chapter 5

X-Bar Theory

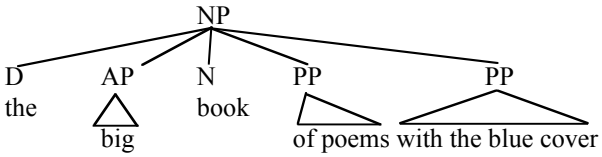
0. INTRODUCTION

As we saw in the last chapter, the theory of sentence structure that we've developed is quite powerful. It correctly predicts constituency and along with structural relations and the binding theory it also accounts for phenomena such as how we interpret nominals. This said, if we look a little more closely at sentence structure in many languages, we see that our theory has some empirical inadequacies. (It can't account for all the data.) Consider, for example, the subject NP in the sentence in (1):

1) [The big book of poems with the blue cover] is on the table.

The structure our NP rule NP → (D) (AP+) N (PP+) assigns to this is:

2)



We can call this a *flat structure*. The PP *of poems* and the PP *with the blue cover* are on the same level hierarchically; there is no distinction between them in terms of dominance or c-command. In other words they are "flat" with respect to the head word *book*. From the point of view of constituency, we see that a number of tests

point towards a more complicated structure. Consider first the constituency test of *replacement*. There is a particular variety of this process, called **one-*replacement***, that seems to target precisely a group of nodes that don't form a constituent in (2):

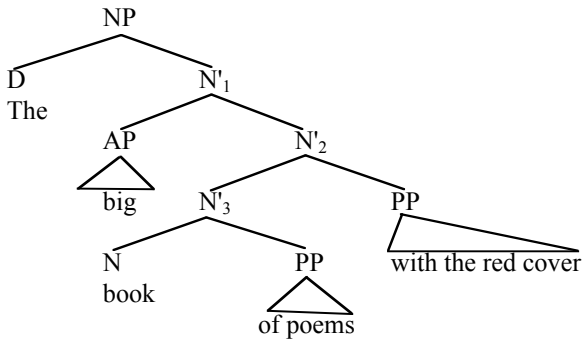
3) I bought the big [book of poems with the red cover] not the small [one].

Here, *one*-replacement targets *book of poems with the red cover*, this group of words does not form constituent in the tree in (2). Furthermore, *one*-replacement seems to be able to target other subgroups of words that similarly don't form constituents in (2):

4) I bought the big [book of poems] with the red cover not the small [one] with the blue cover.

These facts seem to point to a more deeply embedded structure for the NP:

5)



The *one*-replacement in (4) targets the node labeled N'_3. The *one*-replacement in (3) targets the node labeled N'_2. We have to change the NP slightly to get evidence for N'_1. If we change the determiner *the* to the determiner *that*, we can use *one*-replacement to target N'_1.

6) I want [$_{NP}$ this [$_{N'}$big book of poems with the red cover]] not [$_{NP}$that [$_{N'}$one]].

Similar evidence comes from conjunction:

7) Calvin is [the [dean of humanities] and [director of social sciences]].
8) Give me [the [blue book] and [red binder]].

We need these "intermediate" N' (pronounced "en-bar") categories to explain the items that are conjoined in these sentences.

The flat structure seen in (2) is clearly inadequate and a more articulated structure is needed. This chapter is about these articulated trees. The theory that accounts for these is called X-bar theory.

Before getting into the content of this chapter, a few bibliographic notes are in order. The first presentation of X-bar theory appeared in Chomsky (1970). Jackendoff's (1977) seminal book *X-Bar Theory* is the source of many of the ideas surrounding X-bar theory. Perhaps the most complete description of X-bar theory comes from an introductory syntax textbook (like this one.) This is Radford's (1988) *Transformational Grammar: A First Course*. That textbook presents one of the most comprehensive arguments for X-bar theory. This chapter draws heavily on all three of these sources. If you are interested in reading a more comprehensive (although slightly out-of-date) version of X-bar theory, then you should look at Radford's book.

1. BAR-LEVEL PROJECTIONS

In order to account for the data seen above in the introduction, let us revise our NP rules to add the intermediate structure:

9) NP → (D) N'
10) N' → (AP) N' *OR* N' (PP)
11) N' → N (PP)

These rules introduce a new character to our cast of nodes, seen briefly above. This is the N' node. It plays the role of the intermediate constituent replaced by *one* above. The tree in (5) is repeated here showing how these rules (9-11) apply.

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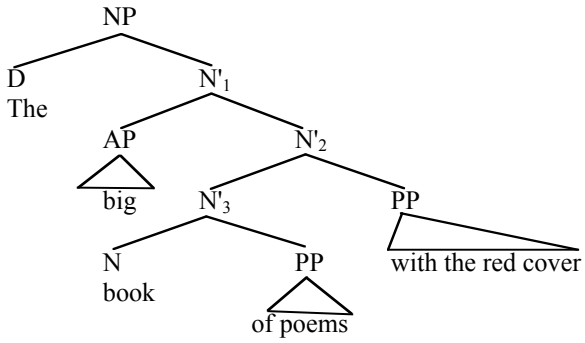


Rule (9) generates the NP node of this tree, with its daughters D and N'. The first version of rule (10) generates N'_1. The second version of rule (10) generates N'_2. Finally the last rule (11) spells out N'_3 as N and its PP sister.

We can now straightforwardly account for the *one*-replacement sentences. *One*-replacement is a process that targets the N' node:

13) One-*replacement*
Replace an N' node with *one.*

Without the intermediate N' node we would have no way of accounting for *one*-replacement or conjunction facts. With N', explaining these sentences is easy, since there is more structure in each phrase.

The rule system in (9)-(11) has a number of striking properties (including the facts that it is binary branching and the first N' rule is iterative or self-recursive). We will return to these properties in a later section and show how they account for a number of surprising facts about the internal structure of phrases. First, however, let's see if any other categories also have intermediate structure.

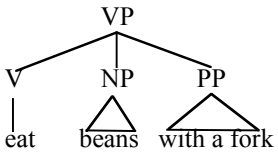
1.1 V-bar

There is an identical process to one-replacement found in the syntax of VPs. This is the process of ***do-so-*** (or ***did-so***) ***replacement***. Consider first the VP in the following sentence, which has both an NP and a PP in it.

14) I [eat beans with a fork].

The rule we developed for VPs in chapter 2 generates the following flat tree:

15)



In this tree, there is no constituent that groups together the V and NP and excludes the PP. However, *do-so*-replacement targets exactly this unit:

16) I [eat beans] with a fork but Janet [does so] with a spoon.

Let's formalize this rule as:

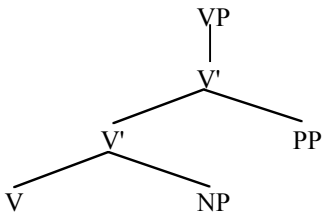
17) Do-so-*replacement*
Replace a V' with *do so.*

For this, to work we need the following rules:

18) $VP \rightarrow V'$ [1]
19) $V' \rightarrow V'$ (PP)
20) $V' \rightarrow V$ (NP)

The tree structure for the VP in (14) will look like:

21)



Rule (18) generates the VP and the V' under it; the next rule (19) expands the top V' into another V' and a PP. Finally, the lower V' is expanded into V and NP by rule (20).

The rule of *do-so*-replacement seen in (17) targets the lower V' and replaces it with *do so*. Evidence for the higher V' comes from sentences like (22).

22) Kevin [ate spagetti with a spoon] and Geordi [did so] too.

In this sentence, *did so* replaces the higher V' (which includes the V, the lower V', the NP, and the PP).

Similarly, conjunction seems to show an intermediate V' projection:

23) The chef [eats beans] and [tosses salads] with forks.

The tree for a structure like this requires a V' node (a description of the conjunction rule can be found below in section 4):

[1] This rule may appear a little mysterious right now (since it appears to introduce a vacuous structure) but we will have need of it in a later chapter. For the moment, just assume that it is necessary, and we will provide additional justification for it later. You can note for now that in order to account for sentences like (22) below, we will need to assume that the entire replaced structure is a V', if we assume that *do-so*-replacement only targets V' nodes (and not VP nodes).

