Language Under Discussion

Tests for constituents:
What they really reveal about the nature of syntactic structure

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Abstract. Syntax is a central subfield within linguistics and is important for the study of natural languages, since they all have syntax. Theories of syntax can vary drastically, though. They tend to be based on one of two competing principles, on *dependency* or *phrase structure*. Surprisingly, the tests for constituents that are widely employed in syntax and linguistics research to demonstrate the manner in which words are grouped together forming higher units of syntactic structure (phrases and clauses) actually support dependency over phrase structure. The tests identify much less sentence structure than phrase structure syntax assumes. The reason this situation is surprising is that phrase structure has been dominant in research on syntax over the past 60 years. This article examines the issue in depth. Dozens of texts were surveyed to determine how tests for constituents are employed and understood. Most of the tests identify phrasal constituents only; they deliver little support for the existence of subphrasal strings as constituents. This situation is consistent with dependency structure, since for dependency, subphrasal strings are not constituents to begin with.

Keywords: phrase structure, phrase structure grammar, constituency tests, constituent, dependency grammar, tests for constituents

1. Dependency, phrase structure, and tests for constituents

Syntax, a major subfield within linguistics, is of course central to all theories of language. How one approaches syntax can vary dramatically based upon starting assumptions, though. Theories of syntax based on *dependency* view syntactic structures much differently than theories based on *phrase structure*. One of these two broad possibilities, or perhaps a

combination of the two, necessarily serves as a starting point when one begins to develop a theory of natural language syntax, for the syntax community recognizes no third option. The message developed here is that dependency is a plausible principle upon which to build theories of syntax, and in light of the results from widely employed tests for constituents, dependency is in fact more suited than phrase structure to serve as the basis for constructing theories of syntax. This statement is controversial, since phrase structure has been dominant in the study of syntax over the past 60 years.

Grammars that assume dependency are known as *dependency grammars* (DGs), and grammars that assume phrase structure are known as *constituency* or *phrase structure grammars* (PSGs).[1] Phrase structure is familiar to most people who have studied grammar and syntax at the university level, since most university courses on syntax and linguistics take phrase structure for granted. Certainly, most linguistics and syntax textbooks written over the past 50 years assume phrase structure, often not even mentioning dependency as an alternative. The most prominent names in linguistics and syntax from the 20th century took phrase structure for granted, e.g. Bloomfield, Chomsky, etc. In contrast, dependency structure is associated most with the French linguist Lucien Tesnière (1893–1954), whose main oeuvre, *Éléments de syntaxe structurale,* appeared posthumously in 1959.

Dependency is both a simpler and more accurate principle upon which to build theories of syntax. A preliminary example is now given to illustrate the point. The example considers two competing analyses of a simple sentence, one analysis in terms of dependency and the other in terms of phrase structure. The validity of these two competing analyses is then evaluated further below by considering the results of three tests for constituents (topicalization, pseudoclefting, and answer fragments). The competing analyses are given next (A=adjective, N=noun, NP=noun phrase, S=sentence, V=verb, VP=verb phrase):

(1)

a.   Trees   can show syntactic structure.   – Dependency structure

b.   Trees   can show syntactic structure.   – Phrase structure

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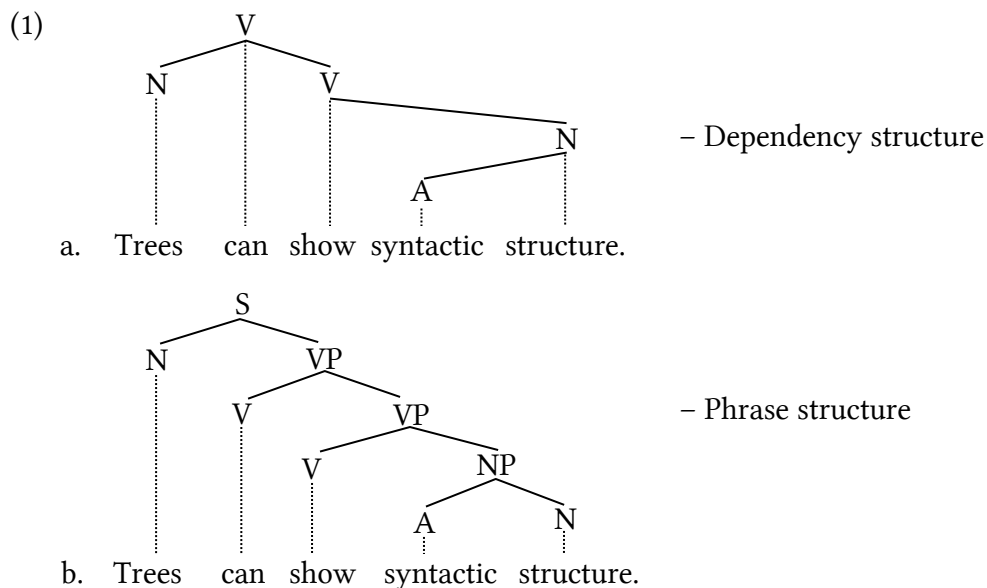
[1] The terms *constituency* and *phrase structure* are synonymous in the current context. The term *constituency* is, however, dispreferred in this article in order to avoid confusion associated with the constituent unit. Part of the message presented below is, namely, that dependency grammars and phrase structure grammars alike acknowledge constituents (= complete subtrees).

These trees show syntactic structure according to dependency structure (1a) and phrase structure (1b). Note that the dependency tree is minimal compared to the phrase structure tree, containing many fewer nodes (5 nodes in 1a vs. 9 nodes in 1b).

Standard tests for sentence structure verify aspects of these trees. The trees agree and the tests largely verify that certain words and strings of words should be granted the status of constituents (= complete subtrees). Taking topicalization, pseudoclefting, and answer fragments as example tests, they verify aspects of the two trees—an introduction to these three and the other 12 tests employed and discussed in this article is given in the Appendix. The three tests verify that the string *syntactic structure* is a constituent as shown in both trees:

(2) a. ...and **syntactic structure**, trees can show.   – Topicalization

b. What trees can show is **syntactic structure**.   – Pseudoclefting

c. What can trees show? – **Syntactic structure**.   – Answer fragment

They verify that the string *show syntactic structure* is a constituent as shown in both trees:

(3) a. ...and **show syntactic structure**, trees can.   – Topicalization

b. What trees can do is **show syntactic structure**.   – Pseudoclefting

c. What can trees do? – **Show syntactic structure**.   – Answer fragment

Two of the three tests verify that *trees* is a constituent as shown in both tree diagrams, whereas the third test, i.e. topicalization, is inapplicable:

(4) a. (Inapplicable)   – Topicalization

b. What can show syntactic structure is **trees**.   – Pseudoclefting

c. What shows syntactic structure? – **Trees**.   – Answer fragment

One or two of the tests even suggest that *syntactic* should be a constituent as shown in both trees:

(5) a. *...and **syntactic**, trees can show structure.   – Topicalization

b. The structure that trees can show is **syntactic**.   – (Pseudoclefting)[2]

c. Which structure can trees show? – **Syntactic**.   – Answer fragment

In sum, the results of these three tests support the analyses of constituent structure shown in (1a) and (1b) regarding the strings *syntactic structure*, *show syntactic structure*, and *trees*.

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[2] Example (5b) is technically not an instance of pseudoclefting, but rather a sort of relativization. It has been adapted from the standard pseudoclefting format in order to support the status of the attributive adjective *syntactic* as a constituent. The actual pseudoclefting variant of the sentence is clearly bad: **What structure trees show is syntactic* / **What trees show structure is syntactic*. Since the two trees (1a) and (1b) agree about the status of *syntactic*, altering the pseudoclefting test somewhat to verify *syntactic* as a constituent is not a misrepresentation of the current debate (dependency vs. phrase structure).

Concerning *syntactic*, the results are less clear, but since the two analyses agree insofar as they both view *syntactic* as a constituent, the inconsistency concerning the results of topicalization (and pseudoclefting) on the one hand and answer fragments on the other is a secondary issue.

The primary issue for the analyses given as trees (1a) and (1b) concerns the points of disagreement. The phrase structure tree (1b) shows the strings *can*, *show*, *structure*, and *can show syntactic structure* as complete subtrees, whereas these strings are not given as complete subtrees in the dependency tree (1a). The three tests agree that these strings should not be granted the status of complete subtrees. The tests reveal that *can* should not be taken as a constituent:

(6)　a.　*...and **can** trees show syntactic structure.　　　– Topicalization
　　　　(Unacceptable as a declarative statement)

　　　b.　*What trees show syntactic structure is **can**.　　　– Pseudoclefting

　　　c.　*What about trees showing syntactic structure? – **Can**.　　　– Answer fragment

The tests reveal that *show* should not be viewed as a constituent:

(7)　a.　*...and **show** trees can syntactic structure.　　　– Topicalization

　　　b.　*What trees can do about syntactic structure is **show**.　　　– Pseudoclefting

　　　c.　*What can trees do about syntactic structure? – **Show**.　　　– Answer fragment

The tests reveal that *structure* should not be deemed a constituent:

(8)　a.　*...and **structure** trees can show syntactic.　　　– Topicalization

　　　b.　*What trees can show syntactic is **structure**.　　　– Pseudoclefting

　　　c.　*Syntactic what can trees show? – **Structure**.　　　– Answer fragment

And the tests reveal that *can show syntactic structure* should not be construed as a constituent:

(9)　a.　*...and **can show syntactic structure**, trees.[3]　　　– Topicalization

　　　b.　*What trees do is **can show syntactic structure**.　　　– Pseudoclefting

　　　c.　What can trees do? – ***Can show syntactic structure**.　　　– Answer fragment

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[3] Concerning example (9a), an anonymous reviewer comments as follows:

> (9a) is odd because matrix VPs do not topicalize in English in general, only complement VPs can do that (e.g. *Win this war, you never will!* or *I can win this war, and win this war I shall* or *Fooled you, didn't I?*).

The reviewer's examples here support the point being developed, namely that nonfinite VPs (or complement VPs), which are constituents on both analyses (cf. *show syntactic structure* in 1a and 1b), are verified as such by topicalization. Topicalization delivers no evidence, however, for the status of finite VP as a constituent, e.g. *Will win this war, you never!, *Shall win this war, I!, *Didn't fooled you, I.

Note that many of these examples are difficult to formulate in a way that is appropriate for testing the status of the indicated string, and this difficulty is already a signal that the string should not be viewed as a constituent.

The data just examined speak strongly in favor of the dependency tree (1a) over the phrase structure tree (1b). The dependency tree is congruent with the strings that the three tests reveal as constituents and nonconstituents, whereas the phrase structure tree is incongruent with the results concerning four of the strings. The problem facing phrase structure can be understood in terms of phrasal and subphrasal constituents. The exploration of this issue below demonstrates that the tests generally identify phrasal strings as constituents, whereas they often fail to identify subphrasal strings as constituents. This situation speaks in favor of dependency syntax, since the constituents that are taken to be subphrasal in phrase structure syntax are not complete subtrees in dependency syntax to begin with. The goal of this article is to develop this insight in detail by examining a wide variety of the tests for constituents that are commonly employed in linguistics, syntax, and grammar books and textbooks.

This article is organized as follows: Section 2 presents some background information on the dependency vs. phrase structure distinction. Section 3 lists texts that employ tests for constituents, documenting the extensive use of these tests. Section 4 repeats the main message established above with examples (1–9), but it does so more extensively. Section 5 examines the inconsistency between what phrase structure grammars predict concerning constituent structure and what most tests for constituents actually reveal. Section 6 considers the reasons why phrase structure grammars have not acknowledged and probed the lack of evidence for the existence of subphrasal strings as constituents. Section 7 scrutinizes three widely employed tests for constituents that do in fact seem to support the existence of subphrasal strings as constituents. Section 8 provides some brief comments about the use and importance of the tests for languages other than English. Section 9 gives a concluding statement.[4]
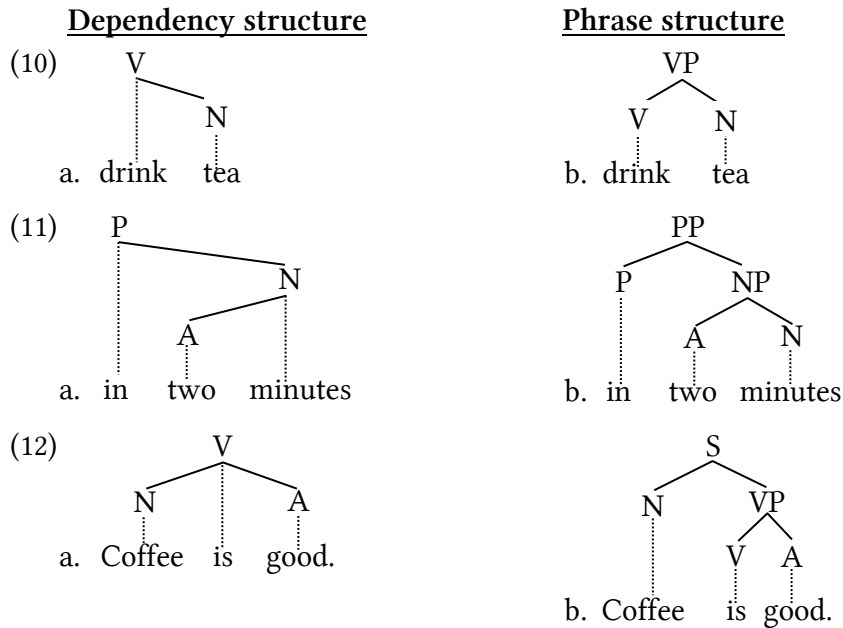
2. Dependency vs. phrase structure

Dependency syntax has a rich tradition (e.g. Kern 1883; Tesnière 1959/2015; Hays 1964; Robinson 1970; Matthews 1981; Mel'čuk and Pertsov 1987; Mel'čuk 1988; Schubert 1987; Starosta 1988; Engel 1994; Heringer 1996; Bröker 1999; Groß 1999; Eroms 2000; Ágel et al. 2003; Hudson 1984; 1990, 2007, 2010). It has, however, been on the periphery of developments in syntactic theory over the past 60 years. Many readers may therefore be unfamiliar with its basic tenets. For this reason, some background information on the distinction between dependency and phrase structure is due.

Various criteria have been used to characterize the difference between dependency and phrase structure, e.g. the ratio of words to nodes, the (non)necessity to acknowledge heads,

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[4] The subject discussed in this article appears as a tangential issue and in much abbreviated form in three earlier journal articles (Osborne 2005: 254–8, 2006: 53–8, 2008: 1126–32), and it is presented more extensively in recent conference proceedings (Osborne 2015). The current article develops the subject much more rigorously than these previous works.

the (non)contiguity of related syntactic units.[5] My stance is that the first of these, i.e. the word-to-node ratio, is the most principled. Many grammarians take a strict one-to-one mapping of atomic units of syntax (e.g. words) to nodes as a trait of dependency syntax (e.g. Mel'čuk 1979: 96; Mel'čuk and Pertsov 1987: 48, 57–8; Schubert 1987: 78–86, 129; Engel 1994: 25, 28; Kahane 1996: 45; Bröker 2003: 297; Hudson 2003: 520, 2007: 183; Carnie 2010: 177). Phrase structure grammars, in contrast, have the number of nodes in the syntactic structure outnumbering the number of atomic units by at least one. The distinction is immediately visible in simple tree structures like (1a–b) above and (10–12) here:

Dependency structure   **Phrase structure**

(10)

(11)

(12)

The dependency structures on the left adhere to strict one-to-one mapping; each word maps to one node in the structure and vice versa. In contrast, the phrase structures on the right have the number of nodes in the structure outnumbering the number of words by at least one. This is due to the presence of the purely phrasal nodes VP and PP, as well as of the S node.

Observe that both means of conceiving of syntactic structure view the words as organized hierarchically. The dependency structures acknowledge a hierarchy of words by linking words to each other directly, whereas the phrase structures posit the existence of purely phrasal nodes that mediate between the terminal nodes that correspond directly to words. In this respect, dependency is characterized as a strict *parent-child relation,* whereas phrase structure is taken to be a *part-whole relation.* Observe also that both approaches to syntactic structure, dependency and phrase structure, can acknowledge constituents. Given a dependency or phrase structure tree, a constituent is *any node/word plus all the nodes/words that that node/word dominates.* Numerous phrase structure grammarians have put forth this sort of definition of the constituent unit (see Table 4 below), and some dependency grammarians have also acknowledged that such a definition of the constituent unit is possible

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[5] A node is understood here as an indicator in the syntactic structure that shows a distinct grouping of atomic units (e.g. words). If two or more vertices in a syntax tree mark the same grouping of words, then they together qualify as a single node. This technical point is intended to preempt objections that could be leveled at the current characterization of dependency in terms of one-to-one mapping.
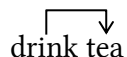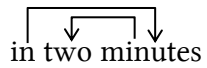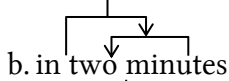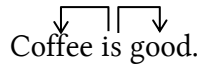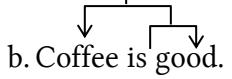
in dependency syntax (e.g. Hudson 1984: 92; Starosta 1988: 105; Hellwig 2003: 603; Anderson 2011: 92).[6]

The parent-child relation of dependency and the part-whole relation of phrase structure are also visible when brackets are used to indicate the presence of syntactic groupings:[7]

Dependency structure	**Phrase structure**
(13) a. [drink [tea]]	b. [[drink] [tea]]
(14) a. [in [[two] minutes]]	b. [[in] [[two] [minutes]]]
(15) a. [[Coffee] is [good]].	b. [[Coffee] [[is] [good]]].

The brackets in these trees are used consistently: words appearing lower in the structure appear inside more sets of brackets. An advantage that dependency has over phrase structure is visible in these cases. The brackets showing dependency structure on the left identify heads and dependents: heads appear enclosed in fewer brackets than their dependents. The phrase structures on the right, in contrast, do not identify heads and dependents. For instance, in (13b) one cannot see whether *drink* or *tea* should be construed as the head of the phrase *drink tea* because both are enclosed in the same number of brackets. In order to identify heads, node labels are needed, e.g. *[VP [V drink] [N tea]]*.

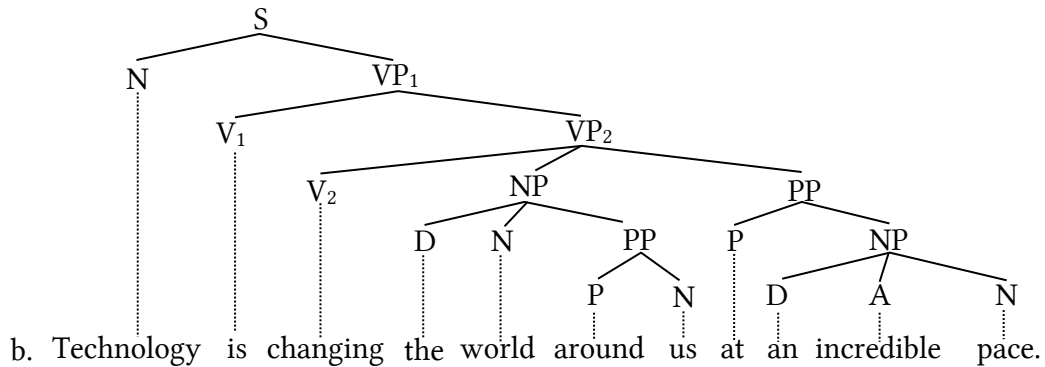Another convention used for showing hierarchical structure is arrows of the following sort:

Dependency structure   **Phrase structure**

(16) a. drink tea   b. drink tea

(17) a. in two minutes   b. in two minutes

(18) a. Coffee is good.   b. Coffee is good.

This convention is frequently used for showing dependency structure; the arrows point from heads to their dependents. The structures on the right demonstrate that the convention is also capable of indicating phrase structure, the arrows again pointing from heads to their dependents, whereby a dependent can be an individual word or a grouping of words.

The examples produced so far illustrate some important differences between dependency structures and phrase structures. Above all, dependency structures are minimal compared to the phrase structure counterparts. This minimalism is a result of the strict one-to-one mapping of words to nodes that characterizes dependency. To emphasize this point, the dependency and phrase structures of a longer sentence are now given:

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[6] Hays (1960: 261, 1964: 520) and Kunze (1975: 13) acknowledge complete subtrees in dependency syntax (called *vollständige Teilbäume* in German), whereby their understanding of the complete subtree matches the definition of the constituent just produced.

[7] The standard convention for using brackets to mark the constituents of phrase structure grammars omits the brackets around the individual words, e.g. *[in [two minutes]]*, since words are always constituents by default. This convention of abbreviations runs into difficulties when the desire is to clearly identify heads and dependents throughout the entire structure.

(19)

a. Technology is changing the world around us at an incredible pace.

b. Technology is changing the world around us at an incredible pace.
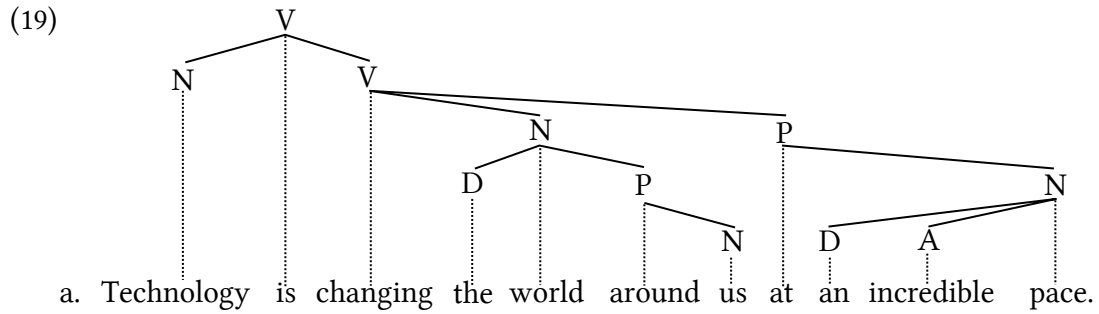
While one can debate the validity of these hierarchies, the minimalism of the dependency structure in (19a) is obvious compared to the phrase structure in (19b). Tree (19a) contains 11 nodes, one for each of the 11 words present. The phrase structure tree in (19b), in contrast, contains 18 nodes, 7 more than the number of words.

Proponents of phrase structure might object at this point. Minimalism of theoretical apparatus is of course of no benefit if this minimalism is incapable of shedding light on the phenomena under scrutiny, for complexity of theoretical apparatus may be necessary in order to address complex phenomena. The proponents of dependency syntax must concede this objection in general. In the specific area explored in this article, however, dependency syntax need concede nothing, since as suggested above with examples (1–9) and as established in much detail below, the minimal dependency structures are in fact more in line with what most tests for sentence structure actually reveal about the nature of syntactic structure in English. This point is the main message developed and presented in this article.

To conclude this discussion of the distinction between dependency and phrase structure, some clarification is necessary concerning the term *phrase structure grammar*. This term is being used here in a broad sense, to denote those grammars that are clearly not dependency grammars. In this respect, all of the following grammar frameworks are phrase structure grammars:

Phrase structure grammars
Transformational Grammar (TG),
Government and Binding Theory (GB),
Minimalist Program (MP),
Generalized Phrase Structure Grammar (GPSG),
Head-Driven Phrase Structure Grammar (HPSG),
Categorial Grammar (CG),
Lexical Functional Grammar (LFG).

Some prominent dependency grammars are:

<u>Dependency grammars</u>
Meaning-Text Theory (MTT),
Word Grammar (WG),
Lexicase,
Functional Generative Description (FGD).

Important in this area is that some linguists (e.g. Borsley 1991: 8–9) use the term *phrase structure grammar* more narrowly to denote the non-transformational grammars based on rewrite rules (mainly GPSG and HPSG). On this understanding, phrase structure grammars stand in contrast to transformational grammars (e.g. TG, GB, and MP). The debate about transformational (≈ derivational) vs. non-transformational (≈ nonderivational) syntax is not directly relevant to the message presented in this article and can hence be sidestepped.

3. Texts surveyed and overview of tests

To get a sense of how widely employed tests for constituents actually are and thus how important they are for constructing theories of syntax, several dozen linguistics, syntax, and grammar books have been surveyed. These texts are listed here in chronological order of publication:

Texts surveyed

Keyser and Postal 1976: 29–41; Baker 1978: 261–68, 327–40, 413–25; Allerton 1979: 109–32; Brown and Miller 1980: 21–49; Matthews 1981, Radford 1981: 34–117, Aarts and Aarts 1982: 7–14, 56–8, 60–78, 88, 97–8, Atkinson et al. 1982: 170–4, Mel'čuk and Pertsov 1987, Radford 1988: 69–108, Baker 1989, Akmajian et al. 1990: 149–53, Borsley 1991: 23–31, Haegeman 1991: 25–28, 79–82, 88–9, Cowper 1992: 19–47, Thomas 1993: 9–34, Napoli 1993: 148, 159–61, 164–9, 417–25, Ouhalla 1994: 14–21, Radford 1997: 102–17, Burton–Roberts 1997: 7–29, McCawley 1998: 55–84, Haegeman and Guéron 1999: 45–53, 68–72, Fromkin 2000: 146–62, Lasnik 2000: 9–11; Lobeck 2000: 47–77; Börjars and Burridge 2001: 21–44; Huddleston and Pullum 2002: 20–3, 1337–50; van Valin 2001: 110–43; Lockwood 2002: 1–5, 42–58; Poole 2002: 29–53; Adger 2003: 62–69, 122–36; Sag et al. 2003: 29–33; Radford 2004: 68–74; Kroeger 2005: 26–50; 81–2, 218–9; Tallerman 2005: 123–54; Downing and Locke 2006: 9–10; Haegeman 2006: 68–99; Moravcsik 2006: 122–4; Payne 2006: 158–80; Herbst and Schüler 2008: 4–15; Kim and Sells 2008: 19–32; Culicover 2009: 79–92; Carnie 2010: 8–24, 125; Hudson 2010: 145–52; Quirk et al. 2010: 38–52; 62–3, 75–83; Miller 2011: 53–7; Sobin 2011: 29–35; Carnie 2013: 98–107, 165–72; Denham and Lobeck 2013: 251–89; Sportiche et al. 2014: 43–85; Müller 2016: 6–17.

The main criterion used for determining whether a text was to be included in the survey concerned the notion of syntactic structure. If a surveyed text endeavors to introduce the concept of syntactic structure or to introduce a theory of syntax, then it was included in the list here. A wide range of syntax, linguistics, and grammar books and textbooks therefore appear in the list.

The pages listed for each text are generally those where the concept of syntactic structure is first introduced. In most cases, various tests for constituents are given and illustrated in

those pages. Some of the texts listed lack page numbers, though (Matthews 1981; Mel'čuk and Pertsov 1987; Baker 1989); in those cases, it was not possible to locate a clear introductory discussion or use of tests for sentence structure.[8] Furthermore, one should note that the large number of texts surveyed of course precluded the possibility of surveying each text in its entirety. The comments and points made below about the texts therefore pertain primarily just to the page ranges just listed (however, at times additional passages outside of the page ranges just listed are also cited, when they are particularly relevant).

Concerning the tests for constituents employed in the texts, Table 1 documents their use. These tests are listed in the order of frequency in which they are used, coordination being employed most frequently and of the 15 tests listed, *right node raising* (RNR) being employed the least:

Table 1. List of tests for constituents and sources that employ them,
including the exact page numbers

Test	Texts that use the test
Coordination	Baker 1978: 269–76; Radford 1981: 59–60; Atkinson et al. 1982: 172–3; Radford 1988: 75–8; Akmajian et al. 1990: 152–3; Borsley 1991: 25–30; Cowper 1992: 34–7; Napoli 1993: 159–61; Ouhalla 1994: 17; Radford 1997: 104–7; Burton–Roberts 1997: 66–70; Haegeman and Guéron 1999: 27; Fromkin 2000: 160–2; Lasnik 2000: 11; Lobeck 2000: 61–3; Börjars and Burridge 2001: 27–31; Huddleston and Pullum 2002: 1348–9; van Valin 2001: 113–4; Poole 2002: 31–2; Adger 2003: 125–6; Sag et al. 2003: 30; Radford 2004: 70–1; Kroeger 2005: 91, 218–9; Tallerman 2005: 144–6; Haegeman 2006: 89–92; Payne 2006: 162; Kim and Sells 2008: 22; Carnie 2010: 115–6, 125; Quirk et al. 2010: 46–7; Sobin 2011: 31–2; Carnie 2013: 99–100; Sportiche et al. 2014: 62–8; Müller 2016: 10, 16–7
Proform substitution using a definite proform	Allerton 1979: 113–4; Radford 1981: 63–6; Atkinson et al 1982: 173–4; Radford 1988: 78–81, 98–9; Thomas 1993: 10–12; Napoli 1993: 168; Ouhalla 1994: 19; Radford 1997: 109; Haegeman and Guéron 1999: 46; Fromkin 2000: 155–8; Lasnik 2000: 9–10; Lobeck 2000: 53–7; Börjars and Burridge 2001: 24–5; van Valin 2001: 111–2; Poole 2002: 29–31; Adger 2003: 63; Radford 2004: 71; Tallerman 2005: 140–2; Haegeman 2006: 74–9; Moravcsik 2006: 123; Kim and Sells 2008: 21–2; Culicover 2009: 81; Carnie 2010: 19–20; Quirk et al. 2010: 75–7; Miller 2011: 54–5; Sobin 2011: 32; Carnie 2013: 98; Denham and Lobeck 2013: 262–5; Sportiche et al. 2014: 50; Müller 2016: 8
Topicalization	Allerton 1979: 114; Atkinson et al. 1982: 171–2; Radford 1988: 95; Borsley 1991: 24; Haegeman 1991: 27; Napoli 1993: 422; Ouhalla 1994: 20; Burton–Roberts 1997: 17–8; Haegeman and Guéron 1999: 46; Fromkin 2000: 151; Lasnik 2000: 10; Lobeck 2000: 47–9; Börjars and Burridge 2001: 26; van Valin 2001: 112; Poole 2002: 32; Adger 2003: 65; Sag et al. 2003: 33; Radford 2004: 72; Kroeger 2005: 31; Downing and Locke 2006: 10; Haegeman 2006: 79; Payne 2006: 160; Culicover 2009: 84; Quirk et al. 2010: 51; Miller 2011: 55; Sobin 2011: 31; Sportiche et al. 2014: 68; Müller 2016: 10
***Do–so* substitution**	Baker 1978: 261–8; Aarts and Aarts 1982: 56, Atkinson et al. 1982: 174; Borsley 1991: 63; Haegeman 1991: 79–82; Cowper 1992: 31; Napoli 1993: 423–5; Burton–Roberts 1997: 104–7; Haegeman and Guéron 1999: 74; Fromkin 2000: 156–7; van Valin 2001: 123, 127; Poole 2002: 41–3; Tallerman 2005: 130–1, 141; Haegeman 2006: 75–6; Payne 2006: 162; Culicover 2009: 81; Carnie 2010: 115–6; Quirk et al.

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[8] Matthews (1981) and Mel'čuk and Pertsov (1987) are included in the list because they are important sources that introduce syntax in terms of dependencies and Baker (1989) is included because it is an introductory text that employs many of the tests sporadically throughout its account of English syntax.

	2010: 76, 82; Miller 2011: 54–5; Sobin 2011: 33; Carnie 2013: 169–70; Denham and Lobeck 2013: 265; Sportiche et al. 2014: 61
One **substitution**	Baker 1978: 327–40, 413–25; Radford 1981: 92, 96–100; Aarts and Aarts 1982: 57; Haegeman 1991: 26, 88–9; Cowper 1992: 26; Napoli 1993: 423–5; Burton–Roberts 1997: 182–9; McCawley 1998: 183; Haegeman and Guéron 1999: 75–6; Fromkin 2000: 157–8; van Valin 2001: 122, 126, 128, Poole 2002: 37–9; Adger 2003: 63; Radford 2004: 37; Kroeger 2005: 97–8; Tallerman 2005: 150; Haegeman 2006: 109; Carnie 2010: 114–5; Quirk et al. 2010: 75; Carnie 2013: 166–7; Sportiche et al. 2014: 52, 57, 60
Answer fragments	Brown and Miller 1980: 25; Radford 1981: 72, 92; Radford 1988: 91; Burton–Roberts 1997: 15–8; Radford 1997: 107; Börjars and Burridge 2001: 25; Kroeger 2005: 31; Tallerman 2005: 125; Downing and Locke 2006: 10; Haegeman 2006: 82; Moravcsik 2006: 123; Herbst and Schüler 2008: 6–7; Kim and Sells 2008: 20; Carnie 2010: 18; Sobin 2011: 31; Carnie 2013: 98
Clefting	Brown and Miller 1980: 25; Radford 1981: 109–10; Aarts and Aarts 1982: 97–8; Akmajian et al. 1990: 150; Borsley 1991: 23; Napoli 1993: 148; McCawley 1998: 64; Haegeman and Guéron 1999: 49; Börjars and Burridge 2001: 27; Adger 2003: 67; Sag et al. 2003: 33; Tallerman 2005: 127; Downing and Locke 2006: 10; Haegeman 2006: 85; Kim and Sells 2008: 19; Carnie 2013: 98; Sportiche et al. 2014: 70
VP–ellipsis	Radford 1981: 67, 1988: 101; Napoli 1993: 424; Ouhalla 1994: 20; Radford 1997: 110; McCawley 1998: 67; Fromkin 2000: 158; Adger 2003: 65; Kroeger 2005: 82; Tallerman 2005: 141; Haegeman 2006: 84–5; Payne 2006: 163; Culicover 2009: 80; Denham and Lobeck 2013: 273–4; Sportiche et al. 2014: 58–60
Pseudoclefting	Brown and Miller 1980: 25; Aarts and Aarts 1982: 98; Borsley 1991: 24; Napoli 1993: 168; McCawley 1998: 64; Haegeman and Guéron 1999: 50; Kroeger 2005: 82; Downing and Locke 2006: 10; Haegeman 2006: 88; Payne 2006: 160; Culicover 2009: 89; Miller 2011: 56; Carnie 2013: 99; Sportiche et al. 2014: 71
Passivization	Brown and Miller 1980: 25; Borsley 1991: 24; Thomas 1993: 10; Lobeck 2000: 49–50; Downing and Locke 2006: 10; Carnie 2010: 21; Sobin 2011: 30; Carnie 2013: 99; Denham and Lobeck 2013: 277
Omission	Allerton 1979: 113–9; Aarts and Aarts 1982: 60–1, 65–7; Burton–Roberts 1997: 14–5; Börjars and Burridge 2001: 33–4; Payne 2006: 163–5; Carnie 2010: 19; Hudson 2010: 147; Quirk et al. 2010: 41, 51, 61; Miller 2011: 54; Sobin 2011: 33
Intrusion	Radford 1981: 60–2; 1988: 93; McCawley 1998: 68–70; Fromkin 2000: 147–51; Börjars and Burridge 2001: 34; Huddleston and Pullum 2002: 21; Moravcsik 2006: 123; Payne 2006: 162
Wh-fronting	Radford 1981: 108; Haegeman 1991: 28; Haegeman and Guéron 1999: 46–7; Lobeck 2000: 57–9; Payne 2006: 160; Culicover 2009: 90–1; Denham and Lobeck 2013: 279–81; Sportiche et al. 2014: 58–60; Müller 2016: 9
General substitution	Allerton 1979: 113; Brown and Miller 1980: 38; Aarts and Aarts 1982: 11; Radford 1988: 89–91; Moravcsik 2006: 123–4; Culicover 2009: 87; Quirk et al. 2010: 41; Müller 2016: 7–8
Right node raising (RNR)	Radford 1988: 77–8, 97; 1997: 106; McCawley 1998: 60–1; Haegeman and Guéron 1999: 52, 77; Sportiche et al. 2014: 67–8

Additional tests not listed in this table are also employed (e.g. shifting, stripping, extraposition, etc.), although these further tests are rarely encountered and will therefore not be considered in this article. Three of these 15 have already been illustrated above (see examples 2–9) and many more of them are illustrated below. Again, see the Appendix for an introduction and illustrations of all 15 of these tests.

Concerning the nomenclature, it must be acknowledged that the terminology employed in the source texts varies, of course. Table 2 lists some of the alternative designations that one encounters:

Table 2. Designations used in this article for tests for constituents as well
as alternative designations found in the literature

Designations used in this article	Alternative designations found in the literature
coordination	conjunction
proform substitution	replacement, substitution
topicalization	displacement, fronting, movement, preposing
do-so-substitution	proform replacement
one-substitution	proform replacement
answer fragment	fragments, stand-alone test, sentence fragment test
clefting	cleft sentence
VP-ellipsis	deletion, ellipsis, omissibility, reduction
pseudoclefting	pseudocleft sentence
passivization	movement
omission	deletion, optionality
intrusion	adverb insertion, interposition
wh-fronting	movement, wh-movement
general substitution	commutability, distribution, replacement, substitution
RNR	shared constituent test

The varying designations bear witness to a mixing and matching of the tests. Proform substitution is separated from general substitution here, although the two tests are closely related and are therefore often viewed as a single type of test. They are separated here because proform substitution (using a definite proform) can deliver much different results from substitution using a non-proform. Topicalization, passivization, and wh-fronting (and extraposition and shifting) are sometimes grouped together as a single type of test, called simply *movement*. Many of the texts separate these tests, though, so that the account here is justified in separating them as well.

