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Syntax: The Sentence Patterns of Language

To grammar even kings bow.

J. B. MOLIÈRE, *Les Femmes Savantes, II*, 1672

It is an astonishing fact that any speaker of any human language can produce and understand an infinite number of sentences. We can show this quite easily through examples such as the following:

The kindhearted boy had many girlfriends.
The kindhearted, intelligent boy had many girlfriends.
The kindhearted, intelligent, handsome boy had many girlfriends.

.
.
.

John found a book in the library.
John found a book in the library in the stacks.
John found a book in the library in the stacks on the fourth floor.

.
.
.

The cat chased the mouse.
The cat chased the mouse that ate the cheese.
The cat chased the mouse that ate the cheese that came from the cow.
The cat chased the mouse that ate the cheese that came from the cow that grazed in the field.

In each case the speaker could continue creating sentences by adding another adjective, prepositional phrase, or relative clause. In principle, this could go on forever. All languages have mechanisms of this sort that make the number of sentences limitless. Given this fact, the sentences of a language cannot be stored in a dictionary format in our heads. Rather, sentences are composed of discrete units that are combined by rules. This system of rules explains how speakers can store infinite knowledge in a finite space—our brains.

The part of grammar that represents a speaker's knowledge of sentences and their structures is called **syntax**. The aim of this chapter is to show you what syntactic structures look like and to familiarize you with some of the rules that determine them. Most of the examples will be from the syntax of English, but the principles that account for syntactic structures are universal.

What the Syntax Rules Do

"Then you should say what you mean," the March Hare went on.

"I do," Alice hastily replied, "at least—I mean what I say—that's the same thing, you know."

"Not the same thing a bit!" said the Hatter. "You might just as well say that 'I see what I eat' is the same thing as 'I eat what I see'!"

"You might just as well say," added the March Hare, "that 'I like what I get' is the same thing as 'I get what I like'!"

"You might just as well say," added the Dormouse . . . "that 'I breathe when I sleep' is the same thing as 'I sleep when I breathe'!"

"It is the same thing with you," said the Hatter.

LEWIS CARROLL, *Alice's Adventures in Wonderland*, 1865

The **rules of syntax** combine words into phrases and phrases into sentences. Among other things, the rules determine the correct word order for a language. For example, English is a Subject–Verb–Object (SVO) language. The English sentence in (1) is grammatical because the words occur in the right order; the sentence in (2) is ungrammatical because the word order is incorrect for English. (Recall that the asterisk or star preceding a sentence is the linguistic convention for indicating that the sentence is ungrammatical or ill-formed according to the rules of the grammar.)

1. The President nominated a new Supreme Court justice.
2. *President the Supreme new justice Court a nominated.

A second important role of the syntax is to describe the relationship between the meaning of a particular group of words and the arrangement of those words. For example, Alice's companions show us that the word order of a sentence contributes crucially to its meaning. The sentences in (3) and (4) contain the same words, but the meanings are quite different, as the Mad Hatter points out.

3. I mean what I say.
4. I say what I mean.

The rules of the syntax also specify the **grammatical relations** of a sentence, such as **subject** and **direct object**. In other words, they provide information about who is doing what to whom. This information is crucial to understanding the meaning of a sentence. For example, the grammatical relations in (5) and (6) are reversed, so the otherwise identical sentences have very different meanings.

5. Your dog chased my cat.
6. My cat chased your dog.

In (7) we see that the phrase *ran up the hill* behaves differently from the phrase *ran up the bill*, even though the two phrases are superficially quite similar. For the expression *ran up the hill*, the rules of the syntax allow the word orders in (7a) and (7c), but not (7b). In *ran up the bill*, in contrast, the rules allow the order in (7d) and (7e), but not (7f).

7. **(a)** Jack and Jill ran up the hill.
   (b) *Jack and Jill ran the hill up.
   (c) Up the hill ran Jack and Jill.
   (d) Jack and Jill ran up the bill.
   (e) Jack and Jill ran the bill up.
   (f) *Up the bill ran Jack and Jill.

The pattern shown in (7) illustrates that sentences are not simply strings of words with no further organization. If they were, there would be no reason to expect *ran up the hill* to pattern differently from *ran up the bill*. These phrases act differently because they have different syntactic structures associated with them. In *ran up the hill*, the words *up the hill* form a unit, as follows:

He ran [up the hill].

The whole unit can be moved to the beginning of the sentence, as in (7c), but we cannot rearrange its subparts, as shown in (7b). On the other hand, in *ran up the bill*, the words *up the bill* do not form a natural unit, so they cannot be moved together, and (7f) is ungrammatical.

Our syntactic knowledge crucially includes rules that tell us how words form groups in a sentence, or how they are *hierarchically* arranged with respect to one another. Consider the following sentence:

The captain ordered all old men and women off the sinking ship.

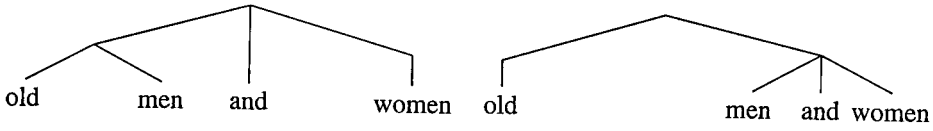
This phrase *old men and women* is ambiguous, referring to either old men and to women of any age or to old men and old women. The ambiguity arises because the words *old men and women* can be grouped in two ways. If the words are grouped as follows, *old* modifies only *men* and so the women can be of any age.

[old men] and [women]

When we group them like this, the adjective *old* modifies both *men* and *women*.

[old [men and women]]

The rules of syntax allow both of these groupings, which is why the expression is ambiguous. The following hierarchical diagrams, also called **tree diagrams**, illustrate the same point:



In the first structure *old* and *men* are under the same node and hence old modifies *men*. In the second structure *old* shares a node with the entire conjunction *men and women*, and so modifies both.

This is similar to what we find in morphology for ambiguous words such as *unlockable*, which have two structures, corresponding to two meanings, as discussed in chapter 2.

Many sentences exhibit such ambiguities, often leading to humorous results. Consider the following two sentences, which appeared in classified ads:

For sale: an antique desk suitable for lady with thick legs and large drawers.
We will oil your sewing machine and adjust tension in your home for $10.00.

In the first ad, the humorous reading comes from the grouping [desk] [for lady with thick legs and large drawers] as opposed to the intended [desk for lady] [with thick legs and large drawers], where the legs and drawers belong to the desk. The second case is similar.

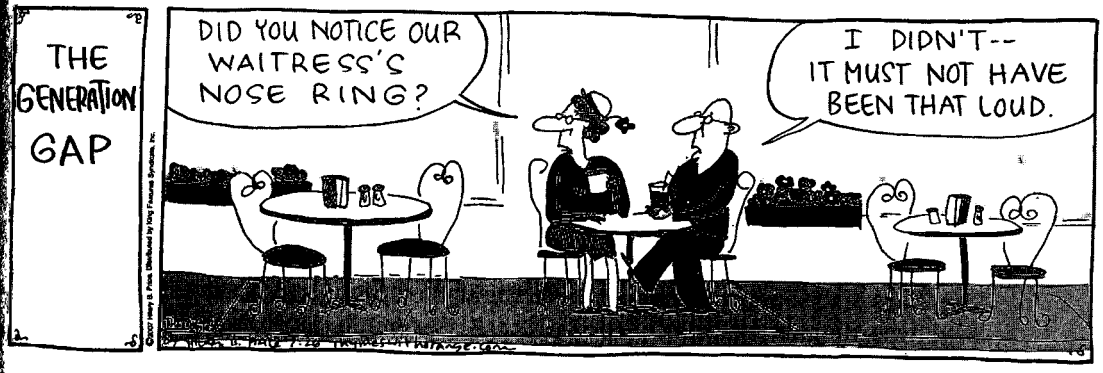
Because these ambiguities are a result of different structures, they are instances of **structural ambiguity**.

Contrast these sentences with:

This will make you smart.

The two interpretations of this sentence are due to the two meanings of *smart*—'clever' and 'burning sensation.' Such lexical or word-meaning ambiguities, as opposed to structural ambiguities, will be discussed in chapter 4.

Often a combination of differing structure and double word-meaning creates ambiguity (and humor) as in the cartoon:



Hilary B. Price. King Features Syndicate

Syntactic rules reveal the grammatical relations among the words of a sentence as well as their order and hierarchical organization. They also explain how the grouping of words relates to its meaning, such as when a sentence or phrase is ambiguous. In addition, the rules of syntax permit speakers to produce and understand a limitless number of sentences never produced or heard before—*the creative aspect of linguistic knowledge.* A major goal of linguistics is to show clearly and explicitly how syntactic rules account for this knowledge. A theory of grammar must provide a complete characterization of what speakers implicitly know about their language.

What Grammaticality Is Not Based On

> *Colorless green ideas sleep furiously.* This is a very interesting sentence, because it shows that syntax can be separated from semantics—that form can be separated from meaning. The sentence doesn't seem to mean anything coherent, but it sounds like an English sentence.
>
> HOWARD LASNIK, *The Human Language: Part One*, 1995

Importantly, a person's ability to make grammaticality judgments does not depend on having heard the sentence before. You may never have heard or read the sentence

Enormous crickets in pink socks danced at the prom.

but your syntactic knowledge tells you that it is grammatical. As we showed at the beginning of this chapter, people are able to understand, produce, and make judgments about an infinite range of sentences, most of which they have never heard before. This ability illustrates that our knowledge of language is creative—not creative in the sense that we are all accomplished poets, but creative in that none of us is limited to a fixed repertoire of expressions. Rather, we can exploit the resources of our language and grammar to produce and understand a limitless number of sentences embodying a limitless range of ideas and emotions.

We showed that the structure of a sentence contributes to its meaning. However, grammaticality and meaningfulness are not the same thing, as shown by the following sentences:

Colorless green ideas sleep furiously.
A verb crumpled the milk.

Although these sentences do not make much sense, they are syntactically well formed. They sound funny, but their funniness is different from what we find in the following strings of words:

*Furiously sleep ideas green colorless.
*Milk the crumpled verb a.

There are also sentences that we understand even though they are not well-formed according to the rules of the syntax. For example, most English speakers could interpret

*The boy quickly in the house the ball found.

although they know that the word order is incorrect. To be a sentence, words must conform to specific patterns determined by the syntactic rules of the language.

Some sentences are grammatical even though they are difficult to interpret because they include nonsense words, that is, words with no agreed-on meaning. This is illustrated by the following lines from the poem "Jabberwocky" by Lewis Carroll:

'Twas brillig, and the slithy toves
Did gyre and gimble in the wabe

These lines are grammatical in the linguistic sense that they obey the word order and other constraints of English. Such nonsense poetry is amusing precisely because the sentences comply with syntactic rules and sound like good English. Ungrammatical strings of nonsense words are not entertaining:

*Toves slithy the and brillig 'twas
wabe the in gimble and gyre did

Grammaticality also does not depend on the truth of sentences. If it did, lying would be easy to detect. Nor does it depend on whether real objects are being discussed or whether something is possible in the real world. Untrue sentences can be grammatical, sentences discussing unicorns can be grammatical, and sentences referring to pregnant fathers can be grammatical.

The syntactic rules that permit us to produce, understand, and make grammaticality judgments are unconscious rules. The grammar is a mental grammar, different from the prescriptive grammar rules that we are taught in school. We develop the mental rules of grammar long before we attend school, as we shall see in chapter 9.

Sentence Structure

> I really do not know that anything has ever been more exciting than diagramming sentences.
>
> **GERTRUDE STEIN**, "Poetry and Grammar," 1935

Suppose we wanted to write a template that described the structure of an English sentence, and more specifically, a template that gave the correct word order for English. We might come up with something like the following:

Det—N—V—Det—N

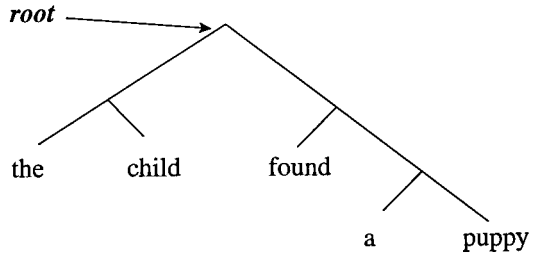
This template says that a determiner (e.g. an article like *the* or *a*) is followed by a noun, which is followed by a verb, and so on. It would describe English sentences such as the following:

The child found a puppy.
The professor wrote a book.
That runner won the race.

The implication of such a template would be that sentences are strings of words belonging to particular grammatical categories ("parts of speech") with no internal organization. We know, however, that such "flat" structures are incorrect. As noted earlier, sentences have hierarchical organization; that is, the words are grouped into natural units. The words in the sentence

The child found a puppy.

may be grouped into [the child] and [found a puppy], corresponding to the subject and predicate of the sentence. A further division gives [the child] and then [[found] [a puppy]], and finally the individual words: [[the] [child]] [[found] [[a] [puppy]]]. It's sometimes easier to see the parts and subparts of the sentence in a tree diagram, as we did earlier to illustrate ambiguity:



The "tree" is upside down with its "root" encompassing the entire sentence, *The child found a puppy*, and its "leaves" being the individual words *the*, *child*, *found*, *a*, and *puppy*. The tree conveys the same information as the nested square brackets. The hierarchical organization of the tree reflects the groupings and subgroupings of the words of the sentence.

The tree diagram shows, among other things, that the phrase *found a puppy* divides naturally into two branches, one for the verb *found* and the other for the direct object *a puppy*. A different division, say, *found a* and *puppy*, is unnatural.

Constituents and Constituency Tests

The natural groupings or parts of a sentence are called **constituents**. Various linguistic tests reveal the constituents of a sentence. The first test is the "stand alone" test. If a group of words can stand alone, for example, as an answer to a question, they form a constituent. So in response to the question "What did you find?" a speaker might answer *a puppy*, but not *found a*. *A puppy* can stand alone while *found a* cannot. We have a clear intuition that one of these is a meaningful unit and the other is just a list of words.