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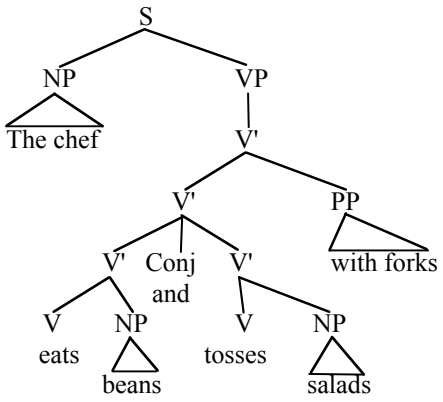

1.2 A-bars

The arguments for intermediate structure in APs are a little more tricky. As English seems to limit the amount of material that can appear in an AP. However, we do see such structure in phrases like (25):

25) the [very [[bright blue] and [dull green]]] gown

In this NP, *bright* clearly modifies *blue*, and *dull* clearly modifies *green*. One possible interpretation of this phrase (although not the only one) allows *very* to modify both *bright blue* and *dull green.* If this is the case then the structure must minimally look like (26) (note: we will have reason to revise this tree later).

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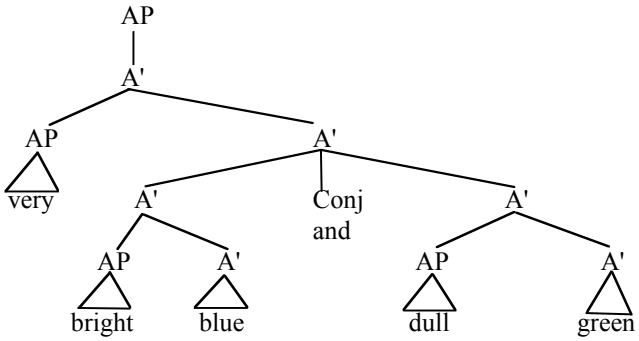

Under certain circumstances, some adjectives appear to allow prepositional modifiers to follow them:

27) I am afraid/frightened of tigers.
28) I am fond of circus performers.

These post-adjectival PPs have the "feel" of a direct object:

29) I fear tigers.
30) I like circus performers.

Consider now:

31) I am [[afraid/frightened of tigers] and [fond of clowns] without exception].

Under one reading of this sentence, *without exception* modifies both *afraid of tigers* and *fond of circus performers*. Again this would seem to suggest that the sentence has the constituency represented by the above bracketing, which points towards an intermediate category of A'

There is also a replacement phenomenon that seems to target A's. This is *so*-replacement:

32) Bob is [very [serious about Mary]], but [less [so]] than Paul.

The adjective phrase here is *very serious about Mary*, but *so*-replacement only targets *serious about Mary*.

The rules that generate these structures are:

33) AP $\rightarrow$ A'
34) A' $\rightarrow$ (AP) A'
35) A' $\rightarrow$ A (PP)

1.3 P-bars

The evidence for an intermediate P-bar projection is, if anything, weaker than that for APs. I'll admit this up front. But some small evidence does exist. Consider the following sentences:

36) Gwen placed it [right [in the middle of the spaghetti sauce]].
37) Maurice was [[in love] with his boss].
38) Susanna was [utterly [in love]].

In these examples, we have what appears to be prepositional phrases (*on the table, in love*) that are modified by some other element: *right*, *with his boss*, and *completely* respectively. Note, however, that you can target smaller units within these large PPs with constituency tests:

39) Gwen knocked it [right [off the table] and [into the trash]].
40) Maurice was [[in love] and [at odds] with his boss].
41) Susanna was [utterly [in love]], but Louis was only [partly [so]].

Examples (39) and (40) show conjunction of the two smaller constituents. Example (41) is an example of *so*-replacement. Let us call the smaller constituent here P' on a parallel with N', A', and V'. The rules that generate PPs are given below:

42) PP → P'
43) P' → P' (PP)
44) P' → P (NP)

2. GENERALIZING THE RULES: THE X-BAR SCHEMA

For each of the major phrase types (NPs, VPs, APs and PPs) we have come up with three rules, where the second and third rules serve to introduce intermediate structure. Let's repeat all the rules here:

45) NP → (D) N'
46) N' → (AP) N' *OR* N' (PP)
47) N' → N (PP)
48) VP → V'
49) V' → V' (PP)
50) V' → V (NP)
51) AP → A'
52) A' → (AP) A'
53) A' → A (PP)
54) PP → P'
55) P' → P' (PP)
56) P' → P (NP)

The evidence for some of these rules (like the N' rules) is quite strong. Evidence for some of the others is quite weak (such as VP → V', for which I've yet to present any evidence at all). However, let's consider the possibility that these are *all* reflective of our human language capability. We can now ask, are we missing any generalizations here?

Indeed we seem to be missing several. First, note that in all the rules above, the category of the rule is the same as the only element that is not optional. For example, in the NP rule, the element that isn't optional is N'. This is the same part of speech. Similarly, the only obligatory element in N' is either another N' or N. This is a very general notion in phrase structure; we call this headedness. All phrases appear to have ***heads***. Heads are the most prominent element in a phrasal category and give their part of speech category to the whole phrase. Note that we don't have any rules of the form:

57) NP→ V AP

This rule not only seems meaningless, it is unattested in the system we've developed here. This property is called ***endocentricity***, meaning that every phrase has a head. The only obligatory element in a phrase is the head.

Second, note that with the exception of the determiner in the NP rule, all non-head material in the rules is both phrasal and optional. We never find rules of the form:

58) VP → A V

Any thing that isn't a head must be a phrase and optional.

Finally, notice that for each major category, there are three rules, one that introduces the NP, VP, AP and PP, one that takes a bar-level and repeats it (e.g., N'→N' (PP)), and one that takes a bar level and spells out the head (e.g., N'→N (PP)). We seem to be missing the generalization that for each kind of phrase, the ***same kinds of rules*** appear. X-bar theory is an attempt to capture these similarities between rules.

We can condense the rules we've proposed into a simple set. To do this we are going to make use of variables (like variables in algebra) to stand for particular parts of speech. Let X be a variable that can stand for any category N, V, A, P. An XP is catch-all term to cover NP, VP, AP, PP, similarly X' stands for N', V', A', P', and X represents N, V, A, and P. The Xs here are what give the theory its name.

Using this variable notation we can capture the generalizations that we have missed. Let's start with the NP, VP, AP, and PP rules:

59) NP → (D) N'
60) VP → V'
61) AP → A'
62) PP → P'

By using the variable notation we can summarize these rules with the single rule:

63) XP → (YP) X' (*to be revised)*

Both X and Y here are variables for categories. This rule says that a phrase consists of some optional, phrasal[2] element followed by a node of *the same category* that is a single bar. Note that this last bit is crucial. If the X in XP stands for NP, then the bar level is an N'. This captures the endocentric property of our rules.

[2] The D in the NP rule is, of course, not phrasal. This is a problem we will return to in later chapters.

Now turn to the recursive N', A', V' and P' rules:

64) N' → (AP) N' *OR* N' (PP)
65) V' → V' (PP)
66) A' → (AP) A'
67) P' → P' (PP)

For each of these rules, a category with a single bar level is iterated (repeated), with some optional material either on the right or the left. Again using X as a variable, we can condense these into a single rule:

68) X' → (ZP) X' *OR* X' (ZP) (*to be revised*)

Again the Xs here must be consistent in part of speech category. The material that is not the head (i.e., not X) must be phrasal and optional. Note that the categories of these non-head items is also indicated with variables (in this case: ZP).