Note further that *do-so*-substitution and *one*-substitution are particular manifestations of proform substitution and could thus be grouped together with proform substitution as a single test. The reason they are viewed as separate tests here concerns their special use. The texts that employ *do-so*-substitution and *one*-substitution usually do so as a means of arguing for the presence of intermediate constituents, i.e. bar-level constituents in the sense of X-bar Theory, inside verb phrases [VPs] (*do-so*-substitution) and noun phrases [NPs] (*one*-substitution). These two tests therefore perform a key role in motivating the rather layered, i.e. tall, phrase structures that one finds in many modern theories of syntax.

Table 1 lists 15 tests. Five of the 15 are, however, not included in the ten main tests that are employed in the following section for probing the syntactic status of strings. The reason they are not included is two-fold: firstly, employing all 15 tests each time would require too much space, and secondly, many of the tests are limited in their ability to cast light on the structure of random test strings. The five excluded tests are mentioned next.

***One*-substitution** is, as just stated, a very widely employed test for probing the structure of NPs. The value of the test is limited, though, since it is only helpful when the test string is part of an NP. This restriction on the use of *one*-substitution means that it is often not helpful

when probing the constituent status of random test strings. For this reason, *one*-substitution is not included in the ten central tests that are employed below. Section 7.2 does, however, examine *one*-substitution, demonstrating that it is not a reliable test for determining the structure of NPs.

The **VP-ellipsis** test is also a widely employed test for constituents; it identifies non-finite predicative phrases as constituents (e.g. *Tom is a good friend, and Fred is a good friend, too*). The test is, however, limited in its applicability since it is helpful only when testing for the status of predicative phrases. More importantly, the predicative phrases that the test identifies are rarely disputed. Phrase structure and dependency grammars alike can agree that such predicative phrases, e.g. non-finite verb phrases, are constituents. Hence since there is little dispute about the status of these phrases, VP-ellipsis is not included among the ten tests that are used time and again in this article.

Although widely employed, the **passivization** test is only helpful for identifying subject and object nouns, NPs, and clauses, e.g. *Stefan painted a picture of Maja → A picture of Maja was painted by Stefan* (Borsley 1991: 24). Since theories of syntax, whether based on dependency or phrase structure, do not disagree about the status of these strings, i.e. they are unanimously taken to be constituents, the passivization test is of little help when the goal is to decide between competing analyses of a given string. For this reason, passivization is not included among the ten central tests for constituents that are employed in the next section.

General substitution is a test that substitutes a single word or a phrase for the test string. When this test is used in a manner that replaces a string of words with a single word (e.g. *Students in evening courses work hard → Adults work hard*), it may be somewhat helpful. In such cases, however, it is closely similar to the proform substitution test (e.g. *Students in evening courses work hard → They work hard*). Furthermore, when this test is used in such a manner that a single non-proform word is replaced by another single non-proform word (e.g. *Students work hard → Adults work hard*), it reveals nothing about syntactic structure beyond the fact that individual words are taken (by phrase structure grammars) to be constituents by default. For these two reasons, general substitution is not included among the core ten tests.

Right node raising (RNR) is a test that probes the status of strings appearing at the end of a phrase or clause. Its usefulness is limited, precisely because it is applicable only in case the test string appears at the end of the phrase or clause at hand. Furthermore, the claim that the shared string to the right of RNR conjuncts is necessarily a constituent is incorrect, a fact that has been established by a number of linguists (Grosu 1976, Abbott 1976, Wilder 1997: 85–6, Chaves 2014: 866–7), e.g. *[Mary gave], and [Tom has now loaned], numerous books to the library recently.* The string *numerous books to the library recently* does not qualify as a constituent in most theories of syntax. For these two reasons, RNR is also not included in the core ten tests.

While the remaining ten tests are generally more widely applicable than the five tests just mentioned, some of them are limited, too. For instance, *do-so*-substitution is useful only when testing for the status of strings containing verbs, and the omission test can only identify optional strings as constituents (adjuncts and optional arguments); it is of no use when the test string is an obligatory argument or part of the main predicate. Despite these limitations, these

tests are relatively easy to use and are included in the main group of ten tests in the interest of arriving at a reasonably extensive inventory of tests for probing the structure of strings.

4. The main point

The difficulty facing phrase structure syntax, established above in the introduction disappears if one assumes dependency syntax instead. Given dependencies, subphrasal strings do not qualify as constituents; the only types of constituents that remain are phrasal ones. This point has already been illustrated with examples (1–9) above, and it is reinforced in what follows with a more extensive illustration and discussion of another example, one taken from Radford (1988: 91):

(20)

a. Drunks would put off the customers.
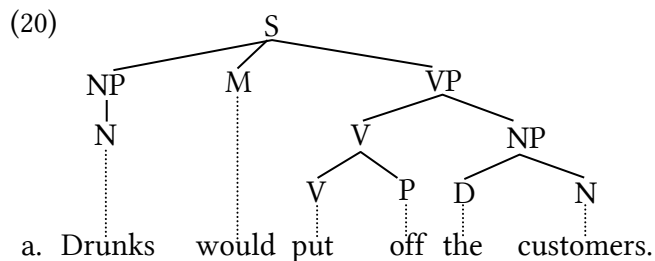
Since there are 11 nodes in this phrase structure tree, the analysis acknowledges 11 constituents, although due to the unary branching of NP—N, the tree effectively acknowledges just ten constituents. Radford motivates the analysis by way of eight tests: general substitution, movement, answer fragments, intrusion, coordination, RNR, proform substitution, and VP-ellipsis.

The tests Radford employs easily verify the structural analysis he gives insofar as they agree that the NP *drunks*, the NP *the customers*, and the VP *put off the customers* are constituents. The tests also easily verify the analysis concerning *off*, namely that it does not form a prepositional phrase [PP] constituent with the NP *the customers*. In the current context, the noteworthy aspect of Radford's analysis concerns the status of the individual words *would, put, off, the*, and *customers* as well as the status of the two-word phrasal verb *put off*. Radford's tree in (20a) shows these strings as constituents, so the tests he employs should identify them as such. Interestingly, however, Radford does not subject these units to the scrutiny of his tests, and the fact that he does not do so is understandable, because if he were to attempt this, the basic problem facing phrase structure syntax would become evident.

The dependency analysis of Radford's sentence is as follows:

(20)

b. Drunks would put off the customers.
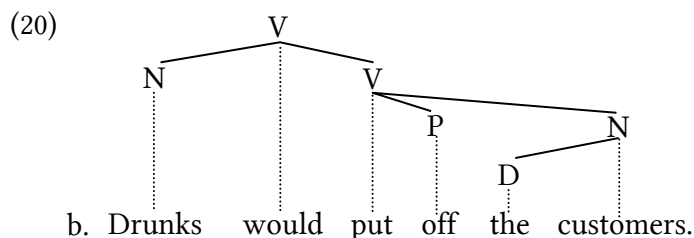
Comparing this analysis with Radford's analysis in (20a), a couple of points are immediately clear. The two analyses agree that *drunks, the customers,* and *put off the customers* should be

identifiable as constituents by the tests because in both trees, they qualify as complete subtrees. Indeed, these strings are easily identified as constituents by the following tests:

(21) a. [**Drunks**] and [vagabonds] would put off the customers.   – Coordination

b. **They** would put off the customers. (*they = **drunks***) substitution   – Proform

c. ...and **the customers**, drunks would put off.   – Topicalization

d. What would drunks do? – **Put off the customers**.   – Answer fragment

e. Drunks would **do so**. (*do so = **put off the customers***)   – *Do-so*-substitution

f. It is **the customers** that drunks would put off.   – Clefting

g. What drunks would do is **put off the customers**.   – Pseudoclefting

h. (Inapplicable because the relevant strings appear obligatorily)   – Omission

i. **Drunks** *probably* would put of the customers.
i'. Drunks would *probably* **put off the customers**.   – Intrusion

j. **Who** would drunks put off? (*who = **the customers***)   – Wh-fronting

The data demonstrate that *drunks*, *the customers*, and *put off the customers* are straightforwardly identified as constituents. Omission is inapplicable in these cases, since it can identify adjuncts and optional arguments only, as mentioned above

Observe that both analyses take *off* and *the* as constituents. Discerning these two words as constituents using tests is much more difficult to do due to the idiosyncratic traits of particles like *off* and determiners like *the*.[9] The ability to shift the particle *off* does support its status as a constituent, though (e.g. *Drunks would put them off*), and the ability to omit *the* supports its status as a constituent (*Drunks would put off customers*). More importantly, however, the two analyses agree that these two words are constituents, for they are complete subtrees in both (20a) and (20b). Their status in the hierarchy is therefore not directly relevant to the current debate (dependency vs. phrase structure).

What is of much greater interest in the current context is the status of *would*, *put*, *customers*, and *put off* in (20) , since the two trees disagree concerning these units. Radford's phrase structure analysis in (20a) views them as subphrasal constituents, whereas on the dependency analysis in (20b), they are not constituents to begin with. The majority of tests Radford employs suggest that these units are not constituents, and when one employs the wider array of tests, the conclusion is strengthened: these unts are not constituents. This point is illustrated first by focusing on *put off*:

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[9] One might object here that the fact that most of the tests fail to identify *the* and *off* as constituents is an indication that both dependency and phrase structure get it wrong and that therefore, the value of both means of modeling sentence structure is debatable. In other words, the worth of tests for constituents comes into question in general. One should keep in mind in this area that tests for constituents are merely tools that deliver clues about the nature of sentence structure. Nowhere in the literature does one find claims to the effect that they are infallible. They are, rather, quite fallible. The relevant question is, rather, which of the two means of modeling sentence structure, dependency or phrase structure, gets one closer to what the tests reveal broadly.

(22) a. Drunks would [**put off**] and [offend] the customers.   – Coordination

     b. *Drunks would **do / do it** the customers.
        (*do / do it* = ***put off***)   – Proform
substitution

     c. *...and **put off** drunks would the customers.   – Topicalization

     d. What would drunks do concerning the customers?
        – *****Put off**.   – Answer fragment

     e. *Drunks would **do so** the customers. (*do so* = ***put off***)   – *Do-so*-substitution

     f. *It is **put off** that drunks would the customers.   – Clefting

     g. *What drunks would do to the customers is **put off**.   – Pseudoclefting

     h. *Drunks would   the customers.   – Omission

     i. Drunks would *certainly* **put off** the customers.
     i'. *Drunks would **put off** *certainly* the customers.   – Intrusion

     j. ***Do what** the drunks the customers? (*do what* = ***put off***)   – Wh-fronting

Of the ten tests illustrated, only coordination supports *put off* as a constituent. The other nine tests suggest that *put off* should not be granted the status of a constituent.

     Similar results are obtained when the tests are applied to *would*, *put*, and *customers*. A majority of the tests suggest that these units are not constituents. The following examples illustrate the point by focusing on *customers*:

(23) a. ?Drunks would put off the [**customers**] and
        [neighbors].   – Coordination

     b. *Drunks would put off the *them.* (*them* = ***customers***)   – Proform
substitution

     c. *...and **customers** drunks would put off the.   – Topicalization

     d. (Inapplicable)   – *Do-so*-substitution

     e. ?Drunks would put off the who? – ?**Customers**.   – Answer fragment

     f. *It was **customers** that drunks would put off the.   – Clefting

     g. *The ones who drunks would put off the are **customers**.   – Pseudoclefting

     h. *Drunks would put off the   .   – Omission

     i. *Drunks would put off the *certainly* **customers**.[10]   – Intrusion

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[10] One might object here that inserting an adjective instead of an adverb results in an acceptable sentence, e.g. *Drunks would put off the **regular** customers.* As it is commonly employed, the intrusion test inserts an adverb, not an adjective or some other part of speech. Consider in this regard that if the intrusion test were not limited in this way, it would almost always be possible to verify every single string as a constituent, since there would always be some part of speech or another that could be inserted into each position in the sentence.

    j. ***Who** would the drunks put off the? (*who* = ***customers***)   – Wh-fronting

In this case, even coordination has difficulty identifying *customers* as a constituent. Example (23a) is better if the determiner is repeated (*Drunks would put off [the customers] and [the neighbors]*). Example (23a) can actually be fully acceptable, but only on the unlikely reading where *customers* and *neighbors* are coextensive. Note as well that the question-answer pair in (23e) involves a rare type of echo question; acceptability in such cases is reduced.

    The next data set focuses on *put*:

(24) a. *Drunks would [**put**] and [**piss**] off the customers.   – Coordination

      b. *Drunks would ***so / do it*** off the customers.
         (*so / do it* = ***put***)   – Proform
substitution

      c. *...and **put** drunks would off the customers.   – Topicalization

      d. *Drunks would **do so** off the customers. (*do so* = ***put***)   – *Do-so*-substitution

      e. *Drunks would **do what** off the customers? – ***Put**.   – Answer fragment

      f. *It was **put** that drunks would off the customers.   – Clefting

      g. *What the drunks would do off to the customers is **put**.   – Pseudoclefting

      h. *Drunks would   off the customers.   – Omission

      i. Drunks would *certainly* **put** off the customers.
      i'. *Drunks would **put** *certainly* off the customers.   – Intrusion

      j. ***Do what** would drunks off the customers?
         (*do what* = ***put***)   – Wh-fronting

Even coordination fails in this case, surprisingly. Apparently, the idiosyncratic meaning associated with phrasal verbs blocks the sharing of the particle *off*.

    The final point of disagreement between the phrase structure tree (20a) and the dependency tree (20b) concerns the finite verb *would*. The tests are again largely consistent, although there is one datum that bucks the pattern:

(25) a. Drunks [could] and [**would**] put of the customers.   – Coordination

      b. *Drunks **so / do it** put off the customers.
         (*so / do it* = ***would***)   – Proform
substitution

      c. ***Would** drunks put off the customers.
         (Unacceptable as declarative statement)   – Topicalization

      d. *Drunks **do so** put off the customers. (*do so* = ***would***)   – *Do-so*-substitution

      e. What about the drunks putting off customers?
         – ***Would**.   – Answer fragment

      f. *It is **would** that drunks put off the customers.   – Clefting

g. *What drunks put off the customers is **would**.   – Pseudoclefting

h. Drunks   put off the customers.   – Omission
(Acceptable, but the meaning has changed significantly)

i. Drunks *certainly* **would** put off the customers.
i'. Drunks **would** *certainly* put off the customers.   – Intrusion

j. ***Do what** drunks put off the customers?
(*do what* = **would**)   – Wh-fronting

Two of the tests, coordination and intrusion, support granting *would* the status of a constituent, whereas the other eight advise against doing this. Note that topicalization changes the speech act (statement → polar question), so the star indicates that (25c) is unacceptable as a statement. Note also that omitting *would* in (25h) results in an acceptable sentence, but one that has a quite different meaning. Why intrusion contradicts the other eight tests in this case is an open question that is not explored here, although data such as (25i–i') probably have to do more with the idiosyncratic distribution of modal adverbs than with constituent structure.[11]

Taken as a whole, the results of the tests just illustrated strongly support the dependency analysis (20b) over the phrase structure analysis (20a). The reason dependency syntax does so much better is that given dependencies, the distinction between phrasal and subphrasal constituents disappears, with only phrasal constituents remaining. The one test that actually seems to consistently support phrase structure syntax is coordination. Coordination is scrutinized in Section 7.1.

5. The inconsistency

The point just established is that there is a significant inconsistency in how phrase structure grammars conceive of constituent structure. On the one hand, they acknowledge the existence of both phrasal and subphrasal constituents, yet on the other hand, the majority of tests they employ do not confirm the existence of subphrasal constituents. Phrase structures therefore lack the empirical support that one would otherwise expect tests for constituents to deliver. This section considers this inconsistency more closely, documenting its existence with the introductory statements that are made about the constituent unit.

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[11] The eight texts surveyed that use intrusion as a test for constituents do so only rather briefly. They do not scrutinize its merits. One difficulty associated with intrusion concerns the fact that the results it delivers vary significantly based upon the type of adverbial that one employs. Modal adverbs, for instance, have a different distribution from frequency adverbs, e.g.

(i) a. Sam *certainly* has tried hard.
     b. Sam has *certainly* tried hard.
(ii) a. ??Sam *repeatedly* has tried hard.
     b. Sam has *repeatedly* tried hard.

Examples (ia–b) suggests that *Sam*, *has*, and *tried hard* are constituents, whereas (iia–b) suggest that *Sam has* and *tried hard* are constituents. The notion that *Sam has* is a constituent is contrary to (most) theories of syntax. These observations cast doubt on the validity of intrusion as a test for constituents. Indeed, six out of the eight texts that employ intrusion do so using modal adverbs. Intrusion used in this manner is thus more informative about the distribution of modal adverbs than it is about constituent structure more generally.

When linguistics and syntax texts first introduce the constituent unit, they often suggest an understanding of the constituent that is synonymous with the traditional phrase. This point is illustrated with the statements about constituents in Table 3. In each case, the passage cited is the key statement that is given when the constituent unit is first presented:

Table 3. Initial statements about the constituent unit, suggesting an understanding of the constituent that sets it equal to the traditional phrase

Source	How the constituent concept is introduced
Lasnik (2000: 9)	"Various tests have proved to be useful in determining what groups of words work together as units of structure, or constituents."
Börjars and Burridge (2001: 22–3)	"…These groups of words which 'go together' are called constituents….A constituent is by definition a string of words which functions as a group at some level."
Poole (2002: 29)	"We all share the feeling that, for example, *at the station* [in the sentence *The student will meet her friend at the station*] forms some kind of unit, a PP in fact, whereas other strings of words don't form a unit. Let's call these units *constituents*."
Adger (2003: 63)	"A group of words that can be picked out in this way is called a constituent,… Essentially, a constituent is a group of words which has a certain internal cohesion."
Kroeger (2005: 26)	"…the words in a sentence are not organized as a simple list. Rather, words cluster together to form groups of various sizes; these groups are referred to as constituents."
Tallerman (2005: 124)	"A constituent is a set of words that forms a phrase in a sentence."
Kim and Sells (2008: 18)	"The grouping of words into larger phrasal units which we call constituents provides the first step…"
Carnie (2010: 18)	"Constituents are groups of words that function as units with respect to grammatical processes."
Sobin (2011: 30)	"…manipulating the form of sentences rarely involves words per se – it is phrases (also called constituents) that are the object of manipulation,"
Carnie (2013: 73)	"*Constituent*: A group of words that function together as a unit."
Sportiche et al. (2014: 47)	"A *constituent* is a string that speakers can manipulate as a single chunk."

These statements reveal a tendency to view the constituent unit as a group, set, or string of words, as opposed to as a single word. The texts do not, for instance, state that a constituent is *a word or a group of words*, but rather they adopt an intuitive understanding of the constituent unit that sets it as equal to the traditional phrase.

The situation is different when the constituent is discussed and defined over trees. Table 4 documents the manner in which constituents are seen as corresponding to nodes in trees:

Table 4. List of definitional statements that define the constituent over tree structures in terms of nodes

Source	How the constituent is defined over trees
Keyser and Postal (1976: 34)	"A certain sequence of words (or subparts of words) in a tree is a constituent of that tree if and only if that sequence makes up all and only the structure attached to some individual node."
Atkinson et al. (1982: 161)	"…a sequence of words is a constituent if the sequence can be traced back to a single *node* in the tree, with no other material under this node, or, correspondingly, if the sequence exhausts the contents of a pair of brackets."

Haegeman and Guéron (1999: 51)	"The material exhaustively dominated by one node is a constituent."
Fromkin (2000: 140)	"Tree diagrams...consist of a set of labeled nodes connected to one another by vertical or diagonal lines. Each node represents a *constituent*, or component part, of the phrase whose structure it represents."
van Valin (2001: 117)	"In terms of tree structure…, a group of words is a constituent if there is a single node in the tree which uniquely and completely dominates them."
Huddleston and Pullum (2002: 21)	Concerning the tree of the sentence *A bird hit the car*: "*A bird*, for example, is identified as a constituent because this word sequence can be traced via the branches to a single point in the tree; similarly, with *the car* and *hit the car*."
Poole (2002: 35)	"Any group of heads which are exhaustively dominated by a given node (i.e., there is a node which dominates every one of those heads and no others) is a constituent."
Kroeger (2005: 40)	"A constituent is a string of words which is exhaustively dominated by some node."
Tallerman (2005: 136)	"A set of elements forms a constituent in a tree diagram if and only if there is a single node that dominates just these elements, and no other items."
Carnie (2010: 37)	"*Constituent*: A set of nodes exhaustively dominated by a single node"
Sportiche et al. (2014: 47)	"If a string of words or morphemes is a constituent, we will represent this constituency by grouping all the words or morphemes as daughters of a single mother node in a tree representation"

These statements reveal that when trees are used to represent syntactic structure, each node in the tree corresponds to a constituent. For instance, if a tree contains five nodes, then there are five constituents in that tree, whereby the whole tree is the greatest constituent. Given a phrase structure approach to syntax, each individual word corresponds to a node, which means that each word is a constituent. This understanding of constituents is hence much more inclusive, since both phrases and individual words qualify as constituents.

The statements in the two tables point to a type of tension concerning how the constituent unit is understood. Table 3 documents an understanding of constituents from intuition, whereby the constituent unit is taken to be synonymous with the traditional phrase as defined in English language dictionaries. Table 4, in contrast, demonstrates that the understanding of the constituent shifts when a more rigorous account of constituents is pursued in terms of tree structures. Individual words now also count as constituents, not just phrases. The tension just established is noted by Carnie (2010: 17–8, n. 12) in his survey of theories of constituent structure. Carnie writes:

> It is worth clarifying a bit of terminology at this point. People frequently use the terms *constituent* and *phrase* interchangeably. The reason for this is quite simple: all phrases are constituents and most constituents are phrases. However, as we will see later in the chapter on X-bar theory, it is not the case that all constituents are phrases. The term *phrase* is limited to a particular kind of constituent: one where all the modifiers of the word heading the constituent (the most semantically prominent word) have been attached. As we will see in detail in Chapter 7, there is evidence for constituent structure smaller than that of phrases (that is, we will see that some phrases contain sub-constituents that are not themselves phrases). For this reason, I will use the term *constituent* to refer to all groups of words that function as units, including single word units, and reserve the name *phrases* for those constituents that are completed by their modifiers.

The type of evidence that Carnie produces (in his Chapter 7) to motivate the existence of subphrasal constituents is examined in Sections 7.1–7.3 below. The discussion there demonstrates that the standard evidence produced in this area (from coordination, *one*-substitution, and *do-so*-substitution) is not conclusive. The putative support for subphrasal constituents disappears upon scrutiny.

Given dependency syntax, the underlying source of the tension just documented with Tables 3 and 4 disappears. The intuitive understanding of the constituent unit (Table 3) is consistent with dependency syntax. At the same time, the more formal understanding of the constituent (Table 4) is also consistent with dependency syntax, since the units that one wants to acknowledge as constituents correspond directly to complete subtrees of dependency structures and thus correspond to single nodes in the dependency tree.

6. Reasons for the oversight

The problem facing phrase structure syntax just established resides with the distinction between phrasal and subphrasal constituents. This aspect of the tests has, interestingly, hardly been acknowledged by the linguists that use them. While some of the texts surveyed do acknowledge that certain tests are sensitive to phrasal constituents only, not one of them draws explicit attention to the inconsistency between the large number of constituents that phrase structures assume and the much smaller number of strings that most of the tests actually succeed at identifying as constituents. The oversight in this area is striking.

Some of the surveyed texts do in fact acknowledge that some of the tests are sensitive to phrasal constituents only. Table 5 documents some of these acknowledgements:

Table 5. List of statements acknowledging that many tests for constituents identify phrasal constituents only

Source	Statements to the effect that the tests identify phrasal constituents only
Concerning **omission**, Allerton (1979: 113) writes:	"What we can say, however, about both of these constructions [=phrases] is that they can only be omitted, if at all, as constructions; their individual parts may not be separately omitted."
Concerning **topicalization**, Radford (1988: 71) writes:	"Only phrasal constituents (whole phrases) can undergo preposing."
Concerning **answer fragments**, Radford (1988: 72) writes:	"Only phrasal constituents (i.e. whole phrases) can serve as sentence fragments (in an appropriate context)."
Concerning **VP-ellipsis**, Radford (1988: 83) writes:	"Only VPs (Verb Phrases) can undergo Ellipsis (under appropriate discourse conditions)."
Concerning **passivization**, Lobeck (2000: 50) writes:	"We further check our hypothesis by applying the Passive rule to other sentences, and we find that even very large noun phrases appear to move as syntactic units,... This supports the idea that this movement rule applies to phrases, and thus that the notion phrase is part of our unconscious knowledge of syntax."
Concerning **proform substitution**, Lobeck (2000: 53) writes:	"Pronominalization, the means by which syntactic material is replaced by a pronoun, or as we shall see, a proform, provides us with further evidence for phrases. This is because proforms replace phrases, rather than heads, and are thus words that 'stand for' phrases."

Concerning **topicalization** and **passivization**, van Valin (2001: 113) writes:	"In the remaining examples, a head noun alone or modifiers alone have permuted, with predictable ungrammatical results. Thus, in all the different permutations…, it is whole constituents that change function or position in every instance,…"
Concerning **topicalization**, Radford (2004: 72) writes:	"The smallest maximal projection is moved which contains the highlighted material."
Concerning **answer fragments**, Moravcsik (2006: 123) writes:	"The selection rule that specifies what can be an answer to a question is simpler if it can make reference to phrases rather than individual word types by stating that sets of words can make answers if they form a phrase."
Concerning **proform substitution**, Quirk et al. (2010: 76) write:	"…a pronoun tends to be a surrogate for a whole noun phrase rather than a noun: *Many students did better than many students expected* → *Many students did better than they expected.*"
Concerning **tests for constituents in general**, Sobin (2011: 30) writes:	"As we will see, manipulating the form of sentences rarely involves words per se – it is phrases (also called constituents) that are the object of manipulation,…"
Concerning **proform substitution**, Denham and Lobeck (2013: 264) write:	"If we assume that pronouns replace only NPs but not Ns, we explain why all of these NPs can be replaced by pronouns. We can also explain why the NPs in which we tried to replace only the head N are ungrammatical; pronouns do not replace nouns. Substitution, therefore, provides evidence for noun phrases as syntactic units."

Further statements that point in the same direction are present in a number of the other texts: concerning topicalization, see Napoli (1993: 422), Adger (2003: 66), and Downing and Locke (2006: 10); concerning answer fragments, see Herbst and Schüler (2008: 7); concerning clefting, see Radford (1981: 110); concerning wh-fronting, see Radford (1981: 108); and concerning intrusion, see Radford (1981: 61) and Börjars and Burridge (2001: 34).

The following question arises at this point: Why have the texts that use tests for constituents overlooked the fact that the tests as a whole do not support the richness of structure that phrase structure posits? There are at least three answers to this question:

1. Data from a couple of the tests, coordination being the most important of these, are unlike most of the other tests as they seem to support the existence of subphrasal constituents;
2. There is a lack of awareness of any sort of alternative analysis of the data; and
3. Those who one might expect to have drawn attention to the greater problem facing phrase structure syntax have not done so.

The first of these three answers is discussed at length below in Sections 7.1–7.3, where coordination, *one*-substitution, and *do-so*-substitution are scrutinized. The second and third of these three answers are addressed in the following paragraphs.

Perhaps the most important reason why the difficulty for phrase structure syntax has not been acknowledged and appropriately discussed by the texts that employ the tests is a lack of awareness of any sort of alternative. Most surveyed texts reflect no awareness of the alternative analysis of the data being developed here in terms of dependency grammar dependencies. Of the dozens of surveyed texts, only eight have anything to say about

dependency grammar, and of these eight, four mention dependency grammar only briefly: McCawley (1998: 11–2, 15, 50) acknowledges dependency grammar briefly three times; Sag et al. (2003: 535–6) grant just a page to dependency grammar; and Carnie (2010: 175–78) fills only three pages with information about dependency grammar. Given this lack of awareness of an alternative account, it is not surprising that the surveyed texts do not scrutinize their understanding of the tests.

The third reason is that even the texts that one might expect to draw attention to the problem have not done so. Six of the surveyed texts exhibit greater awareness of dependency grammar, but they also do not draw attention to the disconnect: Matthews (1981) examines dependency syntax in detail; Mel'čuk and Pertsov's (1987) Meaning-Text account of English syntax is of course a dependency grammar; van Valin (2001: 86–109) devotes a chapter to dependency grammar; Miller (2011) rejects verb phrases and assumes verb-centrality instead, which makes his approach to syntax a dependency grammar; Herbst and Schüler (2008) pursue a valency-based understanding of syntax, the concept of valency being closely associated with Tesnière's dependency grammar (1959/2015) and with dependency grammar in general; Hudson's Word Grammar (2010) is of course a dependency grammar framework; and Müller (2016) explores dependency syntax with a full chapter. Despite this awareness of dependencies, these texts have not seen the greater potential of dependency syntax to serve as a basis for predicting the constituents that tests for constituents do and do not identify.

Herbst and Schüler (2008) provide a good example of the oversight. They in fact seem close to acknowledging the problem that the tests pose to phrase structure syntax. When analyzing example (26), their sentence 6.7, they produce the following comments:

(26) I bought this hat at Heathrow this morning.

> What is remarkable, however, is that constituents such as *bought...*cannot be identified as constituents in this way since they cannot be elicited by a question. Questions of the type *What did you do with this hat at Heathrow?* and *What did you do at Heathrow this morning?* do not permit any response of the type **Buy.*" (Herbst and Schüler 2008: 7)

With these statements, Herbst and Schüler are close to recognizing the advantage that dependency syntax has concerning tests for syntactic structure. They do not, however, develop the insight any further. Their comments in the area remain brief, and they quickly move on to other aspects of their valency-based approach to the syntax of English.

Furthermore, prominent dependency grammars that have been in existence for decades also have not seen the advantage of dependency syntax with respect to the tests. Lucien Tesnière (1959/2015) was not concerned with tests for constituents. Richard Hudson in his works in the Word Grammar framework (e.g. Hudson 1984, 1990, 2007, 2010) also has not focused on tests for constituents. The same is true of Igor Mel'čuk's prolific works in the Meaning-Text framework (e.g. Mel'čuk and Pertsov 1987, Mel'čuk 1979, 1988, 2003, 2009). Thus, given that prominent dependency grammarians have not called attention to the advantage that dependency syntax has over phrase structure syntax with respect to tests for sentence structure, it is not surprising that phrase structure grammarians have not seen the need to scrutinize what the tests are actually revealing about the nature of sentence structure.

7. **Putative evidence for subphrasal constituents**

While the majority of tests for constituents support the existence of phrasal constituents only, a couple of the others do suggest that subphrasal strings can be constituents. In fact, there are three frequently employed tests in the surveyed texts that appear to support syntax in terms of phrase structure. Coordination is the most important of these, and the other two are *one*-substitution and *do-so*-substitution. The following three subsections scrutinize these tests.

7.1 Coordination

Coordination has played a central role in motivating syntactic analyses in terms of phrase structure. Chomsky (1957: 36) wrote in this regard that "...the possibility of conjunction offers one of the best criteria for the initial determination of phrase structure", and the discussion above has repeatedly drawn attention to the fact that coordination is the one main source of support produced in the surveyed texts for taking various subphrasal strings as constituents. The discussion above has also drawn attention to the fact that many of the texts that employ coordination as a test for constituents overlook the unique behavior of coordination in this regard. The texts have not appropriately addressed the fact that the data coordination delivers are quite unlike the data delivered by the other tests.

To illustrate this point, consider the example sentence in (27), for which the dependency tree is included:

(27)
```
              V
        ┌────╱│╲──────┐
       N    │    N    N    Adv
      Bill  gave you  these today.¹²
```
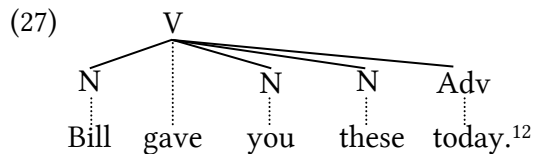
This analysis acknowledges five constituents including the whole: *Bill, you, these, today,* and *Bill gave you these today.* The tests discussed above confirm the presence of these five constituents. A large majority of the tests do not, however, see the number of constituents exceeding five. In this regard, coordination is much more permissive. It allows one to acknowledge 15 constituents:

(27) a. [Bill] and [Fred] gave you these today.

b. Bill [found] and [gave] you these today.

c. Bill gave [you] and [me] these today.

d. Bill gave you [these] and [those] today.

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¹² Given the equi-level appearance of subject and object in this tree, an anonymous reviewer poses a general question about how dependency syntax understands evidence suggesting the presence of a finite VP constituent, such as the numerous verb-plus-object idioms (e.g. *eat shit and die, kick the bucket, talk trash,* etc.) but almost complete absence of subject-plus-verb idioms. The answer to this question is that dependency syntax views this issue in a similar way to Chomskyan phrase structure syntax. The subject is licensed by the tense feature in the finite verb, whereas the object is licensed by the lexical content of the finite verb. The difference across the two approaches to syntax, though, is that these two licensers, tense and lexical content, are often unified in a single finite verb in dependency syntax. Dependency syntax cannot split them because of the strict one-to-one mapping of words to nodes.

e. Bill gave you these [today] and [yesterday].

f. ?[Bill gave] and [Fred loaned] you these today.

g. Bill [gave you] and [loaned me] these today.

h. Bill gave [you these] and [me those] today.

i. Bill gave you [these today] and [those yesterday].

j. ?[Bill gave you] and [Sue loaned me] these today.

k. Bill [gave you these] and [loaned me those] today.

l. Bill gave [you these today] and [me those yesterday].

m. ?[Bill gave you these] and [he loaned me those] today.

n. Bill [gave you these today] and [loaned me those yesterday].

o. [Bill gave you these today] and [he loaned me those yesterday].

Some of these examples are rather dubious given a neutral intonation contour; they improve, however, if read with rising-falling prosody. Coordination suggests that three times more constituents are present in this case than most of the other tests (15 vs. 5).

The full extent of the problem facing coordination as a test for constituents becomes apparent when one considers what is and is not possible. On a phrase structure approach that takes all branching to be binary, the most overt constituents an analysis of the sentence *Bill gave you these today* can acknowledge is 9 (=5×2-1).[13] Yet sentences (27a–o) illustrate that each of the 15 distinct strings present can be coordinated.[14] Thus, the number of constituents that coordination suggests are present in this case exceeds the number of possible constituents by 6. Note further in this area that examples (27a–o) arguably do not involve the gapping/stripping mechanism. If gapping/stripping cases are also acknowledged, the discrepancy in the numbers grows further because one must also acknowledge cases such as *[Bill gave you these today], and [me those].*

A few of the surveyed texts that employ coordination as a test for syntactic structure acknowledge there are problems with it, as documented in Table 6:

Table 6. Statements hedging the validity of coordination as a test for constituents

Source	Hedges concerning the value of coordination as a test for constituents
Baker (1989: 425)	"In addition to joining words or phrases with conjunctions, we may also join sequences of phrases. (18) a. *Martha went [to Austin] [on Thursday] and [to Dallas] [on Friday]...* For sentences of this sort, it is very difficult to suggest appropriate tree structures."

---

[13] If covert constituents are also acknowledged, the number of constituents that strictly binary branching structures posit can increase dramatically beyond 9. This is particularly true of the VP shells associated with Larson's (1988) analysis of ditransitive structures.

[14] Note that data of the sort given here as (27a–o) have been (part of) the impetus to pursue very different accounts of constituent structure. For instance, Combinatory Categorial Grammar (Steedman 2000) takes such data as evidence in favor of flexible constituent structure, and Phillips (1996, 2003) develops a dynamic processing approach to constituent structure based on such data.