The second test is "replacement by a pronoun." Pronouns can substitute for natural groups. In answer to the question "Where did you find *a puppy*?" a speaker can say, "I found *him* in the park." Words such as *do* (which is not a pronoun per se) can also take the place of the entire predicate *found a puppy*, as in "John found a puppy and Bill *did* too." If a group of words can be replaced by a pronoun or a word like *do*, it forms a constituent.

A third test of constituency is the "move as a unit" test. If a group of words can be moved, they form a constituent. For example, if we compare the following sentences to the sentence "The child found a puppy," we see that certain elements have moved:

It was *a puppy* that *the child* found.
A puppy was found by *the child.*

In the first example, the constituent *a puppy* has moved from its position following *found;* in the second example, the positions of *a puppy* and *the child* have been changed. In all such rearrangements the constituents *a puppy* and *the child* remain intact. *Found a* does not remain intact, because it is not a constituent.

In the sentence "The child found a puppy," the natural groupings or constituents are the subject *the child,* the predicate *found a puppy,* and the direct object *a puppy.*

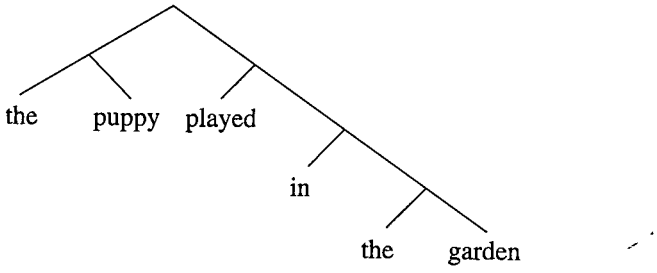
Some sentences have prepositional phrases in the predicate. Consider

The puppy played in the garden.

We can use our tests to show that *in the garden* is also a constituent, as follows:

Where did the puppy play? *In the garden* (stand alone)
The puppy played *there.* (replacement by a pronoun-like word)
In the garden is where the puppy played. (move as a unit)
It was *in the garden* that the puppy played. (move as a unit)

As before, our knowledge of the **constituent structure** of a sentence may be graphically represented by a tree diagram. The tree diagram for the sentence "The puppy played in the garden" is as follows:



In addition to the syntactic tests just described, experimental evidence has shown that speakers do not mentally represent sentences as strings of words but rather in terms of constituents. In these experiments, subjects listen to sentences that have clicking noises inserted into them at random points. In some cases the click occurs at a constituent boundary, and in other sentences the click is inserted in the middle of a constituent. The subjects are then asked to report where the click occurred. There were two important results: (1) Subjects noticed the click and recalled its location best when it occurred at a major constituent boundary (e.g., between the subject and predicate); and (2) clicks that occurred inside the constituent were reported to have occurred between constituents. In other words, subjects displaced the clicks and put

them at constituent boundaries. These results show that speakers perceive sentences in chunks corresponding to grammatical constituents.

Every sentence in a language is associated with one or more constituent structures. If a sentence has more than one constituent structure, it is ambiguous, and each tree will correspond to one of the possible meanings. For example, the sentence *I bought an antique desk suitable for a lady with thick legs and large drawers* has two phrase structure trees associated with it. In one structure the phrase [a lady with thick legs and large drawers] forms a constituent; it could stand alone in answer to the question "Who did you buy an antique desk for?" In its second meaning, the phrase *thick legs and large drawers* modifies the phrase [*desk for a lady*]; it could stand alone in answer to the question "What did the desk have?"

Syntactic Categories

"Very traditional. He's the noun. She's the adjective."

Each grouping in the tree diagrams of "The child found a puppy" is a member of a large family of similar expressions. For example, *the child* belongs to a family that includes *the police officer, your neighbor, this yellow cat, he, John,* and countless others. We can substitute any member of this family for the child without affecting the grammaticality of the sentence, although the meaning of course would change.

A police officer found a puppy.
Your neighbor found a puppy.
This yellow cat found a puppy.

A family of expressions that can substitute for one another without loss of grammaticality is called a **syntactic category**.

The child, a police officer, John, and so on belong to the syntactic category **noun phrase (NP)**, one of several syntactic categories in English and all languages. NPs may function as subjects or as objects in sentences. An NP often contains a *determiner* (like *a* or *the*) and a noun, but it may also consist of a proper name, a pronoun, a noun without a determiner, or even a clause or

a sentence. Even though a proper noun like *John* and pronouns such as *he* and *him* are single words, they are technically NPs, because they pattern like NPs in being able to fill a subject or object or other NP slots.

John found the puppy.
He found the puppy.
Boys love puppies.
The puppy loved him.
The puppy loved John.

NPs can be more complex, as illustrated by the sentence:

The girl that Professor Snape loved married the man of her dreams.

The NP subject of this sentence is *the girl that Professor Snape loved*, and the NP object is *the man of her dreams*.

Syntactic categories are part of a speaker's knowledge of syntax. That is, speakers of English know that only items (a), (b), (e), (f), and (g) in the following list are NPs even if they have never heard the term *noun phrase* before.

1. **(a)** a bird
   (b) the red banjo
   (c) have a nice day
   (d) with a balloon
   (e) the woman who was laughing
   (f) it
   (g) John
   (h) went

You can test this claim by inserting each expression into three contexts: *What/who I heard was* _____, *Who found* _____*?* and _____ *was seen by everyone.* For example, **Who found with a balloon?* is ungrammatical, as is **Went was seen by everyone*, as opposed to *Who found it?* or *John was seen by everyone.* Only NPs fit into these contexts because only NPs can function as subjects and objects.

There are other syntactic categories. The expression *found a puppy* is a **verb phrase (VP)**. A verb phrase always contains a **verb (V)**, and it may contain other categories, such as a noun phrase or **prepositional phrase (PP)**, which is a preposition followed by an NP, such as *in the park, on the roof, with a balloon.* In (2) the VPs are those phrases that can complete the sentence "The child _____."

2. **(a)** saw a clown
   (b) a bird
   (c) slept
   (d) smart
   (e) ate the cake
   (f) found the cake in the cupboard
   (g) realized that the Earth was round

Inserting (a), (c), (e), (f), and (g) will produce grammatical sentences, whereas the insertion of (b) or (d) would result in an ungrammatical sentence. Thus, (a), (c), (e), (f), and (g) are verb phrases.

Lexical and Functional Categories

There are ten parts of speech, and they are all troublesome.

MARK TWAIN, "The Awful German Language," in *A Tramp Abroad*, 1880

Syntactic categories include both phrasal categories such as NP, VP, AP (adjective phrase), PP (prepositional phrase), and AdvP (adverbial phrase), as well as lexical categories such as noun (N), verb (V), preposition (P), adjective (A), and adverb (Adv). Each lexical category has a corresponding phrasal category. Following is a list of phrasal categories and lexical categories with some examples of each type:

Phrasal categories

Noun Phrase (NP)	*men, the man, the man with a telescope*
Verb Phrase (VP)	*sees, always sees, rarely sees the man, often sees the man with a telescope*
Adjective Phrase (AP)	*happy, very happy, very happy about winning*
Prepositional Phrase (PP)	*over, nearly over, nearly over the hill*
Adverbial Phrase (AdvP)	*brightly, more brightly, more brightly than the Sun*

Lexical categories

Noun (N)	*puppy, boy, man, soup, happiness, fork, kiss, pillow*
Verb (V)	*find, run, sleep, throw, realize, see, try, want, believe*
Preposition (P)	*up, down, across, into, from, by, with, over*
Adjective (A)	*red, big, happy, candid, hopeless, fair, idiotic, lucky*
Adverb (Adv)	*again, always, brightly, often, never, very, fairly*

Many of these categories may already be familiar to you. As mentioned earlier, some of them are traditionally referred to as *parts of speech.* Other categories may be less familiar, for example, the category **determiner (Det)**, which includes the articles *a* and *the*, as well as **demonstratives** such as *this, that, these*, and *those*, and "quantifiers" such as *each* and *every.*

Another less familiar category is T(ense), which includes the **modal** auxiliaries *may, might, can, could, must, shall, should, will*, and *would*, and abstract tense morphemes that we discuss below. T and Det are **functional categories**, so called because their members have grammatical functions rather than descriptive meanings. For example, determiners specify whether a noun is indefinite or definite (*a boy* versus *the boy*), or the proximity of the person or object to the context (*this boy* versus *that boy*). Tense provides the verb with a time frame, whether present (*John knows Mary*), or past (*John danced*). In English, T is expressed as a (sometimes silent) morpheme on the verb, except in the future tense, which is expressed with the modal *will.* Modals also express notions such as possibility (*John* may *dance*); necessity (*John* must *dance*); ability (*John can dance*); and so on. The modals belong to a larger class of verbal elements traditionally referred to as **auxiliaries** or helping verbs, which also include *have* and *be* in sentences such as *John is dancing* or *John has danced.*

Each lexical category typically has a particular kind of meaning associated with it. For example, verbs usually refer to actions, events, and states (*kick, marry, love*); adjectives to qualities or properties (*lucky, old*); common nouns to

general entities (*dog, elephant, house*); and proper nouns to particular individuals (*Noam Chomsky*) or places (*Dodger Stadium*) or other things that people give names to, such as commercial products (*Coca-Cola, Viagra*).

But the relationship between grammatical categories and meaning is more complex than these few examples suggest. For example, some nouns refer to events (*marriage* and *destruction*) and others to states (*happiness, loneliness*). We can use abstract nouns such as *honor* and *beauty*, rather than adjectives, to refer to properties and qualities. In the sentence "Seeing is believing," *seeing* and *believing* are nouns but are not entities. Prepositions are usually used to express relationships between two entities involving a location (e.g., *the boy is in the room, the cat is under the bed*), but this is not always the case; the prepositions *of, by, about,* and *with* often have other than locational meanings.

Because of the difficulties involved in specifying the precise meaning of lexical categories, we do not usually define categories in terms of their meanings, but rather on the basis of where they occur in a sentence, what categories co-occur with them, and what their morphological characteristics are. For example, we define a noun as a word that can occur with a determiner (*the boy*) and that can (ordinarily) take a plural marker (*boys*); a verb as a word that can occur with an adverb (*run fast*) or modal (*may go, will dance*); an adjective as a word that can occur with a degree word (*very hungry*) or a morphological marker (*hungrier*), among other properties.

All languages have syntactic categories such as N, V, and NP. Speakers know the syntactic categories of their language even if they do not know the technical terms. Our knowledge of syntactic classes is revealed when we substitute equivalent phrases, as we just did in examples (1) and (2), and when we use the various syntactic tests that we have discussed.

Phrase Structure Trees

> Who climbs the Grammar-Tree distinctly knows
>
> Where Noun and Verb and Participle grows.
>
> JOHN DRYDEN, "The Sixth Satyr of Juvenal," 1693

Now that you know something about constituent structure and grammatical categories, you are ready to learn how the phrases and sentences of a language are constructed. We will begin by illustrating trees for simple phrases and then proceed to more complex structures. The trees that we will build here are more detailed than those we saw in the previous sections, because the branches of the tree will have category labels identifying each constituent.

One of the striking things we observe when we consider the various phrasal categories discussed above is that they have a similar organization. Consider the following examples of each of the phrasal categories

NP: *the mother* of James Whistler
VP: *sing* an aria
AP: *wary* of snakes
PP: *over* the hill

As we noted in the previous section, the core of every phrase is a lexical category of its same syntactic type (italicized), which is its **head**; for example, the NP *the mother of James Whistler* is headed by the noun *mother*; the VP *sing an aria* is headed by the verb *sing*; the AP *wary of snakes* is headed by the adjective *wary*; the PP *over the hill* is headed by the preposition *over*. Loosely speaking, the entire phrase refers to whatever the head refers to. For example, the VP *sing an aria* refers to a "singing" event; the NP *the mother of James Whistler* to someone's mother.

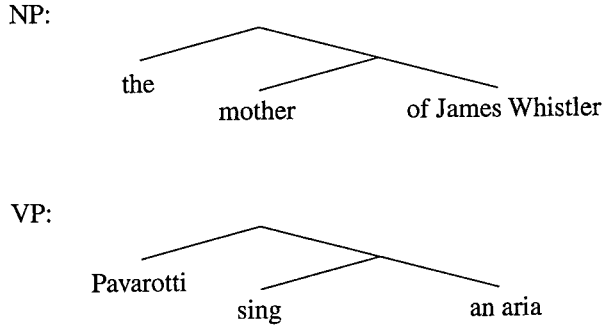
A **complement** is defined as a phrasal category that may occur next to a head, and only there, and which elaborates on the meaning of the head. The complements are underlined: For example, the head N *mother* takes the PP complement *of James Whistler*; the head V *sing* takes the NP *an aria*; the head A(djective) *wary* takes the PP *of snakes*, and the P(reposition) *over* takes the NP *the hill* as complement.

In addition, a phrase may have an element preceding the head. These elements are called **specifiers**. For example, in the NP *the mother of James Whistler*, the determiner *the* is the specifier of the NP. In English, possessives may also be specifiers of NP, as in *Nellie's ball*. Similarly, in the PP *just over the hill*, *just* is the specifier. The specifier position may also be empty, as in the NP *dogs with bones* or the PP *over the hill*. Specifier is a purely structural notion. In English it is the first position in the phrase, if it is present at all, and a phrase may contain at most one specifier. APs and VPs also have a specifier position and their specifiers usually show up when the phrase is embedded in another sentence, as in:

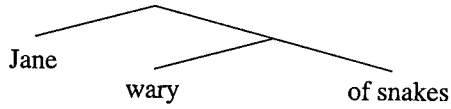
a. Betty made [Jane wary of snakes].
b. I heard [Pavarotti sing an aria].
c. I saw [everyone at the stadium].