Finally, let's consider the rules that introduce the last layer of structure:

69) N' → N (PP)
70) V' → V (NP)
71) A' → A (PP)
72) P' → P (NP)

These rules can also be summarized into a single rule:

73) X' → X (WP) (*to be revised*)

The system we've come up with here is remarkably simple. We've reduced the number of rules to three (63, 68, 73). Because they use variables, these rules can generate most of the sentences of English. This analysis isn't without problems, however. Before we turn to resolving these problems and drafting a final version of the X-bar rules, we need to introduce some new terminology.

3. COMPLEMENTS, ADJUNCTS AND SPECIFIERS.

Consider now the two prepositional phrases that are subconstituents of the following NP:

74) the book [$_{PP}$ of poems] [$_{PP}$ with the glossy cover]

Using the X-bar rules,[3] we can generate the following tree for this NP:

[3] Specific instructions on drawing trees using the X-bar rules are found at the end of this chapter.

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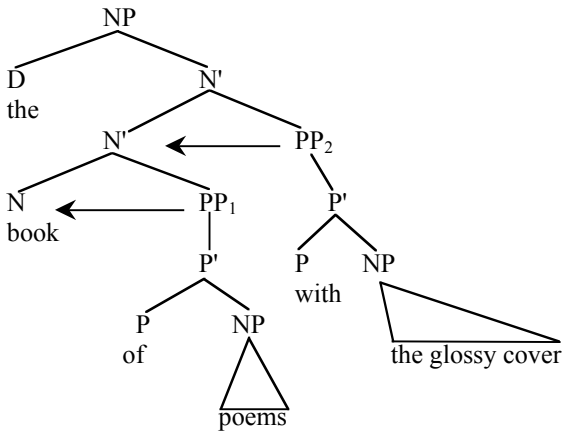


(I've used triangles in this tree to obscure some of the irrelevant details, but you should not do this when you are drawing trees, until you have a confident grasp of how tree notation works.) You'll note that the two PPs in this tree are at different levels in the tree. The lower PP_1 is a sister to the head N (*book*), whereas the higher PP_2 is a sister to the N' dominating the head N and PP_1. You'll also notice that these two PPs were introduced by different rules. PP_1 is introduced by the rule:

76) $X' \rightarrow X$ (WP)

and PP_2 is introduced by the higher level rule:

77) $X' \rightarrow X'$ (ZP)

Let' s introduce some new terminology here to describe these two different kinds of PPs. An XP that is a sister to a head (N, V, A, or P) is called a ***complement***. PP_1 is a complement. Complements roughly correspond to the notion "object" in traditional grammar. XPs that are sisters to single-bar levels (N', V', A', or P') and are daughters of an N' are called ***adjuncts***. PP_2 is an adjunct. Adjuncts often have the feel of adverbial or optional information.

78) *Adjunct*
An XP that is a sister to a single bar level (N', V', A', or P') and a daughter of a single bar level (N', V', A', or P').

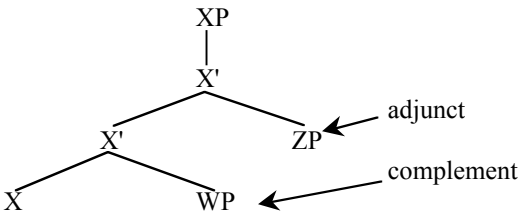
79) *Complement*
An XP that is a sister to a head (N, V, A, P), and a daughter of a single bar level (N', V', A', or P').

The rules that introduce these two kinds of XPs get special names:

80) *Adjunct rule* $X' \rightarrow X'$ (ZP)
81) *Complement rule* $X' \rightarrow X$ (WP)

A tree showing the structural difference between these is given below:

82)



If there really are two different kinds of PP within an NP, then we expect that they will exhibit different kinds of behavior. It turns out that this is true. There are significant differences in behavior between adjuncts and complements.

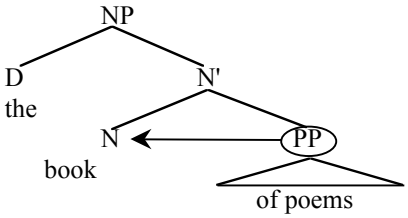
3.1 Complements and Adjuncts in NPs

Take NPs as a prototypical example. Consider the difference in meaning between the two NPs below:

83) the book of poems
84) the book with a red cover

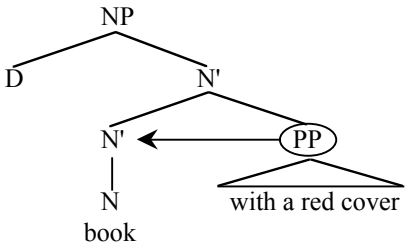
Although both these examples seem to have, on the surface, parallel structures (a determiner, followed by a noun, followed by a prepositional phrase), in reality, they have quite different structures. The PP in (83) is a complement and has the following tree:

85)



You'll note that the circled PP is a sister to N, so it is a complement. By contrast, the structure of (84) is:

86)



Here the PP *with a red cover* is a sister to N', so it is an adjunct. The differences between these two NPs is not one that you can *hear*. The difference between the two is in terms of the amount of structure in the tree. In (86), there is an extra N'. While this difference may at first seem abstract, it has important implications for the behavior of the two PPs. Consider first the meaning of our two NPs. In (83), the PP seems to complete (or complement) the meaning of the noun. It tells us what kind of book is being referred to. In (84), by contrast, the PP seems more optional and more loosely related to the NP. This is a highly subjective piece of evidence, but it corresponds to more syntactic and structural evidence too.

As an easy heuristic (guiding principle) for distinguishing complements from adjuncts PPs inside NPs, is by looking at what preposition they take. In English, almost always (although there are some exceptions) complement PPs take the preposition *of*. Adjuncts, by contrast, take other prepositions (such as *from*, *at*, *to*, *with*, *under*, *on*, etc.) This test isn't 100% reliable, but will allow you to eyeball PPs and tell whether they are complements or adjuncts for the vast majority of cases (such as (83) and (84) above). With this in mind, let's look at some of the other behavioral distinctions between complements and adjuncts.

Think carefully about the two rules that introduce complements and adjuncts. There are several significant differences between them. These rules are repeated here for your convenience:

87) *Adjunct rule* $X' \rightarrow X'$ (ZP)
88) *Complement rule* $X' \rightarrow X$ (WP)

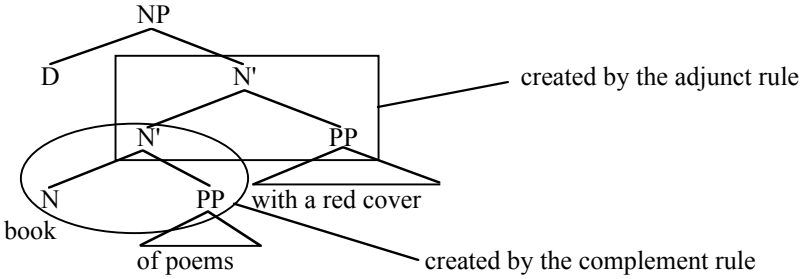
First observe that because the complement rule introduces the head (X), the complement PP will always be adjacent to the head. Or more particularly, it will always be closer to the head than an adjunct PP will be. This is seen in the following data:

89) the book [of poems] [with a red cover]
head *complement* *adjunct*

90) *the book [with a red cover] [of poems]
head *adjunct* *complement*

You can see how this is true if you look at the tree for sentence (89):

91)



Since the adjunct rule takes an X' level category and generates another X' category, it will always be higher in the tree than the output of the complement rule (which takes an X' and generates an X). Since lines can't cross, this means that complements will always be lower in the tree than adjuncts, and will always be closer to the head than adjuncts.