McCawley (1998: 63)	"An important qualification to the use of coordination as a test for constituent structure is raised by sentences as in (18), in which each conjunct consists of two constituents of the V′ that do not comprise a single constituent as far as we can tell from other tests of constituency: (18) a. *John donated $50 to the Anti-Vivisection Society and $75 to the Red Cross.*"
Adger (2003: 125)	"Coordination, however, sometimes gives results which aren't immediately consistent with other constituency tests, and so it's a test to be used carefully."
Payne (2006: 162)	"... coordination can be a way of confirming what phrasal category a clump belongs to, or whether it is a clump at all. However, it can't be the major way of determining constituent structure."
Kim and Sells (2008: 22)	When discussing coordination: "Even though such syntactic constituent tests are limited in certain cases, they are often adopted in determining the constituent of given expressions."
Carnie (2010: 21)	"Perhaps the most difficult class of constituency tests to apply are those involving coordination...this test is prone to false positives. For example, it would appear as if the subjects and the verbs form constituents as distinct from the object in the following right-node-raising sentence: *[Bruce loved] and [Dory hated] tuna salad sandwiches.*"
Carnie (2013: 100)	"Unfortunately, sometimes it is the case that constituency tests give false results (which is one of the reasons why we haven't spent much time on them in this text). Consider the case of the subject of a sentence and its verb. These do not form a constituent. However, under certain circumstances you can conjoin a subject and verb to the exclusion of the object: (i) *Bruce loved and Kelly hated phonology class.* Sentence (i) seems to indicate that the verb and subject form a constituent, which they don't."
Sportiche et al. (2014: 66)	"Anyone using coordination and ellipsis as constituency tests is likely to run into such puzzling constructions as right node raising and gapping. Since these constructions pose particular problems for the claims we have made so far, it is useful to be familiar with them. The analysis of these constructions is an advanced topic, but the basic problem they raise for the interpretation of the constituent tests so far is easy to describe."
Müller (2016: 16–7)	Coordinate structures like the one in (33) are also problematic: (33) *Deshalb kaufte [der Mann einen Esel] und [die Frau ein Pferd]* 'For that reason bought the man a donkey and the woman a horse.' At first blush, it would seem that *der Mann einen Esel* and *die Frau ein Pferd* are now each a constituent. But as other tests for constituents show, the notion that these strings are constituents is not supported..." (Translated from German)

These statements demonstrate that some of the linguists who employ coordination as a test for constituents are aware of the problems associated with it. They also illustrate that the contradictory data delivered by coordination are addressed by augmenting the theory of coordination in terms of gapping and RNR.

The extent to which the acknowledgment of additional mechanisms associated with coordination can rectify coordination as a test for constituents depends on the understanding of these mechanisms (gapping, stripping, right node raising [RNR], and non-constituent conjuncts [NCC]). The literature is massive in this area and the accounts vary in major ways. It should be apparent, however, that the validity of coordination as a test for constituents is directly reliant on the merits of these accounts. In the absence of convincing theories of gapping, stripping, RNR, and NCC, the value of coordination as a test for constituents is seriously reduced.

7.2 One-substitution

The substitution of the pronominal count noun *one* into an NP is another test that seems to support the existence of subphrasal constituents (in NPs). *One*-substitution is, however, much more restricted in its applicability than coordination, since it is helpful only when investigating the structure of NPs. Nevertheless, *one*-substitution is widely employed (21 texts, see Table 1). The majority of authors that use *one*-substitution do so only briefly, though, on just a page or two. Their intent is not to consider the merits of the test or to explore the problems with it, but rather they introduce the test as a means of motivating one or another layered analysis of NPs. The following discussion demonstrates that scrutiny of *one*-substitution as a test for constituents is warranted, since when one takes a closer look, the test is in fact not a reliable test for identifying constituents. Note that the sort of evidence produced here against the value of *one*-substitution as a test for constituents is not new (cf. Culicover and Jackendoff 2005, Payne et al. 2013; Goldberg and Michaelis 2017).

One-substitution is typically employed to motivate the existence of intermediate phrases inside NPs (referred to as N′s). Carnie (2010: 114–5, 125–6) provides a good example of the reasoning. Based on sentences such as (28), Carnie sees motivation for positing layered structures for NPs in the spirit of the X-bar schema:

(28)a.   I bought the big <u>bag of groceries with the plastic handle</u>, not the small **one**.

   b. I bought the big <u>bag of groceries</u> with the plastic handle, not the small **one** with the ugly logo.

Each of these sentences has a reading where pronominal *one* takes the underlined string as its antecedent. Such data therefore seem to motivate a syntactic structure along the following lines (adapted slightly from Carnie 2010: 114):
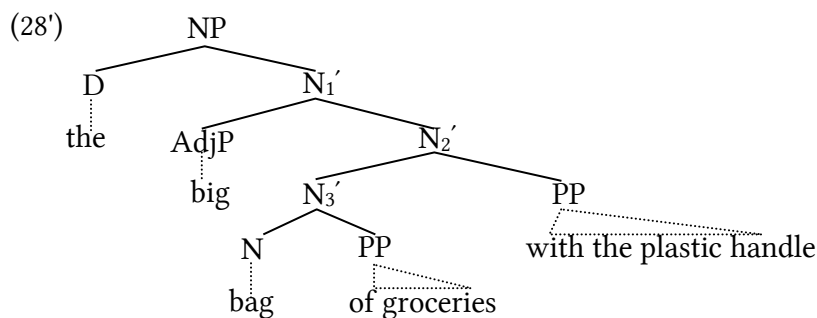

This analysis accommodates (28a–b) insofar as the underlined string each time is a constituent: the underlined string in (28a) is $N_2′$ and the underlined string in (28b) is $N_3′$. The reasoning Carnie produces in this area is present in many of the 21 texts surveyed that use *one*-substitution. By and large the assumption is that in order to accommodate the data delivered by *one*-substitution, one has to posit layered structures for NPs, structures containing intermediate N′ constituents.

There is a problem facing the reasoning concerning intermediate N' constituents, though, a problem that is overlooked by most of the 21 texts listed in Table 1 that employ the *one*-test. This problem becomes evident with the following additional datum:

(28) c. I bought the <u>big bag of groceries</u> with the plastic handle, not the **one** with the ugly logo.

This sentence suggests that *big bag of groceries* should also form a constituent. Carnie's analysis in (28′) does not, however, grant this string the status of a constituent. Based on example (28c), the following analysis would seem appropriate:

(28″)

NP
D — the
N₁′
N₂′
AdjP — big
N₃′
N — bag
PP — of groceries
PP — with the plastic handle
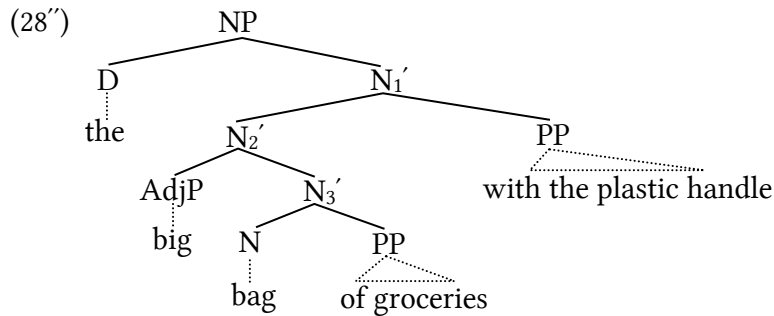
This tree now views *big bag of groceries* as a constituent in line with (28c). Crucially, however, it no longer views *bag of groceries with a plastic handle* as a constituent, so it does not accommodate example (28a). To state the problem more clearly, there is no plausible single analysis that can simultaneously view all three of the relevant strings (*bag of groceries with a plastic handle*, *bag of groceries*, and *big bag of groceries*) as constituents. The data thus reveal a type of bracketing paradox.

This problem is not acknowledged by most of the 21 texts surveyed that employ the *one*-test. Four of the texts do acknowledge the problem, however: Cowper (1992: 30), Napoli (1993: 425), Burton-Roberts (1997: 187), and Carnie (2013: 190–2). While Napoli recommends caution concerning conclusions based on *one*-substitution (and *do-so*-substitution), the solution to the problem that Cowper, Burton-Roberts, and Carnie suggest is to assume that NPs can have two (or more) distinct structures. Carnie's (2013) account in this area is particularly noteworthy, since he acknowledges a nuanced meaning difference across the competing structural analyses.

But even if one is willing to allow the structure of NPs to be flexible, there are further cases that simply cannot be accommodated by allowing flexible constituent structure. Based on examples such as the following ones, Culicover and Jackendoff (2005) reject the use of *one* as a test for constituents:

(29) a. that silly <u>picture of Robin</u> from Mary <u>that is on the table</u>, and this artful **one** from Susan (Culicover and Jackendoff 2005: 137)

b. that <u>silly picture of Robin</u> from Mary <u>that is on the table</u>, and this **one** from Susan (Culicover and Jackendoff 2005: 137)
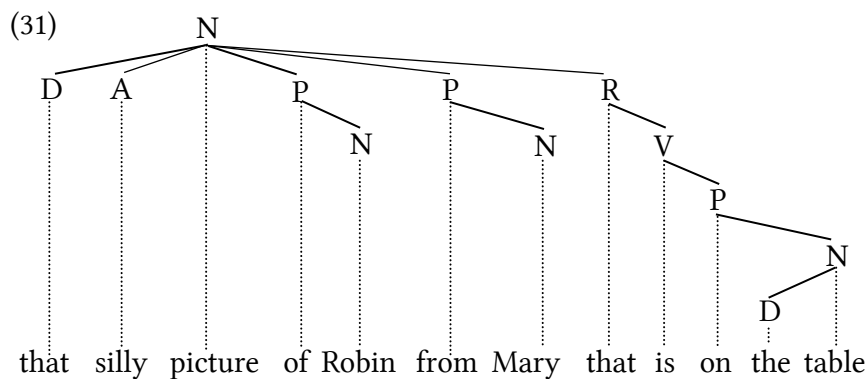
The pronominal count noun *one* takes *picture of Robin…that is on the table* as its antecedent in (29a) and *silly picture of Robin…that is on the table* as its antecedent in (29b). Barring an approach that allows discontinuous constituents, there is no structural analysis of (29a–b) that could assign these word combinations the status of constituents. Thus, Culicover and Jackendoff altogether reject the notion that pronominal *one* identifies constituents.

Based in part on the behavior of *one*, Culicover and Jackendoff assume a relatively flat analysis of NPs in place of the more widely assumed layered analyses like (28′) and (28″) discussed by Carnie and assumed by many others. Dependency-based syntax agrees with Culicover and Jackendoff's flat analysis of NP structure. The dependency-based analysis of the relevant NP from examples (28a–c) is as follows:

(30)

the big bag of groceries with the plastic handle
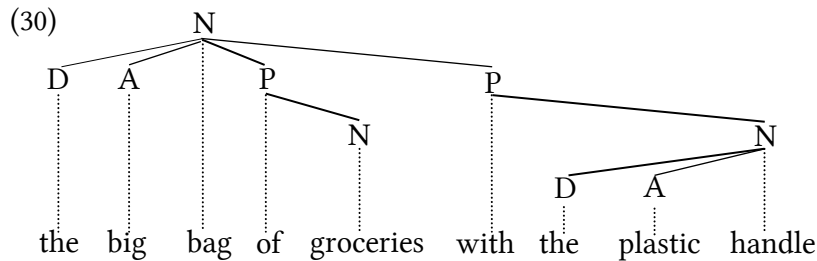
While the strings that pronominal *one* takes as its antecedent in (28a–c) (*bag of groceries with a plastic handle*, *bag of groceries*, and *big bag of groceries*) certainly do not qualify as constituents on this flat analysis, they do qualify as *catenae* (Osborne et al. 2012). A catena is *a word or a combination of words that are linked together by dependencies*, that is, a catena is any *subtree* (complete or incomplete). Since the catena unit is a well-defined unit of structure, a flat analysis like this one is in a strong position to accommodate the distribution of pronominal *one*.

The dependency-based approach that acknowledges catenae is also capable of accommodating Culicover and Jackendoff's examples:

(31)

that silly picture of Robin from Mary that is on the table

The discontinuous word combinations that *one* takes as its antecedent in (29a–b) are catenae on this analysis. The word combination *picture of Robin...that is on the table* in (29a) is a catena in (31) because *picture* immediately dominates *of Robin* and *that is on the table*. Similarly, the word combination *silly picture of Robin...that is on the table* of (29b) is also a catena in (31) because *picture* immediately dominates *silly*, *of Robin*, and *that is on the table*.

To summarize, the numerous texts that employ the pronominal count noun *one* as a test for the structure of NPs largely overlook the data that contradict the layered analyses they assume. The distribution of pronominal *one* cannot be construed as identifying constituents. The distribution of *one* is in fact consistent with the relatively flat NPs assumed by a dependency grammar that acknowledges the catena unit.

7.3 Do-so-substitution

Do-so-substitution is a third widely-employed test that appears to support the existence of subphrasal constituents. Like *one*-substitution, *do-so*-substitution is seen as delivering evidence for layered analyses of sentence structure. *Do-so*-substitution is also like *one*-substitution insofar as it is much more limited than coordination in its applicability; since *do* is a verb, *do-so*-substitution delivers clues about the structure of strings containing one or more verbs only. The discussion below demonstrates that *do-so*-substitution does in fact *not* support the existence of subphrasal constituents, but rather it is consistent with dependency syntax in the same way as *one*-substitution (Osborne and Groß 2016). The problems that *do-so*-substitution faces are of the same nature as those facing the *one*-substitution (the *one*-test is not focused on in Osborne and Groß 2016).

Poole (2002: 41–4) provides good representative examples and a discussion of how *do-so*-substitution is employed to motivate layered VPs. The following examples and tree structure illustrate the same sort of reasoning for *do so* that was just described above for pronominal *one*:

(32) a. John <u>gave a speech</u> at 3 o'clock on the 30th of June in Madrid, and Mary **did so** at 5 o'clock on the 27th of September in Valencia

b. John <u>gave a speech at 3 o'clock</u> on the 30th of June in Madrid, and Mary **did so** on the 27th of September in Valencia

c. John <u>gave a speech at 3 o'clock on the 30th of June</u> in Madrid, and Mary **did so** in Valencia.

(Poole 2002: 44)
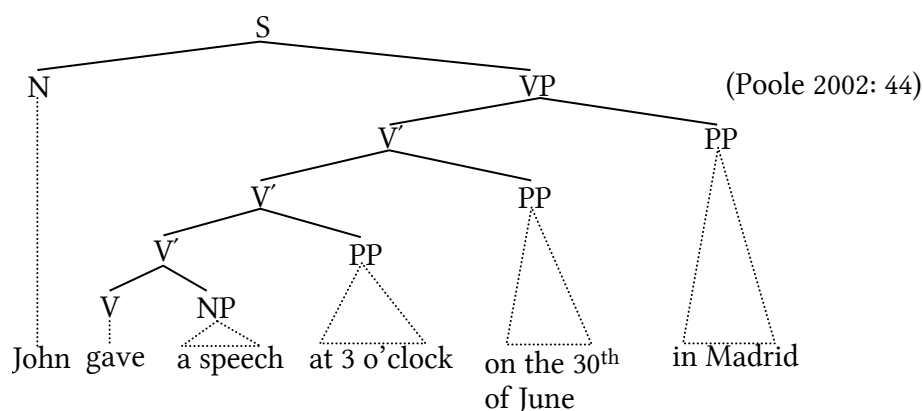
In each of (32a–c), *do so* takes the underlined string as its antecedent. Poole accommodates these data with the tree, which shows each of the underlined strings as a V′ (*V-bar*) constituent.

The striking aspect of Poole's analysis concerning (32a–c) is that the data set is not extended to similar cases. The following examples are not included:

(32) d. John <u>gave a speech</u> at 3 o'clock <u>on the 30th of June in Madrid</u>, and Mary **did so** at 5 o'clock.

e. John <u>gave a speech</u> at 3 o'clock <u>on the 30th of June</u> in Madrid, and Mary **did so** at 5 o'clock in Valencia.

    f. John <u>gave a speech at 3 o'clock</u> on the 30th of June <u>in Madrid</u>, and Mary **did so** on the 27th of September.

The underlined strings now do not qualify as constituents in the tree. Like pronominal *one*, *do so* can take a discontinuous word combination as its antecedent. Of the 23 sources listed in Table 1 that use *do-so*-substitution, only one, Napoli (1993: 425), acknowledges a problem; for her, the validity of the test is in question. Culicover and Jackendoff (2005: 125) also call attention to cases like (32d–f); the example they give is similar: *Robin <u>slept</u> for twelve hours <u>in the bunkbed</u>, and Leslie **did so** for eight hours.* They therefore reject the test and assume flat VPs accordingly.

    Poole's reasoning might attempt to save *do-so-substitution* by conceding that *do so* can take a non-constituent word combination as its antecedent, but at the same time by stipulating that the words that *do so* actually replaces can in fact be construed as a constituent due to the flexible word order associated with adjuncts. For instance, example (32d) without *did so* would actually have the following word order:

(32) d′. John gave a speech at 3 o'clock on the 30th of June in Madrid, and Mary **gave a speech on the 30th of June in Madrid** at 5 o'clock.

On this analysis, when *did so* appears it actually does replace a string of words, although this fact is obscured. While such a stipulation might work for examples (32d–f), it does not work in other cases, e.g.

(33) a. Bill <u>spends time</u> in the mall <u>so that he can meet lots of girls</u>, and Fred **does so** in the movie theater.

    b. *Bill spends time in the mall so that he can meet lots of girls, and Fred **spends time so that he can meet lots of girls** in the movie theater.

The alternative word order given in (33b) is not acceptable; the relatively heavy finite clause *so that he can meet lots of girls* cannot precede the much lighter PP *in the movie theater*.

    The dependency-based analysis in terms of catenae is not confronted with these difficulties:

(34)
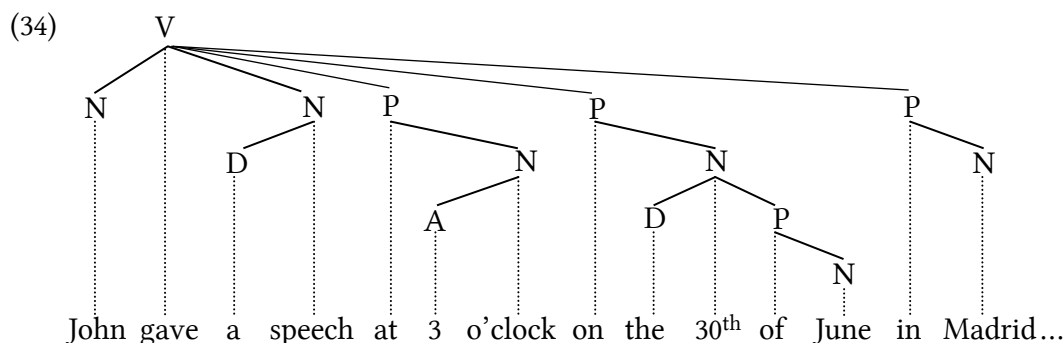
On this analysis, each of the word combinations underlined in examples (32a–f) is a catena, and this is so even in (32d–f), where the underlined words do not qualify as strings. The nature of *do-so*-substitution is hence that *do so* replaces a catena that must minimally contain

the verb. Flexibility of interpretation is possible concerning the adjunct dependents of the verb, that is, which of them should be interpreted as also being replaced by *one*.

To summarize this section and the last, the widespread use of *one*-substitution and *do-so*-substitution to motivate the existence of subphrasal constituents inside NPs and VPs, i.e. bar-level constituents, overlooks important data. In fact, there seems to be willingness to overlook the contradictory cases of the sort discussed here. Relatively flat, dependency analyses of NPs and VPs that acknowledge the catena unit are capable of accommodating the data delivered by *one-* and *do-so*-substitutions. These dependency-based structures have two advantages over the more layered phrase structures: they accommodate a wider range of data, such as examples (32d–f) and (33), at the same time that they are consistent with the other tests for constituents discussed above, these other tests not verifying the existence of subphrasal constituents.

8. Other languages

The discussion so far has focused on data from English. In this respect, one can object that the account of the tests for constituents above is not so relevant from a cross-linguistic point of view, since the extent to which the tests are relevant for other languages is not apparent. Some of the tests explored here may not be directly applicable to the syntax of other languages, especially languages with freer word order than that of English. The account here concedes this point, but the importance of this concession should not be overestimated. There are a couple of considerations that elevate the importance of the data from English, and one should also not ignore the fact that some of the tests employed above are likely valid for many other languages beyond English.

The texts surveyed above focus mainly on the syntax of English, and a majority of the authors of these texts are native speakers of English. The tests have thus been developed primarily with the syntax of English in mind. Consider in this regard that phrase structure syntax has generally been viewed as appropriate for the syntax of languages like English, whereas syntax in terms of dependencies is deemed more capable of accommodating languages with freer word order. The discussion above has demonstrated that this perception of the two basic possibilities for modeling the syntax of natural languages is not accurate. Dependency syntax is in fact more capable than phrase structure syntax of modeling the constituent structure of English, which is, again, a language with relatively strict word order.

The syntax of English has exercised and continues to exercise tremendous influence on the study of syntax as a discipline internationally. Many prominent syntacticians on the international stage are/were native speakers of English (e.g. Bloomfield, Chomsky, Sag, Lasnik, Harris, Bresnan, Langacker, Goldberg, Jackendoff, Culicover, Larson, among many others). These linguists have written a lot about the syntax of English, and so when their works are read, the exposure gained is mainly exposure to the syntax of English. In these respects, it is difficult to underestimate the importance of texts written in English primarily about English for the development of syntactic theory in general.

Many of the textbooks surveyed are used in English departments at colleges and universities around the world. These texts are thus influencing young linguists when they first gain exposure to the formal study of syntax. The importance of the tests should also not be underestimated in this regard. First exposure leaves an impression, and if this impression

does not match the linguistic facts, then correcting the faulty impression can be difficult, requiring much more exposure to the facts at a later stage.

These points about the importance of English on the development of syntactic theory established, some of the tests discussed above should also be valid for many other languages. This is particularly true of proform substitution and answer fragments. Most if not all languages have proforms that can be used to probe syntactic structure, and most if not all languages employ question-answer pairs to illicit information in communicative situations.[15] And further, most languages have various means to focus constituents, these means perhaps being similar to the clefting and pseudoclefting constructions of English.

9. Concluding statement

This article has scrutinized the tests for constituents that are widely employed in syntax, linguistics, and grammar books and textbooks. This scrutiny has revealed that the results of most of the tests are more consistent with dependency syntax than with phrase structure syntax. Syntax in terms of phrase structure posits more structure than most of the tests can motivate. The issue is understood best in terms of phrasal and subphrasal constituents. Most tests for constituents identify phrasal constituents only; they do not support the existence of subphrasal constituents. This situation is consistent with dependency syntax, because most subphrasal constituents are not constituents in dependency syntax to begin with.

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[15] An anonymous reviewer points to a potential difficulty for the reasoning employed in this article when using the answer fragment test in other languages. Many languages produce answers to polar questions consisting of an auxiliary verb alone, as illustrated with the next example from Mandarin:

(i) *Wǒ néng dāi zài kā fēi diàn ma? – Néng.*
    I   may stay in café shop INT   may
    'May I stay in the café?' – You may.

The answer *Néng* consists of the auxiliary verb alone, which would seem to contradict the dependency grammar assumption that the auxiliary is the root of sentence (which means that it alone is not a dependency grammar constituent). This is an open issue that must be conceded at this point. One avenue of accounting for such data, though, is to assume ellipsis of the subject in terms of null anaphora combined with VP ellipsis of the nonfinite verb phrase. Support for this sort of approach is evident in the acceptability of the answer that includes the subject: *Wǒ néng dāi zài kā fēi diàn ma? – Nǐ néng.* 'Can I stay in the café? – You may.' Note that VP-ellipsis occurs frequently in Mandarin, as does null complement anaphora.

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Appendix: Fifteen tests for constituents

The 15 tests for constituents that are mentioned, discussed, and employed in this article are introduced here in one spot, so as to increase the accessibility of the article's content. The tests are illustrated using the test sentence *Frank has been working on the first problem at night.*

The <u>coordination</u> test checks to see if the target string can be coordinated with a similar string using *and*, *or*, or *but* to form a coordinate structure, e.g.

(A) a. [**Frank**] and [Sam] have been working on the first problem.

   b. Frank has been working on [**the first problem at night**] and [the second one during the day].

   c. [**Frank has**], but [Sam hasn't], been working on the first problem.

The square brackets mark the conjuncts of the coordinate structure each time, i.e. the coordinated strings. The acceptability of the coordinate structures in these sentences suggests that the strings *Frank*, *the first problem at night*, and *Frank has* are constituents in the test sentence.

<u>Proform substitution</u> replaces the target string in the test sentence with a proform (pronoun, pro-verb, pro-adjective, etc.), e.g.:

(B) a. **He** has been working on **it then**. (*He = Frank*, *it = the first problem*, *then = at night*)

   b. He has been **doing it**. (*doing it = working on the first problem at night*)

The presence of the pronouns *He* and *it* and the pro-adverb *then* in the acceptable sentence (Ba) suggests that the strings *Frank*, *the first problem* and *at night* are constituents in the test sentence. The same is true of the pro-verb *doing it* in sentence (Bb), which indicates that *working on the first problem at night* is a constituent in the test sentence.

The <u>topicalization</u> test moves the target string to the front of the sentence. Such frontings can be of questionable acceptability when taken out of context, so the examples here suggest context by including *…and*. In addition, an adverb can be added, e.g. *certainly*:

(C) a. …and **at night** Frank has been working on the first problem.

   b. …and **the first problem**, Frank has been working on at night.

   c. …and **working on the first problem at night**, Frank (certainly) has been.

These examples suggest that the strings *at night, the first problem*, and *working on the first problem at night* are constituents in the test sentence.

The <u>*do-so*-substitution</u> test replaces the target string with *do so*. Since the *do* of *do so* is a verb, this test is only useful when probing the structure of strings containing verbs, e.g.

(D) a. Frank has been **doing so**. (*doing so = working on the first problem at night*)

b. Frank has been **doing so** at night. (*doing so = working on the first problem*)

c. Frank **does so**. (*does so ≠ has been working on the first problem at night*)

Sentences (Da) and (Db) suggest that *working on the first problem at night* and *working on the first problem* are constituents in the target sentence. Note, however, that sentence (Dc) does not allow one to construe *has been working on the first problem at night* as a constituent, since there is a mismatch in aspect across the test sentence and (Dc) (present perfect progressive vs. simple present).

The <u>one-substitution</u> test is similar to the *do-so*-substitution test in its limited applicability. Since *one* has the status of a count noun, the test can probe the structure of noun phrases containing a count noun only, e.g.

(E) a. the first <u>problem</u> about ellipsis and the second **one** about anaphora

b. the <u>first problem</u> about ellipsis and the **one** about anaphora

c. the *first* <u>problem about ellipsis</u> and the second **one**, too

The pronoun *one* can be interpreted as standing in for the underlined string each time, hence such data suggest that the strings *problem, first problem*, and *problem about ellipsis* should have the status of constituents in the noun phrase *the first problem about ellipsis.*

The <u>answer fragment</u> test checks to see if the target string can stand alone as the answer to a question that contains a single question word (*what, who, when, where, how*, etc.), e.g.

(F) a. **Who** has been working on the first problem? – **Frank**.

b. **What** has Frank been working on? – **The first problem**.

c. **When** has Frank been working on the first problem? – **At night**.

The acceptability of these answer fragments suggests that the strings *Frank, the first problem*, and *at night* are constituents in the test sentence. An important caveat associated with this test is the requirement that the structure and content of the question correspond as closely as possible to the structure and content of the test sentence.

The <u>clefting</u> test positions the target string as the pivot of a cleft sentence. Cleft sentences in English begin with *it* followed by a form of the copula (*is, are, was, were*), and the pivot immediately follows the copula. A relative clause then fills out the rest of the sentence, e.g.

(G) a. It is **Frank** who has been working on the first problem at night.

b. It is **the first problem** that Frank has been working on at night.

c. It is **on the first problem** that Frank has been working at night.

The acceptability of these sentences suggests that the strings *Frank*, *the first problem*, and *on the first problem* are constituents in the test sentence. The structure and content of the relative clause should correspond as directly as possible to the structure and content of the test sentence.

The <u>VP-ellipsis</u> test omits the target string. This test is only suited for probing the constituent structure of strings that include predicative elements, verbs being the most prominent type of predicative element, e.g.

(H) Sam has been working on the first problem at night, and

    a. Frank has been working on the first problem at night **also**.

    b. Frank has been working on the first problem at night **also**.

    c. Frank has been working on the first problem **during the day**.

    d. Frank has been working on the first problem **during the day**.

The light font shade indicates ellipsis, i.e. the omission of the target string. The acceptability of these examples suggests that the strings marked with a light font shade are constituents in the test sentence.

The <u>pseudoclefting</u> test focuses the target string by positioning it immediately before or after the copula in a sentence including a free relative clause beginning with *what*, e.g.

(I) a. What Frank has been working on at night is **the first problem**.
    a′. **The first problem** is what Frank has been working on at night.

    b. What Frank has been doing is **working on the first problem at night**.

    c. What Frank has been doing at night is **working on the first problem**.

There are two variants of pseudocleft sentences, as indicated with (Ia) and (Ia′). The acceptability of these sentences suggests that the strings *the first problem*, *working on the first problem at night*, and *working on the first problem* are constituents in the test sentence. Note that the necessity to employ a free relative clause introduced by *what* is a limitation on this test. A related test employs a normal relative clause. In this manner, one can test for the constituent status of animate noun phrases, e.g. *The one who has been working on the first problem at night is **Frank***.

The <u>passivization</u> test switches between the active and passive variants of a sentence. The phrases that change functional status in the process are deemed constituents, e.g.

(J) a. **Frank** has been working on **the first problem** at night. – Active

    b. **The first problem** has been worked on at night by **Frank**. – Passive

Based on these data, one can conclude that the strings *Frank* and *the first problem* are constituents in the test sentence. The passivization test is limited in its applicability, since it only identifies subjects and objects (including oblique objects) as constituents.

The <u>omission</u> test is easy to use; one need merely omit the target string from the test sentence. If the resulting sentence is acceptable and there is no major shift in meaning, then the target string is likely a constituent, e.g.

(K) a. Frank has been working on the **first** problem **at night**.

b. Frank has been working on the problem.

Based on the acceptability of sentence (Kb), one can conclude that the strings *first* and *at night* are constituents in sentence (Ka) (note that one would not conclude that *first* and *at night* form a single constituent together, for they are discontinuous and must hence be interpreted as distinct constituents). Like the passivization test, the omission test is quite limited in its applicability, since it is incapable of identifying constituents that appear obligatorily. In other words, it succeeds at identifying only those constituents that appear optionally.

The <u>intrusion</u> test inserts an adverb into the test sentence to see if the target string can be separated from the rest of the sentence, e.g.

(L) a. Frank **certainly** has been working on the first problem at night.

b. Frank has **certainly** been working on the first problem at night.

Sentence (La) suggests that the string *Frank*, which appears to the left of the adverb *certainly*, and the string *has been working on the first problem at night*, which appears to the right of *certainly*, are constituents. Further, sentence (Lb) suggests that *Frank has* and *working on the first problem at night* are constituents. Finally, the combination of (La) and (Lb) suggest that *has* is also a constituent. Note that neither sentence (La) nor sentence (Lb) alone suggests that *has* is a constituent, but rather only the combination of the two allows one to reach such a conclusion.

The <u>wh-fronting</u> test consists of just the first part of the answer fragment test, namely of just the question. If the target string can be fronted as a wh-expression, then it is likely a constituent, e.g.

(M) a. **Who** has been working on the first problem at night? (*who ↔ Frank*)

b. **What** has Frank been working on at night? (*what ↔ the first problem*)

c. **On what** has Frank been working at night? (*on what ↔ on the first problem*)

d. **When** has Frank been working on the first problem? (*when ↔ at night*)

e. **What** has Frank been doing? (*what…doing ↔ working on the first problem at night*)

The acceptability of these questions suggests that the strings *Frank*, *the first problem*, *on the first problem*, *at night*, and *working on the first problem at night* are constituents in the test sentence.

The <u>general substitution</u> test replaces the test string with a single word, e.g.

(N) a. **Sam** has been working on the **second question** at night. (*Sam ↔ Frank, second ↔ first, question ↔ problem*)

b. Sam has been **sleeping**. (*sleeping ↔ working on the second problem at night*)

Based on the acceptability of these sentences, one might conclude that the strings *Frank*, *first*, *problem*, and *working on your second problem at night* are constituents in the test sentence. This test is similar to the proform substitution test, the only difference being that general substitution employs non-proforms.

The right node raising (RNR) test checks to see if the target string can appear to the right of a coordinate structure and be shared by the conjuncts of a coordinate structure.

(O) a. [Frank has been working on the first problem] and [Sam has been working on the second problem] **at night**.

b. ?[Frank has been working on], and [Sam has been altering carefully] **the first problem at night**.

The acceptability of sentence (Oa) suggests that *at night* is a constituent in the test sentence, and the marginality of example (Ob) suggests that *the first problem at night* could perhaps be a constituent. The RNR diagnostic is limited in the strings that it can test, since the target string must appear at the end of the sentence.

About the author

Timothy Osborne did his BA in German at Colorado State University and his Ph.D. in German (with a specialization in linguistics) at Pennsylvania State University, where he then worked for a number of years as an adjunct professor. During his studies, he spent several years in Germany in Regensburg, Flensburg, and Kiel. He is currently an associate professor of linguistics at Zhejiang University in Hangzhou, China. His research efforts are in theoretical syntax, focusing on various phenomena, such as coordination, comparatives, ellipsis, scope, predicate-argument structures, etc. He (in collaboration with Sylvain Kahane) translated Lucien Tesnière's monumental work *Éléments de syntaxe structurale* (1959) to English, the translated volume appearing in 2015. He has been a consistent advocate for dependency grammar (DG) throughout his academic career.

Dependencies are more psychologically plausible, not more parsimonious

Comments on Osborne, Timothy. 2018. Diagnostics for Constituents. What They Really Reveal about the Nature of Syntactic Structure. *Language Under Discussion.*

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Abstract. I argue that the crucial criterion for evaluating analyses is psychological plausibility, and not parsimony, so the number of nodes isn't important—and indeed, one version of dependency analysis recognises as many nodes as some phrase-structure analyses do. But in terms of plausibility, dependency grammar is preferable to phrase structure because the latter denies that the human mind is capable of recognising direct links (dependencies) between words.

Keywords: syntax, dependency structure, phrase structure, psychological plausibility, node counting

Tim Osborne's paper, "Tests for Constituents" (Osborne 2018), raises a really important issue: how should we evaluate syntactic theories (or, more generally, theories of language structure)? For him the question concerns the choice between theories based on dependency and phrase structure, but of course it goes well beyond that.

The answer depends on what kind of science you think linguistics is: is it like astronomy or psychology? If it's like astronomy, then our data are all observational so we're looking for a parsimonious theory which uses the fewest possible assumptions to explain the observed data. But if psychology is our model, our data come from a lot of different sources—observation, experimentation, introspection and everyday experience—and what we're trying to model is the 'theory' that an ordinary person builds to explain their experience of language, and also to guide their own use of the language. In that case, the challenge is to find a theory which meshes as cleanly as possible with everything we know about how human minds work, and parsimony is only as important for linguists as it is for ordinary human beings.

So is language an external phenomenon, like the universe of astronomy, or is it an internal one, like the mental processes of psychology? The answer isn't self-evident, and each option has been espoused by some linguists; for instance, Katz argued that language is a Platonic 'abstract object', and not a mental object (Katz 1981). This position may seem extreme, but a great deal of our theoretical discussion is uncomfortably close to it in practice; and in particular, the argument from parsimony. An abstract object is 'out there', like the universe, so if that's what language is, parsimony is relevant. In contrast, cognitive linguistics assumes the opposite extreme, that language is mental and any theory must be a mental theory, fully compatible with everything we know about the mind. In this approach, parsimony plays a minor role. In the words of Jim McCawley,

> I regard the phenomena ... as being primarily mental in nature. ... the popular idea that grammars must be nonredundant is quite implausible when viewed from the perspective of a scenario for language acquisition in which children extend the coverage of their internalized grammars by making minimal alterations in them. Under such a conception of language acquisition, a child might learn several highly specific rules before he hit on an insight that enabled him to learn a general rule that rendered them superfluous, but learning the general rule would not cause him to purge the now-redundant special rules from his mental grammar. (McCawley 1988: 9–10)

For Osborne, among the potential criteria for distinguishing dependency from phrase structure (including, of course, accuracy as shown by standard tests) "the word-to-node ratio, is the most principled."(page 6). I admit to having made similar claims in the past (Hudson 2016), but given my aims of modeling mental reality, I was surely wrong. The word-to-node ratio is only 'principled' if it is based in some way on the mental reality being modeled, but I no longer believe this is in fact the case. It could be objected that Osborne is talking about sentence structures whereas McCawley's principle concerns rules in the grammar, but the two are so intimately connected that they are inseparable. In short, I no longer believe that dependency necessarily gives more parsimonious structures or grammars than phrase structure, because my own grammars are based on dependency but require a separate node for a word for every dependent it has (Hudson 2018). But neither do I believe that this matters when choosing between dependency and phrase structure.