In (a) *Jane* is the specifier of the AP *wary of snakes*, in (b) *Pavarotti* is the specifier of the VP *sing an aria*, and in (c) *everyone* is the specifier of the PP *at the stadium*. We will have a bit more to say about this kind of embedded phrase later in the chapter.

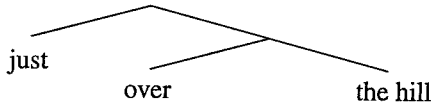
These observations tell us that all of the phrasal categories, NP, VP, AP, and PP, have a similar 3-tiered structure, as follows:



AP:

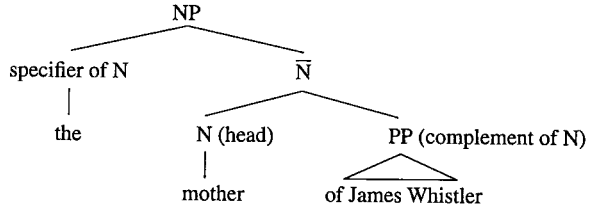


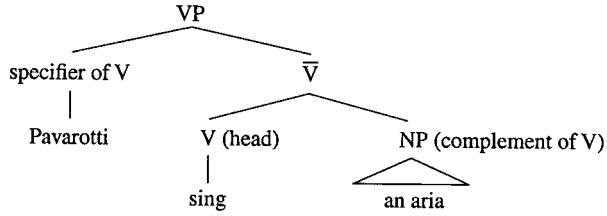
PP:

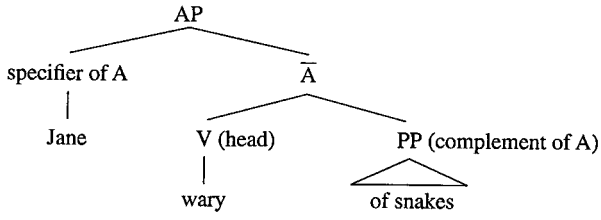


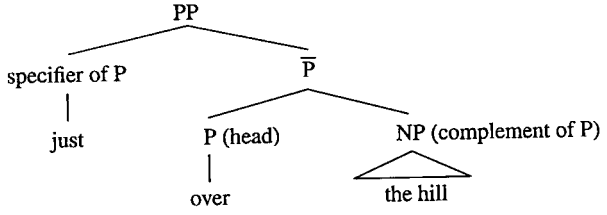
In each of the phrases the head and its complement are under the same **node** (a point in a tree where branches join), reflecting the fact that the complement has an important relationship with the meaning of the head. We refer to categories under the same node as **sisters**. Thus the complement is defined as the sister of the head, and the specifier is defined as the sister to the head + complement complex.

If we now label the branching points or nodes, the trees look like this:

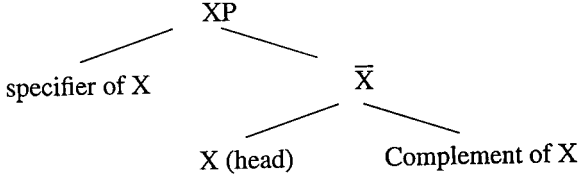






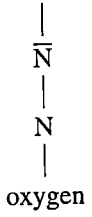


To capture the generalization that each phrasal category has the same internal structure, we substitute X in place of N, V, P, A and we get the following tree:

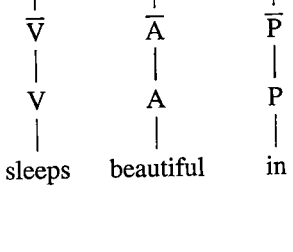


This 3-tiered structure, referred to as the **X-bar ($\bar{X}$) schema**, is a template or blueprint that specifies how the phrases of a language are organized. The X-bar schema "stands for" the various phrasal categories given above (and others we will see later). The X-bar schema applies to all syntactic phrases.

The "bar" category is an intermediate level category necessary to account for certain syntactic phenomena that we'll see shortly. As noted above, the specifier of an NP may be absent or it may be a determiner (or a possessive). The complement, too, may be absent or may be a PP or even another phrasal category. The head N(oun) of the NP is obligatory, however, so a stripped-down NP composed solely of a noun actually has this structure:



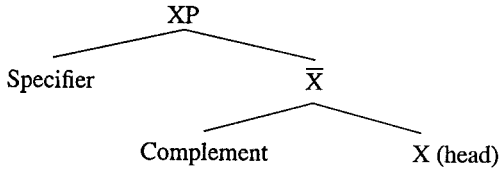
The other phrasal categories follow suit. The specifier of VP may be absent, as may the complement; only the head is obligatory, so we may have structures as simple as:



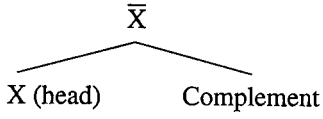
The X-bar schema is hypothesized to be part of Universal Grammar. As such, all languages have phrases that consist of heads, specifiers, and complements that relate to each other as just described. However, the order of the head and complement may differ in different languages. In English, for example, we see that the head comes first, followed by the complement. In Japanese complements precede the head, as shown in the following examples:

Taro-ga	inu-o		mitsuketa.	
Taro-subject marker	dog-object marker		found	(Taro found a dog.)
Inu-ga	niwa-de	asonde	iru.	
dog-subject marker	garden-in	playing	is	(The dog is playing in the garden.)

In the first sentence, the direct object complement *inu-o*, 'dog,' precedes the head verb *mitsuketa*, 'found.' In the second, the NP complement *niwa*, 'garden,' precedes the head preposition *de*, 'in.' English is a VO language, meaning that the verb ordinarily precedes its object. Japanese is an OV language, and this difference is reflected in the head/complement word order. For Japanese the X-bar schema looks like this:

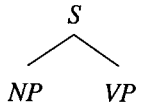


as opposed to English and VO languages in general with this X̄:

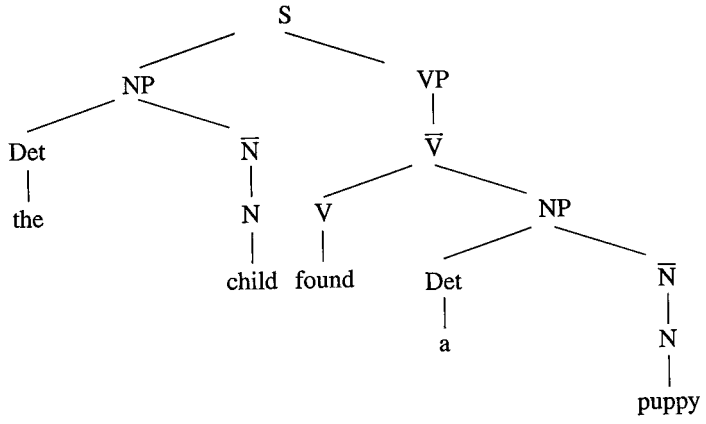


The X-bar schema captures a vast amount of syntactic knowledge in a concise way. If the hierarchical relationships that it expresses are universal (order aside), as many linguists believe, it reveals how children can quickly learn the abstract hierarchical structures associated with phrases in their language (see chapter 9). Given the X-bar schema, the Japanese child upon hearing *Taro-ga inu-o mitsuketa* (Taro dog finds) automatically knows not only that NP complements precede the verb in his language, but also that all other complements do so as well. For example, NPs precede their prepositional heads, as in *niwa-de* (garden in).

Let's now turn to the category S(entence). To keep matters simple—stepping away from the X-bar schema momentarily—we are going to let S have this structure:



This states that a sentence is a Noun Phrase (NP) followed by a Verb Phrase (VP). We are now able to provide a fully labeled tree diagram for entire sentences such as *The child found a puppy* by combining what we know of S, NP, and VP structures:



The tree diagram provides labels for each of the constituents of the sentence "The child found a puppy." These labels show that the entire sentence belongs to the syntactic category of S (because the S-node encompasses all the words). It also reveals that *the child* and *a puppy* belong to the category NP: that is, they are noun phrases, and that *found a puppy* belongs to the category VP or is a verb phrase, consisting of a verb and an NP. It also reveals the syntactic category of each of the words in the sentence.

In chapter 2 we discussed the fact that the syntactic category of each word is listed in our mental dictionaries. We now see how this information is used by the syntax of the language. Words appear in trees under labels that correspond to their syntactic category. Nouns are under N, determiners under Det, verbs under V, and so on. The larger syntactic categories, such as VP, consist of all the syntactic categories and words below that node in the tree. The VP in the tree above consists of syntactic category nodes V and NP and the words *found, a,* and *puppy*. Because *a puppy* can be traced up the tree to the node NP, this constituent is a noun phrase. Because *found* and *a puppy* can be traced up to the node VP, this constituent is a verb phrase.

A tree diagram with syntactic category information is called a **phrase structure tree** (PS trees, for short) or a **constituent structure tree.** The PS tree is a formal device that reflects the speaker's intuitions about the natural groupings of words in a sentence. It shows that a sentence is not simply a linear string of words but has a hierarchical structure with phrases nested in phrases.

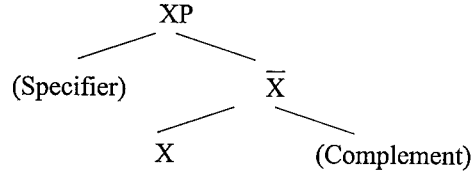
PS trees represent three aspects of a speaker's syntactic knowledge:

1. The linear order of the words in the sentence
2. The identification of the syntactic categories of words and groups of words
3. The hierarchical organization of the syntactic categories as determined by the X-bar schema

Various relationships can be defined on PS trees. Every higher node is said to **dominate** all the categories that can be traced down the tree beneath it. S dominates every node; the NP under S dominates Det, $\overline{N}$, and N (but not, e.g., $\overline{V}$ or V), just as VP dominates $\overline{V}$ and the NP below it, but not the other nodes in the tree. A node is said to **immediately dominate** the categories one level below it. $\overline{V}$ immediately dominates V and NP, the categories of which it is composed, but nothing else. As noted earlier, categories that are immediately dominated by the same node are sisters. V and NP are sisters in the phrase structure tree of "The child found a puppy." PS trees are also useful for defining various grammatical relations in a precise way. For example, the **subject** of a sentence is the NP immediately dominated by S and the **direct object** is the NP immediately dominated by $\overline{V}$.

Selection

We noted that complements (and specifiers) are not always present in the phrasal structure. They are optional; only the head is obligatory. The parentheses included in the X-bar schema below indicate optionality:



Whether a head takes a complement or not depends on the properties of the head. For example, verbs select different kinds of complements: *find* is a transitive verb and requires an NP complement (direct object), as in *The boy found the ball,* but not **The boy found,* or **The boy found in the house.* Some verbs like *eat* are optionally transitive. *John ate* and *John ate a sandwich* are both grammatical. *Sleep* is an **intransitive verb**; it cannot take an NP complement:

Michael slept.
*Michael slept their baby.

Some verbs, such as *think,* may select both a PP and a sentence complement:

Let's think *about it.*
I think *a girl won the race.*

Other verbs, like *tell,* select an NP and a sentence:

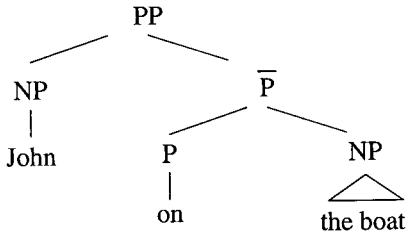
I told *the boy a girl won the race.*

Yet other verbs like *feel* select either an AP or a sentence complement:

Paul felt *strong as an ox.*
He feels *he can win.*

Certain verbs, for example perception verbs such as *see* and *hear* and the causative verb *make* among others, select a particular kind of complement

called a **small clause.** A small clause is an XP composed of an NP followed by a bar level category, for example:



as in the sentence:

I saw [John on the boat].

This sentence illustrates that the verb *see* selects a small clause PP complement. Similarly, the causative verb *make* selects an AP or VP small clause complement, as in:

The food made [John ill].
The wind made [the palm trees sway].

We see that small clause conforms perfectly to the X-bar schema, with the initial NP functioning as the specifier.

Categories besides verbs also select their complements. For example, the noun *belief* selects either a PP or a sentence, while the noun *sympathy* selects a PP, but not a sentence, as shown by the following examples:

the belief *in freedom of speech*
the belief *that freedom of speech is a basic right*
their sympathy *for the victims*
*their sympathy that the victims are so poor

Adjectives can also have complements. For example, the adjectives *tired* and *proud* select PPs:

tired *of stale sandwiches*
proud *of her children*

The information about the complement types selected by particular verbs and other lexical items is called **C-selection** or **subcategorization**, and is included in the lexical entries of the items in our mental lexicons. (C stands for "categorial.")

A verb also includes in its lexical entry a specification that requires certain semantic properties of its subjects and complements, just as it selects for syntactic categories. This kind of selection is called **S-selection.** (S stands for "semantic.") For example, the verb *murder* requires its subject and object to be animate, while the verb *quaff* requires its subject to be animate and its object liquid. Verbs such as *like, hate,* and so on select animate subjects. The following sentences violate S-selection and can only be used in a metaphorical sense. (We will use the symbol "!" to indicate a semantic anomaly.)

!Golf plays John.
!The beer drank the student.
!The tree liked the boy.

The famous sentence *Colorless green ideas sleep furiously*, discussed earlier in this chapter, is anomalous because (among other things) S-selection is violated (e.g., the verb *sleep* requires an animate subject). In chapter 4 we will discuss the semantic relationships between a verb and its subject and objects in far more detail.

The well-formedness of a phrase depends, then, on at least two factors: whether the phrase conforms to the structural constraints of the language as expressed in the X-bar schema, and whether it obeys the selectional requirements of the head—both syntactic (C-selection) and semantic (S-selection). The X-bar schema allows complements of any syntactic category (XP), but the choice of complement type for any particular phrase depends on the lexical properties of the head of that phrase.

