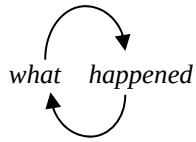


In the framework of Word Grammar, there is no reason to rule out any of (20) and (21). Thus, in *What happened? what* and *happened* depend on each other, and the dependency structure may be either of (22) and (23).

(22)



(23)



Thus, *wh*-interrogatives may involve a mutual dependency (Hudson 1990: 361–382, 2003b, 2007: 142).

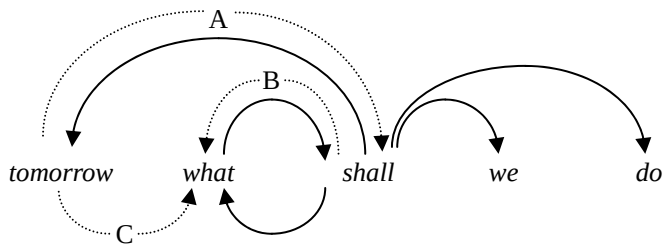
2.4 Adverbial Preposing and Main Wh-*interrogatives*

The syntactic ambiguity of *wh*-interrogatives can be resolved in syntactic contexts where they occur (Hudson 1995, 2003b). As stated above, a *wh*-pronoun and its parent are mutually dependent. In (24) *shall* is the complement of *what* whereas *what* is the extractee of *shall*.

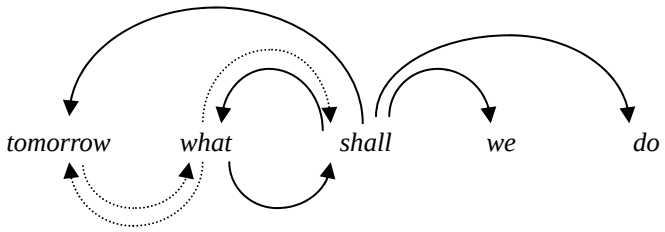
(24) Tomorrow, what shall we do?

The dependency structure for (24) would be either (25) or (26). In (25), *what* is the landmark of *shall* whereas in (26) *shall* is the landmark of *what*.

(25)



(26)



Let us first consider (25). The dotted arrow labelled A indicates that *shall* is the landmark of *tomorrow*. The preposed adjunct *tomorrow* is in the Before relation to its landmark. The dotted arrow B shows that *what* is the landmark of *shall*, which is in the After relation to its landmark. Now, subordinate transitivity requires that *what* should be a landmark for *tomorrow*, as the dotted arrow C shows. Subordinate transitivity also requires that *tomorrow* should be in the After relation to its landmark. Note, however, *tomorrow* precedes *what* in (24). Thus, subordinate transitivity wrongly excludes the correct ordering. Let us turn to (26). In this diagram, *tomorrow* and *what* share *shall* as their parent, and therefore they are sisters. Sister transitivity allows sister dependents to take each other as landmark, so *tomorrow* takes *what* as its "before" landmark, and *what* takes *tomorrow* as its "after" landmark. The correct ordering can thus be captured in terms of sister-ordering.

Thus, the structure in (26) is the only possible Word Grammar analysis of (24).

3 PROBLEMS

In the last section we saw how the NWG framework represents word order in terms of dependencies. In this section, we will see that this version of Word Grammar faces some empirical problems.

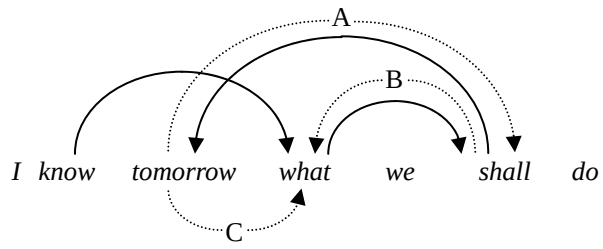
3.1 Adverbial preposing and subordinate Wh-*interrogatives*

It has been known that there are some asymmetries between main clauses and subordinate clauses with regard to linear order. One example is the fact that a fronted adverbial can precede a fronted *wh*-element in a main clause, as seen in (24), but adverbial-fronting is not possible in a subordinate clause.

(27) *I know tomorrow what we shall do.

In the framework of NWG (Hudson 2007), there are two legitimate analyses for (27), depending on whether *what* is the landmark of *shall* or *shall* is the landmark of *what*. Let us consider each case in turn. (28) is the dependency structure in which *what* is the landmark of *shall*.

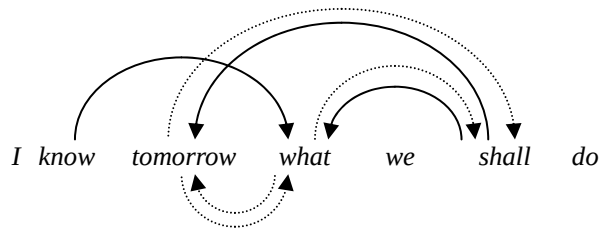
(28)



The dotted arrow labelled A indicates that *shall* is the landmark of *tomorrow*. The preposed adjunct *tomorrow* is in the Before relation to its landmark. The dotted arrow B shows that *what* is the landmark of *shall*, which is in the After relation to its landmark. Now, landmark transitivity (subordinate transitivity) requires that *what* should be a landmark for *tomorrow*, as the dotted arrow C shows. Landmark transitivity also requires that *tomorrow* should be in the After relation to its landmark. In (28), however, *tomorrow* precedes *what*. Thus, subordinate transitivity correctly excludes the wrong ordering.

Now let us turn to another possible dependency structure for (27). In (29) *shall* is the landmark of *what*.

