

Topics in English Syntax: Unbounded Dependency Constructions

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1 Basics

Unbounded Dependency Constructions (UDCs), aka Long Distance Dependencies (LDDs).

The simplest cases to understand are 'Filler-gap' dependencies, and the simplest of these involves Topicalisation, where a constituent is preposed for some special emphasis:

- (1) a. This, I consider an important point. . .
b. I consider *this* an important. . .
- (2) a. This sort of problem she deals with at once. Other problems, she generally ignores.
b. She deals with *this sort of problem* at once. She generally ignores *other problems*.

First, notice that *rely* requires a PP complement:

- (3) a. Sam relies on him.
b. *Sam relies for him.
c. *Sam relies him.
d. Sam relies on him and on her mother.

The complement need not follow the verb, it can appear pre-sententially ('topicalised'), but the same constraints apply:

- (4) On him, Sandy relies Δ .
- (5) Him, Sandy relies on Δ .
- (6) *Him/for him, Sandy relies Δ .
- (7) *He, Sandy relies on Δ .

There seems to be a syntactic and semantic dependency between a preposed constituent and a position or grammatical role elsewhere in the sentence.

This dependency is:

- unbounded, and
- a syntactic dependency

Intuitively, it is very natural to think of the preposed phrase as having been extracted from the embedded position. But unlike other dependencies (even dependencies like Raising which might cross clause boundaries), this dependency is potentially unbounded:

- (8) On him, Chris believes [_S Sandy relies Δ]
- (9) *Him/Of him, Chris believes [_S Sandy relies Δ]
- (10) *He, Chris believes [_S Sandy relies Δ]

Exercise 1.1 Raising can appear to be unbounded, because it is possible to have a large number of verbs between the surface and underlying positions:

- (11) a. Sam seemed to happen to appear to leave. (Sam is subject of *leave*)
b. Sam seemed [_S to happen [_S to appear [_S to leave]]].

But this is not unbounded. It is really just a sequence of local raising relations. (Recall also, that it is not obvious that clause boundaries are being crossed here – we might just have VPs).

Draw a representation of (11) to make this clear.

Exercise 1.2 Construct examples to show that *wh*-preposing, as seen in e.g. question formation, in (12), is unbounded.

- (12) Who does Kim rely on?

Exercise 1.3 The examples above mainly involve topicalising of PPs, but other kinds of constituent can be preposed. Construct examples to demonstrate this. Note any cases where constituents cannot be preposed (to find natural sounding examples, it helps to consider cases where contrastive stress is appropriate):

- (13) a. They said that Sandy put the car in the garage.
b. They said that Sandy will buy a new pet for her sister next year.

The phenomenon of filler-gap dependencies are sometimes called '*wh*-movement' (because *wh*-words so often trigger it, and because of a paper of Chomsky's (Chomsky, 1977) which brought these and other phenomena together under this title. People also speak of A-bar or A' dependencies, or A' movement (because the displaced constituent surfaces in a non-argument position).

Exercise 1.4 Here is a more extensive list of filler-gap constructions in English. Produce examples that show they involve unbounded dependencies.

- (14) Kim_i, Sandy loves Δ_i (Topicalization)
 (15) I wonder [who_i Sandy loves Δ_i] (Wh-Question)
 (16) The person [who_i Sandy loves Δ_i] (Wh-relative)
 (17) Playing football is [what_i Kim loves Δ_i] (Pseudo-cleft)

Exercise 1.5 Not all languages exhibit this kind of dependency, at least not syntactically. For example, in Japanese, *wh*-questions involve no displacement at all:

- (18) a. [Kim-wa [Sam-ga nani-o mottekita-to] itta-ndesu-ka] 'What did Kim say Sam brought?'
 Kim-TOP Sam-NOM what-ACC brought-that said-POLITE-Q
 b. [Kim-wa [Sam-ga wain-o mottekita-to] itta-ndesu-ka] 'Kim said Sam brought wine'
 Kim-TOP Sam-NOM wine-ACC brought-that said-POLITE-Q

Compare English 'echo' and 'quiz-show' questions:

- (19) Sam said Kim brought WHAT? (Sam said Kim brought her pet whale)
 (20) Minsk is the capital of which former Soviet republic, Mr Smith?