Building Phrase Structure Trees

> Everyone who is master of the language he speaks . . . may form new . . . phrases, provided they coincide with the genius of the language.
>
> JOHANN DAVID MICHAELIS, "*Dissertation*," 1739

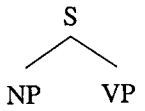
The information represented in a PS tree and by the X-bar schema can also be conveyed by another formal device: **phrase structure (PS) rules**. Phrase structure rules instantiate the principles of the X-bar schema and can be used as a guide for building PS trees. A few of the PS rules needed to express the structures for S and for some of the phrases given above are:

1. S → NP VP
2. NP → Det $\bar{N}$
3. $\bar{N}$ → N
4. VP → $\bar{V}$
5. $\bar{V}$ → V NP

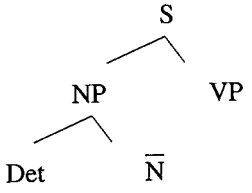
PS rules specify the well-formed structures of a particular language precisely and concisely. They make explicit a speaker's knowledge of the order of words and the grouping of words into syntactic categories. For example, in English an NP may contain a determiner (more generally, a specifier) followed by an $\bar{N}$ which itself may be a bare noun. This is represented by rules 2 and 3. To the left of the arrow is the dominating category, in this case NP, while the categories that it immediately dominates—that comprise it—appear on the right side, in this case Det and $\bar{N}$. The right side of the arrow also shows the linear order of these constituents.

The PS rules are general statements about a language and do not refer to any specific VP, V, or NP. In applying the rules to build trees certain conventions are followed. The S occurs at the top or "root" of the tree (remember that the tree is upside down). So first find the rule with S on the left side of

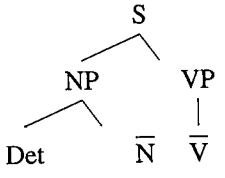
the arrow (rule 1), and put the categories on the right side below the S, as shown here:



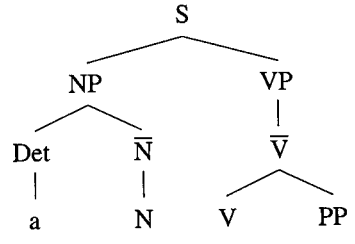
Continue by matching any syntactic category at the bottom of the partially constructed tree to a category on the left side of a rule, then expand the tree downward using the categories on the right side. For example, we may expand the tree by applying the NP rule to produce:



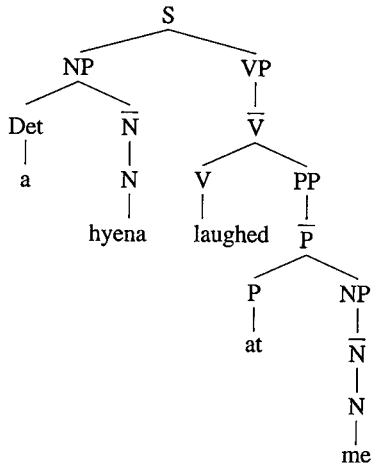
The categories at the bottom are Det, $\overline{N}$ and VP, and both $\overline{N}$ and VP occur to the left of an arrow. We may choose to expand either one; order doesn't matter. If we choose VP our work in progress looks like this:



Although not mentioned specifically in our five rules, certain verbs take a PP complement. According to the X-bar schema, then, the rule that we have just described can be written $\overline{V} \rightarrow$ V PP. Let's expand that along with $\overline{N}$ (applying rule 3) and complete lexical insertion for Det.

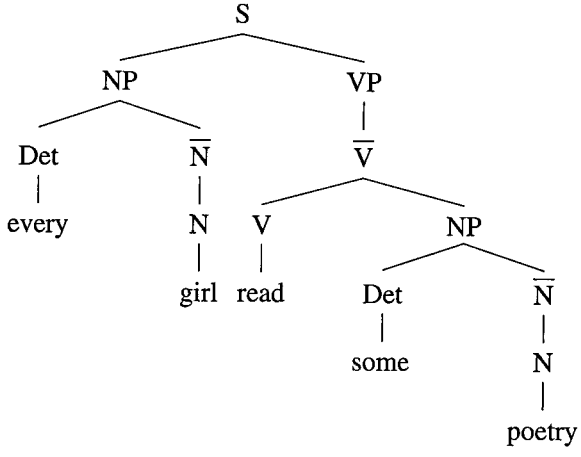


All that is left to expand is the PP, and then we'll fill in the remaining lexical items.

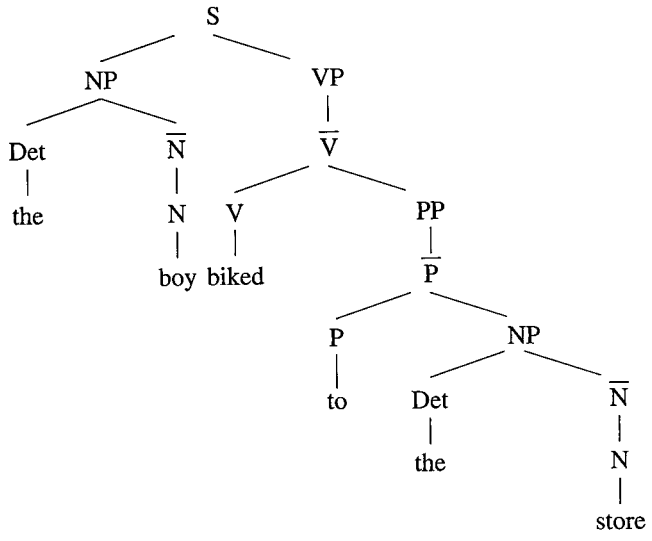


By following these conventions we generate only trees consistent with the X-bar schema and language-specific rules and hence only trees that conform to the syntax of the language. By implication, any tree not specified in this manner will be ungrammatical, that is, not permitted by the syntax. At any point during the construction of a tree, any rule may be used as long as its left-side category occurs somewhere at the bottom of the tree. By instantiating the different X-bar options with PS rules, we can specify all of the structures associated with actual English sentences.

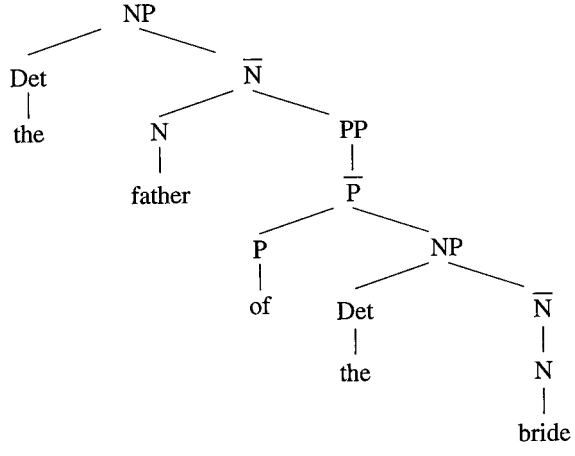
The rules in (1)–(5) above certainly do not exhaust all the possible patterns of the X-bar schema. Below we list a few more rules. Recall that the X-bar schema allows any XP to function as a complement to a head. Rules (4) and (5) expand the VP to include an NP complement—a transitive verb structure such as *Every girl read some poetry*:



But as we've already seen, verbs also allow PP complements (*The boy biked to the store*), among others:



Similarly, nouns take complements, among which are PPs (*the father of the bride*):

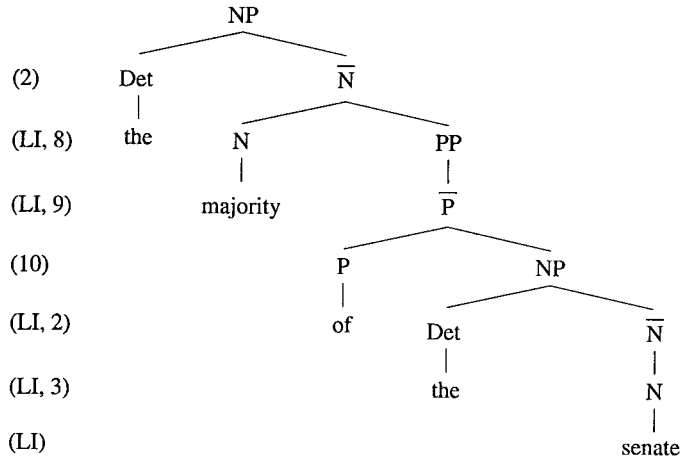


The following additional PS rules (6–14) illustrate these other options. (PS rules 1–5 are repeated for your convenience in following the derivation below.)

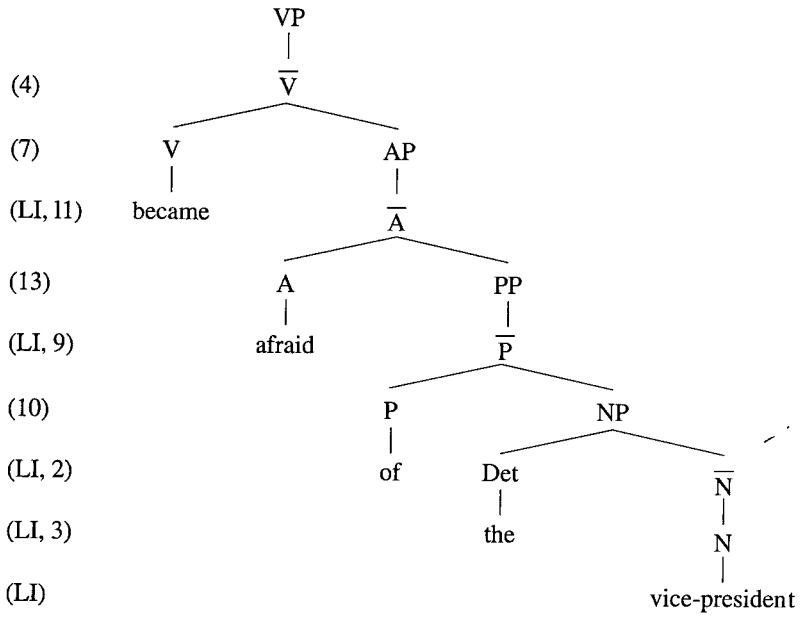
1. S → NP VP
2. NP → Det $\bar{N}$
3. $\bar{N}$ → N
4. VP → $\bar{V}$
5. $\bar{V}$ → V NP
6. $\bar{V}$ → V PP
7. $\bar{V}$ → V AP
8. $\bar{N}$ → N PP
9. PP → $\bar{P}$
10. $\bar{P}$ → P NP
11. AP → $\bar{A}$
12. $\bar{A}$ → A
13. $\bar{A}$ → A PP

By applying these rules in the manner prescribed, we can generate the phrase structure trees for such sentences such as *The majority of the senate became afraid of the vice-president.* In going about constructing such trees, a

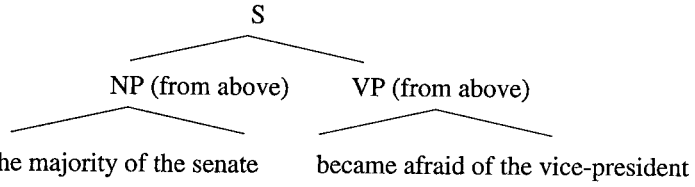
strategy of "divide and conquer" is in order. We'll first assemble the subtree for the NP subject, then the subtree for the VP predicate. Each level of the tree mentions the rule or rules (1–13, or LI for lexical insertion) that apply:



And now the VP:



The final step (technically the first step) is to use rule 1 to expand the start symbol S into an NP VP into which the NP and VP that we just constructed can be inserted:



The Infinity of Language: Recursive Rules

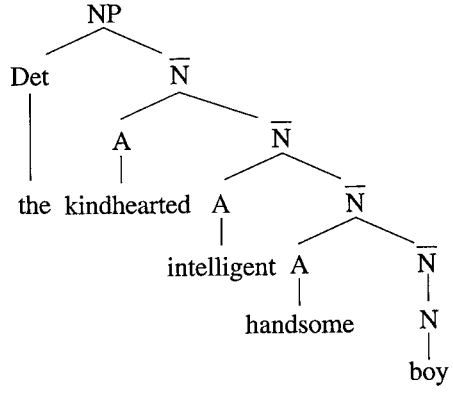
So, naturalists observe, a flea
Hath smaller fleas that on him prey;
And these have smaller still to bite 'em,
And so proceed ad infinitum.
JONATHAN SWIFT, "On Poetry, a Rhapsody," 1733

We noted at the beginning of the chapter that the number of sentences in a language is without bound and that languages have various means of creating longer and longer sentences, such as adding an adjective or a prepositional phrase.