What does matter is psychological plausibility, and here, it seems to me, dependency structure is obviously superior to phrase structure. Dependencies are relations between individual words, which phrase structure declares impossible. At least in Chomsky's definition of phrase structure, the nearest relation that is possible between two words is the part-whole relation between them and a shared mother. Admittedly, some versions of phrase structure recognise additional relations such as government, binding and control, but these are additional and not part of phrase structure as such. So in a simple example such as Osborne's *drink tea*, the important question is not about the nodes but about the relations: is there a direct link between *drink* and *tea*? According to dependency theory, there is, but phrase-structure theory denies it. Without dependencies, the words are related only indirectly, via the phrase *drink tea*.

So, in my opinion, the main issue that distinguishes the two approaches is whether the human mind is capable of recognising a relation between the two words. Put in that way, the answer is surely obvious, and if evidence is needed, we turn to cognitive psychology. For

example, consider the mass of evidence from priming experiments which show that words do in fact activate one another directly; so hearing *doctor* primes *nurse* so that we retrieve the word more quickly than after hearing an unrelated word such as *lorry*. Or consider social networks, where we have no difficulty in recognising direct relations between individuals without invoking some kind of 'phrase' node to bind them together.

In short, psychology favours dependency grammar. But interestingly, the roots of phrase structure also lie in psychology: the theoretical writings of the German psychologist Wilhelm Wundt, much admired by Leonard Bloomfield. Wundt's focus was the structure of thought, in which he was heavily influenced by the logical tradition dating back to Aristotle whose fundamental units were propositions with a two-part structure of subject and predicate. Wundt's main example of a sentence analysis involves the sentence in (1) whose English translation is in (2) (from (Wundt 1900: 318–319) quoted in (Percival 1976)).

(1) Ein edlich denkender Mensch verschmäht die Täuschung.
(2) A sincerely thinking person scorns (the) deception.

Wundt's top-down analysis recognised no relations other than the part-whole relation of the subject and predicate to the proposition, so it was propositions all the way down—including the noun phrases. So 'a sincerely thinking person' was represented in the analysis as 'a person thinks sincerely', and 'thinks sincerely' was then divided into 'thought' and 'is sincere'. The analysis scored high on parsimony: just one structure applied recursively. But few, whether in linguistics or in psychology, would defend it nowadays even as an analysis of the sentence's meaning, let alone of its syntax.

My main point of disagreement with Osborne is therefore over the significance of node-counting. I have argued that node-counting is much less telling than psychological plausibility, and in particular the psychological question of whether the part-whole relation is the only one that the human mind can grasp. That is the big question, and once asked it is very easy to answer; so my test actually leads to the same conclusions as Osborne's: word-word dependencies are real.

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Testing for constituents: A response from Functional Discourse Grammar

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Abstract. Timothy Osborne has surveyed a very large number of published introductions to grammatical analysis, all of which share the assumption that syntactic argumentation is to be conducted without reference to the meanings, uses and contexts of the example sentences. The purpose of Osborne's article is to examine how well syntactic tests identify subphrasal strings as constituents. The aim of this discussion note is not to engage directly with this issue but to consider, from the viewpoint of Functional Discourse Grammar (FDG), the validity of the autonomous syntax assumption shared by Osborne and the authors whose work he considers. The note dwells on the hidden presence of functional and interactive notions in a methodology based on syntactic 'tests' and it is suggested that the difficulties encountered by that methodology (notably with regard to coordination) can be resolved insightfully by FDG with its four levels of analysis.

Keywords: coordination, discourse acts, Functional Discourse Grammar, pseudo-clefting, pseudogapping, subacts, syntactic argumentation, topicalization

This discussion note is an invited response to Osborne (2018) from the viewpoint of functional linguistics and more specifically that of Functional Discourse Grammar (FDG) as developed in the first two decades of this century (Hengeveld and Mackenzie 2008). FDG shares with the focus article the ambition of distinguishing grammatical from ungrammatical forms but its methodological presuppositions are very different from those presented by Osborne. As a consequence, the debate central to his argument, that between constituency and dependency, will play a smaller part in the following than a consideration of an assumption shared by both sides of the debate, namely that syntactic argumentation is to be conducted without reference to the meanings, uses and contexts of the example sentences. It will be suggested in brief format that a functional grammar can provide deeper insight into the phenomena that Osborne has

presented in the wake of his extremely thorough exploration of "several dozen linguistics, syntax and grammar books" (p. 9).

FDG takes as its point of departure the observation that human verbal interaction divides into Discourse Acts, each of which makes its own contribution to the ongoing communicative exchange, and seeks to offer understanding of how Linguistic Expressions encode Discourse Acts. To achieve this aim, FDG provides two analyses of how the Speaker's communicative intention is *formulated*, known as the Interpersonal and Representational Levels of analysis, as well as two analyses of how the formulation is *encoded*, known as the Morphosyntactic and Phonological Levels. All but the most formulaic of Discourse Acts involve all four levels of analysis, and none of the levels has priority over the others. Each of the four levels is *modular* in the sense of being domain-specific: the Interpersonal Level, for example, covers all and only all the rhetorical and pragmatic aspects of the Discourse Act, while the Representational Level accounts exclusively for its semantic aspects. The Morphosyntactic Level is solely concerned with morphological and syntactic properties and, together with the Phonological Level, serves to specify the linguistic forms that reflect the distinctions made at the formulation levels. The observation that justifies all functional approaches to grammar is that there is a large degree of homology between formulation and encoding, operationalized in FDG as the principles of *iconicity, domain integrity* and *functional stability.*

Given these theoretical presuppositions, FDG cannot share an assumption made by both the dependency grammars defended by Osborne and the constituency grammars he argues to be inferior, namely that syntactic structure can and indeed should be analysed independently of the uses to which it is put in verbal interaction, i.e. without also contemplating the rhetorical-pragmatic, semantic and phonological properties of the items under consideration. The objectification of the data items this entails is apparent in the prominence given by the focus article (and the books cited therein) to the application of "tests", which involve manipulations of those items much in the manner of mathematical operations such as addition, subtraction, multiplication, division and exponentiation. These tests yield results which are evaluated for their grammaticality in order to reveal the presence (or absence) of syntactic constituents, the ultimate purpose being to provide evidence for the relative advantages and drawbacks of constituency and dependency diagramming.

However, the very names of many of the tests expose the hidden presence of interpersonal and representational notions that, from a functionalist viewpoint, are capable of explaining the phenomena presented. Consider Osborne's discussion of (1) (also his example (1)), for which he provides rivalling constituent and dependency trees on p. 2:

(1)   Trees can show syntactic structure.

On p. 3 we find mention of the three tests: Topicalization, Pseudoclefting and Answer Fragment, which all have noticeably functional-sounding names that in the last analysis invoke the use of language in interaction. In FDG, Topic is a pragmatic function[1] that can be assigned to one or more Subact, a Subact being a minimal unit of the activity performed by the utterance of a Discourse Act. A speaker uses a Subact either to refer (in a Referential Subact) or to predicate (in an Ascriptive Subact). In (2) (= Osborne's (2a)), the words *syntactic structure* correspond to

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[1] FDG recognizes three pragmatic functions: Topic, Focus and Contrast.

a Topic-marked Referential Subact, and in (3) (= Osborne's (3a)), the words *show syntactic structure* correspond to two Topics, a Topic-marked Ascriptive Subact (*show*) and a Topic-marked Referential Subact (*syntactic structure*):

(2) … and **syntactic structure**, trees can show.

(3) … and **show syntactic structure**, trees can.

When it comes to testing the constituency of *trees*, however, Osborne (2018: 3) states that topicalization is "[i]napplicable". This remark betrays a view of topicalization as necessarily involving a movement rule displacing a Topic from some other position in the syntactic structure. But from a discourse-grammatical viewpoint that eschews movement rules, (4)—as indeed does (1)—involves a Topic-marked Subact (*trees*) just as much as (2) and (3), and its clause-initial position can be explained in exactly the same way as the items in bold print in those examples:

(4) … and **trees** can show syntactic structure.

Finally, the ungrammaticality of (5) (= Osborne's (5a)) is a direct consequence of *syntactic* being only part of the Subact expressed as *syntactic structure*, for which reason it cannot function as a Topic:

(5) *… and **syntactic**, trees can show structure.

Topic is thus the common explanatory function behind the grammaticality of (2)–(4) and the ungrammaticality of (5).

Pseudoclefting and Answer Fragment are presented by Osborne as two separate phenomena but from an FDG standpoint they are very much the same, chiefly differing in involving one or two interactants respectively: in (6a) (= his (2b)), the speaker is, as it were, answering her own question while in (6b) (= his (2c)), a hearer answers the question:

(6) a. What trees can show is **syntactic structure**.

b. What can trees show? – **Syntactic structure**.

Both items in bold print correspond to Subacts marked for the pragmatic function Focus at the Interpersonal Level. The hearer's response in (6b) is a Discourse Act with a single Subact—such single Subacts are always Focus by default. In FDG, pseudoclefting does not result from the manipulation of a single clause, as is proposed both by Osborne and by those whom he criticizes: it not only involves Focus-assignment at the Interpersonal Level but also is specifically distinct at the Representational Level in being an equative clause (as is manifest in its copular structure). All in all, then, the properties of the data presented here are comprehensible provided that the items are seen as reflections of the underlying pragmatic and semantic representations. The autonomy of syntax presupposed by both sides of the debate staged in the focus article is undermined by the indirect allusions to discourse structure (implicit in the three dots in Osborne's examples (6a), (7a), (8a) and (9a)) and to verbal interaction (the question-answer sequences in his examples (6c), (7c), (8c) and (9c)), by the use of impure manipulations (as is

actually conceded by Osborne in footnote 2 on p. 3 of his article) and, as already mentioned, by his use of names for the tests that allude to the functionality of the structures without any exploration of that functionality.

A further pitfall of the test methodology (which is in evidence on Osborne's p. 16 ff.) is that the ungrammaticality of certain structures is envisaged from the viewpoint of the test, while in many cases it is explicable for independent reasons. Consider (7), corresponding to his example (20), and the examples in (8), all of which arise from application of one test or another:

(7) Drunks would put off the customers.

(8) a. *Drunks would **do it** the customers. (Osborne's (22b))

b. ***Do what** the drunks the customers? (Osborne's (22j))

c. *Drunks would put off **the them**. (Osborne's (23b))

d. *It was **customers** that drunks would put off the. (Osborne's (23i))

(8a) is out since *do* here is followed by two NP objects, while its template requires one NP only, a fact which in turn follows from its semantic properties. (8b) similarly cannot be parsed: English cannot question a verb, a possibility found in other languages and investigated by Idiatov and Van der Auwera (2004). (8c) is ruled out by the inherent definiteness of personal pronouns, and (8d)—in FDG terms—by the impossibility of applying the pragmatic function Contrast (which triggers the cleft construction) to only part of the Subact in question. On occasions, even the sentences that prompt the test seem ungrammatical, as with the question in (9):

(9) What would drunks do concerning the customers? – ***Put off**. (Osborne's (22d))

The point that is most salient in the data exemplified in (7) and (8), however, is that *put off* (in the sense of 'disconcert') is, for semantic reasons, highly transitive; i.e., in FDG terms, it is strongly associated with an Actor—Undergoer frame. The ungrammaticality of *Put off* in (9) and indeed the impeccability of *Put them off* as an answer are entirely understandable on this, semantic, basis. This leads us to the question of the omission of *put off* in (10), judged by Osborne to be ungrammatical:

(10) *Drunks would the customers. (Osborne's (22h))

In a discourse context of the type shown in (11), however, (9) is generally taken to be grammatical:

(11) Flower-sellers put off the staff, and drunks would the customers.

This constitutes an example of 'pseudogapping' (a term introduced by Levin 1980; cf. her structurally parallel example *I picked up a newspaper, and Lynn might/will/did a magazine*, 1980: 75).[2] The omissibility of *put off* as a unit is entirely unsurprising given its semantic

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[2] I am aware that, as Hoeksema (2006: 335) has phrased it, "[j]udgments on pseudogapping sentences are often insecure, because this type of ellipsis itself is often viewed as marginal ... and informal, and in addition to this,

coherence, and indeed it is treated as a single lexeme in FDG. Osborne himself elsewhere provides convincing coordination evidence for the coherence of *put off* and for its analogous status to a single transitive verb like *offend*, cf. his (22a) and (24a).

A conclusion drawn from Osborne's Section 4 is that coordination "actually seems to consistently support phrase structure" (2018: 18). However, he is fully aware—and his Section 7.1 is devoted to this issue—that coordination tests can yield results that for syntacticians are counter-intuitive, as in, for example, (12):

(12) Bill gave [you these] and [me those] today. (Osborne's (27i))

Here *you these* and *me those* are seen, for reasons that have to do with syntax, as not being constituents. Semantically, too, they do not form units and in FDG they would accordingly not be units at the Representational Level. However, in FDG it is at the Interpersonal Level that coordination of units of Discourse Acts is accounted for, as involving the multiple occurrence of either Topic-marked or Focus-marked Subacts (but never a mixture). In (12), *Bill* is a Topic, while *gave* and *today* may or may not be in Focus (that depends on the preceding context and the information shared between Speaker and Addressee); in any case, *you* and *these,* and *me* and *those* are all Focus, and it is this, not their putative status as constituents of a syntactic structure, which enables the grammaticality of (12). Similarly, the option of multiple Topics and/or multiple Foci also explains all the data in Osborne's (27).

The project of banning all references to meaning, use and phonology is, FDG would argue, not one that can be sustained. This is apparent from time to time in Osborne's argument. On p. 17, for instance, he attributes the ungrammaticality of (13) (his (24a)) to the idiosyncrasy of *put off* and *piss off*:

(13) *Drunks would put and piss off the customers.

Osborne is surprised that coordination does not work here (as a syntactician might expect), and he is surely right to appeal to the fact, alluded to above, that *put off* and *piss off* are each meaning units (with the senses 'disconcert' and 'annoy' respectively); but this weakens the assumption of autonomous syntax. More generally, his identification of "an understanding of constituents from intuition" (p. 20) appears to involve recourse to units of meaning, as where he quotes Poole (2002: 29) as writing, "We all share the feeling that, for example, *at the station* ... forms some kind of unit". Given the inaccessibility of syntactic structure to introspection (for most of us at least), that universal feeling must be based on an identification of *at the station* as a meaning unit, specifically as pinpointing a location (as proposed in FDG). Similar observations apply to syntacticians' disregard of units of interaction, specifically the Subacts (i.e. the minimal units of communicative activity) that make up the Communicated Content of Discourse Acts. Osborne's Table 5 (pp. 21–22) presents six tests for 'constituent status' drawn from the literature, but all of these are rooted, from an FDG perspective, in the use (or non-use) of Subacts, see Table 1.

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shows a great deal of variation among speakers of English". Nevertheless, I am confident that pseudogapping is found with sufficient frequency in usage to be considered part of English grammar, as is confirmed by Miller's (2014) corpus study of the construction.

Table 1. FDG interpretation of six syntactic tests

Test	FDG analysis at the Interpersonal Level
Omission	Non-performance of a Subact (i.e. *the speaker refrains from carrying out a potential minimal unit of communicative activity*)
Topicalization	Assignment of Topic function to a Subact (i.e. *the speaker treats the information conveyed in a minimal unit of communicative activity as topical*)
Answer fragments	Discourse Acts consisting of a single Subact with the Focus function (i.e. *the speaker performs a Discourse Act that contains only one minimal unit of communicative activity, which is necessarily in focus*)
VP-ellipsis	Non-performance of Subacts that would re-express the Focus Subacts of the preceding Discourse Act (i.e. *to avoid reduplication, the speaker refrains from carrying out one or more minimal units of communicative activity that have already been in focus*)
Passivization	Neutralization of semantic functions across the Representational and Morphosyntactic Levels, often associated with assignment of Topic to the Subject (i.e. *the speaker assigns the same morphological marking to an Undergoer as she would assign to a (typically topical) Actor*)
Proform substitution	Performance of a Subact associated with more schematic semantic information (i.e. *the speaker gives reduced information, confident that the hearer can reconstruct the full information*)

Finally, there is a tacit admission on p. 25 that the Phonological Level also cannot be dispensed with, where Osborne writes of certain examples in his (27) that "they improve ... if read with rising-falling prosody". What is implicit here are the prosodic consequences of assigning the pragmatic function Contrast to the respective Subacts at the Interpersonal Level of FDG.

For various of the reasons adumbrated here, FDG would take issue with the very first sentence of the focus article, which states that syntax is "of course" central to "all theories of language". Just like Simpler Syntax, FDG rejects "syntactocentrism" (Culicover and Jackendoff 2005: 21) and takes the position that morphosyntax has its role to play, but always in conjunction with textuality, pragmatics, semantics and phonology. In fact, it is sympathetic to the view developed by Schoenemann (1999) that whatever complexity there may be in syntax, "the actual grammatical rules in any specific language are simply cultural inventions created to allow speakers to describe the salient features of their semantic universe" (1999: 311), i.e. the syntax has an ancillary role with respect to the conveyance of meaning. Schoenemann (1999: 330) argues from an evolutionary perspective that the hierarchical nature of syntactic structure— which, as Osborne (p. 6) stresses, is common to both constituency and dependency approaches— is fully to be expected since "the evolution of hierarchical systems becomes increasingly probable as the level of complexity of the resultant systems increases". Furthermore, he holds "that new semantic conceptualizations of the world *must necessarily have evolved prior to the evolution of the syntactical devices which allow us to codify these semantic concepts* since there would otherwise be no selective reason for any given syntactical structure to exist"

(Schoenemann 1999: 330, his emphasis), a point he then demonstrates for a rather complete list of presumed universal properties of syntactic structure.

This brief discussion note has not touched on the central question addressed by the focus article, whether the results of syntactic tests align better with dependency syntax, as the author contends, or with phrase structure syntax. Instead, from the perspective of Functional Discourse Grammar (FDG), we have questioned the assumption of autonomous syntax and the methodology that is associated with it, involving manipulations of strings of symbolic elements (words and phrases) without regard to their meaning, use and prosodic properties. It has been suggested that FDG is better placed to offer explanatory accounts of the grammaticality and ungrammaticality of the examples presented.

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Evaluating theories: Counting nodes and the question of constituency

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Abstract. This paper is a reply to Timothy Osborne's paper *Tests for constituents: What they really reveal about the nature of syntactic structure* that appeared 2018 in *Language under Discussion.* This paper discusses how constituent tests work and why it is no problem if they are not applicable. It is argued that Osborne's claims regarding simplicity of Dependency Grammar (DG) in comparison to Phrase Structure Grammar (PSG) are unwarranted and that DG models that include semantics make use of auxiliary structure that is equivalent to the nodes assumed in PSG. A final section of the paper discusses the general validity of counting nodes for theory evaluation and the assumption of empty elements vs. specialized phrasal rules.

Keywords: Dependency Grammar, Phrase Structure Grammar, complexity, constituency

1 Introduction

Timothy Osborne has published a series of papers in which he claimed that Dependency Grammar is simpler than phrase structure grammar and hence has to be preferred for reasons of parsimony (Osborne & Groß 2016: 132, Osborne 2018: 2). One of these papers (Osborne 2018) is a target paper in *Language under Discussion.* Osborne explained why he thinks that grammarians working in the phrase structure tradition got their constituent tests wrong and argued that constituents at the level of complete phrases are justified but constituents at the subphrasal level are not, which, according to him, is obvious if one looks at the results of the tests.

This paper is a reply to Osborne's discussion article including some more general comments on theory evaluation at the end. The paper will be structured as follows: I first discuss constituent tests and some of the claims Osborne has made (Section 2). I then add remarks on evaluating theories in Section 3. I begin with the Dependency/Phrase Structure Grammar comparison and the claim that grammars without sub-phrasal constituents are simpler (Section 3.1). It is shown

that Dependency Grammar approaches are of comparable complexity once semantics is taken into account. Section 3.2 compares the actual grammar rules of Phrase Structure Grammars and Dependency Grammars and motivates nodes as attachment sides for adjuncts. Subsection 3.3 makes a more general point on theory evaluation discussing recent Minimalist proposals and comparing them to earlier phrase structure approaches with fewer nodes and more rules. Section 4 concludes the paper.

2 Constituency tests

This section deals with the way constituent tests are formulated, with the coordination test in particular and with partial constituents in German.

2.1 Words and constituents and the implications of test applicability

Osborne applies tests like topicalization and proform substitution and finds that they sometimes do not apply to words. For example, the pre-nominal adjective *syntactic* and the verb *show* in (1a) cannot be topicalized as (1b) and (1c) show, respectively:

(1) a.   Trees can show syntactic structure.
     b. * ...and *syntactic*, trees can show structure.
     c. * ...and *show* trees can syntactic structure.
     d. * ...and *can show syntactic structure*, trees.

Osborne discusses 15 constituency tests in total and applies a selection of 10, among them pseudo clefting and answer fragments. He concludes that words at the subphrasal level should not be regarded as constituents since most of the applied constituency tests are negative. However, what he misses is the exact formulation of the tests. For example, the topicalization test says: Sequences that can be moved are constituents (von Stechow & Sternefeld 1988: 108, Eroms 2000: 35, Dürscheid 2003: Section 3, Duden 2005: §1170, Flohr & Lobin 2009: 133, Remberger 2016, Schäfer 2015: Section 10.3).[1,2] This means that the constituent test is a sufficient and not a necessary condition: if X holds then the string under consideration is a constituent. The formulation in Müller (2016: 10) is even more cautious and talks about "strong indicator of constituent status".[3] Similar statements can be found in Machicao y Priemer (2018). So we have: if X holds

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[1] "Verschiebeprobe. Was sich verschieben, umstellen läßt, ist eine Konstituente." (von Stechow & Sternefeld 1988: 108) "Nach der Verschiebeprobe ist das, was verschoben werden kann, eine Konstituente." (Flohr & Lobin 2009: 133) "Grundsätzlich kann verallgemeinert werden, dass alles, was sich vor dem finiten Verb im Vorfeld befindet, also auch *wir* in (1), eine Konstituente (ein Syntagma oder eine selbständige Phrase, [...]) bildet." (Remberger 2016).

[2] I could not check all the references listed by Osborne but statements by Haegeman (1994: 35) are similar. Wöllstein (2010: 16) and Dürscheid (2003: 54) are exceptional. Dürscheid states that the other direction of the implication is relevant too and Wöllstein formulates four out of five tests with the implication in the opposite way: *A constituent is frontable.* This means that if something is a constituent it has to be frontable, replaceable by pronouns, deletable and cordinatable. These tests would exclude many partial phrases and in particular words. Since Wöllstein formulated one of the constituent tests in a different way, I believe these statements were made with different intentions.

[3] See Müller (2016: Section 1.3.2) for a discussion of problems related to the tests. While fronting in German is a rather reliable test there is a class of exceptions: so-called apparent multiple frontings (Müller 2003). While these constituents in front of the finite verb can and should be analyzed as one constituent (Müller 2005, 2017), the respective patterns are problematic for constituent tests.

then the string under consideration is likely a constituent. In the case of words, the question of constituent status is trivially decided: constituents are parts of a larger structure and since all more complex structures consist of words (ignoring the possibility of having affixes as parts of syntax), words are constituents (Adger 2003: 66, Schäfer 2015: 312, Müller 2016: 7). I said "trivially" above. Actually, the issue of determining what a word is is not trivial at all, but Dependency Grammar has to make and justify the same decision. Words have certain properties like case, gender, and number. They form distribution classes and on the basis of their distribution, we assign labels to them: something like 3rd person singular count noun. Determining this category involves a test that is also one of the constituent tests: the substitution test. It is clear that some of the standard constituent tests do not work at the subphrasal level. For instance, the pronominalization test with personal pronouns usually does not work since pronouns refer to discourse referents and partial noun phrases do not refer. But the non-replaceability of partial NPs is not a problem, since the test is: if you can replace something with a pronoun, this indicates that this is a constituent. Nothing is said about cases in which this is impossible.

2.2 Coordination

Osborne discusses coordination as a test and notes that it sometimes does not apply, but as he notes himself there are reasons for this and even if there were no sensible explanations this would just mean that it is impossible to apply one of the tests. Let's have a look at coordination and what it tells us about subconstituents. The nominal structure in (2a) can refer to a specific set of skillful children and smart parents, possibly present in the current situation, or it can refer to a specific set of skillful children and some smart parents. Assuming a phrase including nouns and adjectives ($\overline{N}$ in $\overline{X}$ theory, Jackendoff 1977), it is easy to get the coordination facts right: (2b) is a coordination of two $\overline{N}$s and (2c) is the coordination of two full NPs, *smart parents* being an NP without a determiner.

(2)   a. these skillful children and smart parents
      b. [NP these [$\overline{N}$ [$\overline{N}$ skillful children] and [$\overline{N}$ smart parents]]]
      c. [NP [NP these skillful parents] and [NP smart parents]]

Of course, coordination is a very complex phenomenon consisting of various subphenomena: there is gapping, right-node raising and so on (see Osborne, 2018 for examples and references). Some argue that coordination is something entirely different from the rest of syntax and should be treated by special means (Goodall 1983, Hudson 1988, Osborne 2006). Some develop approaches that allow multidominance[4] (Crysmann 2008, Beavers & Sag 2004). It seems to be reasonable to attempt to stay as close as possible to the rules normally used rather than introducing new mechanisms for basic cases. If one has the constituents on the subphrasal level (which are needed for independent reasons, as discussed below), nothing special is needed for cases like (2). So, what is relevant for constituent tests is only a subset of coordination phenomena, namely symmetric coordination, that is, the coordination of two items of the same syntactic category.

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[4] Multidominance would also account for examples like the following one by Osborne (p. c. 2018):

(i)   the children [over here playing soccer] and [over there playing tag]

Multidominance approaches actually allow for material being used twice.

In contrast to symmetric coordination, parts of what we would like to call a constituent are discontinuous in cases of right node raising. The general problem is that we cannot easily restrict the test to symmetric coordination since we would need a pretheoretic way to tell the various types of coordination apart without referring to constituents. So, as argued by several researchers (cited in Osborne's paper), coordination has to be used with care and it has to be checked whether the assumption of a constituent is warranted by the results of other tests and by further assumptions made in the grammar under development.

Osborne (p. c. 2018) argued against assuming $\overline{\text{X}}$-type constituents on the basis of examples like (3):

(3)   a.   these [skillful children] and [intelligent parents] in school
      b.   these skillful [children in school] and [parents at work]

In examples that have both pre-nominal and post-nominal modifiers, the combination of pre-nominal modifier and noun and the combination of noun and post-nominal modifier can be coordinated. He concludes that—provided one accepts constituency tests—both structures are needed in principle, which would result in spurious ambiguities in noun phrases without coordination. For example, (4) would have two structures: one with *children* combining with *skillful* first and another one with *children* combining with *in school* first.

(4)   these skillful children in school

This is indeed unfortunate and in some cases there would not be a difference in meaning but there are cases in which there are two different readings corresponding to the respective bracketings. For instance, (5) can be used to refer to a person that used to be a professor in Tübingen but is living in Stuttgart now (*former* attaches to *professor*) or to a person who was a professor in Stuttgart (*former* attaches to *professor in Stuttgart*).

(5)   a former professor in Stuttgart

Section 3.1 discusses another example from Tesnière (2015: 150), for which Tesnière argued that the pre-nominal modifier and the noun form a unit.

So this shows that it is reasonable to assume different structures in principle. This leaves us with spurious ambiguities in cases of intersective modifiers at both sides of the noun. One could argue for a processing strategy that prefers early attachment: while both structures are available in principle, the one with early attachment is preferred. I discussed this analysis in Müller (1999: Section 4.3.1).

Note that approaches with flat structures as in Dependency Grammar would have to find ways of accounting for the ambiguity in (5) in semantics without the help of syntax. They would then face the same problem as the syntactic approaches namely that they have to explain why one of the possible attachment orders in semantics is ignored for intersective modifiers as in (4). Of course, this depends on the actual semantic representation language chosen.

2.3 Non-maximal constituents

Most of the constituent tests apply to maximal phrases only but such languages as German allow for fronting of partial constituents. The following examples show that the ditransitive verb *erzählen* 'tell' can be fronted with either one of the two objects:

(1) a. [Den   Wählern   erzählen] sollte   man   diese   Märchen   nicht.
       the.DAT voters   tell   should one   this.ACC   stories   not
       'One should not tell the voters these stories.'

    b. [Märchen   erzählen] sollte   man   den   Wählern   nicht.
       stories.ACC   tell   should one   the.DAT   voters   not
       'One should not tell the voters these stories.'

Groß & Osborne (2009) develop a projective Dependency Grammar, that is, discontinuous constituents are not allowed. Therefore their Dependency Grammar has to license a linguistic object consisting of a ditransitive verb and a dative object (6a) and another one consisting of a ditransitive verb and its accusative object (6b). The assumption of such constituents is standard in Head-Driven Phrase Structure Grammars (HPSG) of German (Pollard 1996, Müller 1996, 2017, Meurers 1999).

3 Evaluating theories

Osborne compares phrase structure trees with dependency trees and claims that Dependency Grammars are simpler since the structures they license involve fewer nodes (Osborne & Groß 2016: 132, Osborne 2018: 2). For example, the left tree in Figure 1 contains eight nodes, while the right one has only four nodes.

3.1 Counting nodes and semantics

Osborne is right: if we count nodes, we see that Dependency Grammars need fewer nodes than Phrase Structure Grammars. But does this mean that they are leaner theories? I think this is not the case. Here is why: Osborne's theories do not discuss the integration with semantics.[5] In fact, they are not even theories. Osborne's papers discuss dependency trees. They do not tell us how
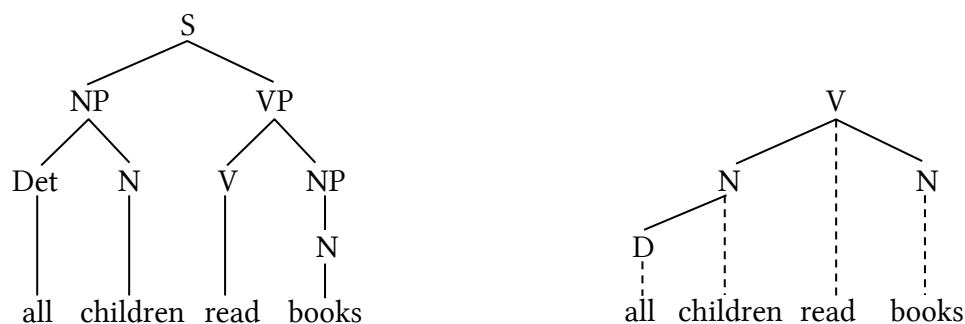

Figure 1. Phrase structure vs. Dependency Grammar analyses

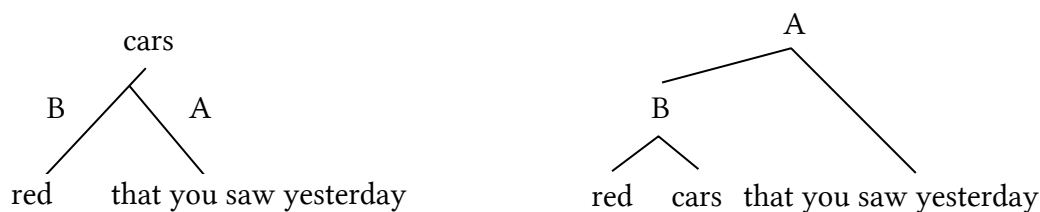[5] See also Dahl (1980) for a similar comment on a discussion note by Richard Hudson.

Figure 2. Tesnière's way of representing scope and the comparison with phrase structure-based analyses by Kahane & Osborne (2015: lix)

these trees are licensed.[6] But let's assume there are some rules of the type suggested by Gaifman (1965: 305) and Hays (1964: 513) licensing Osborne's trees. What we would have then is a syntactic theory. It would predict which word sequences belong to a certain language and which ones do not. But it would not tell us what a certain string means. In order to pair strings with meaning, one has to associate semantic representations to lexical items and to say something about the compositional accumulation of meaning that corresponds to syntactic structure. So, we have to explain that the meaning of *red cars* consists of a combination of the meaning of *red* and the meaning of *car*. Tesnière (2015: 150) noted that simply assuming a flat structure for nominal structures just containing the noun and all adjuncts may be insufficient and more fine-grained distinctions may be necessary. For such cases he suggested using something that Kahane & Osborne (2015: lix) called *polygraphs*. Rather than stating a dependency between a head and an adjunct, one can use polygraphs to state a dependency between a combination of two other items and an adjunct. An analysis using polygraphs is shown in Figure 2 on the left-hand side. As was pointed out by Kahane & Osborne (2015: lix) this polygraph-based analysis is basically equivalent to an $\overline{X}$ analysis, in which adjective and noun form a constituent (an $\overline{N}$) and this constituent is combined with a relative clause. The only difference is that the node gets a name in the $\overline{X}$ variant. (The name also marks which category is the head, something that is indicated in the left figure of Figure 2 by putting *car* above the other material.)

Osborne (p.c. 2016) stated that this was only one of Tesnière's stemmata, one out of 366. But this is irrelevant. The point is that there is a difference that one may want to capture. This is what Tesnière (2015: 150) wrote on his Stemma 149:

§24 Not all subordinates depend as closely on the noun as others. Some of them relate to the noun directly, whereas others are related to it more loosely (cf. Chapter 11, §11–13) and are placed further away. They can be so distant that they seem to depend not on the noun controlling the node but on the node formed by the noun and one of its subordinates.

§25 In order to represent these nuances, which merit a more detailed analysis than can be produced here, it is possible (but not necessary in the standard practice of stemmas) to adopt longer lines for more extended subordinates, and rather than connecting them directly to the node, to connect them to a point along the connection line between the noun and one of its close subordinates. By this process, the phrase *the red car that you saw yesterday* can be analyzed structurally in such a way that the connection line extending upward from the subordinate clause reaches the connection line connecting *red* to *car*. This means that *that you saw yesterday* is connected

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[6] This question is not trivial. For instance, the tree in Figure 10a (on p. 62 below) could be licensed by six different phrase structure rules such as those in (9) or by two very abstract rules such as Merge and Move (Chomsky 1995) and conventions regarding the labeling of the mother node (Chomsky 2008, 2013).
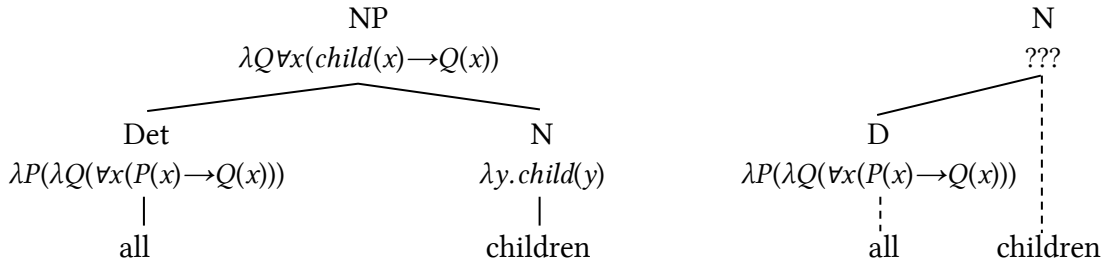
NP
$\lambda Q \forall x(child(x) \rightarrow Q(x))$

Det
$\lambda P(\lambda Q(\forall x(P(x) \rightarrow Q(x))))$

N
$\lambda y.child(y)$

all

children

N
???

D
$\lambda P(\lambda Q(\forall x(P(x) \rightarrow Q(x))))$

all

children

Figure 3. Nodes are used for meaning representation: determiner-noun combinations

not to *car* but to *red car*, since what you saw yesterday was not the car, but the red car (Stemma 149). (Tesnière 2015: 150)

Talking about semantics, consider the meaning of *all children*. While phrase structure grammars can represent the combined meaning of *all* and *children* at the NP node as shown in Figure 3, this is not possible in Dependency Grammar (DG). There is just the N and the Det. One could develop theories in which the meaning of the noun *children* is represented by *Qλx:child(x)* and the quantifier is filled into the meaning representation somehow (I use lambda terms here, see Heim & Kratzer (1998, Section 2.5) for an introduction). This would mean that the meaning associated with *children* in the phrase *all children* would be the meaning representation of the whole phrase (see Müller *20*18: Section 11.7.2.3 for details). While this is technically possible, it entails that the meaning of head nouns in NPs including adjuncts would have to include the meaning of the adjuncts as well.[7] So for instance *children* as in *all smart children* would have the meaning of the complete noun phrase (see Figure 4).