Such examples involve what is called *wh*-expressions '*in situ*'. Notice that in English they involve different intonation and different discourse functions.

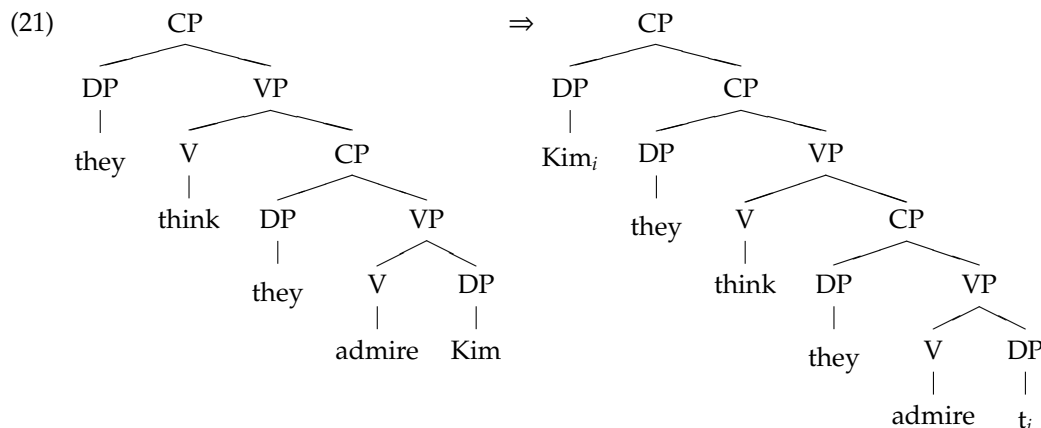
What other languages show filler-gap constructions (*wh*-movement, syntactic A' dependencies)?

2 Approaches

There are basically three approaches that have been taken.

- Historically the earliest involves a movement operation (movement from an 'underlying' position to the 'surface' (preposed) position).
- 'Slash' based approaches, which originate with GPSG (Gazdar et al., 1985).
- In LFG, the standard approach involves a form of 'multi-dominance', whereby the preposed element is grammatically present in both positions (though it is only phonologically realised in the preposed position). (See e.g. Falk, 2001, Ch6)

2.1 Movement



I have changed to node labels here to reflect what most people who accept this approach think (i.e. that what we have been calling NPs should actually be called DPs – headed by determiners – and that what we have been calling Ss are CPs – headed by complementisers, words like *that*, *whether*, etc).

Movement leaves behind a ‘trace’, which makes explicit the relation between surface and underlying positions (and can be used by the semantics, for example).

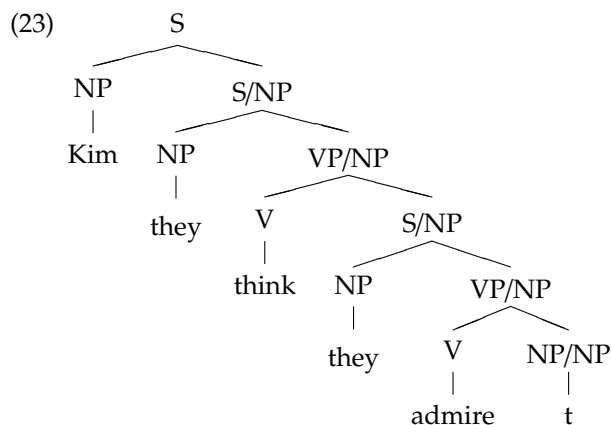
It is possible that movement operates in one ‘jump’, but it is also possible that it involves several ‘jumps’ (e.g. from SPEC of CP to SPEC of CP).