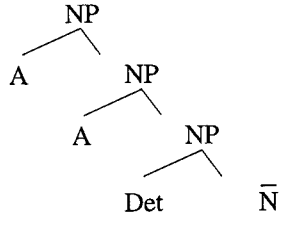
For example, an NP may contain any number of adjectives as in *the kind-hearted, intelligent, handsome boy*. How do we account for this? Here is one reason that linguists posit the abstract category $\bar{N}$. To account for the potentially limitless number of adjectives we need a **recursive rule**—one that repeats itself—on $\bar{N}$:

14. $\bar{N} \rightarrow A\ \bar{N}$

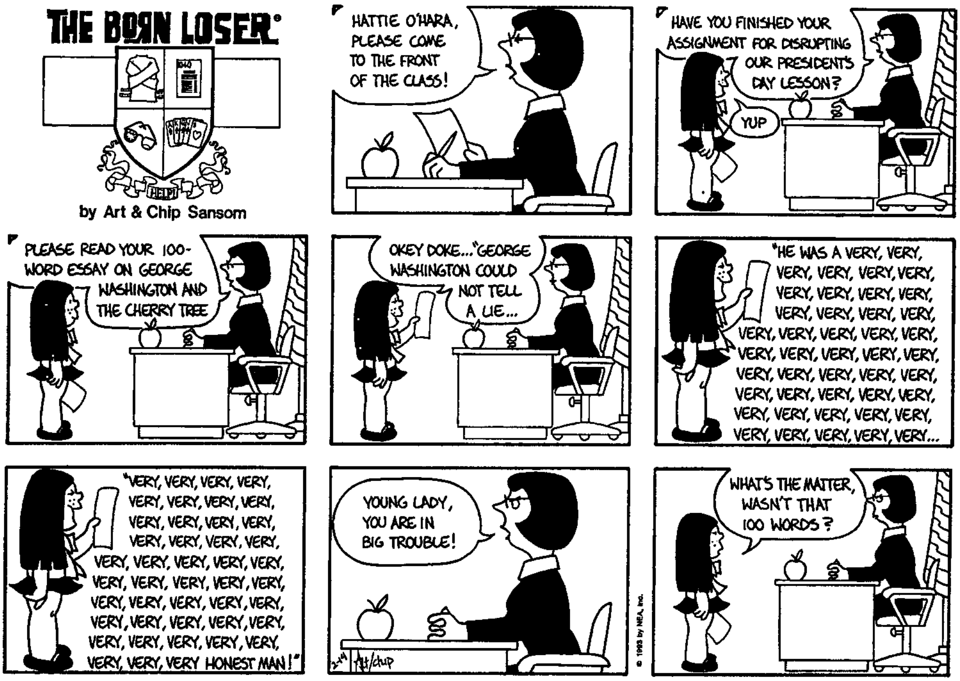
By including this rule, that is, by permitting such structures to grow, we can easily represent the structure of the NP in question:



Without $\bar{N}$ we would be forced to have a recursive rule on NP such as NP→A NP, but although that would capture the recurring nature of the adjective, it would not work because it would allow the Det to show up in an impossible place as in *kind-hearted, intelligent, the boy:



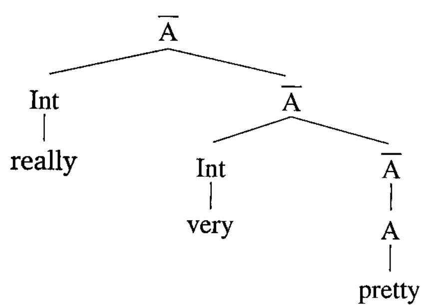
A similar kind of recursion occurs in this cartoon:



Newspaper Enterprise Association/United Features Syndicate

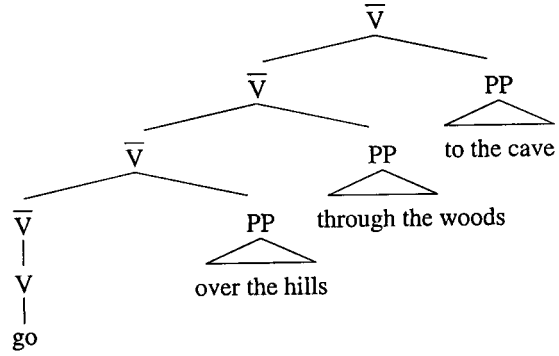
Another way speakers of English can "grow" structures of theoretically limitless size is by repeating the category of Intensifier (Int) within an AP. (Int functions as the specifier of $\bar{A}$.) The recursive rule looks like this and would not only handle Hattie's 100-word essay but also takes care of the more modest expression *really very pretty*:

15. $\bar{A} \rightarrow \text{Int}\ \bar{A}$

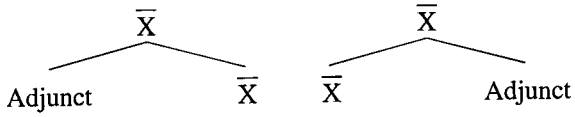


A slightly different form of recursion that also allows sentences of theoretically limitless length involves PP recursion, as illustrated by *she went over the hills, through the woods, to the cave. . . .* In this case the repeated category in the recursive rule on $\bar{V}$ occurs to the right of the barred category:

16. $\overline{V} \rightarrow \overline{V}$ PP



The X-bar schema gives us two ways of capturing this crucial aspect of speakers' syntactic knowledge, both of them being recursion on the $\overline{X}$ category, essentially structures (PS rules) of this form:



A phrasal category that is sister to an $\overline{X}$ and daughter of a higher $\overline{X}$, as in the above structures, is called an **adjunct**, and is distinct from a **complement**, which, as we've seen, is defined structurally as sister to the head X. And like complements, adjuncts may be of any phrasal type (XP). The first of the adjunct patterns above is reflected in the adjective and intensifier recursive rule (15) where the adjunct is the intensifier. It produces a right-branching structure, as you can see. The second pattern is reflected in the prepositional phrase recursive rule (16) where the adjunct is a PP and produces a left-branching structure.

Distinguishing between complements and adjuncts is not always straightforward. Structurally, the distinctions are unambiguous: complements are sisters to X; adjuncts are sisters to $\overline{X}$. But in analyzing sentences it is not always clear whether an addendum to a head is a complement or an adjunct.

We'll give a couple of "rules of thumb" for making the distinction, but an in depth discussion of the subject goes beyond the introductory treatment of our book.

PPs inside NPs are always complements if they are headed by *of*, while PPs headed by *with* are typically adjuncts. Thus in the NP *a patient of the doctor, of the doctor* is a complement, but in *a patient with a broken arm, with a broken arm* is an adjunct. When complements and adjuncts both occur, the complement must come first: thus *a patient of the doctor with a broken arm* is grammatical, but **a patient with a broken arm of the doctor* is ungrammatical. "*One*-replacement" provides a test: only nouns with adjuncts can be substituted for by *one*, as in *a patient with a broken arm and one with a broken leg*, but nouns with true complements do not allow *one*-replacement, so that **a patient of the doctor and one of the chiropractor* is not well-formed. Multiple adjuncts may be reordered without loss of grammaticality, so *a patient of the doctor with a broken arm from Kalamazoo* and *a patient of the doctor from Kalamazoo with a broken arm* are both well-formed NPs.

In verb phrases the direct object is always the complement and nearly every other addendum is an adjunct. As we have seen, *the puppy* in *found the puppy* is a

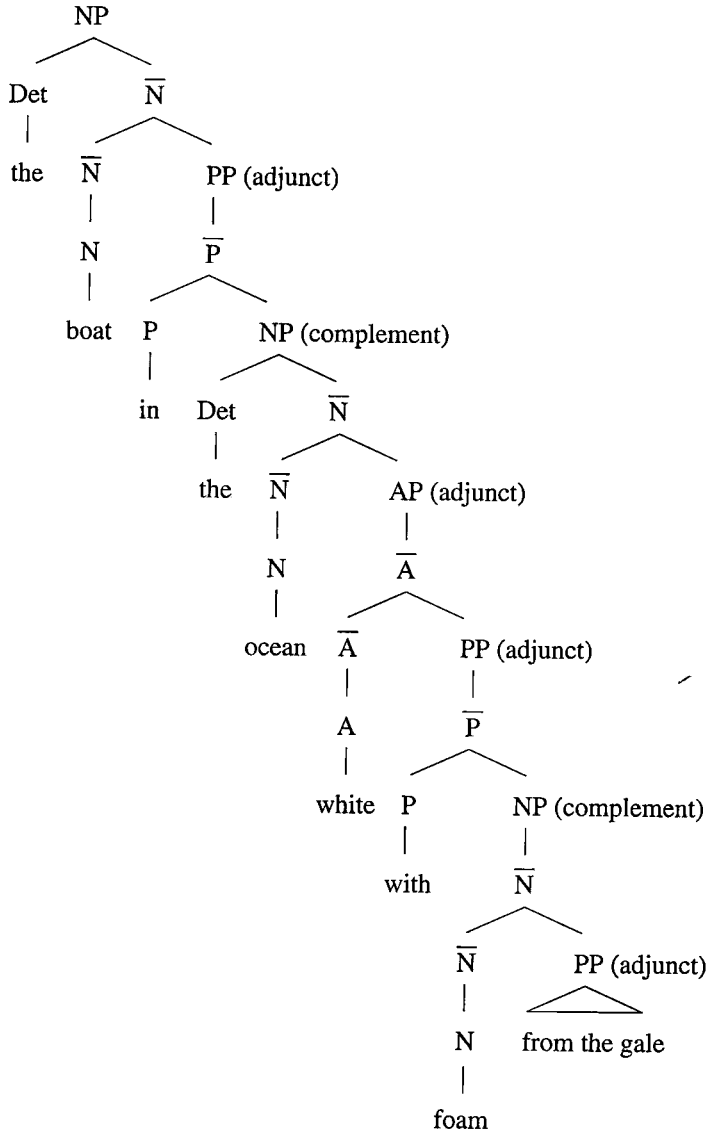
complement, but *in the park* in *found the puppy in the park* is an adjunct. Complements precede adjuncts, so that **found in the park a puppy* is not grammatical.

In prepositional phrases, the NP object of the preposition is a complement, and in adjectives phrases (APs) an *of*-addendum is usually a complement, as in *jealous of Harry*.

Recursion is one of the defining characteristics of human language. Adjunction and complementation, expressed through the X-bar schema, are the sources of recursion or the infinitude/creativity of language that we have been emphasizing in this book.

17. $\overline{N} \rightarrow \overline{N}\,PP$

The following structure for *the boat in the ocean white with foam from the gale* illustrates both NP and PP recursion:



Our brain capacity is finite, able to store only a finite number of categories and rules for their combination. The embedding of categories within categories, common to all languages, places an infinite set of sentences at our disposal.

This linguistic property also illustrates the difference between competence and performance, discussed in chapter 1. All speakers of English (and other languages) have as part of their linguistic competence—their mental grammars—the ability to embed phrases within each other ad infinitum. However, as the structures grow longer, they become increasingly more difficult to produce and understand. This can be due to short-term memory limitations, muscular fatigue, breathlessness, boredom, or any number of performance factors. (We will discuss performance factors more fully in chapter 10.) Nevertheless, these very long sentences would be well-formed according to the rules of the grammar.

What Heads the Sentence

Might, could, would—they are contemptible auxiliaries.

GEORGE ELIOT (MARY ANN EVANS), *Middlemarch*, 1872

The structure of all phrasal categories follows the X-bar schema. One category that we have not yet discussed in this regard is sentence (S). To preserve the powerful generalization about syntax that the X-bar schema offers, we want all the phrasal categories to have a 3-tiered structure with specifiers, heads, and complements and/or adjuncts, but what would these be in the case of S? To answer this question we first observe that sentences are always "tensed." Tense provides a time-frame for the event or state described by the verb. In English, present and past tenses are morphologically marked on the verb:

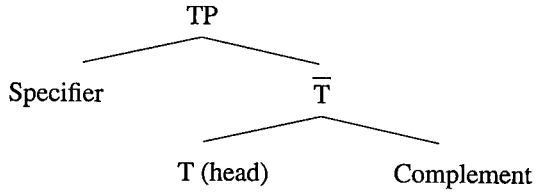
John dances. (present)
John danced. (past)

Future tense is expressed with the modal *will* (*John* will *dance*). Modals also express notions such as possibility (*John* may *dance*); necessity (*John* must *dance*); ability (*John can dance*); and so on. A modal such as *may* says it is possible that the event will occur at some future time, *must* that it is necessary that the event occur at some future time, and so on. The English modals are inherently "tensed," as shown by their compatibility with various time expressions:

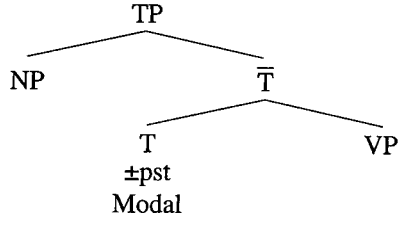
John may/must/can win the race today/tomorrow.
*John may/must/can win the race yesterday.
John could/would have tantrums when he was a child.
John could leave the country tomorrow.

Just as the VP is about the situation described by the verb—*eat ice cream* is about "eating"— so a sentence is about a situation or state of affairs that occurs at some point in time. Thus, the category Tense is a natural category to head S.

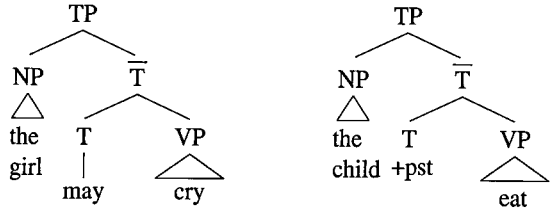
Using this insight, linguists refer to sentences as TPs (Tense Phrases) with the following structure conforming to the X-bar schema:



For sentences, or TPs, the specifier is the subject of the sentence and the complement of the TP is a verb phrase, or predicate, thus giving the sentence its traditional subject-predicate or NP VP form. Finally, the head T contains the tense (±pst) and modal verbs like *can* or *would*. This gives sentences, i.e., TPs, like the following:



We are now able to represent the structures of such sentences as *The girl may cry* and *The child ate*:



In these structures the T containing +pst and *eat* is ultimately pronounced *ate*. When there is no modal under T, the tense is realized on the verbal head of the VP.

Another way tense is expressed is by the tense-bearing word *do* that is inserted into negative sentences such as *John did not go* and questions such as *Where did John go?* In these sentences *did* means "past tense." Later in this chapter we will see how *do*-insertion works.