There is another property of the rules that manifests itself in the difference between adjuncts and complements. The adjunct rule, as passingly observed above, is an iterative rule. That is, within the rule itself, it shows the property of recursivity (discussed in chapter 2): On the left-hand side of the rule there is an X' category, and on the right hand side there is another X'. This means that the rule can generate infinite strings of X' nodes, since you can apply the rule over and over again to its own output:

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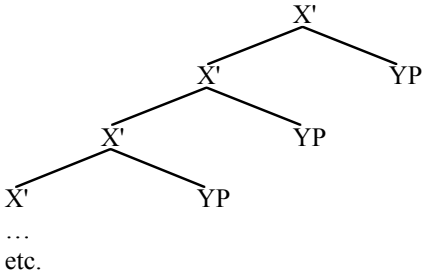


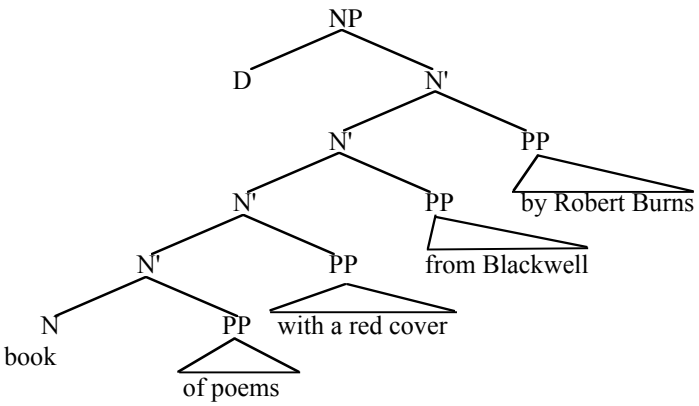
The complement rule does not have this property. On the left side of the rule there is an X', but on the right there is only X. So the rule cannot apply iteratively. That is, it can only apply once within an XP. What this means for complements and adjuncts is that you can have any number of adjuncts (93), but you can only ever have one complement (94):

93) the book [of poems] [with a red cover][from Blackwell][by Robert Burns]
head complement adjunct adjunct adjunct

94) *the book [of poems] [of fiction] [with a red cover]
head complement complement adjunct

The tree for (93) is given below; you'll note that since there is only one N, there can only be one complement, but since there are multiple N's, there can be as many adjuncts as desired.

95)



Related to the facts that the number of adjuncts is unlimited, but only one complement is allowed, and complements are always adjacent to the head, observe that you can usually reorder adjuncts with respect to one another, but you can never reorder a complement with the adjuncts:

96) the book of poems with a red cover from Blackwell by Robert Burns
97) the book of poems from Blackwell with a red cover by Robert Burns
98) the book of poems from Blackwell by Robert Burns with a red cover
99) the book of poems by Robert Burns from Blackwell with a red cover
100) the book of poems by Robert Burns with a red cover from Blackwell
101) the book of poems with a red cover by Robert Burns from Blackwell
102) *the book with a red cover of poems from Blackwell by Robert Burns
103) *the book with a red cover from Blackwell of poems by Robert Burns
104) *the book with a red cover from Blackwell by Robert Burns of poems
(etc.)

Note that adjuncts and complements are constituents of different types. The definition of adjuncthood holds that adjuncts are sisters to X'. Since conjunction (see the rules below at the end of this chapter) requires that you conjoin elements of the same bar level, you could not, for example, conjoin an adjunct with a complement. This would result in a contradiction: Something can't be both a sister to X' and X at the same time. Adjuncts can conjoin with other adjuncts (other sisters to X'), and complements can conjoin with other complements (other sisters to X), but complements cannot conjoin with adjuncts:

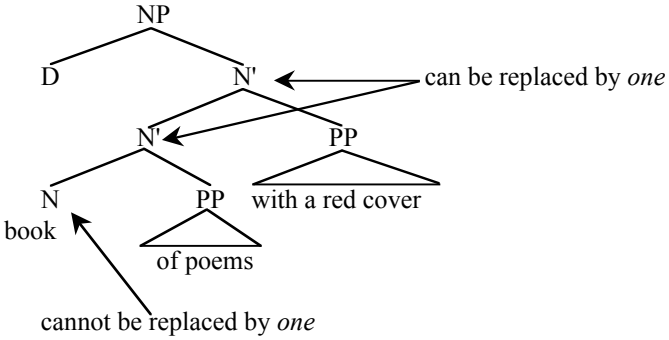
105) the book of poems with a red cover and with a blue spine[4]
106) the book of poems and of fiction from Blackwell
107) *the book of poems and from Blackwell

There is one final difference between adjuncts and complements that we will examine here. Recall the test of *one*-replacement:

108) One-*replacement*
Replace an N' node with *one.*

This operation replaces an N' node with the word *one*. Look at the tree in (109).

109)



If you look closely at this tree you'll see that two possibilities for *one*-replacement exist. We can either target the highest N', and get:

110) the one

or we can target the lower N' and get:

111) the one with a red cover

But we cannot target the N head; it is not an N'. This means that *one* followed by a complement is ill-formed:

112) *the one of poems with a red cover[5]

Since complements are sisters to X and not X', they cannot stand next to the word *one*. Adjuncts, by definition, can.

---

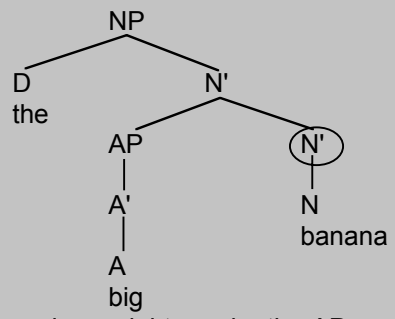
[4] If this NP sounds odd to you, try putting emphasis on the *and*.
[5] Not everyone finds this NP ill-formed. One possible explanation for this is that different dialects have different *one*-replacement rules. The dialect that finds this NP well-formed allows either N or N' to be replaced. The dialect that finds this ill-formed (or at least odd), only allows N' to be replaced.

A Common Error

Many beginning syntacticians, when faced with an NP like:

i) The big banana

will make an easy mistake: They will treat the word *big* as a complement. That is, they draw the tree such that the word *big* is a sister to the N banana. This is very wrong! *Big* here is an adjunct (you can test this yourself with the diagnostics we developed above) so it must be a sister to N'. The tree for this NP is:



The circled N' here is crucial to make the AP an adjunct. Be careful when drawing your trees.

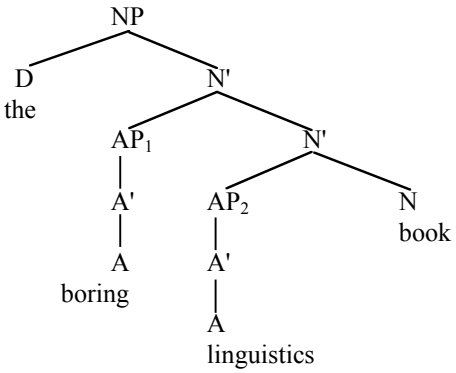
Complements and adjuncts don't have to follow the head. Material that precedes an N head also shows the distinction between complements and adjuncts.

113) the boring linguistics book
adjunct complement head

Boring is an adjunct but *linguistics* is a complement[6]. The tree for this NP is:

[6] Some linguists treat sequences such as linguistics book as a compound noun rather than as an complement adjective preceding a head noun. Can you figure out a way to distinguish these two possible analyses?

114)



The first adjective phrase is an adjunct (sister to N'), the second is a complement (sister to N). The behavioral differences we saw above with post-nominal phrases hold here too. First there is the phenomenon of stacking: You are allowed to have more than one adjunct, but only one complement:

115) the big red boring linguistics book
116) *the boring linguistics fiction book

Complements always appear closer to the head than adjuncts:

117) the red poetry book
118) *the poetry red book.

Adjuncts can be reordered with respect to one another, but complements are fixed in their position (adjacent to the head):

119) the big boring red linguistics book
120) ?[7]the boring big red linguistics book
121) ?the red big boring linguistics book
122) *the big boring linguistics red book
123) *the big linguistics boring red book
124) *the linguistics big boring red book

Adjuncts can be conjoined with adjuncts, and complements can be conjoined with complements, but adjuncts can't be conjoined with complements:

125) the big and boring linguistics book
126) the boring linguistics and anthropology book

[7] Most native speakers of English will find this example and the next one slightly odd. This is because there is a preferred order of adjectives in English. However, what is crucial here is that while these NPs seem odd (or "marked"), they are certainly better than the ones where the complement is reordered with the adjuncts: (122), (123), and (124).