2.2 SLASH

An alternative to a movement based approach is one which just uses a feature or features (‘SLASH’ features): S/NP is an S with an NP hole in it.

(22) $S \rightarrow NP, S/NP$

“A sentence can consist of an NP and an S with an NP-sized hole.”



An important difference between these approaches is that on the SLASH based account, the existence of a ‘hole’ or ‘gap’ is registered on every node above the gap. There is evidence for this, e.g. from Irish (McCloskey, 1979), and see e.g. the references in Bouma et al. (2001), and/or Sag and Fodor (1994).

Implementing this with the sort of framework we have been assuming is fairly straightforward, to a first approximation.

Suppose we have a feature SLASH (or GAPS, or something) which records whether there is a constituent missing ‘downstairs’.

The top S rule could be something like:

$$(24) \quad \begin{array}{c} S \\ \left[\text{SLASH } \langle \rangle \right] \end{array} \rightarrow \boxed{1} \quad \begin{array}{c} S \\ \left[\text{SLASH } \langle \boxed{1} \rangle \right] \end{array}$$

$$\begin{array}{c} S \\ \left[\text{SLASH } \langle \rangle \right] \\ \swarrow \quad \searrow \\ PP_{on} \quad S \\ \triangle \quad \left[\text{SLASH } \langle PP_{on} \rangle \right] \\ \text{on Kim} \end{array}$$

Now we need a rule (actually a whole collection of rules, or better, a principle that applies to all rules) to pass the ‘hole’ down the tree.

$$(25) \quad \begin{array}{c} X \\ \left[\text{SLASH } \boxed{1} \right] \end{array} \rightarrow \dots, \begin{array}{c} Y \\ \left[\text{SLASH } \boxed{1} \right] \end{array} \dots$$

$$\begin{array}{c} S \\ \left[\text{SLASH} \right] \\ \swarrow \quad \searrow \\ PP_{on} \quad S \\ \triangle \quad \left[\text{SLASH } \langle PP_{on} \rangle \right] \\ \text{on Kim} \\ \swarrow \quad \searrow \\ NP \quad VP \\ | \quad \left[\text{SLASH } \langle PP_{on} \rangle \right] \\ \text{we} \end{array}$$

$$(26) \quad \begin{array}{c} S \\ \left[\text{SLASH} \right] \\ \swarrow \quad \searrow \\ PP_{on} \quad S \\ \triangle \quad \left[\text{SLASH } \langle PP_{on} \rangle \right] \\ \text{on Kim} \\ \swarrow \quad \searrow \\ NP \quad VP \\ | \quad \left[\text{SLASH } \langle PP_{on} \rangle \right] \\ \text{we} \\ \swarrow \quad \searrow \\ V \quad PP_{on} \\ | \quad \left[\text{SLASH } \langle PP_{on} \rangle \right] \\ \text{rely} \end{array} \quad \begin{array}{c} S \\ \left[\text{SLASH} \right] \\ \swarrow \quad \searrow \\ \boxed{1} PP_{on} \quad S \\ \triangle \quad \left[\text{SLASH } \langle \boxed{1} \rangle \right] \\ \text{on Kim} \\ \swarrow \quad \searrow \\ NP \quad VP \\ | \quad \left[\text{SLASH } \langle \boxed{1} \rangle \right] \\ \text{we} \\ \swarrow \quad \searrow \\ V \quad \boxed{1} \\ | \quad \left[\text{SLASH } \langle \boxed{1} \rangle \right] \\ \text{rely} \end{array}$$

We need a rule to realise the ‘hole’ at the bottom:

$$(27) \quad \begin{array}{c} \boxed{1} \\ \left[\text{SLASH } \langle \boxed{1} \rangle \right] \end{array} \rightarrow \epsilon$$

$$(28) \quad \begin{array}{c} PP_{on} \\ \left[\text{SLASH } \langle PP_{on} \rangle \right] \end{array} \rightarrow \epsilon$$

(where ‘ ϵ ’ is the empty string or empty expression – one could also have t for ‘trace’, or something else).