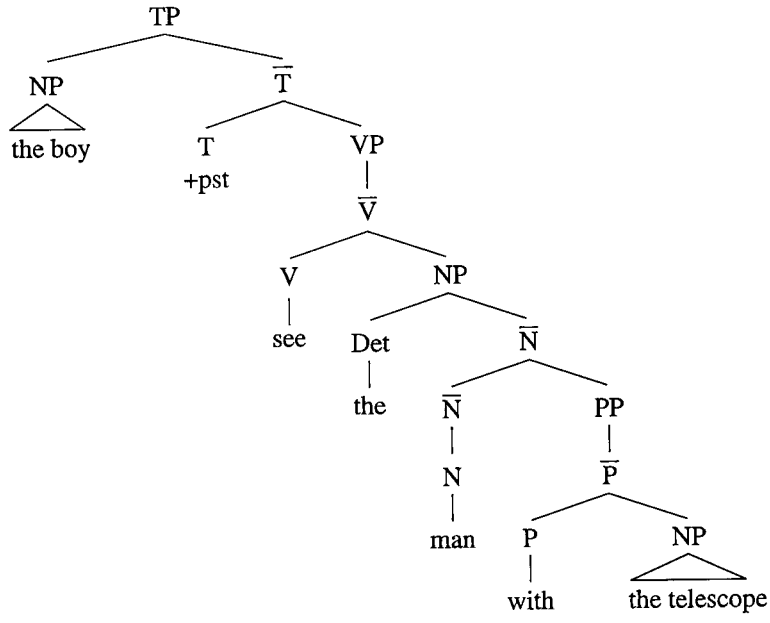
Structural Ambiguities

The structure of every sentence is a lesson in logic.

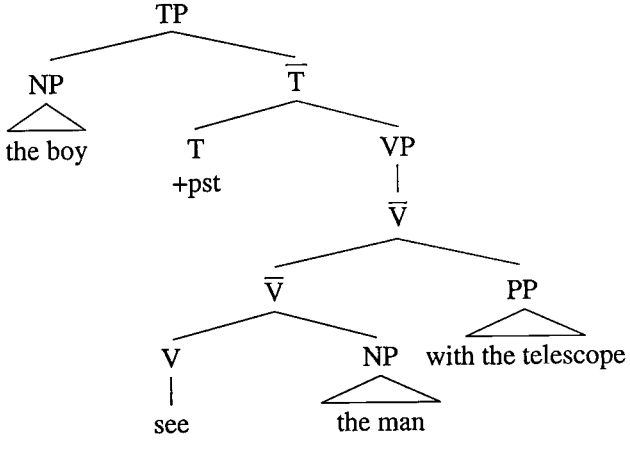
JOHN STUART MILL, Inaugural address at St. Andrews, 1867

As mentioned earlier, certain kinds of ambiguous sentences have more than one phrase structure tree, each corresponding to a different meaning. The sentence *The boy saw the man with the telescope* is structurally ambiguous. In the

meaning in which the man has the telescope, the complement of *saw* is simply the NP *the man with the telescope*, with this structure:

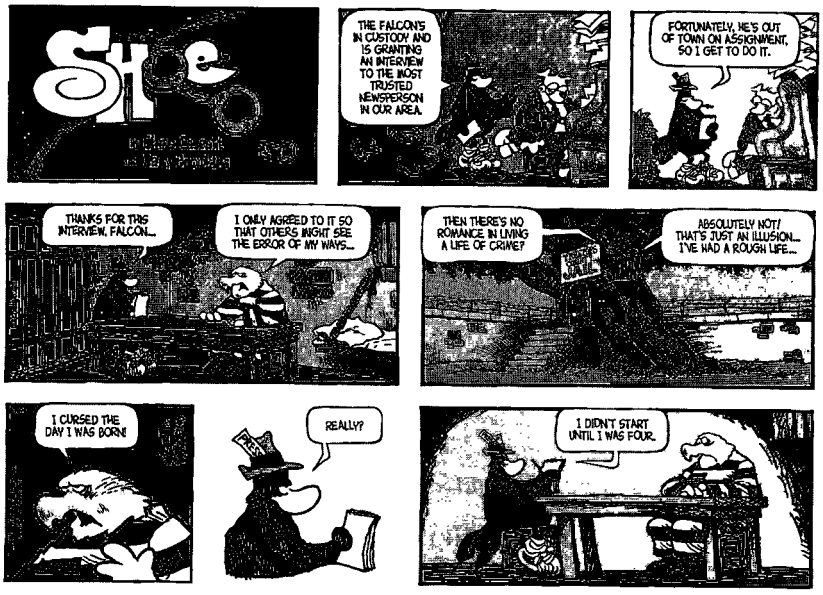


For the meaning in which the boy is using the telescope to see the man, we need to make use of recursive rule 16, name $\bar{V} \rightarrow \bar{V}$ PP, to produce this (slightly abbreviated) structure:



The different meanings arise from the fact that the PP *with the telescope* is sister to (hence modifies) *man* in the first case, but in the second case it is sister to, and hence modifies the $\bar{V}$ *see the man*. Thus, two interpretations are possible because the rules of syntax permit different structures for the same linear order of words.

More Structures



MacNelly/King Features Syndicate

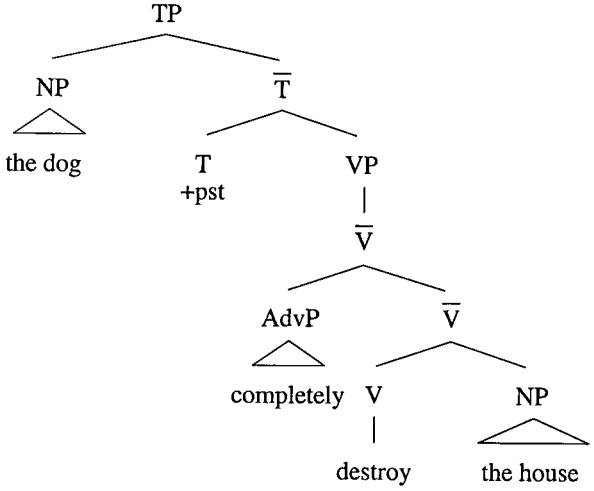
Many other English sentence types are naturally accounted for by The X-bar schema. Consider this example:

The dog completely destroyed the house.

Adverbs are modifiers that can specify how an event happens (*quickly, slowly, completely*) or when it happens (*yesterday, tomorrow, often*). As modifiers, adverbs are adjuncts (sisters) to the $\overline{V}$ category just as adjectives are sisters to $\overline{N}$, as we saw in rule 4. This suggests the following rule:

18. $\overline{V} \rightarrow$ AdvP $\overline{V}$

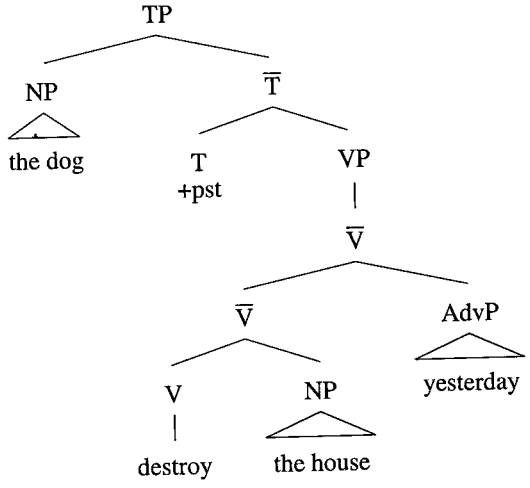
And this rule gives rise to the following structure:



In the similar sentence *The dog destroyed the house yesterday* the structure must be different, as **The dog yesterday destroyed the house* is ungrammatical. We account for this with the following PS rule, expressing the fact that adjuncts may occur on both sides of the barred category, as we saw earlier in its X-bar schema on page 102:

19. $\overline{V} \rightarrow \overline{V}$ AdvP

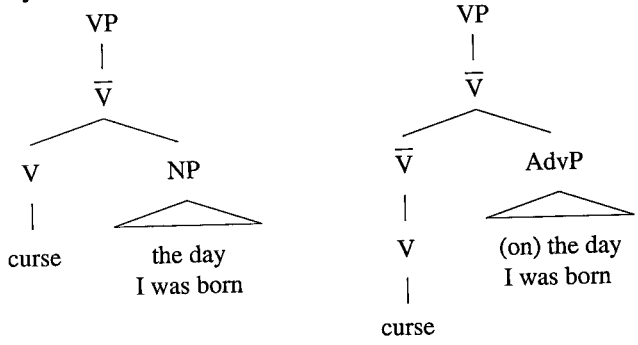
Here, as with adjectival modification of the NP, the VP has a more deeply-tiered structure:



In the first of the two structures the adverb *completely* modifies the verb phrase by describing the extent of the destruction. In the second, the adverb *yesterday* adds information to the meaning of the VP by fixing the time of the event.

Most adverbs (e.g. *completely, often, suddenly*) can combine with a $\overline{V}$ using either rule 18 or 19: in other words, they can either precede or follow the $\overline{V}$. At the same time, some adverbs (e.g. *no longer, just, never*) can only precede $\overline{V}$, and some adverbs (e.g. *yesterday, fast, well*) can only follow $\overline{V}$. In all of these cases, the adverb follows our PS rules and is an adjunct (sister) of $\overline{V}$.

The joke in the "Shoe" cartoon is based on the fact that *curse* may take the NP *the day you were born* as a complement or as a temporal modifier—an adjunct—that is sister to $\overline{V}$ (similar to "cursed *on* the day"), leading to the structural ambiguity:



Interestingly, *I cursed the day I was born the day I was born,* with both the NP complement to the verb and the AdvP adjunct to $\bar{V}$ is grammatical and meaningful. (See exercise 23a.)

Transformational Analysis

I put the words down and push them a bit.

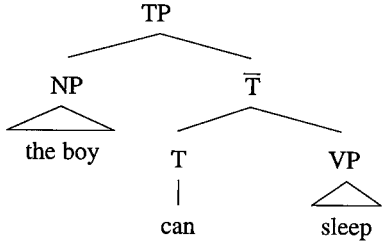
EVELYN WAUGH, quoted in *The New York Times,* April 11, 1966

We are able to characterize a limitless number of sentences via the phrase structure conventions outlined in the previous sections, which assemble words and phrases guided by the X-bar schema and constrained by C-selection and S-selection to satisfy lexical requirements. Nonetheless, phrase structure principles alone cannot account for the fact that certain sentence types in the language relate systematically to other sentence types, such as the following pair:

The boy will dance. Will the boy dance?

These two sentences are about the same situation. The first sentence asserts that a boy-dancing situation will happen. Such sentences are called **declarative** sentences. The second sentence asks whether such a boy-dancing situation will occur. Sentences of the second sort are called **yes-no questions**. The only actual difference in meaning between these sentences is that one asserts information while the other requests it. This element of meaning is indicated by the different word order, which illustrates that two sentences may have a structural difference that corresponds *in a systematic way* to a meaning difference. The grammar of the language must account for this fact.

The standard way of describing these relationships is to say that the related sentences come from a common underlying structure. Yes-no questions are a case in point. They begin life as declarative sentences, or as TPs in the X-bar schema, for example:



The head of the TP, namely T (the modal *can* in this example), is central to the formation of yes-no questions as well as certain other types of sentences in English. In yes-no questions, the modal appears in a different position; it precedes the subject. Here are a few more examples:

The boy will sleep. Will the boy sleep?
The boy should sleep. Should the boy sleep?

A way to capture the relationship between a declarative sentence and a yes-no question is to allow phrase structure principles to manipulate the underlying structure of the declarative sentence. A formal device, called **Move**, relocates the material in T before the subject NP. (Move is also called a **transformational rule** in traditional approaches to sentence relatedness.) For example, Move applies to

The boy must sleep

to derive

Must the boy ___ sleep

Yes-no questions are thus generated in two steps.

1. PS-rules implement the X-bar schema to generate a basic structure.
2. Move applies to the basic structure to produce the derived structure.

The basic structures of sentences, also called **deep structures** or **d-structures**, conform to the X-bar schema. Variants on the basic sentence structures are derived via the transformational operation Move. By generating questions in two steps, we are claiming that a principled structural relationship exists between a question and its corresponding statement. Intuitively, we know that such sentences are related. The transformational rule is a formal way of representing this knowledge.

The derived structures—the ones that follow the application of transformational rules—are called **surface structures** or **s-structures**. The rules of the language that determine pronunciation apply to s-structures (see chapter 6). If no transformations apply, then d-structure and s-structure are the same. If transformations apply, then s-structure is the result after all transformations have had their effect. Many sentence types are accounted for by transformations, which can alter phrase structure trees by moving, adding, or deleting elements.

Other sentence pairs that are transformationally related are:

active-passive

The cat chased the mouse. → The mouse was chased by the cat.

***there*-sentences**

There is a bear in your closet. → A bear is in your closet.

PP preposing

Tom Dooley stabbed her with his knife. → With his knife Tom Dooley stabbed her.

An important question is: what do the *structures* of the derived sentences look like after Move applies? They *must* conform to the X-bar schema if we are to retain that crucial generality about syntax, but to do so requires an additional level of structure. In Appendix A to this chapter we'll show you how one could go about achieving this end.

The Structure Dependency of Rules

> Method consists entirely in properly ordering and arranging the things to which we should pay attention.
>
> RENÉ DESCARTES, *Oeuvres*, vol. X, c. 1637

The transformation Move acts on phrase structures without regard to the particular words that the structures contain, that is, it is **structure dependent**. When Move preposes a PP it moves any PP as long as it is an adjunct to $\overline{V}$, as in *In the house, the puppy found the ball*; or *With the telescope, the boy saw the man*; and so on.

Evidence that transformations are structure dependent is provided by the fact that the sentence *With a telescope, the boy saw the man* is not ambiguous. It has only the meaning 'the boy used a telescope to see the man,' the meaning corresponding to the second phrase structure on page 106 in which the PP is immediately dominated by the $\overline{V}$. In the structure corresponding to the other meaning, 'the boy saw a man who had a telescope,' the PP is in the NP, as in the first tree on page 106. Move as a PP preposing transformation applies to the $\overline{V}$–PP structure and not to the $\overline{N}$–PP structure.