127) *the boring and linguistics book

Finally, adjuncts but not complements can stand next to the *one* of *one*-replacement:

128) the boring book but not the interesting one
129) *the linguistics book but not the anthropology one[8]

The complement/adjunct distinction clearly holds for modifiers that appear prenominally (before the noun) as well.

Before concluding our discussion of complements and adjuncts in NPs, I want to point out one area where the distinction makes an important advance over the theory of phrase structure we developed in chapter 1. Consider the following NP:

130) the German teacher

This NP is actually ambiguous. It can mean either a teacher (say of math) who is German, or it can mean a someone (of any nationality) who teaches the German language. In the old theory of phrase structure, we had no way of distinguishing these. With X-bar theory we do. When *German* refers to the subject being taught, it is a complement to the noun *teacher*. When it refers to nationality, it is an adjunct. We can see this if we apply various tests for distinguishing complements from adjuncts. Note that when we add an adjunct indicating a place of origin, then the NP is no longer ambiguous:

131) the French German teacher

This can only mean "the teacher of German from France." The test of conjunction says that we can only conjoin adjuncts with adjuncts and complements with complements. If we conjoin German with another complement, the NP is again disambiguated:

132) the math and German teacher *(can't mean she is from Germany)*

Finally, if we allow *one* insertion, only the adjunct (country) meaning is allowed:

133) not the American teacher but the German one
(can't mean "teacher of the German language")

In this section, we've covered a huge range of facts, so a quick summary is probably in order. In section 1, we saw that constituency tests pointed towards a more articulated structure for our trees than the one we developed in chapter 2. In section 2, we introduced the X' notation to account for this more complicated structure. In X-bar structure, there are three levels of categories. There are XPs, X's, and

[8] Again, some speakers find this grammatical. This presumably has to do with whether their dialect's *one*-replacement rule targets both N and N' or just N.

Xs. In this section—focusing exclusively on NPs—we introduced special terms for elements that are sisters to X' and X: *adjuncts* and *complements*. These two different kinds of modifier have different properties. Adjuncts but not complements can be iterated and reordered and can stand next to *one*. Complements, by contrast, must be located next to the head and can't be reordered. We also saw that we could conjoin complements with complements and adjuncts with adjuncts, but that we couldn't mix the two. All of these data provide support for the extra structure proposed in X-bar theory. In the next subsection, we'll briefly consider evidence that the complement/adjunct distinction holds for categories other than NP as well.

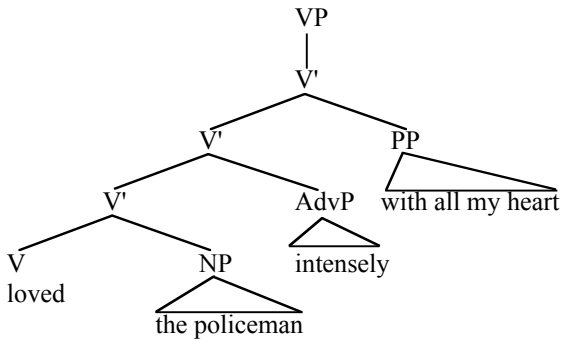
3.2 Complements and Adjuncts in VPs, APs, and PPs

The distinction between complements and adjuncts is not limited to NPs; we find it holds in all the major syntactic categories. The best example is seen in VPs. The direct object of a verb is a complement of the verb. Prepositional and adverbial modifiers of verbs are adjuncts:

134) I loved [the policeman] [intensely] [with all my heart].

V	direct object	adverbial	PP phrase
	complement	*adjunct*	*adjunct*

135)



Direct objects must be adjacent to the verb, and there can only be one of them.

136) *I loved intensely the policeman with all my heart.
137) *I loved the policeman the baker intensely with all my heart.

This is classic adjunct/complement distinction. In general, complements of all categories (N, V, A, P, etc.) are the semantic objects of the head. Consider for example all the complements below:

138) John fears dogs. *(verb)*
139) John is afraid of dogs. *(adjective)*

140) John has a fear of dogs. *(noun)*

In all these sentences, *(of) dogs* is a complement.

The evidence for the adjunct/complement distinction in adjective phrases and prepositional phrases is considerably weaker. Adverbs that modify adjectives have an adjunct flair—they can be stacked and reordered. Other than this, however, the evidence for the distinction in PPs and AdjPs, comes mainly as a parallel to the NPs and VPs. This may be less than satisfying, but is balanced by the formal simplicity of having the same system apply to all categories.

3.3 The Notion Specifier

In the section 3.1 above, we introduced two structural notions: adjuncts and complements. These correspond to two of the three X-bar rules:

141) *Adjunct rule* X' → X' (ZP) *OR* X' → (ZP) X'
142) *Complement rule* X' → X (WP)

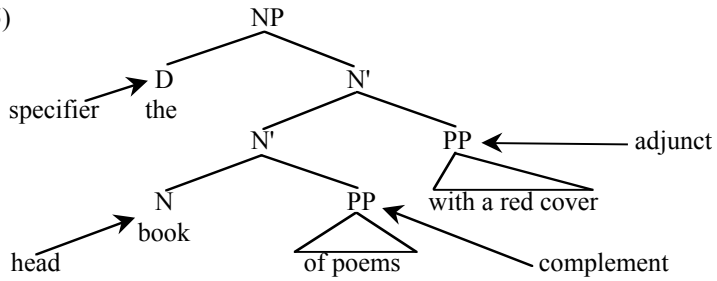
The third rule also introduces a structural position: the specifier.

143) *Specifier rule* XP → (YP) X'

We have only seen one specifier so far—the determiner in NPs:

144) [the] [book] [of poems] [with a red cover]
specifier head complement adjunct

145)



The specifier is defined as the daughter of XP and sister to X':

146) *Specifier*
An XP[9] that is a sister to an X' level, and a daughter of an XP.

We can show that specifiers are different from adjuncts and complements. Since the specifier rule is not recursive, you can only have one specifier[10]:

147) *the these red books

The specifier rule has to apply at the top of the structure, this means that the specifier will always be the left-most element (in English anyway):

148) *boring the book

The above example also shows that specifiers can't be reordered with respect to other adjuncts or complements. As the final difference between specifiers and other types of modifier, specifiers can only be conjoined with other specifiers:

149) two or three books
150) *two or boring books

On the surface, the usefulness of this position may seem obscure, since only determiners appear in it. But in later chapters we will have important use for specifiers. (In particular, we will claim that they are the position where subjects are generated in a variety of categories.)

4. PARAMETERS OF WORD ORDER

In this chapter, and thus far in this book, we've been concentrating primarily on English. The reason for this is that, since you are reading this book, it is the language most accessible to you. However, syntacticians aren't interested only in English. One of the most interesting parts of syntax is comparing the sentence structure of different languages. The X-bar rules we've developed so far for English do an acceptable job of accounting for the order of constituents and hierarchical structure of English:

151) *Specifier Rule* XP → (YP) X'
152) *Adjunct Rule* X' → X' (ZP) *OR* X' → (ZP) X'

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[9] If you are being observant you'll notice that the single example we have of a specifier is not a phrase, but a word (the), so it may seem odd to say XP here. We return to this issue in later chapters.
[10] One possible exception to this is the quantifier *all*, as in *all the books*. In the next chapter, we discuss the idea that determiners head their own phrase (called a DP), which might provide a partial explanation for this exception.

153) *Complement Rule* X' → X (WP)

They don't account, however, well for other languages. Consider the position of direct objects (complements) in Turkish. In Turkish, the complement precedes the head:

154) Hasan kitab-i oku-du.
Hasan-subject book-object read-past
"Hasan read the book."