I have just presented this as ‘top down’, but we could also think of this whole process as being bottom up.

Exercise 2.1 Discuss how you could think of this process as ‘bottom-up’.

I have presented (27) as a rule, but we could also think of it in another way. One way of reading the standard head-complement rule is as saying ‘a complement can be realised as a sister of a head’:

$$(29) \quad \left[\text{COMPS } \langle \rangle \right] \rightarrow \left[\text{COMPS } \langle XP \rangle \right], XP$$

Another way a complement can be realised is by putting it on the slash list of the mother, to be realised ‘higher up’:

$$(30) \left[\begin{array}{l} \text{COMPS } \langle \rangle \\ \text{SLASH } \langle \text{XP} \rangle \end{array} \right] \rightarrow \left[\text{COMPS } \langle \text{XP} \rangle \right]$$

Of course, this would only work for complements (not, e.g. subjects or adjuncts), but one could generalise the process.

There are actually quite a lot of technical details we have ignored here, but the key intuition should be clear.

3 Island Constraints

It is not possible to prepose just any constituent – there are constraints on Filler-Gap constructions. In particular, there seem to be constraints on what constituents can be extracted ‘out of’ (so called extraction ‘islands’ – the terminology has something to do with it being hard to get off an island).

For many speakers, there is a contrast between the following:

- (31) a. Who do we think
 $[_{CP} \text{ (that) Kim claims } [_{CP} \text{ that Sam likes } \Delta]] ?$
 b. *Who do we believe
 $[_{NP} \text{ Kim's claims } [_{CP} \text{ that Sam likes } \Delta]] ?$

Compare:

- (32) We think (that) Kim claims that Sam likes something.

Similarly, many speakers find extraction from a relative clause bad:

- (33) *Who do you know $[_{NP} \text{ a man } [_{Rel} \text{ who likes } \Delta]] ?$

Compare:

- (34) a. Do you know $[_{NP} \text{ a man } [_{Rel} \text{ who reads } \textit{Vogue}]] ?$
 b. Do you know $[_{NP} \text{ a man } [_{Rel} \text{ who reads } \textit{WHAT}]] ?$

Likewise extraction of a determiner from NP:

- (35) a. *Whose do you admire $[_{NP} \text{ a book }] ?$
 b. *Which do you admire $[_{NP} \text{ a book }] ?$
 c. $[_{NP} \text{ Which/whose book }]$ do you admire Δ ?

For many there is a contrast:

- (36) a. *Who do you think $[_{CP} \text{ that } \Delta \text{ likes Sam}] ?$
 b. Who do you think $[_{NP} \text{ } \Delta \text{ likes Sam}] ?$

There may also be lexical effects:

- (37) When do they *deny/?believe
 $[_{NP} \text{ that Sam left } \Delta]$

The following illustrate the co-ordinate structure constraint (CSC):

- (38) *Who do you like $[_{NP} \text{ Sam and } \Delta] ?$
 (39) *Who do you like $[_{NP} \text{ } \Delta \text{ and Sam}] ?$
 (40) *Who do you think
 $[[\text{ Sam likes her }] \text{ and } [\text{ Kim hates } \Delta]] ?$
 (41) *Who do you think
 $[[\text{ Sam likes } \Delta] \text{ and } [\text{ Kim hates her }]] ?$
 (42) Who do you think
 $[[\text{ Sam likes } \Delta] \text{ and } [\text{ Kim hates } \Delta]] ?$ (‘Across the Board’ (ATB) exceptions to the CSC)

Some of these (‘island’) constraints seem very robust (though some are less so), and a considerable amount of effort has been expended over the years since they were first explored in Ross (1967). The classification, and terminology, for various island constraints has varied considerably over the years.