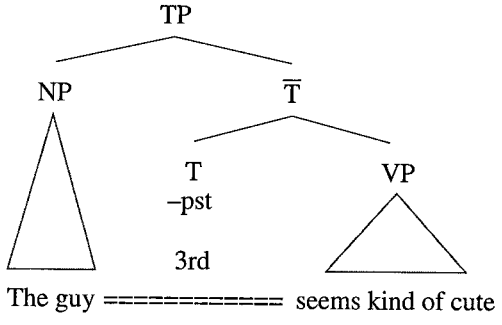
Agreement rules are also structure-dependent. In many languages, including English, the verb must agree with the subject. The verb (in English) is marked with an *-s* when the subject is third-person singular and otherwise unmarked.

> This guy seems kind of cute.
> These guys seem kind of cute.
> Now consider these sentences:
> The *guy* we met at the party next door *seems* kind of cute.
> The *guys* we met at the party next door *seem* kind of cute.

The verb *seem* must agree with the subject, *guy* or *guys*. Even though there are various words between the head noun and the verb, the verb always agrees with the head noun. Moreover, there is no limit to how many words may intervene, or whether they are singular or plural, as the following sentence illustrates:

> The *guys* (*guy*) we met at the party next door that lasted until 3 a.m. and was finally broken up by the cops who were called by the neighbors *seem* (*seems*) kind of cute.

The (much abbreviated) phrase structure tree of such a sentence explains why this is so.

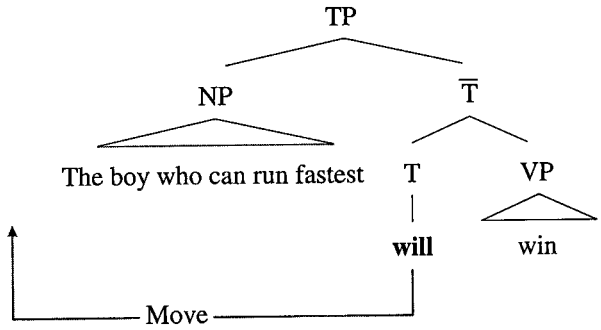


In the tree, "= = = = = =" represents the intervening structure, which may, in principle, be indefinitely long and complex. Speakers of English (and all other languages) know that agreement depends on sentence structure, not the linear order of words: agreement is between the subject and the main verb. As far as the rule of agreement is concerned, all other material can be ignored. (Although in actual performance, if the distance is too great, the speaker may forget what the subject was.)

A further illustration of structure dependency is found in the following declarative-question pairs:

The boy who can run fastest will win.
Will the boy who can run fastest win?
*Can the boy who run fastest will win?

The ungrammatical sentence shows that to form a question, Move applies to the modal dominated by the root TP, and not simply the *first* modal in the sentence as illustrated in this highly abbreviated structure. (See Appendix A for details):



If the rule picked out the *first* modal, *can*, we would have the ungrammatical sentence **Can the boy who _ run fastest will win.* To derive a well-formed question, Move must refer to phrase structure and not to the linear order of elements.

Structure dependency is a principle of Universal Grammar, and is thus found in all languages. For example, in languages that have subject-verb agreement, the dependency is between the verb and the subject, and never some other NP such as the closest one, as shown in the following examples from Italian, German, Swahili, and English, respectively (the third-person singular agreement affix in the verb is in boldface and is governed by the boldfaced NP, not the underlined one, even though the latter is nearest the main verb):

La **madre** con tanti figli lavor**a** molto.
Die **Mutter** mit den vielen Kindern arbeitet viel.
Mama anao watoto wengi **a**najitahidi.
The **mother** with many children work**s** a lot.

Further Syntactic Dependencies

Sentences are organized according to two basic principles: X-bar schema derived constituent structure on the one hand, and the syntactic dependencies derived from the lexical properties of individual words (C-selection and S-selection). Constituent

structure refers to the hierarchical organization of the subparts of a sentence, and transformational rules are sensitive to it. Syntactic dependencies mean that the presence of a particular word or morpheme can be contingent on the presence of some other word or morpheme in a sentence. We have already seen at least two examples of syntactic dependencies. C-selection is one kind of dependency. Whether there is a direct object in a sentence depends on whether the verb is transitive or intransitive, for example. More generally, complements depend on the properties of the head of their phrase. Subject-verb agreement is another kind of dependency between the features of the subject NP and the morphology on the verb.

Wh Questions

> Whom are you? said he, for he had been to night school.
>
> **GEORGE ADE**, "The Steel Box," in *Bang! Bang!*, 1928

The following ***wh* questions** illustrate another kind of dependency:

1. **(a)** What will Max chase?
   (b) Where should Pete put his dogbone?
   (c) Which toys does Pete like?

There are several points of interest in these sentences. First, the verb *chase* in sentence (a) is transitive, yet there is no direct object following it. There is a gap where the direct object should be. The verb *put* in sentence (b) is subcategorized for a direct object and a prepositional phrase, yet there is no PP following *his bone*. Finally, *does* in sentence (c) has the third-person singular *-s* morpheme though it is preceded by a plural noun.

If we remove the *wh* phrases, the remaining sentences would be ungrammatical.

2. **(a)** *will Max chase __?
   (b) *should Pete put his dogbone __?
   (c) *does Pete like __?

The grammaticality of a sentence with a gap depends on there being a *wh* phrase at the beginning of the sentence. The sentences in (1) are grammatical because the *wh* phrase is acting like the verbal object in (a) and (c) and the prepositional phrase object in (b).

We can explain the dependency between the *wh* phrase and the missing constituent if we assume that in each case the *wh* phrase originated in the position of the gap in a sentence with the corresponding declarative structure:

3. **(a)** Max will chase *what*?
   (b) Pete should put his dogbone *where*?
   (c) Pete likes *which toys*?

Phrase structure principles generate the basic declarative word orders in (3) (or more precisely the d-structure) with the *wh* expression in complement position, as required by the X-bar schema and the selectional properties of the transitive verb *chase*. Three transformational operations then occur: Move relocates the *wh* expression from its d-structure position to a structural

position at the beginning of the sentence. A second occurrence of Move preposes the modal to precede the NP subject, and a transformational rule of *do-insertion* inserts the dummy verb *do* into T to carry the tense feature (which is realized as *does*), ultimately producing the s-structures in (1) at the beginning of this section. Appendix B illustrates these complex transformational processes.

A notable property of *wh* questions is that in this case Move can relocate the *wh* phrase outside of the clause in which it originates in d-structure if need be. Indeed, there is no limit to the distance that a *wh* phrase can move, as illustrated by the following sentences. The dashes indicate the d-structure position from which the *wh* phrases has been relocated.

Who did Helen say the senator wanted to hire __?
Who did Helen say the senator wanted the congressional representative to try to hire __?
Who did Helen say the senator wanted the congressional representative to try to convince the Speaker of the House to get the Vice President to hire __?

"Long-distance" dependencies created by *wh* movement are a fundamental part of human language. They provide still further evidence that sentences are not simply strings of words but are supported by a rich scaffolding of phrase structure trees. These trees express the underlying structure of a sentence as well as its relation to other sentences in the language, and as always are reflective of a person's knowledge of syntax.

UG Principles and Parameters

> Whenever the literary German dives into a sentence, that is the last you are going to see of him till he emerges on the other side of the Atlantic with his Verb in his mouth.
>
> MARK TWAIN, *A Connecticut Yankee in King Arthur's Court*, 1889

In this chapter we have largely focused on English syntax, but many of the grammatical structures we have described for English also hold in other languages. This is because Universal Grammar (UG) provides the basic design for all human languages, and individual languages are simply variations on this basic design. Imagine a new housing development. All of the houses have the same floor plan, but the occupants have some choices to make. They can have carpet or hardwood floors, curtains or blinds; they can choose their kitchen cabinets and the countertops, the bathroom tiles, and so on. This is more or less how the syntax operates. Languages conform to a basic design, and then there are choice points or points of variation.

All languages have structures that conform to the X-bar schema. Phrases consist of specifiers, heads, and complements; barred categories express recursive properties; sentences are headed by T, which is specified for information such as tense and modality; and so on.

However, languages may have different orders within the phrases and sentences. The word order differences between English and Japanese, discussed

earlier, illustrate this interaction of general and language-specific properties. UG specifies the structure of a phrase. It must have a head and may take a complement of some type and have adjuncts. However, each language defines for itself the relative order of these constituents: English is head-initial, Japanese is head-final. We call the points of variation **parameters**.

All languages appear to have transformational rules such as Move for reordering elements to achieve certain purposes such as creating questions or emphasizing certain constituents. Move is found in Dutch, for example, in which the modal moves, if there is one, as in (1), and otherwise the main verb moves, as in (2):

1. Zal Femke fietsen? (from "Femke zal fietsen.")
   will Femke bicycle ride
   (Will Femke ride her bicycle?)

2. Leest Meindert veel boeken? (from "Meindert leest veel boeken.")
   reads Meindert many books
   (Does Meindert read many books?)

Main verbs in Standard American English do not move. Instead, *do* spells out the stranded tense and agreement features (see Appendix B). All languages have expressions for requesting information about *who, when, where, what,* and *how*. Even if the question words in other languages do not necessarily begin with "wh," we will refer to such questions as *wh* questions. In some languages, such as Japanese and Swahili, the *wh* phrase does not move. It remains in its original d-structure position. In Japanese the sentence is marked with a question morpheme, *no*:

Taro-ga	nani-o	mitsuketa-no?
Taro	what	found

Recall that Japanese word order is SOV, so the *wh* phrase *nani* ('what') is an object and occurs before the verb.

In Swahili the *wh* phrase—*nani* by pure coincidence—also stays in its base position:

Ulipatia	nani	kitabu?
you gave	who	a book

However, in all languages with *wh* movement (i.e., movement of the question phrase), the question element moves into the CP (complementizer phrase) (Appendix B). The "landing site" of the moved phrase is determined by UG. Among the *wh* movement languages, there is some variation. In the Romance languages, such as Italian, the *wh* phrase moves as in English, but when the *wh* phrase questions the object of a preposition, the preposition must move together with the *wh* phrase. In English, by contrast, the preposition can be "stranded" (i.e., left behind in its original position):

A chi hai dato il libro?
To whom (did) you give the book?
*Chi hai dato il libro a?
Who(m) did you give the book to?

In some dialects of German, long-distance *wh* movement leaves a trail of *wh* phrases:

Mit	wem	glaubst	du	mit	wem	Hans	spricht?
With	whom	think	you	with	whom	Hans	talks

(Whom do you think Hans talks to?)

Wen	willst	Du	wen	Hans	anruft?
Whom	want	You	whom	Hans	call

(Whom do you want Hans to call?)

In Czech the question phrase 'how much' can be moved, leaving behind the NP it modifies:

Jak	velké	Václav	koupil	auto?
How	big	Václav	bought	car

(How big a car did Václav buy?)

Despite these variations, *wh* movement adheres to certain constraints. Although *wh* phrases such as *what, who,* and *which boy* can be inserted into any NP position, and are then free in principle to move into the CP, there are specific instances in which *wh* movement is blocked. For example, a *wh* phrase cannot move out of a relative clause like *the senator that wanted to hire who,* as in (1b). It also cannot move out of a clause beginning with *whether* or *if,* as in (2c) and (2d). (Remember that the position from which the *wh* phrases have moved is indicated with __.)

1. **(a)** Emily paid a visit to the senator that wants to hire who?
   (b) *Who did Emily pay a visit to the senator that wants to hire __?

2. **(a)** Miss Marple asked Sherlock whether Poirot had solved the crime.
   (b) Who did Miss Marple ask __ whether Poirot had solved the crime?
   (c) *Who did Miss Marple ask Sherlock whether __ had solved the crime?
   (d) *What did Miss Marple ask Sherlock whether Poirot had solved __?

The only difference between the grammatical (2b) and the ungrammatical (2c) and (2d) is that in (2b) the *wh* phrase originates in the higher clause, whereas in (2c) and (2d) the *wh* phrase comes from inside the *whether* clause. This illustrates that the constraint against movement depends on structure and not on the length of the sentence.

Some sentences can be very short and still not allow *wh* movement:

3. **(a)** Sam Spade insulted the fat man's henchman.
   (b) Who did Sam Spade insult?
   (c) Whose henchman did Sam Spade insult?
   (d) *Whose did Sam Spade insult henchman?

4. **(a)** John ate bologna and cheese.
   (b) John ate bologna with cheese.
   (c) *What did John eat bologna and?
   (d) What did John eat bologna with?

The sentences in (3) show that a *wh* phrase cannot be extracted from inside a possessive NP. In (3b) it is okay to question the whole direct object. In (3c) it is even okay to question a piece of the possessive NP, providing the entire *wh* phrase is moved, but (3d) shows that moving the *wh* word alone out of the possessive NP is illicit.

Sentence (4a) is a coordinate structure and has approximately the same meaning as (4b), which is not a coordinate structure. In (4c) moving a *wh* phrase out of the coordinate structure results in ungrammaticality, whereas in (4d), moving the *wh* phrase out of the PP is fine. The ungrammaticality of (4c), then, is related to its structure and not to its meaning.

Constraints on *wh* movement are not specific to English. All languages that have *wh* movement show some kind of constraint on its operation. Like the principle of structure dependency and the principles governing the organization of phrases, constraints on *wh* movement are part of UG. These aspects of grammar need not be learned. They are part of the innate blueprint for language that the child brings to the task of acquiring a language. What children must learn are the language-specific aspects of grammar. Where there are parameters of variation, children must determine the correct choices for their language. The Japanese child must determine that the verb comes after the object in the VP, and the English-speaking child that the verb comes before it. The Dutch-speaking child acquires a rule that moves the verb to make a question, while the English-speaking child has a more restrictive rule regarding such movement. Italian, English, and Czech children learn that to form a question the *wh* phrase moves, whereas Japanese and Swahili children determine that there is no movement. As far as we can tell, children fix these parameters very quickly. We will have more to say about how children set UG parameters in chapter 9.