Note also that the left tree in Figure 1 above (p. 56) contains a unary branching from NP to N. Such unary branching structures can be used to introduce the semantics that is usually contributed by the determiner (Müller 1999: 284).[8] Again, one can imagine ways of doing this in the lexical item of the noun but this would be non-trivial and/or unintuitive.[9]
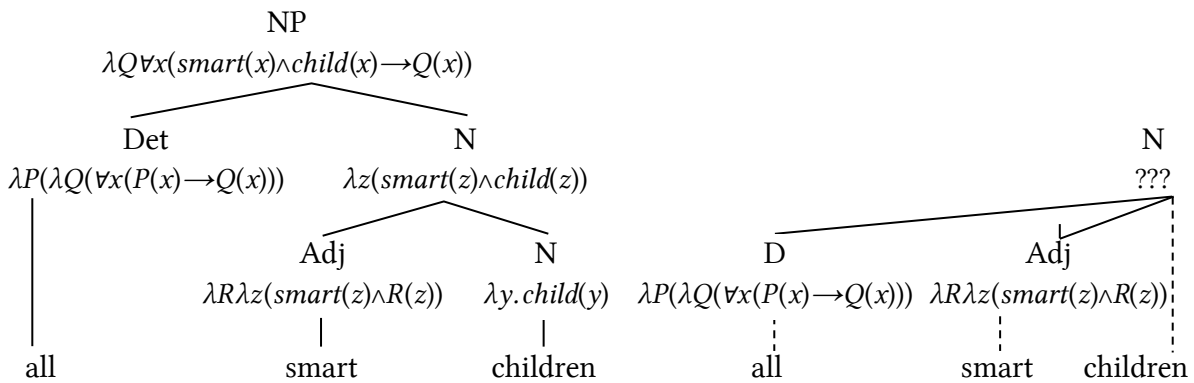
NP
$\lambda Q \forall x(smart(x) \wedge child(x) \rightarrow Q(x))$

Det
$\lambda P(\lambda Q(\forall x(P(x) \rightarrow Q(x))))$

N
$\lambda z(smart(z) \wedge child(z))$

Adj
$\lambda R \lambda z(smart(z) \wedge R(z))$

N
$\lambda y.child(y)$

all

smart

children

N
???

D
$\lambda P(\lambda Q(\forall x(P(x) \rightarrow Q(x))))$

Adj
$\lambda R \lambda z(smart(z) \wedge R(z))$

all

smart

children

Figure 4. Nodes are used for meaning representation: determiner-adjective-noun combinations

[7] Hudson (2003: 391–392) is explicit about this: "In dependency analysis, the dependents modify the head word's meaning, so the latter carries the meaning of the whole phrase. For example, in *long books about linguistics*, the word *books* means 'long books about linguistics' thanks to the modifying effect of the dependents." For a concrete implementation of this idea see Figure 5.

[8] See also Müller (2018: 574, fn. 5) for a discussion of unary projections and semantics.

[9] See for example van Noord & Bouma (1994) for a proposal in HPSG to introduce adjuncts to verbs lexically. In such an approach, all lexical items for verbs are infinitely many times ambiguous. Such an analysis could of course be assumed for nouns as well.
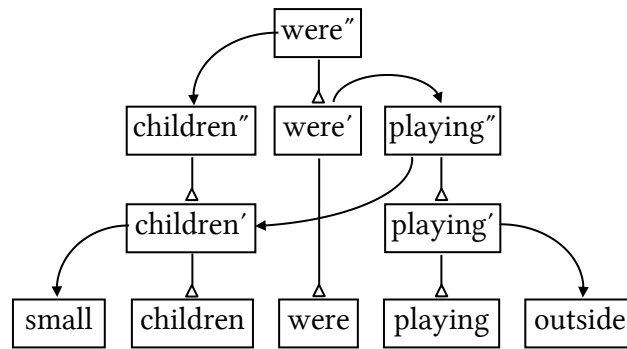
Figure 5. Analysis of *Small children were playing outside.* according to Hudson (2017: 105)
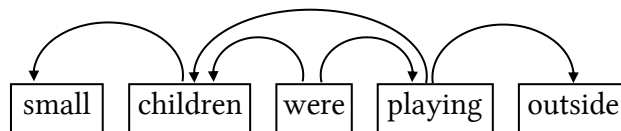

Figure 6. Abbreviated analysis of *Small children were playing outside.* according to Hudson (2017: 105)

There are probably other properties that differ between lexical nouns and the nodes of a complete phrase. A candidate for such a difference is information about nonlocal dependencies (e.g., slash information in HPSG, Pollard & Sag 1994: Chapter 4), but since Osborne's papers are not formalized it is difficult to tell (see Müller (2018: Section 11.5) on a discussion of all the things missing in Groß & Osborne's (2009) account of nonlocal dependencies).

One of the well-formalized versions of DG is Dick Hudson's Word Grammar (Hudson 1991, 2007) and as I show next, it is equivalent to phrase structure grammar in complexity. The representation in Figure 5 is a detailed description of what the abbreviated version in Figure 6 stands for. What is shown in the first diagram is that a combination of two nodes results in a new node. For instance, the combination of *playing* and *outside* yields *playing′*, the combination of *small* and *children* yields *children′*, and the combination of *children′* and *playing′* yields *playing″*. The combination of *were* and *playing″* results in *were′* and the combination of *children″* and *were′* yields *were″*. The only thing left to explain is why there is a node for *children* that is not the result of the combination of two nodes, namely *children″*. The line with the triangle at the bottom stands for default inheritance. That is, the upper node inherits all properties from the lower node by default. Defaults can be overridden, that is, information at the upper node may differ from information at the dominated node. This makes it possible to handle semantics compositionally: nodes that are the result of the combination of two nodes have a semantics that is the combination of the meaning of the two combined nodes. Turning to *children* again, *children′* has the property that it must be adjacent to *playing*, but since the structure is a raising structure in which *children* is raised to the subject of *were*, this property is overwritten in a new instance of *children*, namely *children″*.

The interesting point now is that we get almost a normal phrase structure tree if we replace the words in the diagram in Figure 5 by syntactic categories. The result of the replacement is shown in Figure 7. The only thing unusual in this graph (marked by dashed lines) is that N′ is combined with the *-ing* form of the verb V[*ing*]′ and the mother of N′, namely N″, is combined with the finite verb V[*fin*]′. As explained above, this is due to the analysis of raising in Word Grammar, which involves multiple dependencies between a raised item and its heads. There are
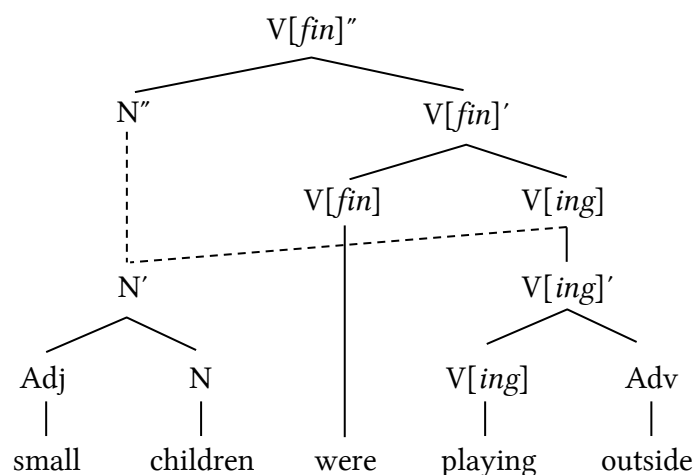
Figure 7. Analysis of *Small children are playing outside.* with category symbols

two N nodes (N´ and N″) in Figure 7 and two instances of *children* in Figure 5. Apart from this, the structure corresponds to what a Phrase Structure Grammar (PSG) would license.

Dick Hudson (p.c. 2018) pointed out to me that his diagram displays is-a relations, while the phrase structure trees visualize consists-of relations. So *playing* is-a *playing´*, while V[*ing*]´ contains-a V[*ing*]. This is an important difference in terms of viewing the domain to be modeled but in terms of complexity the two approaches are at the same level.

3.2 Dependency Grammars vs. Phrase Structure Grammars

Osborne claims again and again that Dependency Grammars are simpler than Phrase Structure Grammars but he does not provide a grammar. If one looks at actual grammar rules as suggested by Gaifman (1965: 305), Hays (1964: 513), Baumgärtner (1970: 61), Heringer (1996: Section 4.1) and others, one sees that the difference is not that large. For instance, Baumgärtner suggests the general rule format in (7):

(2) $\chi \longrightarrow \varphi_1 ... \varphi_i * \varphi_{i+2} ... \varphi_n,$ *where* $0 < i \leq n$

The asterisk in (7) corresponds to the central element of the rule, a word of category χ. In our example in Figure 1 ("All children read books", see p. 56 above), χ would be V, the position of the '*' would be taken by *read*, and φ_1 and φ_3 would be N. Together with the rule in (8b) for the determiner-noun combination, the rule in (8a) would license the dependency tree in Figure 1.

(3) a. V → N * N

b. N → D *

Now compare these rules to phrase structure rules:

(4) a. VP → N V N

b. NP → D N

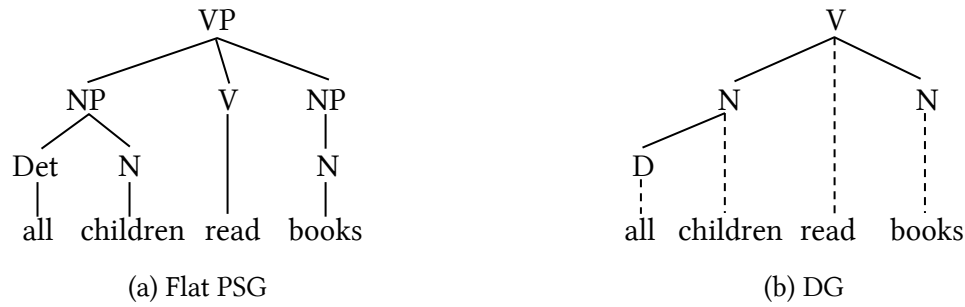(a) Flat PSG   (b) DG

Figure 8. Phrase structure vs. Dependency Grammar with rules for combining the same constituents

As is obvious, the difference is not big. The same holds for the tree visualizations of the structures licensed by the respective grammars, which are given in Figure 8.[10] It is clear how the two figures can be related: the dependency tree results from the phrase structure tree by pulling the lexical element up to the XP node (XP stands for NP, AP, PP, or VP or other maximal phrasal projections) and removing the XP node (Gaifman 1965, Covington 1990: 234, Oliva 2003, Hellwig 2006: 1093).

So, phrase structure grammarians could assume flat structures for sentences as they are assumed in DG. Why do they nevertheless stick to intermediate VP nodes? They could assume totally flat noun phrases having one node for NP dominating the determiner, the head noun, arguments of the head nouns and all adjuncts. Some phrase structure grammarians actually do assume such structures (Eisenberg 2004: 29, 144), but most do not. One reason for assuming intermediate nodes is that they serve as attachment sides for adjuncts. As (10) shows for the nominal domain, it would not be sensible to pose an upper limit on the number of possible adjuncts:

(5)   a. A: All leather chairs are comfortable.
       b. B: No, I know of one uncomfortable leather chair.
       c. A: But all uncomfortable leather chairs are cheap.
       d. B: No, I know of one expensive uncomfortable leather chair.

The same is true in the verbal domain as discussed in Frey & Gärtner (2002: 48). If one assumes a recursive rule like the one in (11), the NPs in (11) are accounted for:

(6)   N′ → A N′

The computation of the semantic contribution is straightforward: the meaning of the adjective is paired with the meaning of the N′ that is modified. The result of this combination is represented at the resulting N′ node. Assuming these nodes also accounts for order: adjectives precede nouns but follow the determiner. It is clear that one can account for such examples as (10) with flat rules but this involves rules with arbitrarily many daughters.

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[10] An additional rule for the projection of N to NP is needed in the phrase structure grammar:

NP → N

This rule introduces the determiner's semantics. See Section 3.1.

(a) PSG analysis with adjunct

(b) Totally flat DG analysis according to Osborne (2018: 24)
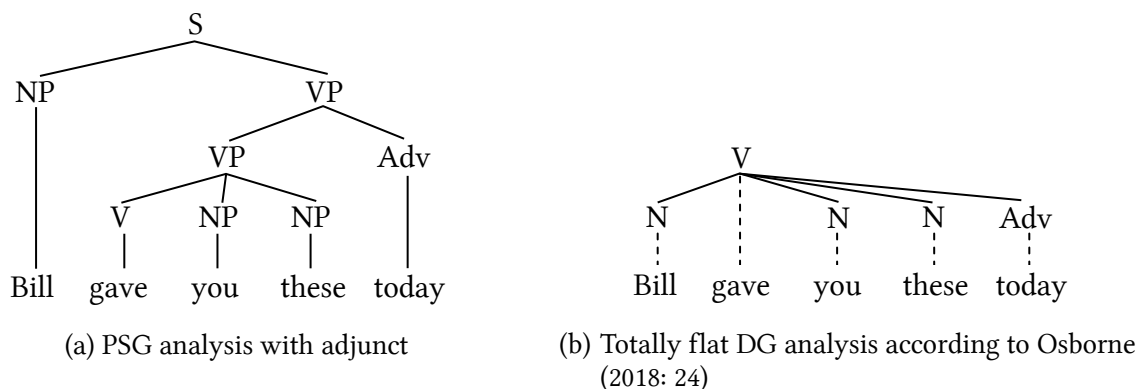
Figure 9. Phrase structure vs. Dependency Grammar with adjuncts

The situation with VPs (in SVO languages, such as English) is similar (see Figure 9): the VP is a certain well-defined area of the clause and adjuncts may attach to the left and to the right of it. The subject has to be placed in front of the VP not, say, somewhere between the objects. All this is accounted for in phrase structure grammars that acknowledge a VP node and recursive rules adding adverbial elements to the VP. Again, flat rules could be assumed for clauses but accounting for linearization of constituents and in particular the scope of adjuncts is not trivial. The computation of adjunct scope will be complex and involves machinery that is not needed in approaches with more structure. See Kasper (1994) for a proposal with flat structures in HPSG.

Linearization constraints are hardly ever provided in DG work. I could not find any statement regarding linearization within phrases in Osborne's work. Until this work is done, it is not justified to claim that DG is simpler since the theories are not comparable. For an extended discussion of these topics in general, and some of Osborne's analyses of German in particular, see the chapter on Dependency Grammar in Müller (2018).

3.3 Rules vs. lexical elements

During a discussion as part of a workshop on long-distance dependencies at the Humboldt-Universität zu Berlin in 2018, Gereon Müller claimed that lexical elements do not count when it comes to the evaluation of syntactic theories. According to him, the only thing that matters is the number of rules. If this was a valid criterion for evaluating theories, a theory assuming the structure in Figure 10a for a prepositional phrase would be better than one assuming the right structure, provided the left structure is licensed by very general rules as it is the case in Minimalism (Chomsky 1995). Radford's (1997) structure, represented in Figure 10a, involves several empty elements, two special part-of-speech labels (p for an additional prepositional category, and AgrO for something having to do with object agreement) and movements and is way more complex than the rather trivial combination of a preposition with its NP dependent in Figure 10b. Nobody outside the Minimalist community would accept the claim that the theory behind the structure on the left-hand side is simpler than others. In fact, such researchers as Wolfgang Sternefeld and Hubert Haider broke up with their school because of analyses like the one in Figure 10a and arguments for analyses similar to the one in Figure 10a (Sternefeld 2006: 549–550, Sternefeld & Richter 2012, Haider 2018).
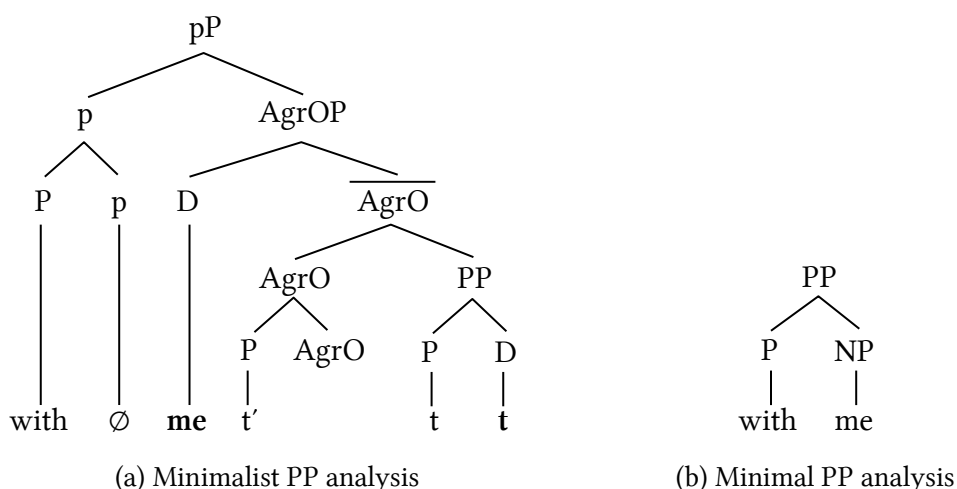
(a) Minimalist PP analysis   (b) Minimal PP analysis

Figure 10. Analysis of prepositional structures according to Radford (1997: 452) and conventional PP analysis

So, to evaluate theories with respect to their complexity, one has to count the distinctions that have to be made: the number of features, the number of their possible values, the constraints on identities of values, the number of rules, the number of lexical entries assumed. The number of lexical entries for normal words like *book* will not tell us much about the parsimony of theories since all theories have to assume a lexical item for *book* but not all theories assume empty elements.[11] Sometimes the empty elements are eliminated by assuming unary branching structures or additional phrasal rules (Müller 2016: Chapter 19). So there is a tradeoff that has to be taken into account when comparing theories.

When comparing theories, it is also important to look at the complexity of the lexicon. Such theories as Construction Grammar of the Goldberg type (Goldberg, 1995, 2006) assume a lot of phrasal schemata while lexical theories assume respective lexical items. For example, Goldberg & Jackendoff (2004) assume a phrase structure rule for resultative constructions while lexical approaches assume lexical rules (Wechsler & Noh 2001, Müller 2002, 2006, Müller & Wechsler 2014). While theories like Lexical Functional Grammar (LFG) and HPSG have elaborated theories of the lexicon, such subtheories are lacking from Osborne's DG and from Minimalism (Newmeyer 2005: 95, fn. 9). See also Borsley & Müller (2019) on the lexicon in Minimalism.

Before concluding the paper, I want to add a caveat: the question which theory is most appropriate depends on what we want to model and what the empirical domain is. If we want our theories to be rather directly related to human behavior and the way things are represented in the brain, developing the most compact and non-redundant theory may not result in the most appropriate theory. The reason is that a lot of information is stored redundantly in the brain. Patterns with high frequency are stored even though their structure follows general rules and they could be analyzed compositionally from their parts (Bybee 2006, Bannard & Matthews 2008).

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[11] The situation is more complicated even for visible lexical items. Some theories introduce adjuncts lexically and hence assume that there are infinitely many possible lexical items for verbs. See van Noord & Bouma (1994) and Bouma, Malouf & Sag (2001).

4 Conclusion

I have shown that Osborne (2018) misunderstood the definitions of constituency tests and that the tests are unproblematic when they cannot apply. I further argued that his proposals lack an integration of semantics and if semantics is taken into account, some Dependency Grammar approaches get even closer to phrase structure-based ones than they already are. I discussed some other phenomena, such as constituent order and adjunct attachment interacting with intermediate phrasal nodes.

As for theory evaluation in general, I argued that rather than looking at the rules only as in Minimalism or looking at the nodes in the syntactic tree only as in Dependency Grammar, we have to look at the number of theoretical entities and mechanisms as a whole. We also have to look at the bigger picture and think about the integration of semantics. After all, doing syntax in isolation is fun but pointless: syntax is the bridge between form (sound, writing or signing) and meaning.

Acknowledgements

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Beyond constituency tests: A reply to Osborne

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Abstract. Timothy Osborne argues that phrase structure grammars (PSGs) postulate unnecessarily complex structures, and that Dependency Grammar (DG) is to be preferred on grounds of simplicity (1:1 word-to-node ratio) and empirical adequacy (capturing the results of constituency tests). In this reply, I argue that, while some of Osborne's criticisms of PSGs are justified, there are both empirical and theoretical problems with his major claims. In particular, his version of DG is too restrictive with respect to certain constituency facts (modified nouns, verbal phrases), and what it gains in simplicity qua number of nodes, it loses in requiring a more complex interface between syntax and other linguistic components (phonology, semantics). I argue that Mirror Theory, a framework that is in a sense intermediate between DG and PSGs, answers Osborne's justified criticisms while not suffering from the problems of his version of DG.

Keywords: Dependency Grammar, Minimalism, Mirror Theory, constituency test, head, verb phrase, adverb

1. Introduction

Osborne (2018) argues that syntactic frameworks based on phrase structure, such as Chomskyan Minimalism, postulate unnecessarily complex structures, and that Dependency Grammar (DG) is to be preferred on both theoretical and empirical grounds: theoretically because of its maximally simple 1:1 word-to-node ratio, and empirically because it captures the results of constituency tests better than phrase structure grammars (PSGs). A key assumption lying behind Osborne's remarks is that the results of constituency tests can decide between rival syntactic frameworks regardless of other possible reasons for postulating relatively complex structures. I will argue that, while some of Osborne's criticisms are justified, his reply overlooks

the trade-off between the relative complexity of the syntactic structures posited by PSGs and the relative simplicity of the phonological and semantic interpretation of these structures. I will argue that Mirror Theory (MT; Brody 2000a, 2000b, 2003), an offshoot of Minimalism that approaches DG in certain respects, answers most of the challenges that Osborne poses for PSGs, while still enabling a relatively simple interface between syntax and phonological/semantic interpretation.

Section 2 briefly introduces MT, noting the key similarities and differences between MT, Osborne's variant of DG (henceforth O-DG), and PSGs (head/phrase distinction; word-node ratio; number of daughters). Section 3 argues that Osborne is correct in identifying certain heads (transitive verbs, auxiliaries) as non-constituents, but that O-DG (but not MT) is too restrictive with respect to modified nouns, which behave like constituents. Section 4 argues that Osborne's use of constituency tests as necessary (rather than sufficient) conditions for constituency is too strict, in particular with respect to verbal phrasal constituents. Section 5 argues that the 1:1 word-node ratio of O-DG creates complications for the interface between syntax and other components of the language faculty (phonology, semantics), focusing in particular on the ordering and scope of adverbial and verbal elements. I argue that the relaxation of the 1:1 ratio in MT and PSGs is compensated for by a simpler interface relation as compared with O-DG.

2. Mirror Theory

Although one could get the impression from Osborne's paper that the central debate is between dependency-based and constituency-based frameworks, this is not quite true. Osborne's variant of DG also makes crucial use of the notion of constituent, in that respect departing from most DG frameworks, as he himself notes. The central question, then, is really how many constituents there are in a given sentence.

I believe that Osborne is partly correct in his claim that the head-phrase distinction posited within PSGs is unnecessary. In fact, this kind of argument has also been made within the generative literature, though for different reasons, by Brody (2000a, 2000b, 2003) and Bury (2003), among others. In this discussion note, I will argue that the framework proposed in Brody's work, Mirror Theory (MT), can answer the criticisms posed by Osborne, while preserving the desirable aspects of Minimalist PSG work (essentially the framework deriving from Chomsky 1995, 2000, 2001, with accessible introductions including Adger 2003 and Hornstein et al. 2005).

MT is particularly interesting in that it is in a sense intermediate between Minimalism and DG. On the one hand, it is like O-DG in that it rejects the distinction between heads and phrases (a property Brody 2000a, 2000b refers to as Telescope), and allows spell-out of non-terminal nodes. On the other hand, MT is like Minimalism, and unlike O-DG, in postulating a relatively 'abstract' syntactic structure in which the number of nodes is normally larger than the number of words, and in adopting a maximally binary-branching structure (i.e., a mother node has no more than two daughter nodes).[1] The key motivation behind MT is to account for what Brody (2000a) calls the 'mirror generalisation' (see, e.g., Baker 1985, Cinque 1999, Adger et al. 2009). In

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[1] As Brody (2000a: 41) puts it, "Telescope can be viewed as eliminating the apparent conflict between the long tradition of dependency theories (see, e.g., Hudson 1990 and references cited there) and phrase structure theories of syntactic representations." Brody also cites Brody (1994) and Manzini (1995) as "recent attempts to simplify the theory of phrase structure in terms of dependencies" (Brody 2000a: 41 fn. 10).

the form that Brody adopts (see also Cinque 1999), the mirror generalisation amounts to the claim that morphological suffixes appear in the opposite order to their equivalent syntactic heads (i.e., independent words). To take a relatively simple example, Cinque (1999: 198 fn. 2) suggests that Hawick Scots 'double modal' sentences such as (1a) have their "exact mirror image" in Turkish, as seen in (1b):

(1) a. He'll   might could do it for you. (Cinque 1999: 79)
        he.FUT POSSIB ABIL do it for you
        'He might be able to do it for you.'

    b. Gel-e-me-yebil-ecek. (ibid.: 198 fn. 2)
        come-ABIL-NEG-POSSIB-FUT
        '(S)he may in the future not be able to come.'

In Hawick Scots, future tense, epistemic modality, negation and deontic/dynamic modality are expressed by independent words preceding the main verb. By contrast, in Turkish these categories are expressed by verbal suffixes appearing in the reverse linear order of the Scots equivalents.
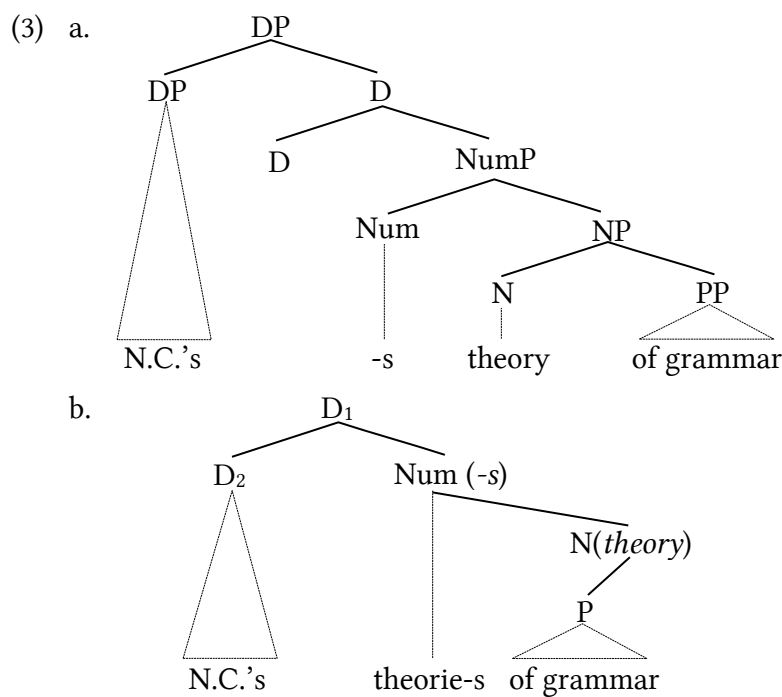
The basic structural principle of MT can be illustrated by comparing the tree in (2a), which depicts the general 'X-bar' structure of phrases in PSGs, with the equivalent MT tree in (2b). In (2a), XP represents the whole phrase, headed by X, ZP is a phrase that functions as the 'specifier' of XP, and YP is a phrase that functions as the 'complement' of X. For example, in earlier analyses of the noun phrase *Noam Chomsky's theories of grammar* (e.g., Chomsky 1970), *theories* would be the head, *Noam Chomsky's* (a distinct NP) the specifier, and *of grammar* (a prepositional phrase) the complement. By contrast, the equivalent MT tree in (2b) simplifies the structure by abolishing the 'XP' and 'X′' levels; here, X corresponds to the head, Z is its specifier and Y is its complement (see Brody 2000a: 40):

(2) a.   XP   b.   X
            ZP   X′   Z   Y
                        X   YP
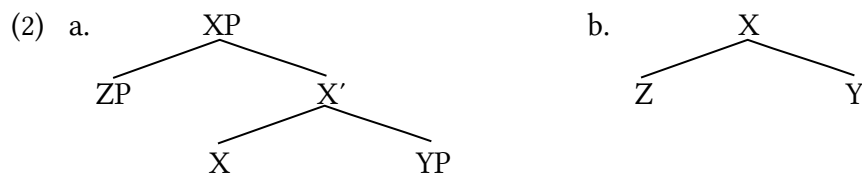
The relation between X and its specifier can be seen as parallel to the relation between a head and its dependent in O-DG; here, Z is an independent word or phrase that is grammatically dependent on X (e.g., the object of a lexical verb). The relation between X and its complement also represents a dependency, but one that is expressed in terms of inflectional morphology. A further important aspect of the tree in (2b) is the claim that a specifier always precedes its head, and a head precedes its complement (following Kayne 1994).[2] For Brody, Z is a syntactic

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[2] Inflectional suffixation is overwhelmingly preferred over inflectional prefixation in the world's languages. For example, Dryer (2013) gives 406 languages as "predominantly suffixing" and 123 as having a "moderate preference for suffixing", as against 58 that are "predominantly prefixing" and 94 having a "moderate preference for prefixing". While the directionality of this tendency is as expected under the mirror generalisation (cf. Svenonius 2016: 211), the existence (in fact, non-rarity) of inflectional prefixation still needs to be explained. MT must either reanalyse inflectional prefixes as independent words or claim that Mirror does not apply systematically (cf. Brody 2000a: 34), but discussion of this issue would take us too far afield.

specifier of X, and hence Z precedes Y/X. On the other hand, the syntactic complement relation also represents a 'morphological specifier' relation 'in reverse'. That is, Y and X form a single word in which Y is a morphological specifier of X, so Y precedes X. For example, the structure of *Noam Chomsky's theories of grammar* might be represented in MT as in (3b), corresponding to the more recent Minimalist PSG analysis in (3a):

(3) a.

DP
├─ DP
│   └─ N.C.'s
└─ D
    ├─ D
    └─ NumP
        ├─ Num
        │   └─ -s
        └─ NP
            ├─ N
            │   └─ theory
            └─ PP
                └─ of grammar

b.

D₁
├─ D₂
│   └─ N.C.'s
└─ Num (*-s*)
    ├─ theorie-s
    └─ N(*theory*)
        └─ P
            └─ of grammar

In (3a), the noun *theory* is normally taken to be combined with the plural affix either through N 'raising' to Num, or through Num 'lowering' to N. In (3b), by contrast, the word is directly 'read' off the tree from bottom to top: the noun (N) *theory* is a morphological specifier of the affix in Num, and hence N precedes Num. There is then a choice – fixed for a particular language – to pronounce the noun (plus any affixes) either in the N node or in the Num node. If it is pronounced in N, then it follows its complement (*of grammar*), as in Mandarin Chinese *guānyú yǔfǎ de lǐlùn* (lit. 'about grammar LINKER theory'). If it is pronounced in Num, then it precedes its complement, resulting in 'head-initial' word order, as in English.

As the remainder of my discussion note will focus on the structure of the clause, let us now consider how this is represented in the three approaches. For example, the MT-style analysis of the sentence *John writes poems* is given in (4) (I ignore the question of whether the subject and object have internal structure):

(4)

T
├─ D
│   └─ John
└─ *v*
    ├─ writes
    └─ V
        └─ D
            └─ poems
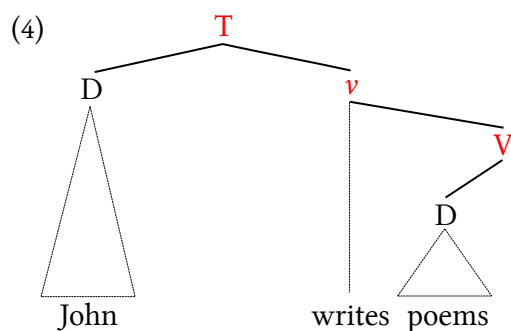
Here, the *-s* suffix, representing T(ense), forms a morphological word with the main verb, in contrast to cases in which an auxiliary represents T (e.g., *He will write poems*), in which case the auxiliary precedes the main verb. In (4), the verb is the morphological specifier of a functional category *v* ('little V'), which itself is the morphological specifier of T.[3] This means that the verb's morphological word (represented by the nodes in red in the tree) is pronounced in the order *write>v>-s*. In English, the chosen node for pronouncing the verb plus its affix is *v*; because V is the complement of *v*, this means that *writes* precedes *poems*. In OV languages such as Hindi-Urdu, the verb plus any affixes is pronounced in V; as *poems* is the specifier of V, this results in the order *poems>writes.*

If (4) is compared with the Minimalist-type analysis in (5a) and the O-DG analysis in (5b), it will be clear that MT has commonalities with both approaches:

(5) a.

 b.
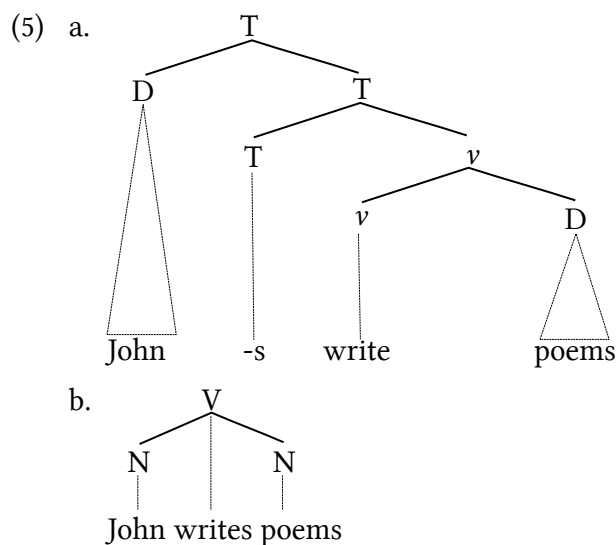
(5a) differs from (4) in that only 'terminal nodes' (nodes that dominate no other nodes) are pronounced, and in the notion of categorial projection (e.g., the verb forms a verb phrase with its sister node in the tree). In these respects, MT is like O-DG. (5a) and (4) are similar, however, in that the tense/agreement suffix *-s* spelled out on the verb corresponds to a distinct syntactic node, T(ense).[4] That is, the word-to-node ratio is not 1:1, in contrast to O-DG.

In the following sections, I will argue that MT is not subject to the (justified) criticisms that Osborne levels at PSGs, but has advantages over O-DG in its ability to handle certain constituency and ordering facts that Osborne does not discuss. I begin by examining Osborne's claim that heads (in the PSG sense) may be non-constituents.

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[3] The category *v* is a 'light verb' that originates in Chomsky (1995) and Kratzer (1996). While *v* does not correspond to a pronounced morpheme in this sentence, it has been argued that the *do* of *do so* (*John must do so*) and British English *do* (*John must do*) are realisations of *v* (see Haddican 2007 and references cited there).

[4] As for how the verb is combined with its suffix, it is normally assumed either that the verb 'moves to T' (e.g., Chomsky 1995) or that the two are combined in the morphological component of the grammar (e.g., Bobaljik 1995).

3. Heads as non-constituents

Because it is like O-DG in (largely) abolishing the head-phrase distinction, MT can account for Osborne's evidence against treating transitive verbs and auxiliaries as constituents; for example, the fact that they cannot undergo topicalisation:

(6) a. … and <u>show syntactic structure</u>, trees CAN.[5]

b. *… and <u>show</u>, trees can syntactic structure.

c. *…and <u>can</u> trees show syntactic structure. [declarative]

Just as in the O-DG tree, the auxiliary and verb in the MT tree do not correspond to constituents.

The situation is slightly different in the case of nouns modified by a determiner or an adjective, which Osborne also claims should not be constituents. He uses the following examples to support this claim:

(7) a. <u>Syntactic structure</u>, trees can show.

b. *<u>Structure</u>, <u>trees</u> can show syntactic.

While the noun phrase as a whole can be topicalised, the noun alone cannot. While it is indisputable that topicalisation fails to identify the noun as a constituent, the fragment answer test contradicts this result. In response to an 'echo' *wh*-question, for example, the noun alone can be used as a fragment answer, as in (8a). Contrast this with (8b), in which the same is attempted with a verb, but the result is very unnatural:[6]

(8) a. This test probes syntactic WHAT? <u>STRUCTURE</u>.

b. This test does WHAT to syntactic structure? #<u>PROBES</u>. / <u>PROBES it</u>.

This fact is problematic for the O-DG analysis, under which the noun could not be a constituent here, as it dominates the adjective that modifies it.[7] Whether the same problem holds for MT depends on how modification should be treated. I will assume, as was standard within earlier generative work (e.g., in the Government-Binding tradition following Chomsky 1981), that modifiers are introduced by 'adjunction', an operation that creates an extra node of the same label as the modified category.[8] An adjunction analysis correctly predicts that the noun can be

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[5] *Can* in (6a) is in all-capitals to indicate that topicalisation here requires main stress to fall on the auxiliary.

[6] Sergeiy Sandler (p.c.) suggests that the following dialogue is also possible:

(i) A: This test WHAT syntactic structure?

B: PROBES.

Although this seems ill-formed to me, if there are speakers who find it acceptable, this is problematic for O-DG in the same way that (8a) is.

[7] It is also problematic for approaches that seek to equate the set of possible fragments with the set of constituents that can undergo movement (e.g., Merchant 2004). See also Culicover & Jackendoff (2006) for criticism of this approach.