Recently, there has been a up-surge of work suggesting that many of these constraints are not really grammatical in nature (e.g. Hofmeister and Sag, 2010).

Exercise 3.1 Discuss why ATB exceptions to the CSC might appear problematic for movement based approaches.

Exercise 3.2 Are there any constraints on ATB extraction from co-ordinate structures. For example, do the gaps have to have the same grammatical function or category, can they come from different depths of embedding? Are other conjunctions equally good?

4 Other UDCs

Not all Unbounded Dependency Constructions involve a filler and a gap – the constituent you might take to be the ‘filler’ has a full/independent grammatical role of its own (as opposed to just having some kind of discourse role, e.g.):

- (43) Sandy_i is hard (for us) to love Δ_i (Tough Movement)
- (44) I bought it_i for Sandy to eat Δ_i (Purpose Infinitive)
- (45) It's Kim [that_i Sandy loves Δ_i] (It-cleft)

Sometimes people talk about these as ‘weak’ UDCs (as opposed to ‘strong’, i.e. filler-gap, UDCs).

Exercise 4.1 Construct examples to show that these do indeed involve *unbounded* dependencies.

5 Issues, Discussion, etc.

5.1 Pied-Piping, and Preposition Stranding

It's striking that in English you cannot question just a determiner, as in (46):

- (46) a. They say they really admire [Sam's new book].
- b. They say they really admire [WHO's new book]?
- c. *[Whose] do they say they really admire [Δ new book].
- d. [Whose new book] do they say they really admire Δ .

Or a degree modifier of an adjective:

- (47) a. They think she is [incredibly old].
- b. They think she is [HOW old]?
- c. *[How] do they think she is [Δ old].
- d. [How old] do they think she is Δ .

Following Ross's terminology, we talk about ‘pied-piping’ (the other words in a constituent follow the ‘triggering’ word – e.g. the *wh*-word – as it is preposed).

Pied-piping is obligatory in some cases (as above), in English it is optional with prepositions:

- (48) a. Who do you rely on Δ ? (stranding)
- b. On whom do you rely Δ ? (pied-piping)

In the case where the preposition is not pied-piped, we say it is *stranded*.

In many (perhaps most) languages, preposition stranding is not allowed.

Exercise 5.1 Discuss whether languages you know allow preposition stranding.

5.2 Resumptive Pronouns

In the examples we have looked at, the ‘gap’ really is a phonological gap. But this is not always the case. Sometimes the ‘gap’ position is filled by a pronoun (a so-called ‘resumptive’ pronoun).

This can be seen in English in ‘left-dislocation’ and ‘right-dislocation’ structures:

- (49) [These meeting], I think everyone hates them.
- (50) I think everyone hates them, [these meetings].

and to avoid some kind of island violations:

- (51) a. *This is the road that I don’t know [where Δ goes].
- b. This is the road that I don’t know [where it goes].

5.3 Mutiple Extraction

Many languages allow multiple gaps (maybe even English):

- (52) a. It is difficult for them to play these sonatas on this violin.
- b. These sonatas_j are difficult for them to play Δ_j on this violin.
- c. Which violin_i is it difficult for them to play these sonatas on Δ_i ?
- d. Which violin_i are these sonatas_j difficult for them to play Δ_j on Δ_i ?
- (53) This sort of problem_j, my mother_i is difficult to talk to Δ_i about Δ_j .

Exercise 5.2 Notice that the approach we sketched above does not allow multiple gaps (because there is only a single element on the SLASH list).

Exercise 5.3 Discuss other languages.

5.4 ‘Connectivity’

It is typical of UDC constructions that the ‘filler’ (in the case of filler-gap constructions) or the ‘antecedent’ (in others) behaves in some ways as if it were ‘upstairs’ and in some ways as if it were ‘downstairs’.