If you look carefully at sentence (154) you notice that the word *kitabi* 'book' precedes the word *okudu* 'read'.

Not all languages put the complement on the right-hand side like English. Not all languages put the specifier before the head either. Our rules, while adequate for English, don't really get at the syntactic structure of languages in general. Remember, syntax is the study of the mental representation of sentence structure, and since we all have the same basic gray matter in our brains, it would be nice if our theory accounted for both the similarities and the differences among languages.

X-bar theory provides us with an avenue for exploring the differences and similarities among languages. Let's start by generalizing our rules a little bit. Let's allow specifiers and adjuncts to appear on either side of the head:

155) *Specifier rule* XP → (YP) X' *or* XP → X' (YP)
156) *Adjunct rule* X' → X' (ZP) *or* X' → (ZP) X'
157) *Complement rule* X' → X (WP) *or* X' → (WP) X

Each of these rules has two options, the specifier/complement/adjunct can all appear on either side of their head. Obviously, these rules are now too general to account for English. If these rules, as stated, were adopted straight out, they would predict the grammaticality of sentences like:

158) *[$_{NP}$ Policeman the] [$_{VP}$ Mary kissed].
(meaning *The policeman kissed Mary.*)

It would be a bad thing to do this. At the same time, constituent orders like the one in (158) are, in fact, seen the world's languages, so this clearly is an option. Our theory must capture both facts: The fact that the order in (158) is an option that languages use, and that it isn't the option used by English.

The way that generative syntacticians accomplish this is by claiming that the rules in (155), (156) and (157) are the possibilities universally available to human beings. When you acquire a particular language you, based upon the input you hear from your parents, select *one* of the options in the rule. Take, for example, the complement rule. In English, complements of verbs follow the verbal head. In Turkish, they precede the head. There are two options in the rule:

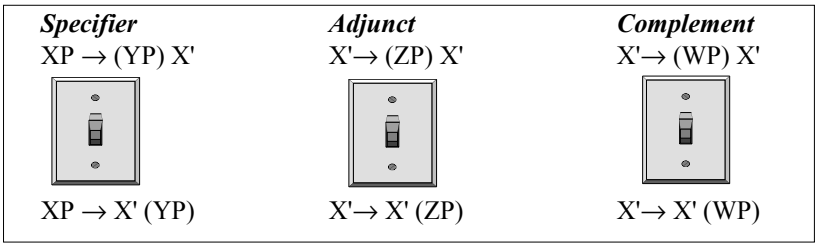
159) i) X'→ X (WP)

ii) X' → (WP) X

The child learning English will adopt option (i), the child learning Turkish will adopt option (ii). These options are called ***parameters***. The proposal that word order is parameterized finds its origins in Travis (1984).

Here is an analogy that might help you understand this concept. Imagine that in your head you have a box of switches, just like the box of master breaker switches which controls the electricity in your house. These switches can be set *on* or *off*. The options in the X-bar rules are like these switches, they can be set in one direction or the other (and in some situations—such as adjuncts in English—allow both settings).

160) *X-bar parameters switch box*



When you are a child acquiring your language, you subconsciously set these switches, to tell you which version of the rules to use.

Notice that this gives us a very simple system for acquiring the word order of our languages. There are a finite set of possibilities, represented by the different settings of the parameters. English sets its complement parameter so that the complement follows the head. Turkish sets it the other way. The child only has to hear a small amount of data (perhaps even as little as one sentence) to know what side of the head complements go in their language. Once children have set the parameter, they can apply the right version of the rule and generate an unlimited number of sentences. In the problem sets at the end of this chapter, you have the opportunity of looking at some data from a variety of languages and determining how their X-bar parameters are set. For your reference, the English settings are give below:

161) *Specifier* specifier on left, head on right (XP → (YP) X')
e.g., *The* book

162) *Adjunct* Both options allowed (X' → (ZP) X' and X' → X' (ZP))
e.g., *Yellow* roses
Books *from Poland*

163) *Complement* head on left, complement on right[11] (X'→ X (WP))
e.g., Books *of Poems*
John kissed *his mother*.

5. X-BAR THEORY: A SUMMARY

Let's summarize the rather lengthy discussion we've had so far in this chapter. We started off with the observation that there seemed to be more structure to our trees than that given by the basic phrase structure rules we developed in chapter 2. In particular, we introduced the intermediate levels of structure called N', V', A' and P'. The evidence for these comes from standard constituency tests like conjunction, and from processes like *one*-replacement, and *do-so*-replacement. We also saw that material on different levels of structure behaved differently. Complements exhibit one set of behaviors and adjuncts a different set. Next we observed that our rules were failing to capture several generalizations about the data. First was the endocentricity generalization: all NPs, have an N head, all APs an A head, etc. There is no rule like NP → V A. Next, there was the observation that all trees have three levels of structure. They all have specifiers (weak evidence here), adjuncts and complements. In response to this, we proposed the following general X-bar theoretic rules.

164) *Specifier rule* XP → (YP) X' *or* XP → X' (YP)
165) *Adjunct rule* X' → X' (ZP) *or* X' → (ZP) X'
166) *Complement rule* X' → X (WP) *or* X' → (WP) X

These rules use variables to capture cross-categorial generalizations. In order to limit the power of these rules, and in order to capture differences between languages, we proposed that the options within these rules were parameterized. Speakers of languages select the appropriate option for their language.

This is, you'll note, a very simple system. There are, of course, some loose ends, and in the next couple of chapters we'll try to tidy these up.

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[11] The world is rarely as clean and tidy as we would like. We've already observed one exception to this principle. Some complements to N can appear before the head as in *poetry book*. There is an obvious way out of this problem. Each major part of speech has its own set of parameters (i.e., there is a different set of parameters for N than for V, etc.) This adds a layer of complication to the system not necessary for our purposes here, but you should keep this in mind.

Important Extra Rules

You'll need the following additional rules to do the homework in this chapter:

Sentence rules

S' → (C) S

S → NP (T) VP

Conjunction rules

XP → XP Conj XP

X' → X' Conj X'

X → X Conj X

The first two rules are your sentence and S' rule to introduce complementizers. The last three are the conjunction rules.

6. DRAWING TREES IN X-BAR NOTATION

6.1 Important Considerations in Tree Drawing.

In this section, we'll run through the steps for drawing trees in X-bar notation. The basics of tree drawing that you learned in Chapter 2 hold here too:

i) Write out the sentence and identify the parts of speech
ii) Identify what modifies what.
iii) Start linking material together, it often helps to start at the right edge. I also recommend starting with APs, then NPs, then PPs, then NPs again, and then VPs.
iv) Make sure you've attached everything according to the rules.
v) Keep applying the rules until everything is linked up.
vi) Apply the S & S' rules last.
vii) Go back and check your tree against the rules.

These general principles, explored in depth in chapter 2, will also hold you in good stead here. But there are a couple of additional points that are necessary when you are using X-bar theory.

A) When identifying what modifies what, it is also important to know whether it is a complement, adjunct, or specifier. This is important because you have to know whether to make it a sister to the head, to an X', etc.

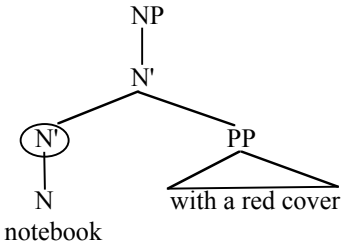
B) We will need to slightly modify our golden rule of modification so that modifiers are always attached to a projection of the head they modify (N' and NP are ***projections*** of N).

C) When linking material up, start with the modifiers closest to the head. Because X-bar structure is formulated the way it is, material closest to the head will be the most deeply embedded material—so it will have to attach to the head *first*.

D) Keep in mind that none of the X-bar rules are optional. That is, they must all apply. This results in a fair amount of vacuous or non-branching structure. Even if you have only a single word you will have *at least* the following structure:

E) Perhaps one of the most common errors of new syntacticians is in drawing trees for phrases with an adjunct and no complement. Consider the NP [notebook with a red cover]. *With a red cover* is an adjunct – that means that it has to be a sister to N' and a daughter to N' (by definition). This is seen in the following tree:

167)



The circled N' here must be present in order to make the PP an adjunct. Be very careful to draw in these vacuous nodes that distinguish adjuncts from complements.