(29)



In this diagram, *tomorrow* and *what* are sisters. Sister transitivity allows sister dependents to take each other as landmark, so *tomorrow* can take *what* as its "after" landmark, and *what* can take *tomorrow* as its "before" landmark. Sister-ordering can thus exclude the wrong ordering.

In the earlier framework of Word Grammar, structures like (29) are excluded in terms of the No-Dangling Principle: every word must have one parent (Hudson 2003a, b). In this version, the ungrammaticality of (29) could be attributed to the fact that *what* has two parents. Note that the No-Dangling Principle has exactly the same problems as the No-Tangling Principle (Hudson 2007: 140): they both do not generalise beyond syntax and do not apply to coordinate structures. NWG has abandoned the No-Tangling Principle because of these problems (section 3.1). This means that the No-Dangling Principle should also be abandoned. Without the No-Dangling Principle, the NWG framework does not have a way to exclude (29).

What is clear from the above discussion is that we end up having two ways of excluding (27): subordinate transitivity (28) and sister transitivity (29). It would not be preferable to have such a redundancy.

3.2 Parentness of Wh-*pronoun*

Recall that in Word Grammar the *wh*-pronoun is the parent of the subordinate *wh*-interrogatives. We should note that this assumption is problematic. First of all, there is no clear evidence that *wh*-word has a tensed verb as its complement. The evidence which Hudson (2007) gives is sluicing (Ross 1969).

(30) A Somebody came.
B Who?

(30) shows that the *wh*-word can occur without the verb. The same pattern can be found in indirect questions.

(31) John cooked something, but Betty didn't know [what John cooked].
(32) John cooked something, but Betty didn't know [what]. (Baker 1996: 523)

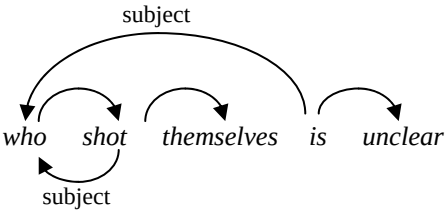
In Word Grammar, *cooked* in (31) is the complement of *what*, and it is deleted, along with its dependent, in (32).

Now let us consider examples in (33) and (34). (33) is cited by Hudson himself as a problematic data for his analysis (Hudson 1990: 365).

(33) Which students have failed is unclear. (Hudson 1990: 365)
(34) Who shot themselves is unclear. (Bob Borsley, p.c.)

In Word Grammar treatment of *wh*-pronoun, *which* and *who* are not only the subject of *have* and *shot*, respectively, but also the subject of *is*. The dependency structure for (34) is shown below.

(35)



The verb should agree in number with its subject, so *have*/*shot* and *is* should both agree with *which*/*who*. *Which* in (33) should share its plurality with *students* since the former is a determiner of the latter; *who* in (34) should share its plurality with *themselves* since the former is the antecedent of the latter. This does not explain the morphology of the copula verb in both sentences, which requires the singular subject. This analysis would predict the sentences like the following to be grammatical.

(36) *Which students have failed are unclear.
(37) *Who shot themselves are unclear.

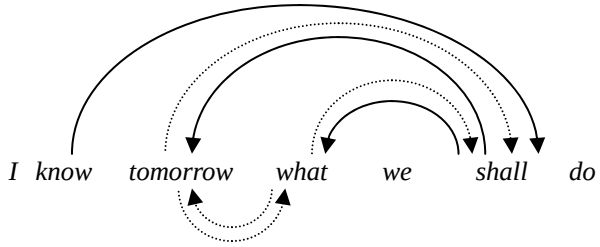
The copular verb is *are*, not *is*, agreeing with its subject *which* in (36) and *who* in (37). These sentences are, however, ungrammatical.

It seems, then, that the assumption that the *wh*-pronoun is the parent of the subordinate interrogatives has weakness.

3.3 An Apparent Solution

It might appear that the above problems disappear if we give up the assumption that the *wh*-word is a parent of the subordinate *wh*-question. The alternative structure for (27) would be (36), in which the auxiliary *shall*, not *what*, is the parent of the subordinate *wh*-question.

(38)



Tomorrow and *what* are sisters, whose parent is *shall*. It might appear that sister-ordering in terms of sister transitivity in (5) (b) could exclude the wrong ordering and capture the correct ordering, by stating something like the following.

(39) *Tomorrow* is in the After relation to its landmark *what*, and *what* is in the Before relation to its landmark *tomorrow* in subordinate clauses.

Note, however, that this statement refers to subordinate clauses since the same ordering is legitimate in main *wh*-questions.

(40) Tomorrow, what shall we do? [=

Recall that Word Grammar does not recognise any unit larger than a word, so it does not recognise clauses. This means that Word Grammar does not have a way to explicitly distinguish main and subordinate clauses. Therefore it is impossible to have a statement or constraint like (37), which explicitly refers to subordinate clauses.

4 CONCLUDING REMARKS

In this paper, we had a critical look at how Word Grammar, especially the NWG framework, handles word order. As we discussed at the outset of this paper, there are real differences between dependency structure and phrase structure and we should choose between the two. We argued that dependency structure is simpler and less

redundant than phrase structure. Other things being equal, we should choose dependency structure as a basis for representing syntactic structure. However, if the preceding discussion is sound, the dependency-based analysis in NWG contains some problems in dealing with linear order. More specifically, the NWG framework does not have a way to capture the asymmetries between main and embedded clauses with respect to the positioning of fronted adverbials. This drawback should be ascribed to the fact that Word Grammar is a dependency grammar: it has no means to explicitly refer to a unit larger than a word.

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