[8] Bury (2003) adopts a similar view in an MT-related framework (see also Uchida & Bury 2008, Bury & Uchida 2012). This is different from the treatment of modifiers in 'standard' MT (e.g., Brody 2000a: 53, 2003, Brody & Szabolcsi 2003: 37, Adger et al. 2009, Adger 2013), but the choice between these analyses does not affect the argumentation here.

treated as a constituent.[9] Such an analysis, however, is incompatible with the basic tenets of O-DG, as it entails giving up the 1:1 word-to-node ratio. If they are taken to be necessary conditions for constituency, then, constituency tests cut both ways: they are problematic for O-DG as well as for MT and standard Minimalism. In the next section, I will examine another such case, concerning the question of which verbal phrasal constituents are identified by constituency tests.

4. Finite VPs as constituents?

As Osborne has emphasised in other work (esp. Osborne & Gross 2016), an O-DG analysis entails that there is no such thing as a tensed or finite verb phrase (VP) constituent, as is clear from the tree in (5b). By contrast, in Minimalism the tensed verb and its object must correspond to a constituent (whether or not this is a VP) excluding the subject, as seen in (5a). As for MT, although the tree in (4) represents the affix *-s* in the T node dominating the subject, it is assumed that it is ultimately spelled out in *v* along with the verb, and hence that in some sense there is a finite VP (*v*P) constituent.

Although Osborne does not discuss this difference in detail in the target paper (Osborne 2018), he provides examples such as (9) to support the claim that the tensed auxiliary does not form a constituent with its dependents:

(9) a. *...and <u>can show syntactic structure</u>, trees.

    b. *What trees do is <u>can show syntactic structure</u>.

    c. *What can trees do? <u>Can show syntactic structure</u>.

Again, the results of these tests are indisputable, and it is true that O-DG predicts this as a matter of principle, while it is less clear that this is the case for Minimalism and MT. Yet the problem of what kinds of verbal strings pass these tests is broader than Osborne acknowledges. For example, some non-finite auxiliary phrases do not pass any of the tests (Pullum & Wilson 1977), despite indisputably being constituents under an O-DG (or Minimalist or MT) analysis:[10]

(10) a. *<u>Have been being eaten</u>, the banana must.

    b. *<u>Been being eaten</u>, the banana must have.

    c.   <u>Being eaten</u>, the banana must have been.

    d. *<u>Eaten</u>, the banana must have been being.

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[9] As for why topicalisation fails, it is an old observation that extraction from noun phrases, even of constituents, is highly restricted (see Reeve 2019 and references cited there).

[10] There are also 'intermediate' cases such as (i), in which the 'raising infinitive' *to avoid syntax* is a constituent under anyone's approach, but does not pass most of the tests:

    (i) a. *<u>To avoid syntax</u>, Bill seems.

        b. ?What Bill seems to do is <u>to avoid syntax</u>.

        c. *?What does Bill seem to do? <u>To avoid syntax</u>.

        d. *It is <u>to avoid syntax</u> that Bill seems.

It therefore seems unsatisfactory to attribute the failure of the tests in (9) purely to syntactic constituency without providing a reason why the tests also fail in (10). At the very least, such an argument ought to clarify why these phenomena should be treated differently.

In fact, the constituency tests are not even consistent in ruling out a finite VP constituent, as finite VP fragment answers are perfectly acceptable (see Culicover & Jackendoff 2006 for further divergences between the fragment answer and movement tests):

(11) A: He did WHAT?

     B: <u>Threw away Mary's present</u>.

A potential objection is that that B's response involves not a VP fragment answer, but an instance of 'topic drop', a phenomenon known to occur in English (e.g., Haegeman 1990). I think this analysis is doubtful, however, given that a finite VP answer does not seem very good when the context makes *John* a topic, but does not introduce a 'question under discussion' for which a finite VP would be an appropriate answer:

(12) A: So I heard some really bad things about John.

     B: ?#Yeah, <u>threw away Mary's present yesterday</u>.

This suggests that (11B) does involve fragment answer ellipsis.[11] Note further that fragments do need to be syntactic constituents: it is not simply possible to delete just any 'backgrounded' material, leaving behind a non-constituent fragment:

(13) A: What happened to John?

    a. B: #<u>Mary attacked</u>.

    b. B: #<u>Mary leapt on</u>.

    c. B: #<u>Mary gave a present</u>.

It seems that we must acknowledge the possibility of finite VP constituents, contrary to the prediction made by O-DG. How can we account for the fact that this putative constituent does not pass the remaining constituency tests? This is a topic of ongoing debate (see, e.g., Harwood 2015 and references cited there), but I am not aware of a better alternative than simply stipulating a particular 'cut-off point', which in Harwood's analysis corresponds to the notion of 'phase' (Chomsky 2000 *et seq.*); only phases (or complements of phase heads) can be moved. Regardless of the particular terminology chosen, though, from anyone's point of view there must be certain constituents that can undergo VP-fronting or VP-ellipsis, and others that cannot.
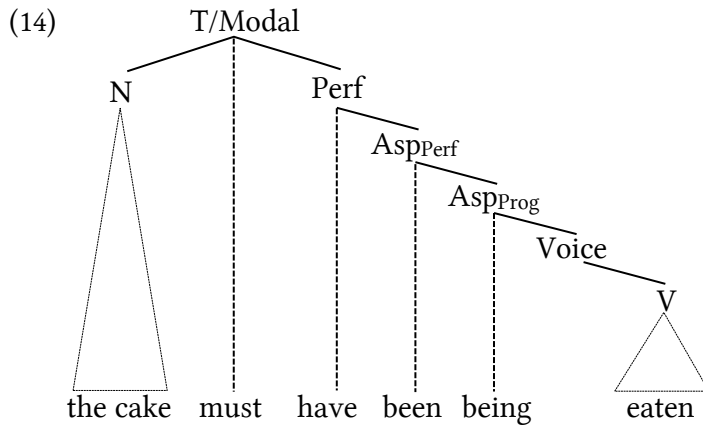
Suppose we adopt the clausal structure in (14) for the sentence *The cake must have been being eaten* (I abstract away from the structure underlying each auxiliary and its inflectional affix for ease of presentation):

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[11] Indeed, sometimes a finite VP answer seems better than a non-finite VP answer:

   (i) A: What does he do?

      B: <u>Works in Asda</u>.

      B': ?# <u>Work in Asda</u>.

(14)

In terms of essential constituent structure, (14) corresponds both to the O-DG and MT analyses of the sentence (see, e.g., Brody 2000a, 2000b, Osborne 2016: section 7.11).[12] Under both frameworks, then, it is necessary to say something like: only the Asp_{Prog} constituent can undergo VP-fronting (cf. Harwood 2015). For VP-ellipsis, the possibilities are wider: any auxiliary-headed constituent can be elided except the topmost, which is as expected given that *must have been being eaten* does not correspond to a constituent.

The two frameworks can be separated, however, in the case of fragments. Under the O-DG analysis of a sentence containing a tensed main verb, such as (5b), there cannot be a constituent containing only the main verb and the object and excluding the subject, as a matter of principle. Under the MT-type analysis, however, the question of whether there is a 'finite VP constituent' depends on the node in which the verb plus its affix are pronounced, which must be *v* in English (see section 2). We then have two potential constituents to which grammatical rules may refer: (i) the smallest constituent containing all of the syntactic nodes belonging to the verb, and (ii) the smallest constituent containing the node in which the verb is pronounced. In the tree in (4), (i) is the smallest constituent containing T, *v* and V (i.e., the whole tree), while (ii) is the smallest constituent containing *v* (the node where the inflected verb is pronounced). We can then say that rules such as VP-fronting and VP-ellipsis refer to constituents in the sense of (i), while fragment answers refer to constituents in the sense of (ii), and are hence more permissive than the other rules.

One advantage of the relative structural flexibility of MT, then, is that it can express the differences between fragment answers and other constituency tests in a simple way. By contrast, it is difficult to see how O-DG could handle these differences, as there is only one syntactic (i.e., hierarchical) 'position' for any given finite verb.

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[12] The analysis in (14) is also somewhat similar to the Minimalist analysis of Bjorkman (2011), who argues that auxiliary *be* does not constitute a separate node from its affix, but is inserted as a 'last resort' to provide an attachment site for the affix. She further assumes (for reasons of adverb placement, etc.) that the main verb in English is always spelled out (with its suffix) in the V position. Although I refer to (14) as essentially corresponding to an MT analysis, it is not quite equivalent to the MT structures proposed by Brody (2000a, 2000b) for auxiliary sequences. As noted in section 1, Brody argues that the head-complement relation only holds between a verbal root and its inflectional suffix(es), with dependencies between independent words always being expressed as specifier-head relations. Thus, in (14), for example, the Voice node (corresponding to the *-en* affix ultimately spelled out in the position of the verb) would be the specifier of passive *be*, not its complement. My reason for choosing (14) is ease of presentation, and this choice does not affect the argument being made here.

5. Ordering and scope

In this section, I will argue that the relaxation of the 1:1 word-node ratio in MT (as in PSGs) allows it to account more straightforwardly than O-DG for the ordering and interpretation of adverbials with respect to verbal elements.

O-DG differs from both standard Minimalism and MT in that a clause with no auxiliary lacks an auxiliary (T) node. One very influential argument for positing a T node relates to cross-linguistic differences in the ordering of verbs and adverbs. For instance, it is generally assumed within Minimalism that the finite verb remains within the VP (or perhaps *v*P) in English, but 'moves to T' in French. If adverbs such as *often* appear in the same position in both languages (e.g., adjoined to *v*P), this accounts for the fact that the neutral ordering of the verb is after the adverb in English, but before it in French (see esp. Emonds 1978, Pollock 1989, Cinque 1999):

(15) a. Bill often kisses John.　　　　　　a'. *Bill kisses often John.

　　 b. Guillaume embrasse souvent Jean.　b'. *Guillaume souvent embrasse Jean.
　　　　 Guillaume kisses　　often　　Jean　　　Guillaume often　　kisses　　Jean

MT eschews movement in this case, instead requiring the verb, together with its affix(es), to be spelled out in a particular verbal node, the identity of which may vary from language to language (*v* in English, T in French).

Under an O-DG analysis, the differences in (15) cannot be captured in terms of the hierarchical structure of the sentences. Rather, linearisation rules must be provided, saying simply 'adverbs must precede the finite verb' in English and 'adverbs must follow the finite verb' in French.[13] Given the lack of apparent independent motivation for V-to-T movement, or spell-out in T rather than in V, one might concede that there is no particular advantage to stating the restriction hierarchically in this case, as opposed to stating it purely linearly. When more facts are considered, however, it becomes clear that a purely linear account results in considerable complications.

First, consider the fact that adverbials in English tend to show 'mirror image' effects, in that the natural order of two given adverbs when they appear before the verb is normally the opposite of that when they appear after the verb and its objects (e.g., Andrews 1983, Quirk et al. 1985, Ernst 1994, 2002, Pesetsky 1989, 1995):[14,15]

(16) a. Tom has already completely ruined dinner.
　　 a'. *Tom has completely already ruined dinner.

---

[13] Ordering statements will also be needed for auxiliaries with respect to adverbs, indicating their neutral position:

　　(i) a. Bill has often kissed John.　　a'.　　Bill often has kissed John. [ok only if *has* is stressed]

[14] The judgements in (16) assume that the sentence corresponds to a single intonational phrase, with no 'comma' intonation around the adverbs. For instance, (i) seems acceptable, with *generally* treated as a parenthetical:

　　(i) Tom has already, generally, done his homework by the time we get home.

[15] As Phillips (2003: section 4.5) discusses in detail, left-to-right scope is sometimes possible with post-verbal adverbials if the final adverbial is focused (see also Haider 2004: 795–796, Larson 2004, Bobaljik 2017, Neeleman & Payne 2017). The important point for the in-text discussion is the availability of right-to-left scope, not the additional possibility of left-to-right scope.

b. Tom has ruined dinner completely already.

b'. *Tom has ruined dinner already completely.

A simple way of capturing this order, under a Minimalist/PSG approach, is to represent the verb phrase as a 'nested' structure, with each adverb being interpreted as modifying (taking scope over) its sister node in the tree. Under this approach, (16a) would have the constituent structure in (17a), in which the adverb *completely* takes the verb phrase *ruined dinner* (i.e., the node marked C) as its sister, and *already* attaches to the resulting constituent (i.e., the node marked B) to form the node marked A, also a verb phrase. (16b), in which the adverbs appear after the minimal verb phrase, and in the opposite order to that in (16a), then involves exactly the same hierarchical structure, but with the linear order of the adverb and its sister node reversed, as in (17b):

(17) a.

b.
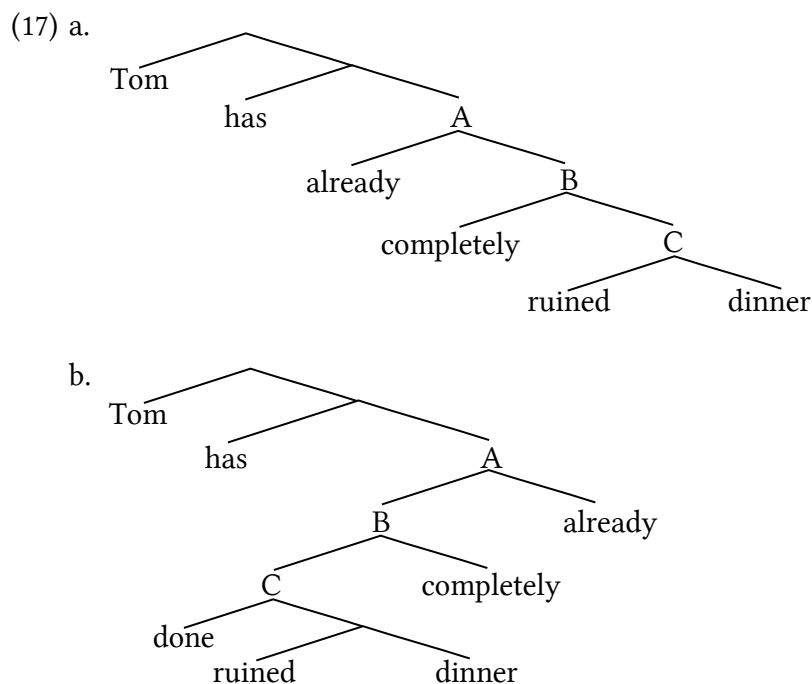
These structures also have the immediate advantage that they naturally express the semantic 'scope' relations between the adverbs. For example, (16a,b) both mean that what is already the case is 'John has completely ruined dinner', and not that what has happened completely is 'John has already ruined dinner'. That is, there is a correspondence between the relative positions of the adverbs and their semantic scope. In the structures in (17), this is straightforwardly expressed hierarchically: in both trees, *already* takes semantic scope over its sister, the node marked B, which includes *completely*, whereas *completely* takes scope over its sister, node C, which does not include *already*.

Under an O-DG analysis, this fact cannot be expressed purely hierarchically, but must make reference only to the linear order of the adverbs with respect to each other and to the verb. For example, one might generalise over (16a,b) by stating that each adverb takes scope over the rest of the V-headed constituent between it and the verb. Given the natural semantic scope relation *already* > *completely*, this would force *already* to precede *completely* in (16a) but follow it in (16b). But now consider that in at least some Romance languages, when more than one adverb

intervenes between the verb and the object, the scope order is left-to-right, as with preverbal adverbs in English (Italian examples in (18) from Cinque 1999: 207):[16]

(18) a. Gianni vede {di solito} {sempre} {raramente} i   suoi parenti.
         Gianni sees usually   always rarely   the his   relatives
         'Gianni {usually} {always} {rarely} sees his relatives.'

   b. *Gianni vede {sempre} {di solito} {raramente} i   suoi parenti.
         Gianni sees always   usually   rarely   the his   relatives
         'Gianni {always} {usually} {rarely} sees his relatives.'

   c. *Gianni vede {di solito} {raramente} {sempre} i   suoi parenti.
         Gianni sees usually   rarely   always   the his   relatives
         'Gianni {usually} {rarely} {always} sees his relatives.'

Thus, the linearisation statements about (16) will not extend to (18), and a different statement is needed for this case. By contrast, under a Minimalist or an MT approach, the same underlying hierarchical positions are assumed in all cases.[17] The differences between English and Italian are then captured as follows. In English, the finite verb is pronounced in *v*, and there is a choice of locating the adverbs before or after *v*(P), as in (17). In Italian (as in French), the finite verb is pronounced in T, and adverbs are located before *v*(P), so adverbs appear between the verb and its object, with left-to-right scope.

A further weakness of the linearisation approach is that it is unprincipled; there is no theoretical motivation for referring to the linear position of the verb, as opposed to just the positions of the adverbs alone. This means that it makes no predictions about possible scope relations cross-linguistically; for example, we might expect that some languages make reference to the position of the verb and others do not, with no correlation between this choice and other aspects of the grammar. By contrast, the postulation of a consistent hierarchical ordering of adverbs, plus the possibility of verb-movement to higher positions, leads us to expect, for example, that there should be no languages in which verb and object can be linearly separated by adverbs (V>Adv1>Adv2>O) but such adverbs take right-to-left scope (e.g., Adv2 taking scope over Adv1 in the preceding example). While I am unaware of work that specifically examines this prediction, I have also been unable to find evidence in the literature of such a language (cf. Nilsen 2003: 30). If correct, this supports the hierarchical approach over an O-DG approach, as there is no reason in the latter why a linearisation rule could not say something like 'an adverb takes scope over everything between it and the finite verb' when the adverb appears between verb and object.

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[16] Although Cinque (1999) presents the examples with all three adverbs simultaneously, the intended meaning is difficult to access. I use curly brackets to indicate that when any two of the three adverbs appear, they combine in that order. (This is to distinguish the situation from that indicated by round brackets, which would indicate that in (18b-c) the sentence would be bad even if none of the adverbs were present, which is of course not the case.)

[17] The assumption I am making here is that a theory of grammar should aim to characterise Universal Grammar – the structural rules underlying human language in general – rather than concerning itself only with the grammar of a single language. (Probably the most famous statement of this aim can be found in chapter 1 of Chomsky 1965.) From a methodological point of view, if one notices the same or similar phenomena arising in language after language, it seems to me to be preferable to provide a single explanation for the similarities, in the absence of evidence to the contrary. See Cinque (1999) for a prominent example of this approach applied to adverb ordering in a wide range of languages.

To summarise, although the number of syntactic nodes in Minimalist and MT structures is larger than that in O-DG structures, Minimalism and MT allow for a simpler relation between syntax (tree structures) on the one hand and semantics (scope) and phonology (word order) on the other. That is, scope is determined in terms of sisterhood in a tree structure, while word order is determined in terms of the specifier-head-complement relations described in section 2.

6. Conclusion

I believe that Osborne's critique of phrase structure grammars is justified to the extent that there is no real evidence for the head-phrase distinction (aside, possibly, from the case of adjunction), and that textbook presentations of constituency tests often gloss over the question of whether a particular structure is really supported by a particular test or set of tests. I also believe, however, that some of Osborne's criticisms are overstated, in that they focus on constituency tests to the exclusion of other reasons for positing more complex structures: in particular, linearisation and scope (not to mention binding, secondary predication, control, etc., which would require much more space for adequate discussion). Furthermore, lying behind Osborne's criticisms of the use of constituency tests within PSG is the assumption that such tests are a necessary condition for constituency. As I have shown, this clearly cannot be the case given that even Osborne's dependency grammar structures are not fully supported by constituency tests. I have argued that a Mirror-Theory-type framework is sufficiently restrictive to account naturally for the restrictions on constituency that Osborne identifies, while providing enough flexibility to account for discrepancies among constituency tests, as well as cross-linguistic differences in the ordering of adverbs and verbal elements.

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In defense of the simplicity and accuracy of dependency syntax: A reply to the discussion notes

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Abstract. My focus article in *Language Under Discussion* from 2018 argued that dependency syntax is both simpler and more accurate than phrase structure syntax with respect to the results delivered by tests for constituents. Four linguists (Richard Hudson, Lachlan Mackenzie, Stefan Müller, and Matthew Reeve) have responded to my focus article with discussion notes, challenging aspects of my message in various ways. In this article, I respond to the counterarguments produced in the discussion notes. In order to address one of the main counterarguments, having to do with scope and meaning compositionality, I introduce a new unit of dependency syntax, namely the *colocant*. My claim is that aspects of scope and meaning compositionality, for which phrase structure is deemed necessary, can be addressed in terms of colocants. Hence, scope phenomena and the manner in which meaning is composed can no longer be construed as an argument against dependency syntax and in favor of the necessity of phrase structure.

Keywords: colocant, constituent, dependency grammar, phrase structure grammar

1. Introduction

In my focus article in *Language Under Discussion* (Osborne 2018), I developed an argument in favor of dependency syntax over phrase structure syntax based on tests for constituents. The same message also now appears in my book on *dependency grammar* (DG), which has just appeared (Osborne 2019: Ch. 3). I again demonstrate that most of the tests for constituents that are frequently employed in introductory textbooks on linguistics and syntax produce results that are actually more in line with the dependency analysis of sentence structure than with that

of phrase structure. The tests for constituents readily support the existence of phrasal constituents, but they do little to support the existence of subphrasal strings as constituents. This situation is consistent with dependency syntax, because dependency does not acknowledge the existence of subphrasal strings as constituents to begin with. My message is controversial because phrase structure has been dominant in the study of syntax over the past 60 years and is taken for granted by most of the textbooks and monographs surveyed in my focus article.

Four linguists responded to my focus article with discussion notes, namely: Richard Hudson (2018), Lachlan Mackenzie (2018), Stefan Müller (2018), and Matthew Reeve (2018). All four of these discussion notes disagree with the message in my focus article at least to some extent, although the natures of the disagreements and counterarguments vary considerably. The current contribution responds to the various points raised in the four discussion notes, these issues being both empirical and conceptual in nature. I defend the original message in my focus article at length. Before beginning this defense, however, let it be known that I am thankful and grateful for the interest and earnestness that these four esteemed linguists have demonstrated and devoted to my focus article. The issues raised in the discussion notes and the discussion of these issues below deepen our understanding of the distinction between dependency and phrase structure syntax.

This paper is divided into five sections. The next section, Section 2, addresses challenges to my main message of the sort that I view as empirical in nature, these objections including data that are construed as contradicting my message to a greater or lesser extent. Section 3 then switches to objections to my message that are more conceptual in nature. I consider each of the four discussion notes in turn, examining the various critiques they express that have less to do with concrete data and more with general linguistic reasoning. Section 4 presents new material, namely the *colocant* unit. The colocant is the means of addressing a main objection to my message produced by Müller and Reeve, this objection being that phrase structure is needed to accommodate aspects of scope and meaning compositionality. Section 5 concludes my response.

2. Empirical challenges

The next five subsections examine what I consider to be direct observational and empirical challenges to the core data and message I present and develop in my focus article. These challenges are from Reeve, Mackenzie, and Müller.

2.1 Echo questions

The biggest challenge to the message in my target article comes, I believe, in the form of Reeve's echo questions and the corresponding answer fragments (Reeve 2018: 73–75), in particular his examples (8) and (11), which I reproduce here as (1) and (2):

(1) a. This test probes syntactic WHAT? – STRUCTURE.

b. This test does WHAT to syntactic structure? – #<u>TESTS</u>. / <u>TESTS it</u>.

(2) A: He did what?

B: – Threw away Mary's present.

These answer fragments cannot be construed as constituents based on *dependency grammar* (DG) assumptions, as Reeve points out, hence they directly contradict the message in my target article. The noun – *STRUCTURE* in (1a) is not a DG constituent because it is not a complete subtree in the corresponding full sentence, but rather it takes a dependent. Similarly, the strings – *Tests it* in (1b) and – *Threw away Mary's present* in (2) are not DG constituents because they also are not complete subtrees in the corresponding full sentences. This challenge to my message must be conceded. However, there is an important aspect of these counterexamples that reduces the importance of the concession. The discussion in this section examines this aspect.

Examining (1a) first, consider its dependency structure (the dependency trees henceforth mark adjuncts using an arrow dependency edge, as done here with the attributive adjective *syntactic*):[1]

(3)

```
              probes
       test            WHAT
   This        syntactic
   This  test  probes  syntactic  WHAT?
```
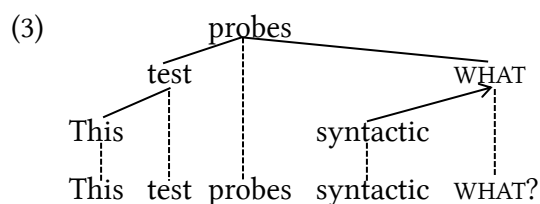
The ability of *what* to take an overt dependent (*syntactic* here) means that it is focusing a non-phrasal string. Given this ability, the fact that the corresponding answer fragment is non-phrasal is not surprising. The DG account distinguishes between *ex situ* and *in situ* focusing, whereby answer fragments responding to the former are necessarily constituents, whereas answer fragments responding to the latter can be non-constituents. Reeve (2018) acknowledges that this sort of distinction is necessary in his footnote 7. He mentions that approaches to answer fragments that see all fragments as originating from movement are also challenged by *in situ* focusing of the sort illustrated with his example (8). Worth noting in this area is that when the answer fragment test is used in the texts cited in my focus article (16 of them), *in situ* focusing is rarely considered.

Examples (1b) and (2) involve finite verb phrase (VP) fragments. A fuller data set is needed in order to discern what is going on in such cases. There is a systematic difference in the nature of the fragments according to whether the *wh*-word is *in situ* or *ex situ*:

> <u>*In situ* focusing (echo questions):</u>

(4) He does what?
    a. – Throws away the cake.
    b. –*Throw away the cake.

---

[1] The practice of marking adjuncts in dependency trees has precedents, although the exact convention employed varies (e.g. Tesnière 1959/2015: 36; Baum 1976: 79; Tarvainen 1981: 61; Engel 1994: 44; Jung 1995: 111–6; Eroms 2000: 85–6; Uzonyi 2003: 237). The arrow convention employed here, pointing from the adjunct towards its head, is intended to indicate that semantic selection runs up the hierarchy, signifying that the adjunct semantically selects its governor. Note that adjuncts were not marked in the dependency trees in my focus article. There are two reasons why they are now being marked in this response to the discussion notes. The first is to deliver a more complete picture of the theoretical apparatus being employed and the second is that Müller's discussion note includes an example, the second tree in his Figure 4, in which an adjunct is marked using a different convention from what is employed here (Müller 2018: 58).

(5) He did what?
    a. – Threw away the cake.
    b. –*Throw away the cake.

Ex situ focusing:

(6) What did he do?
    a. –??Threw away the cake.
    b. – Throw away the cake.

(7) What does he do?
    a. –??Throws away the cake.
    b. – Throw away the cake.

The acceptability pattern reveals that the form of the answer fragment should match the form of lexical *do* (as opposed to auxiliary *do*). When lexical *do* is finite in the question, as in (4) and (5), then the answer fragment should be finite and match the form of *do* in tense. When lexical *do* is an infinitive in the question, as in (6) and (7), then the answer fragment should be infinitival. What this means is that lexical *do* is necessarily part of the interrogative proform, that is, the interrogative proform has two parts, lexical *do* and *what*. Thus, the interrogative proform is *does what* in (4), *did what* in (5), and *What...do* in (6) and (7).

The insight that the form of lexical *do* is key to determining which VP fragments are possible is supported by a data set produced by Culicover & Jackendoff (2005: 252):

(8) What did you do?
    a. –*Ate the bagel.   – Finite VP fragment
    b. – Eat the bagel.   – Infinitive VP fragment

The acceptability judgements given here are those of Culicover & Jackendoff. We again see that the form of lexical *do* is responsible for determining which of the two fragments is possible. Since lexical *do* in the question in (8) is the infinitive, the VP fragment must be infinitival.

Another pertinent observation is that while lexical *do* must be construed as part of the two-part interrogative proform, it is not a pure proform, but rather it has some content of its own. This fact is evident in its need to take an agentive subject argument, e.g.

(9) Frank does what?
    a. –*Knows the answers.
   b. –*Looks like his father.
    c. –*Is quite friendly.

These finite VP fragments fail because the predicates there are stative and hence require that *Frank* be interpreted as a theme subject, which contradicts the use of lexical *do* in the question, which itself requires that *Frank* be construed as agentive.

A further pertinent issue concerns the fact that if lexical *do* is not present at all, it is impossible to produce such finite VP answer fragments. This fact is apparent when one attempts to produce finite VP fragments as answers to yes/no-questions. It is also apparent when one produces echo questions using *what* in the absence of lexical *do*, e.g.

(10) a. Has he thrown away Mary's present?   – *Yes, has thrown it away.
     b. Does he like Mary's present?   – *Yes, does like it.

     c. Will he throw away Mary's present?   – *Well, could throw it away.
     d. Should he throw away Mary's present?   – *Well, can throw it away if he wants to.

     e. He is what?   – *Is a good friend.
     f. They were what?   – *Were quite helpful.

While one can explain the badness of examples (10a–b) and (10e–f) in terms of the failure to omit backgrounded material (i.e. material that appears in the question – the auxiliary/copula each time), the same explanation does not account for (10c–d). The auxiliaries *could* and *can* there do not appear in the questions and therefore cannot be construed as backgrounded material. Examples (10e–f) are of course fine if the copula is omitted from the fragment (e.g. – *A good friend*), but as finite VPs, they are robustly ungrammatical. These examples therefore help draw attention to the fact that finite VP answer fragments are possible only under narrow circumstances: finite lexical *do* together with interrogative *what* in an echo question format.

The necessity to view lexical *do* as a quasi-proform in interrogative combination with *what* means that Reeve's echo questions in examples (1b) and (2) can be analyzed along the same lines as (1a) – see (3). The root word of the interrogative proform, i.e. *did*, is the root of the sentence:

(11)   did
       ⟋   ⟍
    He   │   WHAT
    ┊   ┊   ┊
    He   did WHAT – Threw away Mary's present.
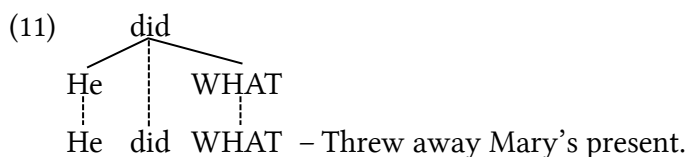
The fact that *did* takes a dependent that is not part of the proform, i.e. *he*, means that *did what* puts a string in focus that is not a DG constituent, similar to the manner in which *what* in (1a) and (3) is focusing a string that is not a DG constituent. The ability to do this means that the answer fragment elicited is also not a DG constituent.

To provide some commentary on the data just considered, both the dependency approach and phrase structure approach need to distinguish between *in situ* and *ex situ* focusing to address convincingly the variation that occurs in the nature of the fragments. The dependency approach sees *ex situ* focusing as necessarily involving constituents, whereas *in situ* focusing using *what* (and lexical *do*) has the ability to focus a non-constituent string. The phrase structure approach, in contrast, views *ex situ* focusing as necessarily involving phrasal constituents, whereas *in situ* focusing using *what* has the ability to focus certain subphrasal constituents. The ability of both approaches to address the distinction similarly in terms of *ex situ* and *in situ* focusing does not give the one approach an advantage over the other. The simpler dependency apparatus continues, however, to be advantageous in this area and others

The points just made concerning Reeve's echo question examples mitigate the challenge they pose to the DG analysis of fragments. Furthermore, one should not lose sight of the fact that other tests fail to identify head nouns alone and finite VPs as constituents and hence such answer fragments are an outlier, a point that Reeve (2018: 75) acknowledges, e.g.

(12) a. *...and **structure** the test probes syntactic.   – Topicalization
      b. *It is **structure** that the test probes syntactic.   – Clefting
      c. *What the test probes syntactic is **structure**.   – Pseudoclefting

(13) a. *...and **threw away the cake** he.   – Topicalization
      b. *It was **threw away the cake** that he (did).   – Clefting
      c. ??What he (did) was **threw away the cake**.   – Pseudoclefting

Examples (12a–c) suggest that the word *structure* alone is not a constituent, and examples (13a–c) that the finite VP *threw away the cake* is not a constituent.

2.2 Nonfinite VPs

Reeve (2018: 75–76) also points out that at times, the dependency analysis of sentence structure makes incorrect predictions. His message is that to be convincing, the dependency account would have to also correctly predict why certain dependency constituents fail the tests, such as nonfinite VPs headed by auxiliaries. An example sentence he discusses in this area is used here to illustrate his point (Reeve 2018: 76; I have adapted somewhat his dependency structural analysis to simplify and more clearly show what is at issue):

(14)
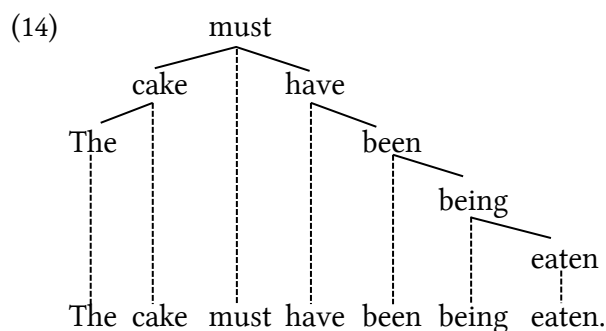
      a. *...and **have been being eaten** the cake must.
      b. *...and **been being eaten** the cake must have.
      c. ...and **being eaten** the cake must have been.
      d. *...and **eaten** the cake must have been being.

This dependency analysis makes three incorrect predictions concerning this set of examples, since it predicts all four of these examples to be possible, as in each case, the topicalized nonfinite VP is a dependency constituent. Reeve's argument in this area must be conceded insofar as the dependency account has to be augmented in order to determine which nonfinite VPs can and cannot be topicalized.

   However, one should again not lose sight of the big picture, that is, of the comparison across dependency and phrase structure. The phrase structure analysis makes the same three incorrect predictions with respect to the data set, since it too views nonfinite VPs as constituents. Hence, with respect to nonfinite VPs, both analyses come up short and must be augmented in some way to address the shortcoming.

   The big picture includes the status of individual words with respect to topicalization. Recall that phrase structure views each individual word as a constituent, whereas dependency sees

only those individual words as constituents that are not modified by any other word(s). In this area, dependency makes the correct prediction where phrase structure fails:

(14) e. *...and **must** the cake have been being eaten.
     (unacceptable as a declarative statement)
  f. *...and **have** the cake must been being eaten.
  g. *...and **been** the cake must have being eaten.
  h. *...and **being** the cake must have been eaten.

The dependency analysis correctly predicts ungrammaticality in these cases, whereas the phrase structure analysis must be augmented again to account for the fact that auxiliary heads cannot be topicalized alone without their complements. An additional datum that is problematic for the phrase structure analysis occurs when finite VP is topicalized (as mentioned in the previous section; see example 13a):

(14) i.   *...and **must have been being eaten** the cake.

The dependency analysis correctly predicts (14i) to be ungrammatical, whereas the phrase structure analysis must again augment its apparatus to account for this unexpected ungrammaticality.

Summarizing all the results just considered for Reeve's example sentence, nine instances of topicalization were produced, examples (14a–i). Of these nine, the dependency analysis makes the correct prediction in six of them, whereas the phrase structure analysis makes the correct prediction in just one of the nine cases. It should therefore be apparent that this big picture strongly supports dependency over phrase structure.

Reeve (2018: 75) also mentions VP-ellipsis in the context of his example sentence. The data delivered by VP-ellipsis contradict those delivered by topicalization, as the following data set illustrates:

(15) We think the cake must have been being eaten, and
  a. ? it definitely must ~~have been being eaten~~.
  b. it definitely must have ~~been being eaten~~.
  c. it definitely must have been ~~being eaten~~.
  d.?? it definitely must have been being ~~eaten~~.

Both dependency and phrase structure make mostly correct predictions with respect to this set of examples. When one probes further with such data, however, one again sees that dependency fares much better than phrase structure:

(15) We think the cake must have been being eaten, and
  e. *it definitely must ~~have~~ been being eaten.
  f. *it definitely must have ~~been~~ being eaten.
  g. *it definitely must have been ~~being~~ eaten.[2]

---

[2] Example (15g) can be acceptable on the reading where nothing is omitted. In such a case, the voice and aspect have changed.

The dependency analysis correctly predicts these attempts at ellipsis to fail, whereas the phrase structure analysis does not necessarily do the same. One might object here that VP-ellipsis necessarily elides a phrase, not just the head of a phrase. While this objection is based on a valid observation, it constitutes a clarification about the nature of the ellipsis mechanism implicated; the dependency analysis does not need this clarification.

To summarize my response to Reeve's argument that dependency makes incorrect predictions, he is right – but it makes many fewer incorrect predictions than phrase structure. Hence, augmenting the dependency apparatus to address the deviant data is going to take less effort than augmenting the phrase structure apparatus to do the same. Furthermore, one should not forget that the results of tests for constituents are known to be inconsistent, at times contradicting each other. My message is therefore that absolute accuracy and consistency in the predictions that each theory makes is unobtainable; the one theory (dependency) does, however, get one much closer to what the tests actually reveal than the other (phrase structure).