6.2 A Sample Tree

To get the full feel of tree drawing, let's do a sample tree. The sentence we'll draw is:

168) The$_1$ man from Brazil found books of poems in the$_2$ puddle.

Our first step, as always, is to identify the parts of speech:

169) D N P N V N P N P D N
The$_1$ man from Brazil found books of poems in the$_2$ puddle.

Next, and most importantly, we have to identify what modifies or relates to what, and whether that modification is as an adjunct, complement or specifier. This is perhaps the most difficult and tedious step, but it is also the most important. You will get better at this with practice. You can use the tests we developed above (stacking, coordination, etc.) to determine whether the modifier is a complement, adjunct or specifier.

170) [The$_1$] modifies [man] as a specifier.
[Brazil] modifies [from] as a complement.
[from Brazil] modifies [man] as an adjunct.
[Poems] modifies [of] as a complement.
[of Poems] modifies [books] as a complement.
[books of poems] modifies [found] as a complement.
[the$_2$] modifies [puddle] as a specifier.
[the puddle] modifies [in] as a complement.
[in the puddle] modifies [found] as an adjunct.

Keeping in mind the (revised) golden rule of modification, and the strict X-bar structure, we next start to build the trees. I suggest you generally start with APs. There are no APs in this sentence, so we'll start with NPs. We'll also start on the right hand side of the sentence. The first NP is *the puddle*, be sure to apply all three of the NP rules here. Don't forget the N' node in the middle. The determiner is the specifier of the NP, so it must be the sister to N' and daughter of NP.

171)

The$_1$ man from Brazil found books of poems in the$_2$ puddle.

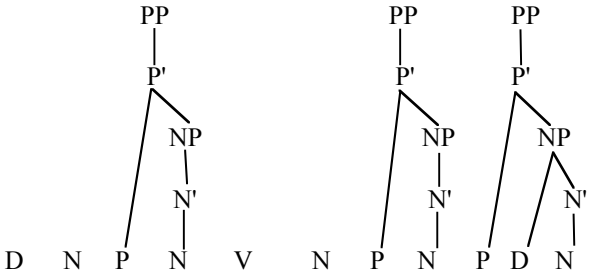
There are two nouns in this sentence that aren't modified by anything (*Brazil* and *poems*). Let's do these next. Even though they aren't modified by anything they get the full X-bar structure, with NP, N' and N: This is because the rules are *not* optional.

172)

The$_1$ man from Brazil found books of poems in the$_2$ puddle.

There are two more nouns in this sentence (*man* and *books*), but if you look carefully at our list of modifications (170), you'll see that they are both modified by PPs. So in order to do them, we have to first build our PPs. There are three Ps in this sentence (and hence three PPs), each of them takes one of the NPs we've built as a complement. The objects of prepositions are always complements. That means that they are sisters to P, and daughters of P':

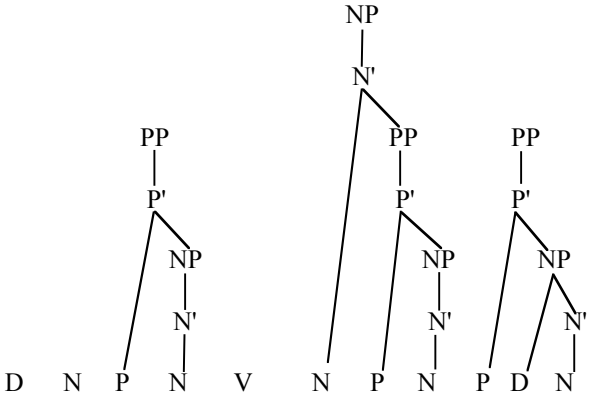
173)



The$_1$ man from Brazil found books of poems in the$_2$ puddle.

Now that we've generated our PPs, we'll go back to the two remaining NPs. Let's first observe that the PP *in the puddle* does *NOT* modify an N (it modifies the V *found*, so it is *NOT* attached at this stage. Now, turn to the N *books*. This N is modified by *of poems* as a complement, that means that the PP will be the sister to the N head, and the daughter of N'. Again make sure you apply all three layers of structure.

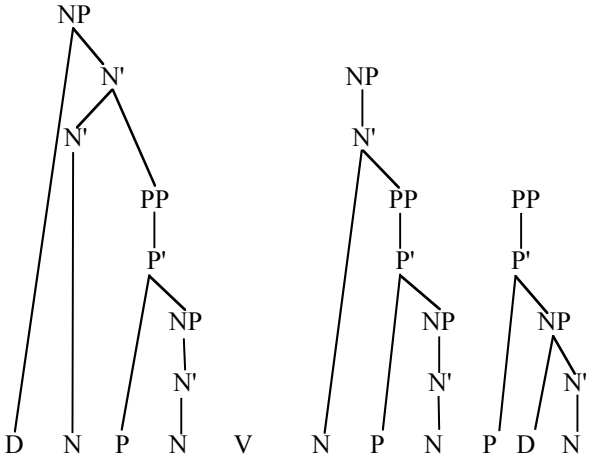
174)



The$_1$ man from Brazil found books of poems in the$_2$ puddle.

Finally, we have the NP *the man from Brazil*, *from Brazil* modifies *man* as an adjunct. This means that it has to be a sister to N' and a daughter of N'. This will necessitate an extra layer of structure. (Note the difference between this NP and *books of poems*). The determiner is a specifier, which is a daughter of XP and a sister to X'.

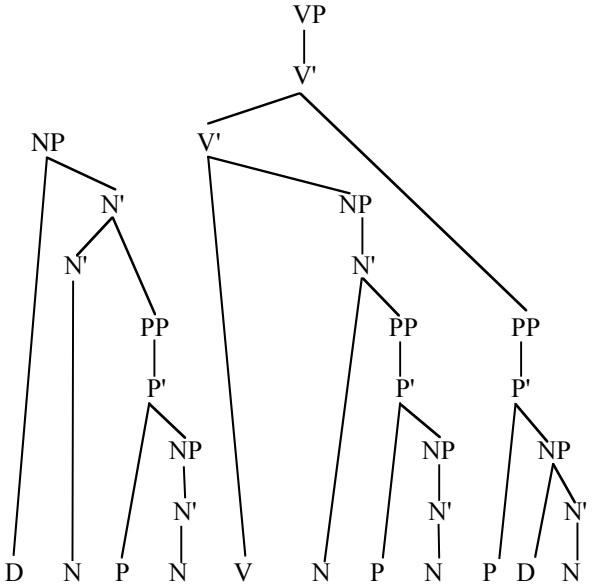
175)



The$_1$ man from Brazil found books of poems in the$_2$ puddle.

Now we turn to the VP. The verb found has two modifiers. *Books of poems* is a complement, and *in the puddle* is an adjunct. ***You should always start with the complement, and then follow with the adjuncts*** because complements are closer to the head. Remember, complements are sisters to V, and adjuncts to V'. Notice that the complement NP, which is closer to the head, is attached lower than the adjunct PP.

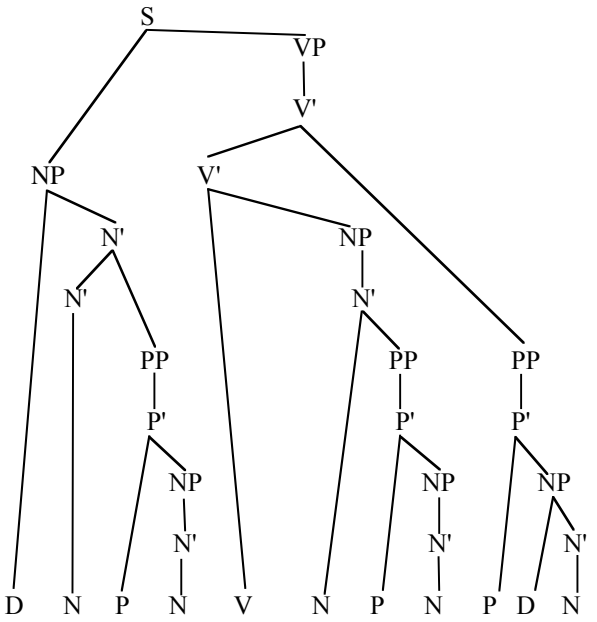
176)



The$_1$ man from Brazil found books of poems in the$_2$ puddle.