For example, there are constraints on the appearance of reflexive pronouns (*herself*, *themselves*), which seem to require the reflexive and its antecedent to be fairly close, and for the antecedent to be earlier or ‘higher up’:

- (54) a. Kim thinks they_i admire themselves_i.
- b. *They_i think Kim admires themselves_i.

But Topicalisation is not affected:

- (55) a. Kim thinks they_i admire themselves_i.
- b. Themselves, Kim thinks they_i admire Δ_i .

That is, as regards pronoun-antecedent relations, the displaced constituent behaves as though it were downstairs. But in other respects they behave as if they were upstairs. For example, in *Tough*-constructions, the case assigned is the ‘upstairs’ case:

- (56) a. She_i/*Her is hard to love Δ_i (Tough Movement)
- b. cf. It is hard to love *she/her.

And in some cases, ‘preposing’ makes something grammatical, which would not be possible without it:

- (57) *You can rely on *that Kim will help you*.
- (58) *That Kim will help you*, you can rely on.

5.5 What are SLASH values

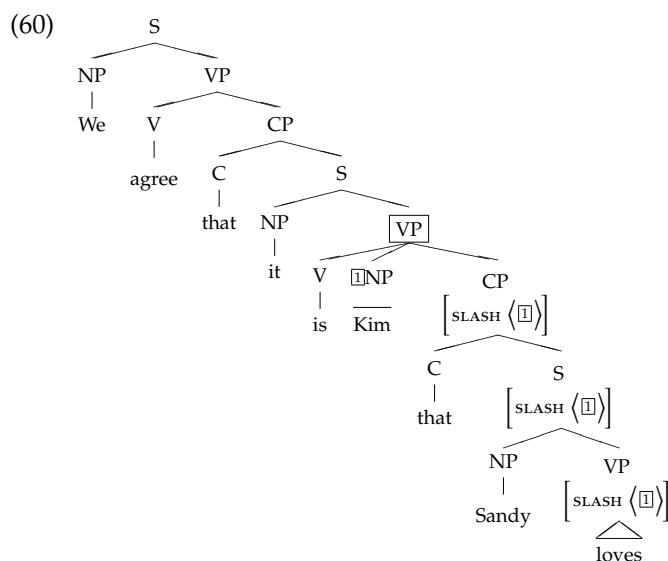
SLASH values are lists (or sets), but lists of what? Presumably we do not want them to be things that contain SLASH values. So we should divide information up into LOCAL information (the usual things: part of speech, complements, etc.) and NON-LOCAL (SLASH values). Only the former should be put in a SLASH list.

5.6 Stopping Slash Percolation

The main technical issue we have evaded is how to stop a SLASH value being percolated upwards after the corresponding filler or antecedent has been found.

For example, in (59) the SLASH dependency between *Kim* and the gap should not go higher up the tree.

(59) We agree that it is Kim_i that Sandy loves Δ_i (*it-cleft*)



If it does go higher up, we will produce:

(61) * Kim_i , we agree that it is Kim_i that Sandy loves Δ_i

The simplest way to deal with this is to introduce another feature (e.g. TO-BIND) and require that the SLASH value on a mother is the SLASH value on the daughter(s) minus the value of *to-bind*.

So, the lexical entry for *be* that is involved in cleft constructions can be along the lines of (62):

$$(62) \left[\begin{array}{l} \text{COMPS} \quad \left\langle XP_{[1]}, CP \left[\begin{array}{l} \text{SLASH} \langle [1] \rangle \end{array} \right] \right\rangle \\ \text{TO-BIND} \quad \langle [1] \rangle \end{array} \right]$$

This says that *be* takes two complements: an XP, and a CP ‘with an XP hole in it’. The CP sister of *be* will be SLASH(*XP*), and this will be passed downward, but the TO-BIND specification means it will not be passed upwards.

6 Reading

There will be a great deal about movement rules in any introduction to Minimalist syntax, e.g. Radford (2004), Radford (1997) or Adger (2003).