2.3 Pseudogapping

Transitive verbs taking complements are not DG constituents. Mackenzie draws attention to pseudogappiing as a source of contradictory data in this area, that is, to a source of support that one can in fact take individual transitive verbs as constituents, contrary to the DG analysis (Mackenzie 2018: 48). The relevant example from the focus article is (22h), given here as (16):

(16) *Drunks would ~~put off~~ the customers.   – Omission

The claim in the focus article is that the inability to omit *put off* in this case suggests that it is not a constituent. Mackenzie produces the next example to illustrate that *put off* can in fact be omitted if the context licenses the omission:

(17) Flower-sellers put off the staff, and drunks would ~~put off~~ the customers.

This example of pseudogapping strikes me as somewhat unsuccessful, but if a clear contrast is established using a comparative clause, it becomes perfect:

(18) Flower-sellers would put off the staff more than drunks would ~~put off~~ the customers.

It must be conceded that such instances of pseudogapping can be construed as supporting the status of *put off* as a constituent. There are, however, additional considerations that mitigate any conclusion based on such data from pseudogapping. Most importantly, the pseudogapping mechanism can easily elide strings that no approach to syntax would view as constituents (cf. Osborne et al. 2012: 386–390).

First, however, the standard use of the omission diagnostic is relevant. The omission diagnostic is usually employed in such a manner that does not involve a specialized context and can hence identify only those constituents that are standardly viewed as optional, e.g.

(19) a. The (very muscular) gentleman
         (next to me) lit a cigar.   (Burton-Roberts 1997: 14–15)
     b. This is (very) important (indeed).   (Quirk et al. 2010: 61)
   c. Mary arrived (in the afternoon).   (Sobin 2011: 33)

The strings in parentheses are optional, that is, they can be omitted without rendering the sentences ungrammatical. Such optionality is possible in the absence of a specialized context and hence easy to test.

The notion that pseudogapping can help identify constituents is problematic in view of examples like the following ones (I include the dependency analyses to make a point about the elided material):
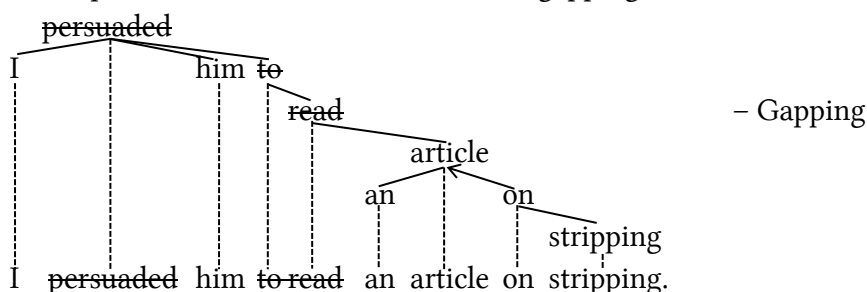
(20) My dog forces me to take her for a walk more often than

– Pseudogapping
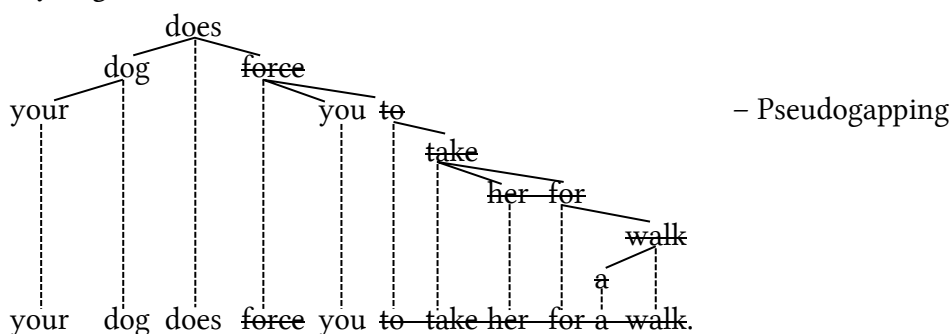
(21) Frank would give up studying syntax more readily than
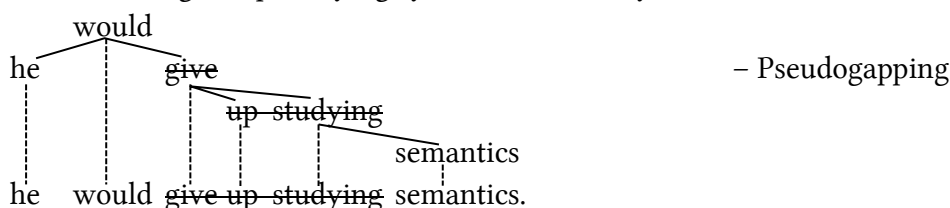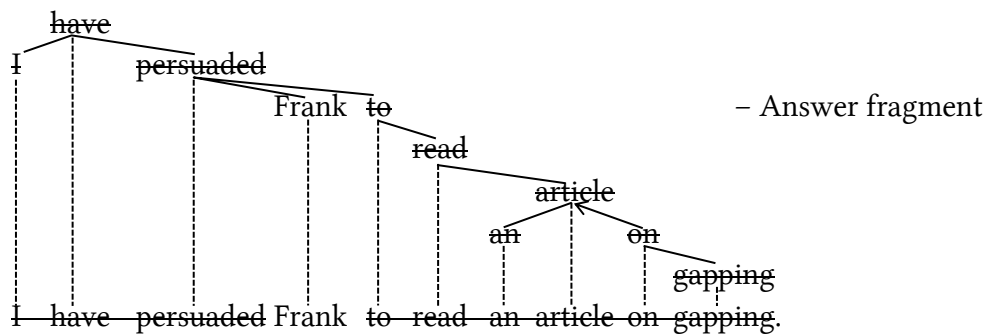

– Pseudogapping

The elided material indicated in these cases cannot be construed as forming constituents on most any approach to syntax. This fact is most vividly true of example (20), in which the pseudogapping mechanism has elided a non-string word combination. It is also true of example (21), where the verb combination *give up studying* cannot, to the exclusion of the object *semantics*, be construed as a constituent in most any approach to the syntax of English.

Pseudogapping is like gapping in its ability to elide word combinations that clearly do not form constituents, and the same goes for answer fragments and sluicing as well. In fact, most ellipsis mechanisms often elide non-constituent material, as in (22):
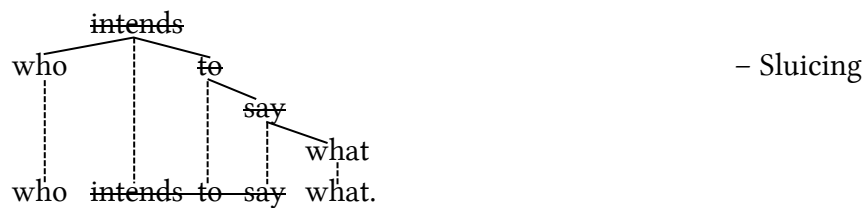
(22) Frank persuaded me to read an article on gapping, and

– Gapping

(23) Who have you persuaded to read an article on gapping?

~~have~~
I ~~persuaded~~
Frank ~~to~~   – Answer fragment
~~read~~
~~article~~
~~an~~ ~~on~~
~~gapping~~

I ~~have~~ ~~persuaded~~ Frank ~~to~~ ~~read~~ ~~an~~ ~~article~~ ~~on~~ ~~gapping~~.

(24) Someone intends to say something, but we don't know

~~intends~~
who ~~to~~   – Sluicing
~~say~~
what

who ~~intends~~ ~~to~~ ~~say~~ what.

The elided material in each of these examples cannot be construed as a constituent in most any approach to syntax. It does form a catena, however, as my co-authors and I have discussed and illustrated at length (see Osborne 2005: 275–285; Osborne et al. 2011: 343–347; Osborne et al. 2012: 379–391). The catena unit was mentioned in my focus article in the context of *one* and *do so* substitution (Sections 7.2 and 7.3), and it appears again below in Section 4.2.

2.4 Coordination

Müller (2018: 54–55) appeals to coordination as providing support for phrase structure. The crux of his argument is apparent with his example (5), given here as (25):

(25) a former professor in Stuttgart

This phrase is ambiguous: 'a person who used to work as a professor in Stuttgart' or 'a person who used to work as a professor elsewhere but now lives in Stuttgart'. Müller's point is that an X-bar-style phrase structure is warranted in such a case because the flatness of dependency structure cannot capture the ambiguity in an obvious way. The relevant structural analyses should be as follows:

(26) a. [a [former [professor in Stuttgart]]]

    b. [a [[former professor] in Stuttgart]]

These two analyses are congruent with an X-bar analysis, because such an analysis allows for the indicated flexibility in groupings. In contrast, the dependency analysis cannot accommodate the ambiguity because it allows for just the rather flat structural analysis, with *former* and *in Stuttgart* as sibling dependents of *professor*.

While the ambiguity Müller points to does seem to support phrase structure at first blush, considering a more extensive set of examples undermines this support:

(27) a former professor of linguistics in Stuttgart

    a. [A former] and [a current] professor of linguistics in Stuttgart sat next to each other.

    b. Hans is a former professor [of linguistics in Stuttgart] and [of political science in Tübingen]

    c. A [former instructor] and [current professor] of linguistics in Stuttgart was present.

It is difficult to see how an X-bar analysis could group the determiner *a* and the attributive adjective *former* together to the exclusion of the noun *professor* to accommodate the coordinate structure indicated in (27a). Similarly, the X-bar analysis that could group the PPs *of linguistics* and *in Stuttgart* together to the exclusion of the noun *professor* to accommodate the coordinate structure in (27b) is also not apparent. Example (27c) presents a somewhat different challenge to the X-bar analysis: it would require the adjective *former*, which is an adjunct, to combine with the noun *instructor* before *instructor* combines with the PP *of linguistics*, which is a complement, despite the fact that *former* necessarily scopes over *instructor of linguistics* (not just over *instructor*). The distinct readings of the starting noun phrase that would be necessary to motivate the distinct structural analyses in these cases are elusive.

To further establish the point, examine the next set of examples from German. Verb-final word order in subordinate clauses in German illustrates well the extent to which non-constituent strings can be coordinated:

(28) dass er sie zweimal gestern   zu erreichen versucht hat
     that he her twice   yesterday to reach   tried   has
     'that he tried to reach her twice yesterday'

    a. dass [er sie] und [sie ihn] zweimal gestern zu erreichen versucht hat
          he her   she him

    b. dass er [sie zweimal] und [mich dreimal] gestern zu erreichen versucht hat
            her twice   me   thrice

    c. dass er sie [zweimal gestern] und [dreimal heute] zu erreichen versucht hat
             twice   yesterday   thrice   today

    d. dass [er sie zweimal] und [sie ihn dreimal] gestern zu erreichen versucht hat
          he her twice   she him thrice

    e. dass er [sie zweimal gestern] und [mich zweimal heute] zu erreichen
              her twice   yesterday   me   twice   today
       versucht hat

    f. dass [er sie zweimal gestern] und [sie ihn zweimal heute] zu erreichen
           he her twice   yesterday   she him twice   today
       versucht hat

Further similar examples of this sort could easily be produced. Coordination is symmetric in these cases, and the intonation contour is standard, which means that the gapping or the Right Node Raising (RNR) mechanisms are likely not implicated. It should be apparent that it is impossible to produce a single phrase structure analysis that could view all of the bracketed strings as forming constituents simultaneously. If one chooses instead to allow for flexible
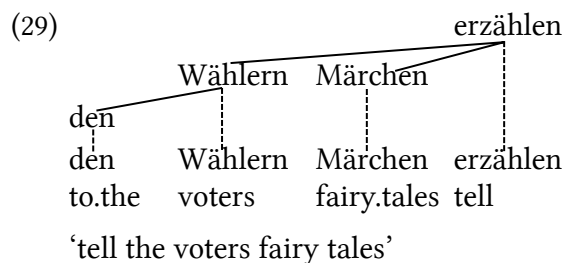
constituent structure, then one is faced with the difficulty of motivating the distinct structures in terms of the distinct readings associated with ambiguity.

The fuller sets of examples just considered suggest that the ambiguity in Müller's example (5), example (25) above, is not present in the hierarchy of syntactic structure. It is, rather, present purely in the linear dimension of organization. The attributive adjective *former* can scope over the string *professor* or over the string *professor in Stuttgart*. Both of these strings are what I have chosen to call *colocants* – much more about the colocant unit below in Section 4. On a related note, the fact that it is so easy to produce instances of symmetric coordination in which the coordinated strings clearly are not constituents has long motivated dependency grammars to abandon the stance that coordination necessarily operates on phrase structure constituents (e.g. Hudson 1988, 1990: 404–421; Lobin 1993; Osborne 2006a, 2006b, 2006c, 2008; Osborne & Groß 2017). These approaches all assume that coordination coordinates strings, some of which are non-constituent strings.
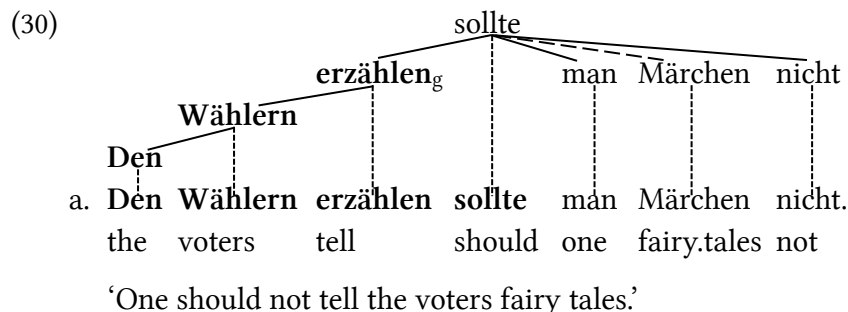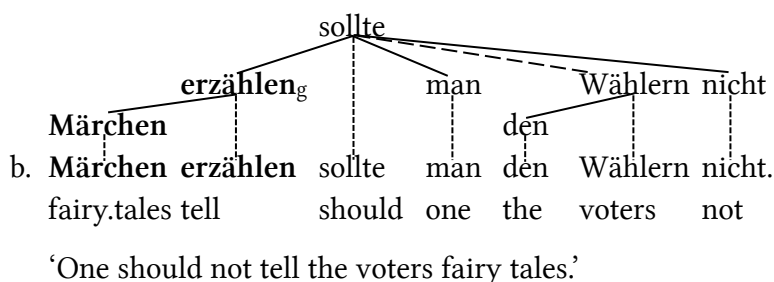
2.5 Fronting in German

Müller (2018: 56) draws attention to the ability to front 'partial constituents' in German. His two examples in this area are given below as (29a–b); I have added the dependency structural analyses that we, Thomas Groß and I, assign to them (following Groß & Osborne 2009, which Müller cites). Based on such data, one can construct an argument against dependency syntax because the fronted strings do not qualify as constituents in more canonical structures.

First, however, the neutral analysis of the core verb phrase is provided as a point of comparison:

(29)

den	Wählern	Märchen	erzählen
to.the	voters	fairy.tales	tell

'tell the voters fairy tales'

Müller's examples are next with the dependency analyses we assume added:

(30)

a. **Den Wählern erzählen sollte** man Märchen nicht.
the   voters   tell   should   one fairy.tales not

'One should not tell the voters fairy tales.'

b. **Märchen erzählen** sollte man den Wählern nicht.
  fairy.tales tell   should one the voters not

'One should not tell the voters fairy tales.'

Müller's point is that assuming that the neutral structure of the infinitival verb phrase is as shown in (29), the fronted strings in bold in (30a–b) cannot be construed as full constituents; they are, rather, 'partial constituents'. In Groß & Osborne (2009), we address this aspect of fronting (and other types of discontinuities) in German. Our solution to the problem is the notion of *rising*, which is indicated in these dependency analyses by the presence of the dashed dependency edges and the g-subscripts. The dashed dependency edge marks a constituent that has 'risen' and the g-subscript marks the governor of the risen constituent. The risen constituent takes a word as its head that is not its governor. This rising analysis of discontinuities results in dependency structures that are entirely projective (i.e. no crossing lines in the tree). Our analysis is in a sense similar to how movement is employed in many phrase structure grammars to address long distance dependencies, the result being essentially the same in that the resulting phrase structures are also entirely projective.[3]

The necessity to acknowledge the existence of these partial constituents must be conceded. Permutation diagnostics such as topicalization are more flexible in languages that have freer word order than English, such as German and the Slavic languages. I was aware of this issue when drafting my focus article, adding Section 8. The first paragraph of Section 8 is cited next:

> The discussion so far has focused on data from English. In this respect, one can object that the account of the tests for constituents above is not so relevant from a cross-linguistic point of view, since the extent to which the tests are relevant for other languages is not apparent. Some of the tests explored here may not be directly applicable to the syntax of other languages, especially languages with freer word order than that of English. The account here concedes this point, but the importance of this concession should not be overestimated. There are a couple of considerations that elevate the importance of the data from English, and one should also not ignore the fact that some of the tests employed above are likely valid for many other languages beyond English (Osborne 2018: 32.)

The difference between English and German suggested with examples (30a–b) is sometimes characterized in terms of *scrambling*. Languages that have relatively free word order like German and Russian allow scrambling, whereas relatively strict word order languages like English do not. In any case, the problem of how to address data such as (30a–b) confronts dependency and phrase structure syntax alike.

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[3] The terminology we (Groß & Osborne 2009) employ – e.g. *rising, risen constituent,* etc. – is to be understood metaphorically. Our DG is monostratal and representational. We do not posit a deep layer of syntax, transformations, or derivations that derive surface structures from underlying ones.

3. Conceptual objections

The next four subsections respond to each of the discussion notes individually. The issues addressed concerning each of the four have more to do with conceptual objections to the methodology and message in my focus article than with empirically motivated counterevidence (of the sort addressed in the preceding section).

3.1 Hudson

Richard Hudson's discussion note is brief (Hudson 2018). He makes two central points: the first is to disagree with the main message in my focus article that the combination of simplicity and accuracy (concerning the strings identified as constituents by the tests for constituents) gives dependency an advantage over phrase structure, although he characterizes my position in this area entirely in terms of "node counting" (Hudson 2018: 44). Hudson's second point draws attention to what he views as a valid argument in favor of dependency over phrase structure, namely the psychological reality of dependencies as opposed to the absence of this reality for phrase structure. Concerning this second point, there is full agreement. I also view the psychological reality of dependencies as an argument in their favor. Due to full agreement on this second point, the issues addressed in the next paragraphs focus on Hudson's first point.

Hudson characterizes my position entirely in terms of the counting of nodes, without addressing any of the extensive examples and discussion of the tests for constituents that constitute the bulk of my focus article. He does not engage with the tests, but rather he seems uninterested in what they might reveal about the nature of sentence structure, commenting instead that linguistics is more like psychology than astronomy, so parsimony is not so relevant for assessing linguistic theories. His reasoning in this area is difficult for me to grasp. Given two competing theories of how the mind works whereby both are capable of explaining and predicting mental processes, the simpler of the two is better. In other words, Hudson seems to be claiming that Occam's Razor has no import in psychology and linguistics.

Hudson concedes that in the past, he too has argued that parsimony is a strength of dependency syntax. To provide an example, the following passage is from his 2007 book, *Language Networks*:

> The contrast between the two approaches [dependency and phrase structure] can be seen in Figure 3.1, which makes the rather obvious point that dependency structures [...] are very much simpler than phrase structures. Of course, this is not in itself evidence for or against either theory, but other things being equal *we should presumably prefer the simpler analysis* [emphasis mine]. Since the early 1980s my view has been that the *extra nodes* [emphasis mine] are not only unnecessary, but undesirable because they make certain kinds of generalization harder to state. Since 1990, this view has been confirmed by other kinds of evidence – statistical and psychological – which I shall report later (Hudson 2007: 117.)

From early in his academic career, Hudson has been a strong and consistent advocate of dependency syntax – see especially his works from the early 1980s (Hudson 1980a, 1980b, 1984: 94–98), in which he explicitly argues that phrase structure is not needed (except for coordination). Hudson's views, reasoning, and arguments in this area have influenced my own position strongly, especially regarding the nature of coordination. As recently as 2016 (Hudson 2016: 660), Hudson was continuing to point to parsimony as an advantage of dependency syntax,
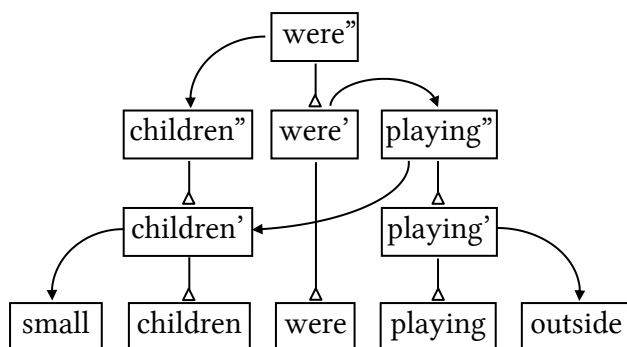
Figure 1. Hudson's (2017: 106) structural analysis of the sentence *Small children were playing outside.*

as he himself states. It is hence with some surprise and disappointment that I learn about his new position, namely that he no longer views the simplicity (as understood in terms of the number of nodes) as a strength of dependency syntax.

Hudson is now arguing that (something akin to) phrase structure is needed in Word Grammar (Hudson 2017: 104–108), a fact that Stefan Müller discusses in his discussion note (Müller 2018: 57–58) and in his book (Müller 2016: 401). Müller considers Hudson's new position, examining a key example from Hudson's (2017) article. Müller renders Hudson's full syntactic analysis of the sentence *Small children were playing outside* in terms of the conventions of phrase structure. Hudson's original diagram and Müller's phrase structure rendition thereof are given as Figure 1 and Figure 2.

For explicit statements about how Hudson's diagram is to be interpreted, see Hudson's (2017: 106) and Müller's (2018: 59) discussions thereof. What is important in the current context is the nodes in these diagrams. Both diagrams contain 11 nodes, six more than the number of words (11 vs. 5). Therefore, from the point of view of node counting, Hudson's diagram is a phrase structure analysis.

My understanding is that the impetus motivating Hudson to expand his Word Grammar apparatus in the direction of phrase structure is

Figure 2. Müller's (2018: 60) reinterpretation of Hudson's structural analysis in terms of X-bar conventions.

an old problem facing dependency syntax in general. This problem has to do with scope and the manner in which meaning is compositional. The problem is evident in the noun phrase *an ordinary French house*, which is the example Dahl (1980) produced in response to Hudson's (1980a) attack on phrase structure. Dahl argued that the additional nodes of phrase structure are necessary to accommodate the fact that *ordinary* scopes over *French house*, not just over *house*. This issue comes up again in Section 3.3 below where aspects of Müller's discussion note are considered. It is also taken up explicitly below in Section 4, where I sketch the manner in which the *colocant* unit can account for meaning compositionality and aspects of scope without recourse to the extra nodes of phrase structure.

3.2 Mackenzie

In his discussion note (Mackenzie 2018), Lachlan Mackenzie also does not engage with the main issue discussed in my focus article (dependency vs. phrase structure), but rather he critiques
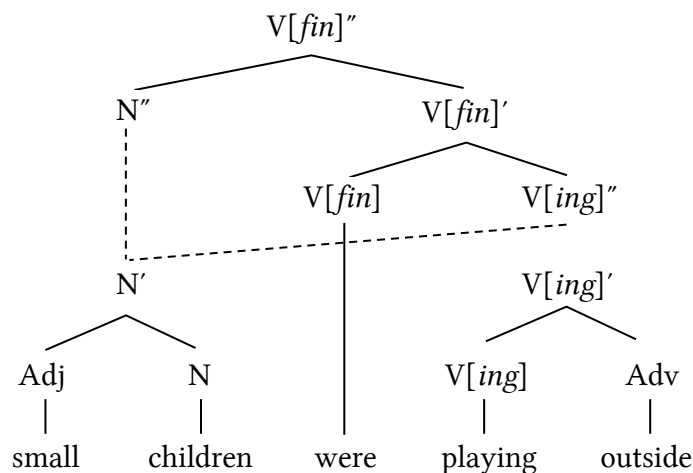
what he perceives as an erroneous assumption underlying the entire endeavor of the focus article. He characterizes this endeavor in terms of a tacit belief in autonomous syntax on my part and on the part of phrase structure grammarians who use the tests. His point is that tests for constituents should not be exacted on test sentences in the absence of considerations of meaning and context in which the sentences might appear. His critique is hence directed both at the dependency grammar in my focus article and at the phrase structure use and interpretation of the tests for constituents described in my focus article. A related point is that Mackenzie seems reluctant to acknowledge sentence structure of the sort represented using brackets and/or trees; he does not show the reader how atomic units of syntax, e.g. words, are grouped into larger units of syntax, phrases and clauses in the grammar framework he prefers.[4]

Nowhere in my focus article do I express a stance in favor of autonomous syntax. My personal view is that syntax, semantics, pragmatics, etc. are intertwined and that attempts to view each as an autonomous module of grammar are mistaken. It is impossible to produce syntactic analyses in the absence of meaning. In order to assign a structural analysis to a given sentence, one has to have at least some inkling of what the sentence means. If, for instance, I am confronted with an utterance in a language that is completely unknown to me, it is impossible for me to assign a syntactic structure to that sentence, for I cannot recognize modifier from modified and am therefore unable to acknowledge any groupings of the linguistic units involved. For the linguist who lacks exposure to Chinese, it is impossible to produce a syntactic analysis of the Chinese sentence 我用筷子吃饭. Compare this Chinese sentence to Chomsky's famous sentence *Colorless green ideas sleep furiously*.[5] As a native speaker of English, I can assign a meaning to each of the individual words of Chomsky's sentence, which enables me to recognize syntactic categories and thus to subject the sentence to a structural analysis. While the whole is nonsensical, I can nevertheless assign it a meaning, however metaphorical this meaning may be. The same is not true of the Chinese sentence, where there is a complete absence of ability to recognize and assign meaning.

Turning to Mackenzie's interpretation of the data delivered by tests for constituents, it is difficult for me to assess his points, since he couches his critique in his own grammatical framework, namely *Functional Discourse Grammar*, in which I am not versed. The points I am now going to make should therefore be viewed with my lack of exposure to FDG in mind.

My main difficulty concerns Mackenzie's notion of *subact* – the word *subact* occurs 26 times in his discussion note. In many of these 26 cases, I can replace *subact* with *constituent* to help make the point at hand more accessible to me. In this respect, I wonder how many subacts one can acknowledge in a given sentence. For instance, Mackenzie discusses the first example sentence in my focus article, *Trees can show syntactic structure*. He comments that the string *show syntactic structure* contains two potential topics, each of which is a subact, the referential subact *syntactic structure* and the ascriptive subact *show*. At the same time, the former subact, i.e. *syntactic structure*, can itself NOT be divided into two smaller subacts, *syntactic* and *structure*, because neither word alone can be topicalized.

---

[4] In a personal communication, Mackenzie comments that he did not do this because that was not the/a goal of his discussion note and there was not necessarily room to do it. He points to a recent book chapter where such details about his syntactic approach are indeed provided (Mackenzie 2019).

[5] Chomsky's (1957) intent with this sentence was to demonstrate that a sentence can be syntactically well-formed, yet nonsensical.

The question I am entertaining with these comments is whether Functional Discourse Grammar's understanding of syntax is more aligned with dependency or phrase structure. On the one hand, the fact that the verb *show* alone corresponds to a subact suggests that the subact is closer to the phrase structure constituent than to the dependency constituent. On the other hand, the fact that Mackenzie does not divide *syntactic structure* into the two smaller subacts, *syntactic* and *structure*, suggests his understanding of sentence structure is more aligned with dependency than with phrase structure because dependency cannot view each of the two words alone as a constituent. This question about whether Functional Discourse Grammar is more a phrase structure grammar or a dependency grammar must, however, be answered by those versed in Functional Discourse Grammar.

Mackenzie offers alternative explanations for why certain target strings cannot be confirmed as constituents/subacts using the tests, and these explanations are plausible. This plausibility does not contradict my claims about constituent structure, however, but rather the two types of explanations dovetail. Consider example (22d) from my focus article, given here as (31):

(31) What would drunks do concerning the customers? – *Put off.

Mackenzie explains the ungrammaticality of the answer fragment *Put off* in terms of the strongly transitive nature of the phrasal verb *put off*; it necessarily takes an object. While this explanation is correct, it does not detract from, or otherwise contradict, the observation that *put off* is NOT a dependency constituent and that most of the tests confirm that it is not a constituent.
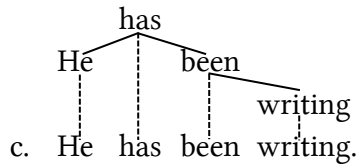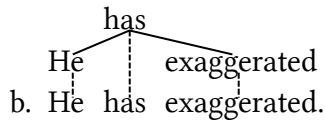
At other times, Mackenzie misinterprets what the tests reveal. For instance, he observes that the phrasal verb *put off* cannot be questioned as just illustrated with example (31) and he states that "English cannot question a verb" (Mackenzie 2018: 48). This claim is incorrect;[6] English can question many verbs if the verb is nonfinite and lacks dependents, that is, if it is a dependency constituent, e.g.

(32) a. What will Fred do tomorrow? – Relax.
     b. What has Fred now done? – Exaggerated.
     c. What has Fred been doing? – Writing.

The dependency analyses of the full sentences corresponding to each of these answer fragments are as follows:
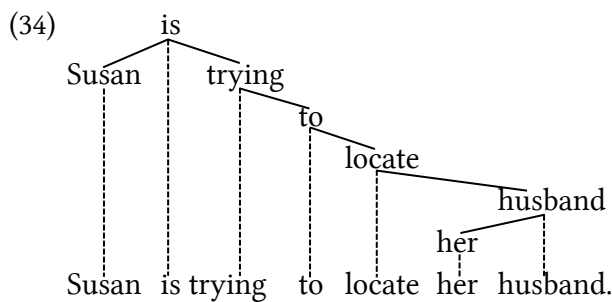
(33)

a. He will relax.

---
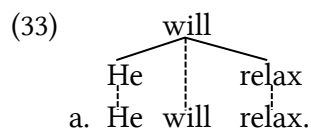
[6] In a personal communication, Mackenzie clarifies his point concerning the ability to question a verb. He states that English lacks a single-word verbal proform of the sort that exists in other languages such as Chukchi, e.g. *Req*-ərkən-əm 'do.what?-PROG-EMPH', cited from Idiatov & van der Auwera (2004).

```
         has
  He          exaggerated
b. He  has  exaggerated.
```

```
         has
  He          been
                      writing
c.  He   has  been  writing.
```

In each of these structures, the content verb alone is a dependency constituent because it lacks dependents of any sort.

Mackenzie also misinterprets the nature of the questions that elicit fragment answers. Mackenzie (2018: 48) states that "On occasions, even the sentences that prompt the test seem ungrammatical." This insight is correct, but it should not be interpreted in such a manner that the test itself is faulty, but rather it is indicative of whether the target string is or is not a constituent. It is at times difficult to form *ex situ wh*-questions that target non-constituent material, and this difficulty is an indication that the target string is not a constituent to begin with.

Observe the following dependency analysis and corresponding examples in this regard:

```
(34)            is
      Susan        trying
                          to
                              locate
                                        husband
                                  her
Susan   is trying    to  locate  her  husband.
```

    a. Who is trying to locate her husband? – Susan.
    b. Who is Susan trying to locate? – Her husband.
    c. What is Susan trying to do? – Locate her husband.
    d. What is Susan trying to do? – ?To locate her husband.
    e. What is Susan doing? – Trying to locate her husband.

Of the six constituents shown in the dependency tree, only the possessive determiner *her* clearly cannot be questioned and then appear alone as an answer fragment (not illustrated). Switching to the target strings in (34) that are not shown as dependency constituents, it is impossible in most cases to form an *ex situ* question that could focus those strings, e.g.

    (34) f. What is Susan doing to locate her husband? – *Trying.
         g. What is Susan trying to do about her husband? – *Locate.
         h. What is Susan doing about her husband? – *Trying to locate.

There is a mismatch in these cases insofar as the question each time, while it is a perfectly good question, is focusing something other than what appears as the answer fragment. The difficulty

in such cases is that it is impossible to form standard questions that could focus the indicated strings (because those strings are not dependency constituents).

The difficulty is even more evident when one tries to form a question that could focus the particle *to*, which is a phrase structure, but not a dependency, constituent. Even the *in situ wh-*question fails in such a case:

(34) i. *Susan is trying what locate her husband? – *To.

The point to all these examples is that a majority of dependency constituents can serve as answer fragments elicited by standard *ex situ wh*-questions, whereas the same is not true of phrase structure constituents. In fact, a majority of phrase structure constituents cannot be questioned. Mackenzie's comment concerning the difficulty in forming a sentence that prompts the test is also indicative of whether or not the target string is a dependency constituent; it offers further support to the dependency understanding of constituent structure.

I hope that my comments above help motivate functional grammarians to engage with the dependency vs. phrase structure distinction, and in so doing, to determine whether functional grammars are better served by dependency or phrase structure.

3.3 Müller

Stefan Müller (2018) critiques the message in my focus article in a number of respects. His objections are both empirical and conceptual in nature. Two of his empirical objections have been addressed above in Sections 2.4 (coordination) and 2.5 (fronting in German). Concerning his main conceptual objections, I recognize four main critiques, which I paraphrase and summarize in the following manner:

1) Individual words are constituents by default, that is, by virtue of the simple fact that they are recognizable parts of larger units, phrases and sentences.
2) Some prominent dependency grammarians (Lucien Tesnière and Richard Hudson) have seen the need to employ (some measure of) phrase structure to address the manner in which meaning is constructed compositionally.
3) My (Osborne's) dependency grammar is not formalized, a significant shortcoming.
4) My (Osborne's) dependency syntax does not address the manner in which meaning is constructed compositionally; it does not, for instance, address aspects of scope.

Critiques 2–4 reach far beyond my focus article, taking issue with central aspects of the body of my works on dependency syntax. In this respect, I would like to draw attention to the main caveat that I included in Section 2 of my focus article (Osborne 2018: 8):

> Minimalism of theoretical apparatus is of course of no benefit if this minimalism is incapable of shedding light on the phenomena under scrutiny, for complexity of theoretical apparatus may be necessary in order to address complex phenomena. The proponents of dependency syntax must concede this objection in general. In the specific area explored in this article, however, dependency syntax need concede nothing, since as suggested above with examples (1–9) and as established in much detail below, the minimal dependency structures are in fact more in line with what most tests for sentence structure actually reveal about the nature of syntactic structure in English.

These statements were intended to keep the debate concentrated on tests for constituents and what they reveal about the structure of English sentences. Hence, in order to address Müller's critiques 2–4, it will be necessary to expand the discussion considerably to areas that were not targeted in my focus article.

Concerning the first point just listed, Müller adopts the stance that individual words are constituents by default, he writes:

> In the case of words, the question of constituent status is trivially decided: constituents are parts of a larger structure and since all more complex structures consist of words (ignoring the possibility of having affixes as parts of syntax), words are constituents... (Müller 2018: 54.)

This default position is certainly correct from the viewpoint of phrase structure syntax, but it is a byproduct of the phrase structure starting point. Only when confronted with the alternative analysis of sentence structure that dependency brings to the table does this default position come into question. In any event, tests for constituents are the standard means by which phrase structure syntax identifies constituents. As I demonstrate in my focus article, most of the tests fail to identify most individual words as constituents, a fact that I will not demonstrate again here, since copious examples of this point are provided in my focus article (see examples 22– 25 there).

The discussion now turns to the second point listed above, namely that some prominent dependency grammarians have reached to phrase structure to address how meaning is constructed. Müller discusses one of Tesnière's stemmas in this regard and then turns to Hudson's recent article on pied-piping (Hudson 2017), in which Hudson augments his Word Grammar apparatus by adding nodes that can be construed as a type of phrase structure – see Section 3.1 above. I agree with Müller's point in this area insofar as I also think that Hudson has introduced a type of phrase structure into his Word Grammar framework. I disagree, however, insofar I do not think that phrase structure is needed to accommodate the manner in which meaning is constructed compositionally. I address this matter further below in Section 4.