Last, but not least, we apply the S rule, and then check the tree against the X-bar rules. Making sure that everything is attached; there are no crossing lines; adjuncts are sisters to a bar level, complements are sisters to a head; and finally every head has at least an X, X', and XP on top of it.

177)



The$_1$ man from Brazil found books of poems in the$_2$ puddle.

Each tree will be different, of course, but with practice and patience you will develop the skill quite easily.

IDEAS, RULES AND CONSTRAINTS INTRODUCED IN THIS CHAPTER

i) ***Specifier*** Sister to X', daughter of XP.

ii) ***Adjunct*** Sister to X', daughter of X'.

iii) ***Complement*** Sister to X, daughter of X'.

iv) ***Head*** The word that gives its category to the phrase.

v) **One-*replacement***
Replace an N' node with *one.*

vi) **Do-so-*replacement***
Replace a V' with *do so.*

vii) ***Specifier Rule*** XP → (YP) X' or XP →X' (YP)

viii) ***Adjunct Rule*** X' → X' (ZP) or X' → (ZP) X'

ix) ***Complement Rule*** X' → X (WP) or X' → (WP) X

x) ***Additional Rules***
S' → (C) S
S → NP VP
XP → XP Conj XP
X' → X' Conj X'
X → X Conj X

xi) ***Parameterization***
The idea that there is a fixed set of possibilities in terms of structure (such as the options in the X-bar framework), and people acquiring a language choose from among those possibilities.

FURTHER READING

Baltin, Mark and Anthony Kroch (1989) *Alternative Conceptions of Phrase Structure.* Chicago: Chicago University Press.
[This is a collection of papers about phrase structure theory.]

Borsley, Robert (1996) *Modern Phrase Structure Grammar.* Oxford: Blackwell.
[This book presents a different view of phrase structure (from the HPSG perspective.)]

Carnie, Andrew (1995) *Head Movement and Non-Verbal Predication.* Ph.D. Dissertation, MIT.
[This work argues presents arguments against X-bar theory.]

Chametzky, Robert (1996) *A Theory of Phrase Markers and the Extended Base*. Albany: SUNY Press.
[This book presents a version of X-bar where the properties of the different rules are derived from other phenomena (advanced).]

Chomsky, N (1970) "Remarks on Nominalization" in R. Jacobs and P. Rosenbaum (eds.) *Readings in English Transformational Grammar*. Waltham: Ginn. 184-221.

[The original proposal for X-bar theory.]

Jackendoff, Ray (1977) *X-bar Syntax: A Theory of Phrase Structure*. Cambridge: MIT Press.
[This is the classic work on X-bar theory. The particular implementation of the theory is slightly different than the one discussed here.]

Kayne, Richard (1995) The Antisymmetry of Synta. Cambrige: MIT Press.
[This book discusses the possibility of deriving X-bar theory from deeper principles]

Lightfoot, David (1991) *How to Set Parameters: Evidence from Language Change.* Cambridge: MIT Press.
[This is an interesting read about how parameter setting might work.]

Radford, Andrew (1988) *Transformational Grammar*. Cambridge: Cambridge University Press
[This introductory syntax provides one of the most complete descriptions of X-bar theory.]

Speas, Margaret (1990) *Phrase Structure in Natural Language*. Dordrecht: Kluwer Academic Publishers
[The book argues for a derived notion of X-bar theory.]

Stowell, Tim (1981) *Origins of Phrase Structure*. Ph.D. dissertation, MIT.
[This thesis contains a significant development of Jackendoff's work.]

Travis, Lisa (1984) *Parameters and Effects of Word Order Derivation.* Ph.D. dissertation, MIT.
[The proposal for parametric explanations for word order.]

PROBLEM SETS

1. TREES

Draw the X-bar theoretic trees for the following sentences:

a) Lewinsky wrote a poem about Clinton.
b) Lewinsky wrote a poem with Clinton in mind.
c) Lewinsky wrote a poem with Clinton's pen.
d) The red volume of obscene verse from Italy shocked the puritan soul of the minister with the beard quite thoroughly yesterday.
e) The biggest man in the room said that John danced an Irish Jig from County Kerry to County Tipperary all night long.

2. GERMAN NOUN PHRASES

Consider sentence (i) from German:[12]

i) Die schlanke Frau aus Frankreich isst Kuchen mit Sahne.
the slim woman from France eats cake with cream
"The thin woman from France eats cake with cream."

The following sentences are grammatical if they refer to the same woman described in (i):

ii) Die Schlanke aus Frankriech isst Kuchen mit Sahne.
"The thin one from France eats cake with cream."

iii) Die aus Frankriech isst Kuchen mit Sahne.
"The one from France eats cake with cream."

iv) Die Schlanke isst Kuchen mit Sahne.
"The thin one eats cake with cream."

v) Die isst Kuchen mit Sahne.
"She eats cake with cream."

Now consider sentences (vi-ix):

vi) Die junge Koenigin von England liebte die Prinzessin.
The young queen of England loved the princess
"The young queen of England loved the princess."

vii) Die junge liebte die Prinzessin.
"The young one loved the princess."

viii) Die liebte die Prinzessin.
"She loved the princess."

ix) *Die von England liebte die Prinzessin.
"the one of England loves the princess."

[12] Thanks to Simin Karimi for providing the data for this question.

Assume the following things:

1) *Der/Die* are always determiners, they are never nouns or pronouns

2) *Kleine, junge*, are always adjectives, even in sentences (vi) and (iv)—assume they never become nouns. (Ignore the rules of German capitalization.)

The questions:

a) Describe and explain the process seen in (ii-v) and (vii-ix), be sure to make explicit reference to X-bar theory. What English phenomenon (discussed in this chapter) is this similar to? Make sure you analyze the ***German*** sentences not the English translations.

b) Draw the trees for sentences (i) and (vi). Sentence (i) requires TWO different trees.

c) Explain the ungrammaticality of (ix) in terms of X-bar theory. In particular explain the difference between it and sentence (iii). Draw trees to explicate your answer.

3. JAPANESE

Consider the following data from Japanese:

1) Masa-ga kita.
"Masa came."

2) Toru-ga shinda.
"Toru died."

3) Kumiko-ga yonda.
"Kumiko read."

4) Kumiko-ga hon-o yonda.
"Kumiko read the book."

5) Toru-ga Kumiko-o mita.
"Toru saw Kumiko."

6) Kumiko-ga Toru-o mita.
"Kumiko saw Toru."

7) hon-ga akai desu.
"the book is red."

8) Toru-ga sensei desu.
"Toru is a teacher."

9) Masa-ga ookii desu.
"Masa is big."

10) Sono hon-ga ookii desu.
"that book is big."

11) Toru-ga sono akai hon-o mita.
"Toru saw that red book."

A) What is the function of the suffixes *-o* and *-ga*?
B) What is the word order of Japanese?
C) Does the complement precede or follow the head in Japanese?
D) Do adjuncts precede or follow the head in Japanese?
E) Do specifiers precede or follow the X' node in Japanese?
F) Draw the tree for sentence (11) using X-bar theory. Keep in mind your answers to questions A-E.

4. PARAMETERS

Go back to the foreign language problems from the previous three chapters, and see if you can determine the parameter settings for these languages. You may not be able to determine all the setting Is for each language.