On resumptive pronouns the early chapters of Asudeh (2012) can be recommended.

The HPSG approach to unbounded dependencies is a direct descendent of the SLASH-based approach described above. Text book description can be found in Kim and Sells (2008) and Sag et al. (2003), and some parts of Pollard and Sag (1994), Levine and Hukari (2006), are reasonably accessible.

Other reasonably introductory discussion can be found in Culicover (2009, Ch9), Borsley (1996, Ch9), and Culicover and Jackendoff (2005, Ch9). There is some relevant discussion in Börjars and Burridge (2010, ch9), and Tallerman (2011, Ch8).

References

- Adger, David. 2003. *Core syntax: A minimalist approach*, volume 33. Oxford University Press Oxford.
- Asudeh, Ash. 2012. *The Logic of Pronominal Resumption*. Oxford University Press.
- Börjars, K E. and Burridge, K. 2010. *Introducing English Grammar, second edition*. Oxford University Press.
- Borsley, Robert D. 1996. *Modern Phrase Structure Grammar*. Blackwell textbooks in linguistics, No. 11, Blackwell Publishers.
- Bouma, Gosse, Malouf, Rob and Sag, Ivan A. 2001. Satisfying Constraints on Extraction and Adjunction. *Natural Language and Linguistic Theory* 1(19), 1–65.
- Chomsky, Noam. 1977. On *wh*-movement. In Peter W. Culicover, Thomas Wasow and Adrian Akmajian (eds.), *Formal syntax*, pages 71–132, New York: Academic Press.
- Culicover, Peter W. 2009. *Natural language syntax*. Oxford: Oxford University Press.
- Culicover, Peter W and Jackendoff, Ray. 2005. *Simpler Syntax*. Oxford: Oxford University Press.
- Falk, Yehuda N. 2001. *Lexical-Functional Grammar: An Introduction to Parallel Constraint-Based Syntax*. Stanford, CA: CSLI Publications.
- Gazdar, Gerald, Klein, Ewan, Pullum, Geoffrey and Sag, Ivan. 1985. *Generalized Phrase Structure Grammar*. Blackwell.
- Hofmeister, Philip and Sag, Ivan A. 2010. Cognitive Constraints and Island Effects. *Language* 86(2), 366–415.
- Kim, Jong-Bok and Sells, Peter. 2008. *English Syntax: An Introduction*. Stanford, Ca.: CSLI Publications.
- Levine, Robert and Hukari, Thomas. 2006. *The Unity of Unbounded Dependency Constructions*. Stanford, Calif: CSLI Publications.
- McCloskey, J. 1979. *Transformational Syntax and Model Theoretic*. Reidel.
- Pollard, Carl J. and Sag, Ivan A. 1994. *Head-Driven Phrase Structure Grammar*. Chicago: University of Chicago Press.
- Radford, Andrew. 1997. *Syntax: A minimalist introduction*. Cambridge: Cambridge University Press.
- Radford, Andrew. 2004. *Minimalist syntax: Exploring the structure of English*. Cambridge University Press.
- Ross, J R. 1967. *Constraints on Variables in Syntax*. PhD thesis, MIT, (published 1986, as *Infinite Syntax*, Norwood, Ablex Publishing Corp).
- Sag, Ivan A. and Fodor, Janet D. 1994. Extraction Without Traces. In Raul Aranovich, William Byrne, Susanne Preuss and Martha Senturia (eds.), *Proceedings of the Thirteenth West Coast Conference on Formal Linguistics*, volume 13, Stanford University: CSLI Publications/SLA.
- Sag, Ivan A., Wasow, Thomas and Bender, Emily M. 2003. *Syntactic Theory: A Formal Introduction*. Stanford, Ca: CSLI Publications, second edition.
- Tallerman, Maggie. 2011. *Understanding Syntax*. Understanding Language Series, Abington and New York: Routledge.