Müller's discussion of Tesnière's 'polygraph' stemma (Tesnière 1959: Stemma 149) focuses on a related point, namely that Tesnière augmented his syntax in order to address an aspect of meaning compositionality in noun phrases.[7] While it is true that Tesnière considered augmenting his account of the structure of noun phrases in terms of the 'polygraph' analysis, the claim that such an analysis is like an X-bar analysis is not correct. The pure dependency tree of Tesnière's polygraph example *red cars that you saw yesterday* appears next. A phrase structure rendition thereof and Tesnière's actual polygraph analysis then follow for easy comparison:

(35)

a.   – Pure dependency analysis

b.   – A pure phrase structure rendition

---

[7] *Stemma* is the term Tesnière used to denote his sentence diagrams.

cars

c. red   that you saw yesterday   – Tesnière's polygraph
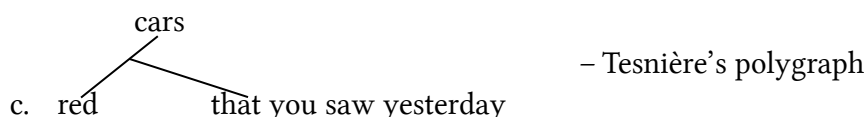
These structural analyses are distinct. Tesnière's polygraph is a hybrid structure, combining both dependency and phrase structure. This point becomes evident when one renders each tree in terms of brackets, whereby a node in the tree corresponds to a pair of brackets:

(36) a. [[red] cars [that you saw yesterday]]   – Pure dependency analysis
     b. [[[red] [cars]] [that you saw yesterday]] – Pure phrase structure analysis
     c. [[[red] cars] [that you saw yesterday]]   – Hybrid polygraph analysis

There are three sets of brackets in (36a), five in (36b), and four in (36c). Of these three analyses, only the pure dependency analysis completely identifies heads and dependents; it shows *cars* as head over both *red* and *that you saw yesterday*. The phrase structure analysis (36b), in contrast, provides no guidance concerning heads and dependents. The polygraph analysis (36c) occupies an intermediate position between the two insofar as it identifies *cars* as head over *red*, but fails to indicate whether *red cars* should be construed as head over *that you saw yesterday* or vice versa. For these two latter analyses to completely identify heads and dependents, the brackets can be augmented with node labels, e.g. *[NP [N' [A red] [N cars]] [CP that you saw yesterday]]* and *[NP [N [A red] cars] [Rel that you saw yesterday]]*.

Müller's discussion of Tesnière's unique stemma, one of the 366 that Tesnière produced in his main oeuvre (Tesnière 1959), overlooks an important aspect of Tesnière's position toward phrase structure. I argue in the introduction to the translation Müller cites (Kahane & Osborne 2015) and elsewhere (Osborne 2013) that Tesnière's transfer schema is a manifestation of phrase structure. Tesnière devoted almost half his massive volume *Éléments de syntaxe structural*, approximately 300 pages, to discussing transfer, and he produced countless stemmas illustrating it, as opposed to just the one "polygraph" stemma. Hence, my position, as the primary translator into English of Tesnière's volume, is that Tesnière's grammar is a hybrid, combining dependency and phrase structure extensively. It is important in this regard to be aware that Tesnière himself did not set out to produce a dependency grammar. Awareness of the distinction between dependency and phrase structure was first established in the 1960s – Tesnière died in 1954 – as Tesnière's ideas were being received and evaluated. Thus, my response to Müller pointing out that Tesnière saw the need to use phrase structure is, well, yes, but much more extensively than the one "polygraph" stemma implies.[8]

Müller's third main critique of my works points to the absence of formalization (Müller 2018: 59). Müller goes so far as to state that "they [Osborne's theories] are not even theories" (Müller 2018: 56). Müller's trust in the value of formalization in linguistics is greater than my own. For me, formalization of linguistic ideas, insights, and concepts should occur sparingly,

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[8] In a personal communication, Müller disagrees with my characterization of his discussion of Tesnière's polygraph example. He comments at this point as follows:

What I did with this example was pointing out that there is complexity in the data that was acknowledged by Tesnière but not by you. Acknowledging it results in more complex theories. PSG is one way to go. You do not provide one and have to augment your theory. Until this is done, no comparison is possible.The necessary augmentation of the DG apparatus that this comment points to is provided below in Section 4.

and when it does occur, it should be accompanied by examples and much discussion of these examples in plain language. Heavily formalized accounts of linguistic phenomena are difficult to access for the average linguist. When I encounter them, the suspicion often arises that obfuscation is occurring, that is, the linguist behind the formalizations does not have much to say that is insightful because if they did, they would choose to express those insights in a manner that is accessible to a wider audience.

The fourth main critique Müller expresses concerns the extent to which dependency syntax is capable of addressing aspects of scope and meaning compositionality. Müller's critique in this area is warranted. Some in the dependency grammar community have been aware of the difficulty for decades, at least since Hudson (1980a, 1980b) and Dahl (1980) discussed it in their exchange from 1980. The issue is taken up in Section 4 below, where I sketch the problem and my solution to it.

3.4 Reeve

Matthew Reeve's discussion note contains a number of counterarguments pointing to the necessity of at least some measure of phrase structure. These counterarguments have been addressed in sections 2.1 (echo questions) and 2.2 (non-finite VPs), and yet more of his counterarguments are addressed below in Sections 4.4 and 4.5 (scope of adverbs). An interesting aspect of Reeve's position in these matters is that he does not deliver a full-throated defense of phrase structure, but rather he takes an intermediate position between dependency and phrase structure. He comments that in line with dependency syntax, "the head-phrase distinction posited within PSGs is unnecessary" (Reeve 2018: 69). His intermediate position should be evaluated with Michael Brody's (2000a, 2000b, 2003) *Mirror Theory* in mind, which Reeve sees as in some sense ideal in that it combines the advantages of both dependency and phrase structure at the same time that it avoids the drawbacks of each.

My exposure to Brody's works is superficial, so I cannot assess with confidence the extent to which his approach to syntax can be deemed in line with dependency syntax, phrase structure syntax, or a hybrid syntax of some sort. I will instead cautiously express my skepticism that his approach can be construed as close to dependency syntax. I base my skepticism in part on Reeve's own assessment of Brody's Mirror Theory (MT). Reeve writes:

> MT is particularly interesting in that it is in a sense intermediate between Minimalism and DG. On the one hand, it is like O[sborne's]-DG in that it rejects the distinction between heads and phrases (a property Brody 2000a, 2000b refers to as Telescope), and allows spell-out of nonterminal nodes. On the other hand, MT is like Minimalism, and unlike O-DG, in postulating a relatively 'abstract' syntactic structure in which *the number of nodes is normally larger than the number of words, and in adopting a maximally binary-branching structure (i.e., a mother node has no more than two daughter nodes)* [my emphasis] (Reeve 2018: 69.)

The fact that Brody's syntax does not allow the number of branches reaching down from a node to exceed two is the main source of my skepticism. Given this restriction to unary (one branch) or binary (two branches) branching, Brody's structural analyses must be quite layered, and hence quite unlike the relatively flat structures that dependency necessitates.

Also noteworthy is the existence of multiple phonologically null nodes, i.e. nodes that do not correspond to sounds actually produced by the speaker Reeve's example (4) is reproduced

in Figure 3. This tree shows the *Mirror Theory* analysis of the simple sentence *John writes poems*. The nodes in red are those associated with the verb *writes*. The nodes marked as *v* and V here are unary branching, and the T and V nodes are phonologically null. Dependency syntax rejects the existence of phonologically null nodes as a matter of principle.

Figure 4 contains Reeve's example (14). Concerning Reeve's account of this tree, he states that it "corresponds both to the O-DG and MT analyses" of the sentence (Reeve 2018: 76), although he clarifies that he has "abstract[ed] away from the structure underlying each auxiliary and its inflectional affix for ease of presentation" (Reeve 2018: 75) – note that the example was discussed above in the context of nonfinite VPs (see example 14) .

The second tree (Figure 4) is almost entirely dependency-based. The only points where a measure of phrase structure is arguably present concern the indication of branching underneath V. Observe, however, that there are four instances of unary branching in the tree (at the nodes Perf, Asp_perf, Asp_prog, Voice). The question I have in this regard concerns the phonologically null nodes that Reeve has suppressed from the tree. Based on the tree in Figure 3, which shows three nodes (T, *v*, V) corresponding to the verb *writes*, there may be one or more phonologically null nodes corresponding to each of the auxiliary verbs. As stated above, most dependency grammars reject phonologically null nodes as a matter of principle, and if they do assume they exist, it is usually in the context of ellipsis.

To summarize my points, I am skeptical that Brody's Mirror Theory has much affinity with dependency syntax. The necessity that all branching be at most binary and the presence of multiple phonologically null nodes are inconsistent with tenets of dependency syntax. To more confidently assess the extent to which Brody's syntax is aligned more with dependency or phrase structure syntax requires more complete tree analyses and/or the use of brackets to indicate how units of syntactic structure are grouped.

4. Scope and meaning compositionality

The discussion above has repeatedly drawn attention to a weakness associated with dependency syntax. This weakness is the perceived inability of the relatively flat dependency structures to account for the manner in which meaning is constructed compositionally. Müller and Reeve both draw attention to this issue. Müller explicitly mentions it, providing an example with the associated tree structures. Reeve references the problem less directly when he points out that
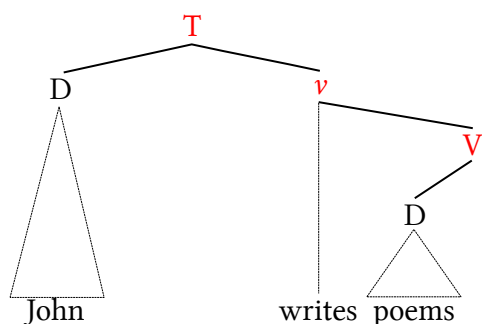

Figure 3. Reeve's (2018: 71) example (4) illustrating the basic architecture of Brody's Mirror Theory
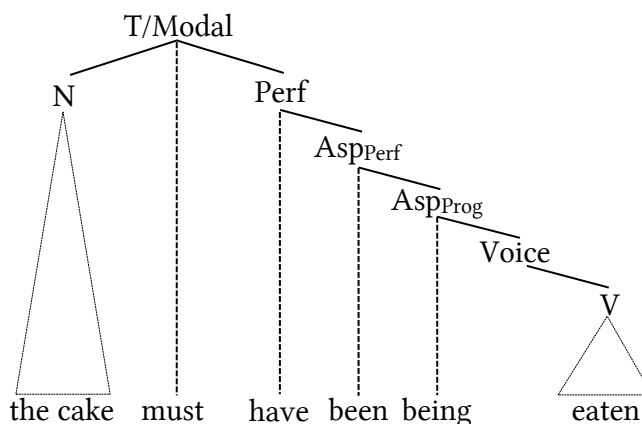

Figure 4. Reeve's (2018: 76) example (14) illustrating the structure of a sentence containing multiple auxiliaries

phrase structure is needed to account for the distribution and scope of adverbs. The problem may have been first pointed out by Dahl (1980) when he defended phrase structure against Hudson's (1980a) attack. The key example Dahl produced was *an ordinary French house*, where it is clear that *ordinary* scopes over *French house*, not just over *house*. In this section, I propose that the *colocant* unit is the means by which dependency syntax can, despite its minimal structures, address aspects of scope and ultimately, the manner in which meaning is constructed compositionally.

4.1 Entailments

The issue at hand is evident when one considers the competing dependency (37a) and phrase structure (37b) analyses of Dahl's example:

(37)

                      N

        D   A   A

    a. an ordinary French house

              NP

        D   N'

           A   N'

                A   N

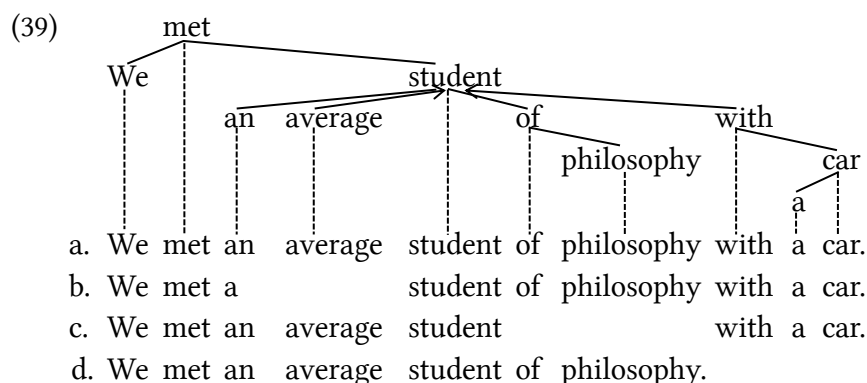   b. an ordinary French house
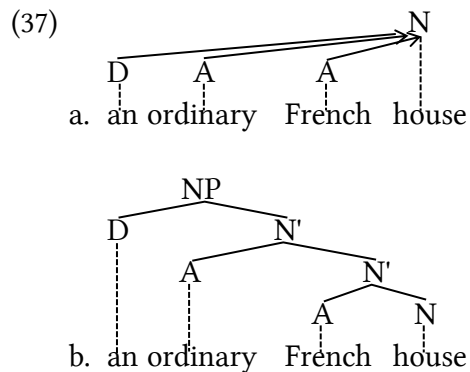
The flatness of the dependency analysis seems to incorrectly predict that the house is both an ordinary house and a French house, whereas the phrase structure analysis does not have this problem because *French* and *house* form a constituent together over which *ordinary* scopes. The issue can be characterized in terms of entailments. The flat dependency analysis seems to incorrectly predict that sentence (38a) should entail both sentence (38b) and sentence (38c):

(38) a. Jean wants an ordinary French house.
      b. Jean wants a   French house.
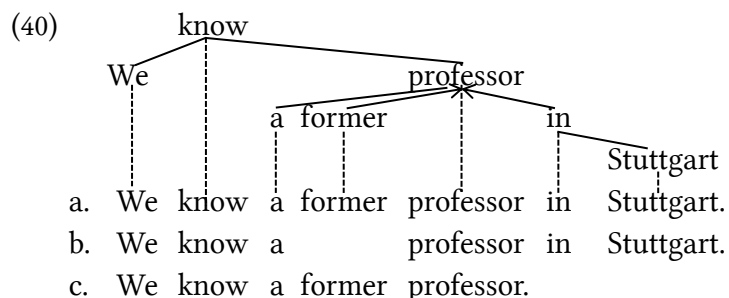   c. Jean wants an ordinary   house.

While sentence (38a) does entail sentence (38b), it does not entail sentence (38c). The phrase structure analysis appears to predict this entailment pattern, since it views *French house* as a sibling constituent of the adjective *ordinary*, meaning that *ordinary* necessarily scopes over the two words *French* and *house* together.

    When a post-dependent appears on the noun, ambiguity can occur, whereby the ambiguity is a function of the scope of the noun's pre-dependent, e.g.

(39) met
　　　We　　　　　　　student
　　　　　　an　average　　　　of　　　　　with
　　　　　　　　　　　　　　　philosophy　　　　car
　　　　　　　　　　　　　　　　　　　　　　　a

    a. We met an　average　student of philosophy with a car.
    b. We met a　　　　　　　student of philosophy with a car.
    c. We met an　average　student　　　　　　　with a car.
   d. We met an　average　student of philosophy.

Sentence (39a) is ambiguous, the ambiguity being a function of the scope of *average*; it can scope over *student of philosophy*, in which case the student is an average student of philosophy who just happens to have a car, or it can scope over *student of philosophy with a car*, in which case the student is average among those students of philosophy who have cars. Sentence (39a) entails sentence (39b), but it does not entail sentence (39c), and it can be construed as entailing sentence (39d) only on the reading in (39a) where *average* scopes over just *student of philosophy*.

Returning to Müller's example from Section 2.4 above, the ambiguity is of a similar nature, but there is no complement prepositional phrase (PP) present, but rather just an adjunct PP:

(40)　know
　　　We　　　　　professor
　　　　　　a former　　　in
　　　　　　　　　　　　　Stuttgart

    a. We know a former professor in　Stuttgart.
    b. We know a　　　　professor in　Stuttgart.
    c. We know a former professor.

The ambiguity arises from the potential scope of *former*; it extends either over just *professor* or over *professor in Stuttgart*. Interestingly, sentence (40a) does not entail sentence (40b), but it does entail sentence (40c) on either reading.

To summarize the scope facts in examples (37–40), the ambiguity each time arises from the ability of the attributive adjective to scope over strings of varying length. Each time the adjective necessarily scopes over any material between it and its head noun and, if the noun takes a complement, over that complement as well, and it optionally scopes over any adjunct following the complement. The scope of the relevant attributive adjectives is shown schematically as follows:

(41)　　　　　　　　N
　　　Det. X1　(X2…)　　(Comp)　(Adjunct…)
　　　　　　　A
　　　　　　　　　B
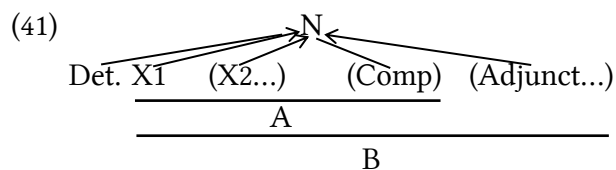
The scope of X1 necessarily extends over the underlined string marked with A, and it optionally includes the additional underlined material marked with B. These strings marked as A and B are colocants.

4.2 Colocants

The solution to this problem posed by Dahl's example and the further examples just considered is the *colocant* unit. Meaning is constructed in terms of colocants, whereby the relevant colocant at hand need not be a constituent. A colocant is a particular type of *component*. An understanding of these units is established in terms of a set of similarly defined units of dependency syntax. The presentation that follows is closely similar to what one finds in Osborne et al. (2012: 358–360) and Osborne and Groß (2016: 117–118; 2018: 167):

> **String**: A word or a combination of words that are continuous in the linear dimension (precedence, X-axis).
>
> **Catena**: A word or a combination of words that are continuous in the hierarchical dimension (dominance, y-axis).
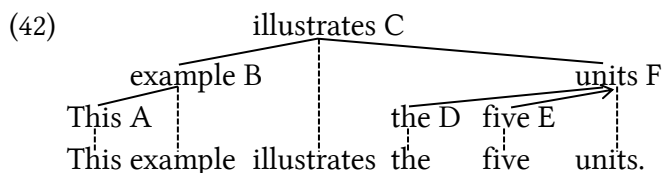>
> **Component**: A word or a combination of words that are continuous in both the linear and hierarchical dimensions (precedence and dominance, x- and y-axes)
>
> **Constituent**: A component that is complete

A component is complete if it includes all the words that its root word dominates. Now, for the first time, I propose acknowledging a fifth, similarly defined unit of dependency syntax, the *colocant*:

> **Colocant**: A component that is complete insofar as it includes all the words that its non-root words dominate.

The following dependency tree illustrates these units of dependency syntax. The capital letters serve to abbreviate the words:

(42)

```
                    illustrates C
         example B                    units F
  This A                    the D  five E
  This example  illustrates  the    five    units.
```

Including the whole each time, all the distinct strings, catenae, components, constituents, and colocants in this tree are listed next:

21 distinct strings in (42)
A, B, C, D, E, F, AB, BC, CD, DE, EF, ABC, BCD, CDE, DEF, ABCD, BCDE, CDEF, ABCDE, BCDEF, and ABCDEF

24 distinct catenae in (42)
A, B, C, D, E, F, AB, BC, CF, DF, EF, ABC, BCF, CDF, CEF, DEF, ABCF, BCDF, BCEF, CDEF, ABCDF, ABCEF, BCDEF, and ABCDEF

14 distinct components in (42)
A, B, C, D, E, F, AB, BC, EF, ABC, DEF, CDEF, BCDEF, and ABCDEF
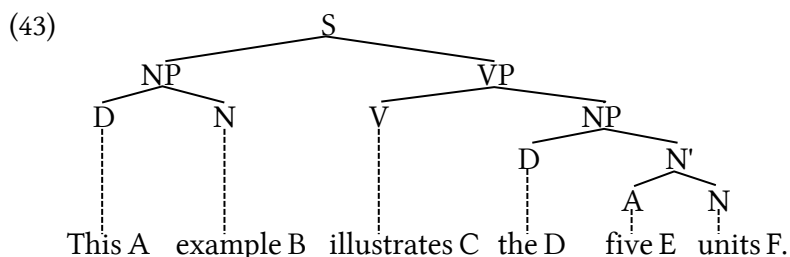
6 distinct constituents in (42)

A, D, E, AB, DEF, and ABCDEF

12 distinct colocants in (42)

A, B, C, D, E, F, AB, EF, ABC, DEF, CDEF, and ABCDEF

To provide some perspective for these numbers, there are all told 63 (=2^6-1) distinct combinations of the words in example (42).[9]

These units of dependency syntax can be compared with the distinct constituents of the phrase structure analysis:

(43)

Including the whole again, the distinct constituents present here are listed as follows:

11 distinct constituents in (43)

A, B, C, D, E, F, AB, EF, DEF, CDEF, and ABCDEF

These phrase structure constituents overlap almost completely with the colocants in (42), the one exception being the string ABC, which is a colocant but not a phrase structure constituent.

The strings present on both analyses, dependency structure and phrase structure, are of course the same ones, strings being unimpacted by hierarchical organization. The constituent unit defined and compared here is the subject of my focus article. The catena unit has been the target of much research (e.g. O'Grady 1998; Osborne 2005; Osborne et al. 2012; Osborne & Groß 2012; Groß 2014), and it plays a role in Sections 7.2 and 7.3 of my focus article, where the distributions of *one* and *do so* are considered. The component unit is the subject of current research efforts (Niu & Osborne 2019).

4.3 Compositionality

The colocant unit allows dependency syntax to characterize the manner in which meaning is constructed compositionally while the assumed syntactic structures remain minimal and relatively flat. The meaning of a given head node is compositionally determined by its meaning plus the meaning of its dependents. In other words, the meanings of the dependents are added to that of their head word, as Müller (2018: 58) suggests is necessary for dependency syntax to address meaning compositionality. When the meaning of a dependent is added to the meaning of the head word or to the meaning that has accumulated at the head word, the two together form a colocant. Nuanced meaning differences that arise in the area are due to the order in

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[9] The total number of distinct combinations of the words in a given sentence is calculated by the formula 2^n-1, where n is the number of words.

which the dependents' meanings are added to the meaning of their head word, giving rise to subtle ambiguities associated with scope phenomena.

The next schema illustrates the flexibility of meaning compositionality in noun phrases. X1 and X2 are pre-dependents of the noun (i.e. dependents of the noun that precede it), and X3 and X4 are its post-dependents (i.e. dependents of the noun that follow it). Assume in this case that X3 is a complement of the noun and that X1, X2, and X4 are adjuncts. The meaning of the noun phrase can be composed in three different orders. The {}-brackets are used to mark colocants and the order in which the meaning can be composed in terms of these colocants:[10]

(44)

$$N$$

X1 X2   X3 X4

  a. {X1 {X2 {{N X3} X4}}}
  b. {X1 {{X2 {N X3}} X4}}
  c. {{X1 {X2 {N X3}}} X4}
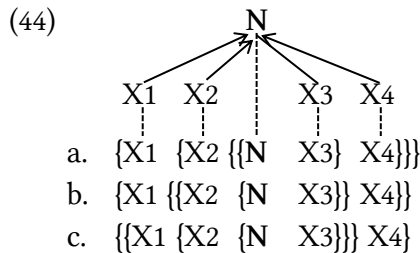
Since X3 is a complement, its meaning is added to that of the noun N first.[11] Thereafter, there are three distinct orders in which the meanings of the adjunct dependents X1, X2, and X4 are added to the combined meaning at the N node. The flexibility with which the meanings of the dependents of N are added to the cumulative meaning at N gives rise to nuanced ambiguity, in this case potentially to a three-way ambiguity. What occurs is akin to *currying*.[12] Instead of the meanings of the dependents all being added to the head N node simultaneously, they are added one at a time in succession.

This understanding of the compositionality of meaning in dependency syntax should be compared to that of Hudson (2017), which was discussed briefly in Section 3.1 above. The two approaches to meaning compositionality are similar. The difference lies with the number of nodes assumed. Hudson introduces the additional nodes to characterize how meaning is composed, whereas the current account avoids these extra nodes by appealing to the colocant unit instead.
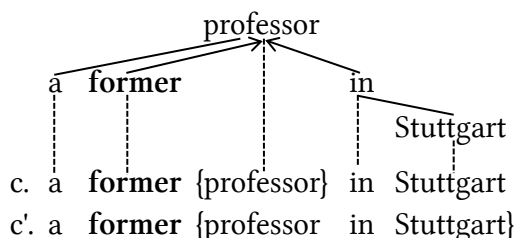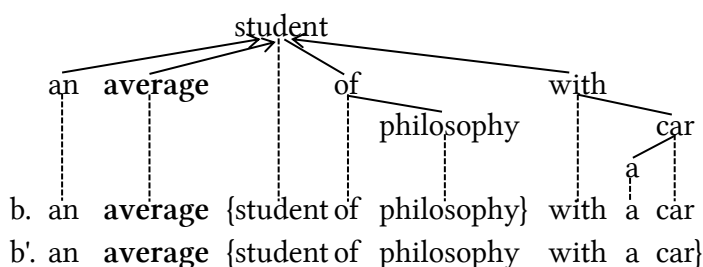
4.4 Scope of adverbs

The dependency trees in (45) are of the noun phrases discussed in Section 4.1. The relevant string that constitutes the scope of the bolded adjective each time is marked with {}-brackets and is a colocant:

(45)

house

an **ordinary** French

  a. an **ordinary** {French house}

---
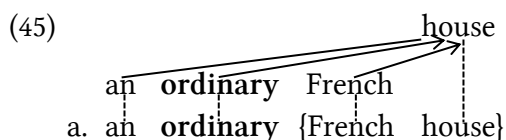
[10] An important distinction is that between {}-brackets to mark colocants and []-brackets to mark constituents. The latter appear above marking constituents, in the manner that is standard in the field of syntax.

[11] This aspect of the account is consistent with the strong lexicalism of most DGs. The meanings of the valents of a given valency carrier are added to valency-carrier's meaning before that of adjuncts.

[12] Concerning currying, see the Wikipedia article on the topic: https://en.wikipedia.org/wiki/Currying

student
an **average** of with
philosophy car
a

b. an **average** {student of philosophy} with a car
b'. an **average** {student of philosophy with a car}

professor
a **former** in
Stuttgart

c. a **former** {professor} in Stuttgart
c'. a **former** {professor in Stuttgart}

To accommodate the ambiguity of (45b, b') and (45c, c') in terms of constituents, the phrase structure account assumes the structure of such NPs is flexible to an extent. This flexibility allows phrase structure to characterize the scope of the relevant scope-bearing expression as a constituent. In contrast, the current dependency grammar account maintains a single structure and assumes that the flexibility resides with the choice of colocant that the scope-bearing expression takes as its scope. The flexibility is therefore present in one form or another. The advantage that the flexibility of the dependency grammar analysis has is that the structures involved remain minimal and constant.

The colocant is also the means by which Reeve's observations about the scope of adverbs can be addressed given minimal dependency structures. Reeve argues that phrase structure is needed to plausibly address the scope of adverbs such as *already* and *completely*. He produces the following set of examples (Reeve 2018: 77–78):

(46) a.   Tom has **already completely** ruined dinner.
     a'. *Tom has **completely already** ruined dinner.

     b.   Tom has ruined dinner **completely already**.
     b'. *Tom has ruined dinner **already completely**.

These acceptability judgments are Reeve's. For me, (46b') is at least marginally possible. For the time being, however, Reeve's acceptability judgments are taken at face value. I return to the possibility that such examples as (46b') can be acceptable in the next subsection.

The acceptability pattern shown in (46) suggests that in order for *already* to scope over *completely*, it needs to precede it when the two precede the content verb *ruined* and it needs to follow it when the two follow the content verb *ruined*. Reeve (2018: 78) sees this data set as supporting, for the two sets of sentences, the phrase structures in Figure 5.

On each of these analyses, the adverb *already* appears as a sibling constituent of the constituent containing *completely*. Scope is characterized in terms of these sibling constituents; *already* scopes over *completely* in both structures, but not vice versa, because *completely* is properly contained inside the sibling constituent of *already*.
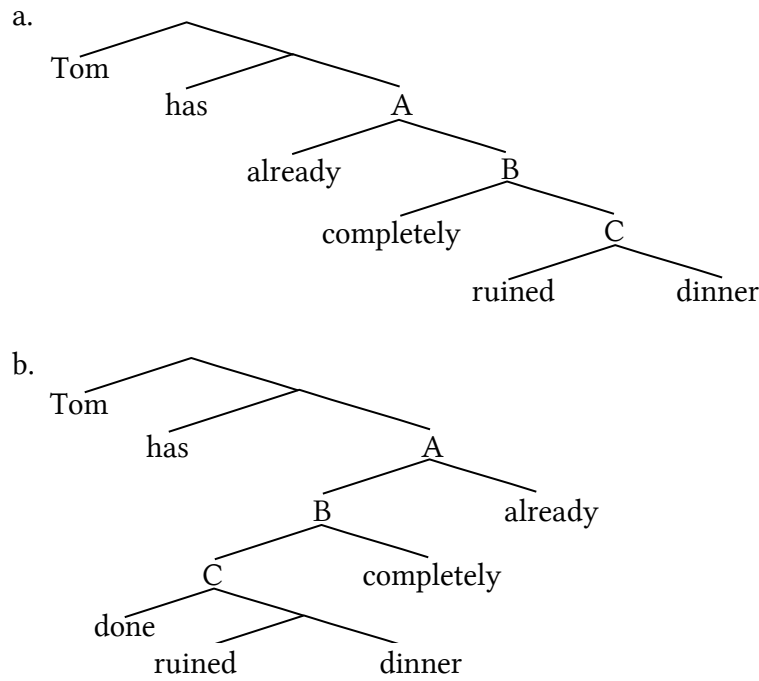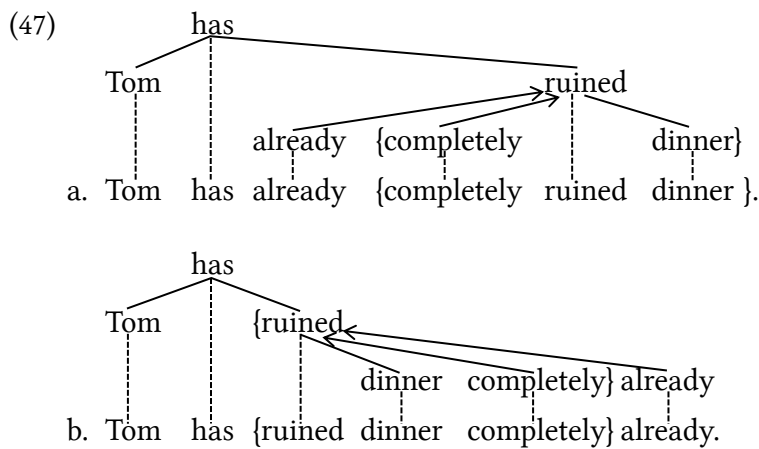
a.

```
        Tom
              has        A
                   already    B
                        completely    C
                                 ruined    dinner
```

b.

```
        Tom
              has        A
                    B        already
                C    completely
            done
              ruined    dinner
```

Figure 5. Reeve's (2018: 78) phrase structure analyses showing
the scope of the adverbs *already* and *completely*

The colocant unit of dependency grammar can produce an analogous account, but in terms of the relatively flat VPs of dependency syntax:

(47)
```
              has
        Tom              ruined
           already  {completely    dinner}
   a. Tom  has  already  {completely  ruined  dinner }.
```

```
              has
        Tom         {ruined
                     dinner  completely} already
   b. Tom   has  {ruined  dinner  completely} already.
```

The {}-brackets mark the scope of the adverb *already*. In each case, the bracketed string is a colocant. There is, as Reeve (2018: 78) points out, hence a mirror effect that characterizes scope in such cases. In order for a pre-dependent to scope over a sibling pre-dependent, it should precede it.

4.5 Reeve's counterarguments

Reeve (2018: 78) acknowledges that the sort of account of adverb scope just presented is possible, that is, an account that appeals to linear order as primitive and to the position of sibling dependents in relation to each other and their common head, which I have now formulated more concretely in terms of the colocant unit. He produces a couple of counterarguments against such an approach, counterarguments based on the extent to which pure linearity can or cannot

be a basis for predicting scope patterns. Addressing his counterarguments appropriately would necessitate some dense discussion of the opaque examples he produces from Italian and of the overall reasoning he appeals to based on the configurational template of mainstream phrase structure syntax (think T, TP, *v*, *v*P, V, VP, etc.). I have decided not to attempt such a discussion of his data and reasoning in this area and will instead draw attention to the fact that the data he points to are diverse, and that conclusions about the scope of adverbs are difficult to draw definitively.

My comment about example (46b') above alluded to a scope pattern that should not be sanctioned according to the reasoning employed in the previous subsection. The next examples draw further attention to the sort of scope pattern that is problematic for the reasoning employed above:

(48) a. Frank sneezes intentionally loudly.
    b. Frank sneezes intentionally.

(49) a. Jim walks reluctantly at a slow pace.
    b. Jim walks reluctantly.

(50) a. Jill sacrifices readily only when she is forced to do so.
    b. Jill sacrifices readily.

The natural reading of each of these a-sentences is such that the adverb immediately following the verb scopes over the following adverb/adjunct. That this reading is indeed preferred is evident from the fact that in each of these pairs, the a-sentence does not clearly entail the b-sentence – see Section 4.1 concerning the use of entailment to identify scope. These examples are therefore contrary to the reasoning based on the colocant unit.

The difficulty examples (48–50) pose is not limited to the account in terms of colocants, but rather it also challenges Reeve's preferred analysis in terms of layered phrase structures. Based on the type of analysis Reeve gives for sentence (46b) with the b-tree in Figure 5, the following phrase structure analysis for sentence (49a) seems likely:[13]

(51)
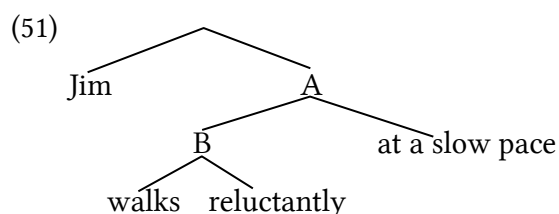
Left branching of this sort is the traditional analysis in phrase structure syntax assumed to accommodate post-verb adjuncts. This analysis does not allow for the scope pattern revealed in (49a–b), where the absence of entailment suggests that *reluctantly* scopes over *at a slow pace*.

---

[13] In personal communications, Reeve has commented that he might not assume the analysis shown in (51), but rather he might adjoin *reluctantly* to *at a slow pace* or assume a VP-shell type analysis. On either of these alternative analyses, the string *reluctantly at a slow pace* is a constituent in surface syntax. The problem in this regard is that it does not behave like a constituent, e.g. *??Reluctantly at a slow pace, John walks. How does John walk - ??Reluctantly at a slow pace; ??It is reluctantly at a slow pace that John walks.*

Concerning example (49a) more broadly, note that its meaning remains consistent when the order of the adjuncts is reversed: *Jim walks at a slow pace reluctantly.* This fact suggests that *reluctantly* can scope forwards or backwards over *at a slow pace.* In order to accommodate this flexibility, the phrase structure analysis would also have to sanction a structural analysis in which *reluctantly* and *at a slow pace* are sibling constituents. The following analysis would suffice:

(52)

Jim ... A

walks   reluctantly   at a slow pace
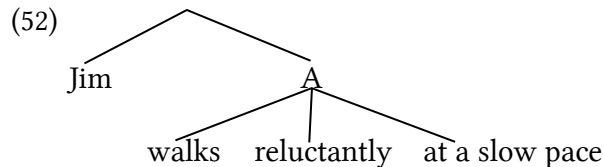
The flat analysis in this case is anathema to most modern versions of phrase structure syntax. It is, however, consistent with the sort of flat analysis that dependency syntax necessitates.

In sum, Reeve points to difficulties facing an approach to the scope of adverbs based on the colocant unit. When one examines a fuller data set, however, there are also difficulties facing the sort of phrase structure approach to scope he espouses. The conclusion I draw from all this is that at present the one or the other approach to the scope of adverbs can hardly be preferred due to the diverse nature of the data that are to be addressed.

5. Conclusion

This contribution has defended the main message in my focus article in *Language Under Discussion* (Osborne 2018) concerning the simplicity and accuracy of dependency syntax. This defense has involved conceding certain counterarguments (echo questions and fronting in German), although the concessions made are not clear refutations of the plausibility of the dependency analyses, but rather they reveal that the data delivered by tests for constituents are not always straightforward. Addressing one of the main counterarguments has necessitated bringing in aspects of dependency syntax that were not included in my focus article, such as the status of adjuncts and the nature of scope. Addressing this latter matter required the introduction of new material, in particular, the *colocant* unit. My claim now is that meaning is composed in terms of colocants, not in terms of constituents.

Let it be stated that the desire on my part in producing my focus article and defending its message here is to raise awareness of the potential of dependency to serve as the basis upon which theories of syntax can be constructed. Hopefully, beginning texts on syntax will no longer overlook the alternative interpretation of sentence structure that dependency brings to the table. Hopefully, they will instead include a discussion of dependency as an alternative way to interpret the results of tests for constituents and acknowledge dependency's potential to serve as a basis for theory building.

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