Sign Language Syntax

All languages have rules of syntax similar in kind, if not in detail, to those that we have seen for English, and sign languages are no exception. Signed languages have phrase structure (PS) rules that build hierarchical structures out of linguistic constituents and specify the word order of a given signed language. ASL is an SVO language. The signer of ASL knows that the first two sentences below are grammatical sentences of ASL, but the third is not. [The capitalized words represent signs.]

CAT CHASE DOG
'The cat chased the dog.'
DOG CHASE CAT
'The dog chased the cat.'
*CHASE CAT DOG

Unlike in English, however, adjectives can follow the head noun in ASL, as in Spanish, for example, and other spoken languages.

The PS rules also determine the grammatical functions of a sentence such as subject and object, so that a signer of ASL knows that while the first two sentences are both grammatical, they differ with respect to who is chasing whom. Finally, the PS rules of signed languages exhibit language-specific variation, just as those of spoken languages do. The grammatical sentences given above for ASL would not be grammatical for signers of Italian Sign Language (LIS or "Lingua dei Segni Italiana"), because LIS is an SOV language.

In ASL, as in English and other spoken languages, the basic word order can be modified by Move. For example, a direct object or other constituent such as a temporal adverb can be moved to the beginning of the sentence in a process called topicalization. This is done to bring attention to this constituent:

BOOK, JOHN READ YESTERDAY
YESTERDAY, JOHN READ BOOK

It is also possible for Move to apply iteratively, giving a double topicalization structure, as in:

YESTERDAY, BOOK, JOHN READ

Topicalization in ASL is accompanied by raising the eyebrows and tilting the head upward, marking the special word order, much as intonation does in English. The use of such non-manual markers is a salient feature of signed languages and something that distinguishes them from spoken languages. Spoken language may be accompanied by facial expressions and other non-manual gestures. But however expressive or informative such gestures are, they do not form part of the grammatical system of a spoken language as they do in signed languages.

Wh questions in ASL may also be formed via Move. In contrast to English, the movement is optional. In ASL *wh* phrases may remain in the d-structure position as in Japanese and Swahili. The ASL equivalents of *Who did Bill see yesterday?* and *Bill saw who yesterday?* are both grammatical. As in English and other spoken languages, *wh* movement in signed languages is constrained in various ways. For example, in ASL it is not possible to question one member of a coordinate structure:

*WHO JOHN KISS MARY AND ___YESTERDAY?
*'Who did John kiss Mary and yesterday?'

Similar constraints operate in topicalization. For example, a constituent cannot be moved out of the clause beginning with another *wh* phrase:

*MOTHER, I NOT-KNOW WHAT LIKE
*'(As for) Mother, I don't know what ___ likes.'

Wh questions in ASL are accompanied by an obligatory facial expression with a tilted head and furrowed brows. These non-manual markers are analogous to the special intonation that indicates interrogatives in many spoken languages.

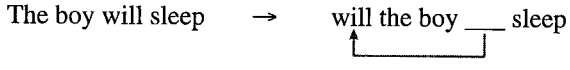
Signed languages also have complex structural means to express notions such as tense, modality, and negation. For example, in ASL, as in English,

there are several forms of negation, including NO, NOT, NONE, and NEVER, and they may follow different rules. The sign NOT, for example, can come at the end of an ASL sentence, quite unlike the behavior of the English word *not*. The structural rules for negation in ASL also require that the signer shake his or her head while producing a negative sentence, and even allow a signer to "shorten" or "reduce" the negation of a sentence to just a head shake, without producing the actual sign for NOT or NEVER. This is similar to how a speaker of English can shorten *not* to *n't*.

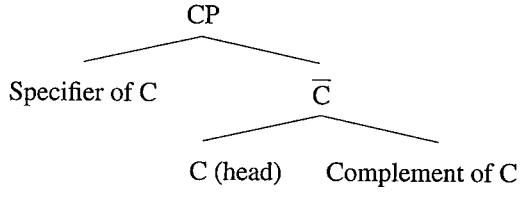
Thus, ASL and other sign languages show an interaction of universal and language-specific properties, just as spoken languages do. The rules of sign languages are structure-dependent, and movement rules are constrained in various ways, as illustrated earlier. Other properties, such as the non-manual markers and the use of space, are an integral part of the grammar of sign languages but not of spoken languages. The fact that sign languages appear to be subject to the same principles and parameters of UG that spoken languages are subject to shows us that the human brain is designed to acquire and use language, not simply speech.

APPENDIX A

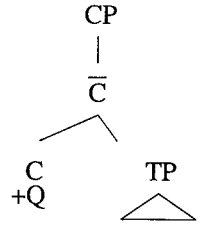
The formation of yes-no questions comes from the transformation Move relocating the T from the corresponding declarative sentence:



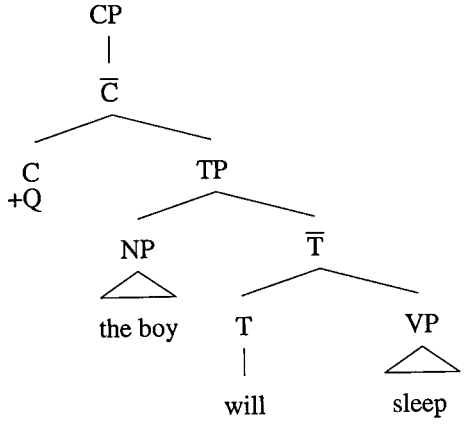
But what is the structure of *will the boy sleep*? In keeping with the X-bar schema, linguists have proposed that the entire TP is actually a subpart of a phrasal category called a Complementizer Phrase or CP, which, of course, conforms to the X-bar schema:



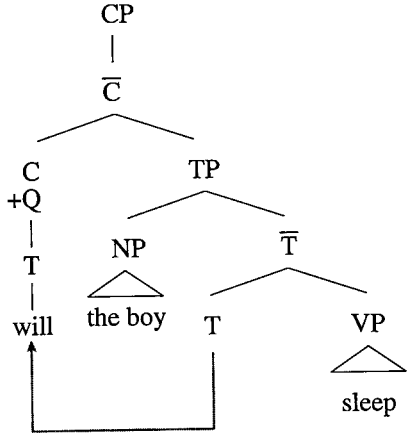
Putting the specifier aside for the moment, we see that TP occurs in this structure:



Thus, the TP is the complement to the complementizer phrase, while the head of the CP contains the abstract element +Q for questions or –Q for declaratives. The advantage of this analysis is that C provides a home for T when Move relocates it. The d-structure for questions is:



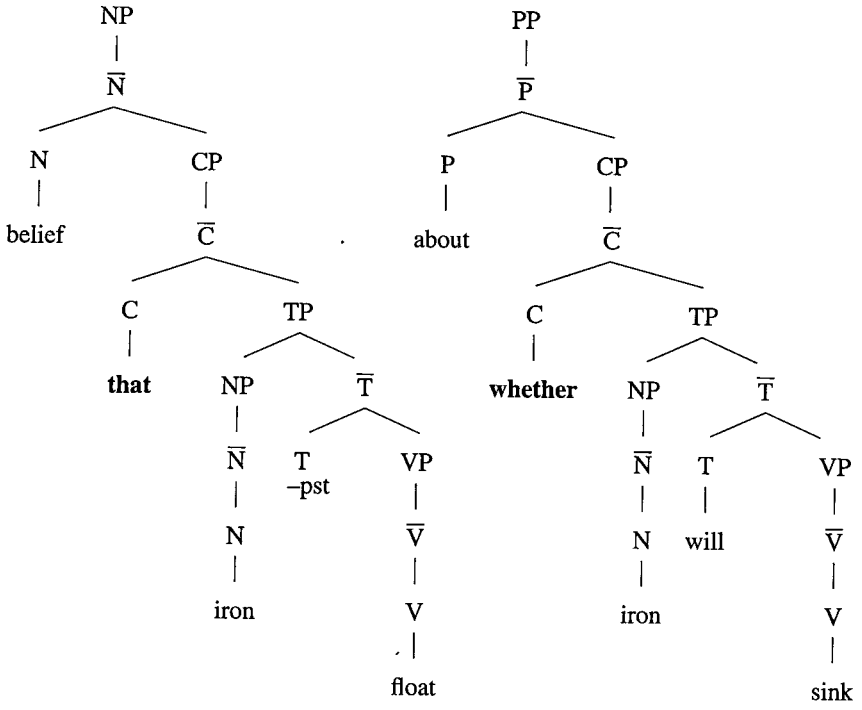
and the modal is moved to the front of the phrase:



A further need for the complementizer phrase (CP) is provided by phrasal categories that take sentences (TPs) in their complements (underlined):

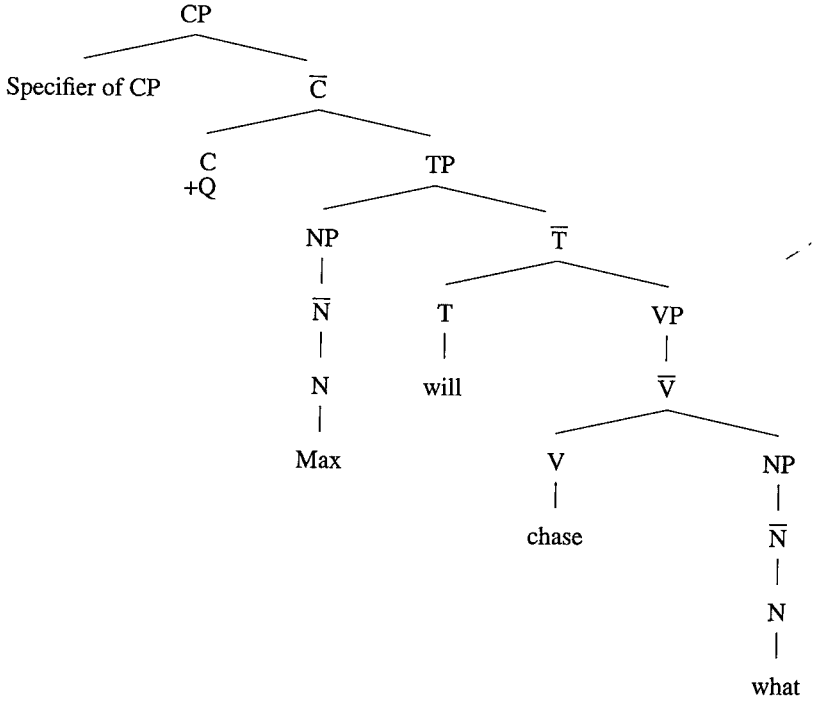
belief that iron floats (NP complement)
wonders if iron floats (VP complement)
happy that iron floats (AP complement)
about whether iron will sink (PP complement)

The words *that, if,* and *whether* are complementizers and the CP has a place for them under its head C, for example:

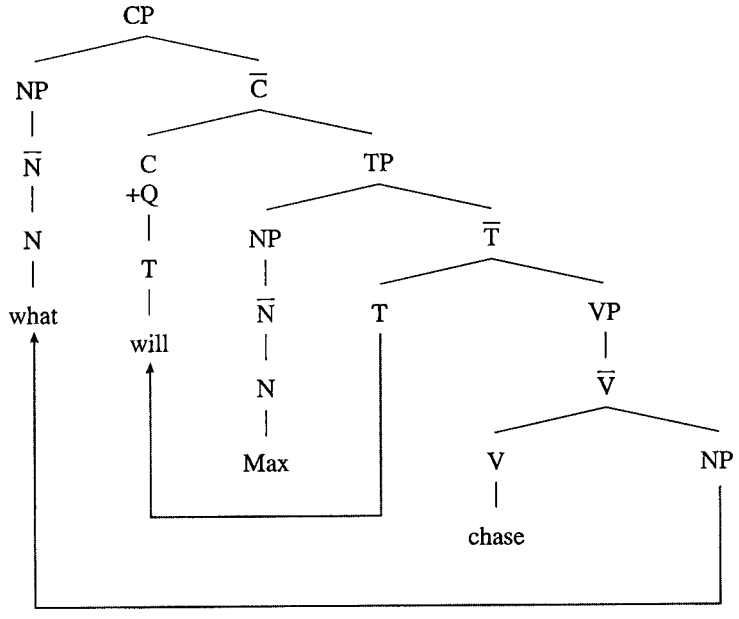


APPENDIX B

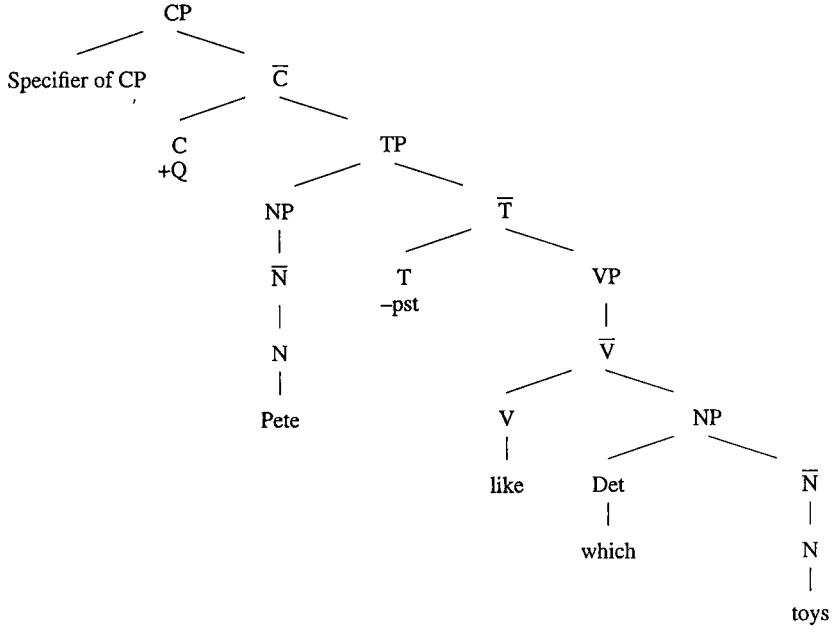
The d-structure for *What will Max chase?* is:



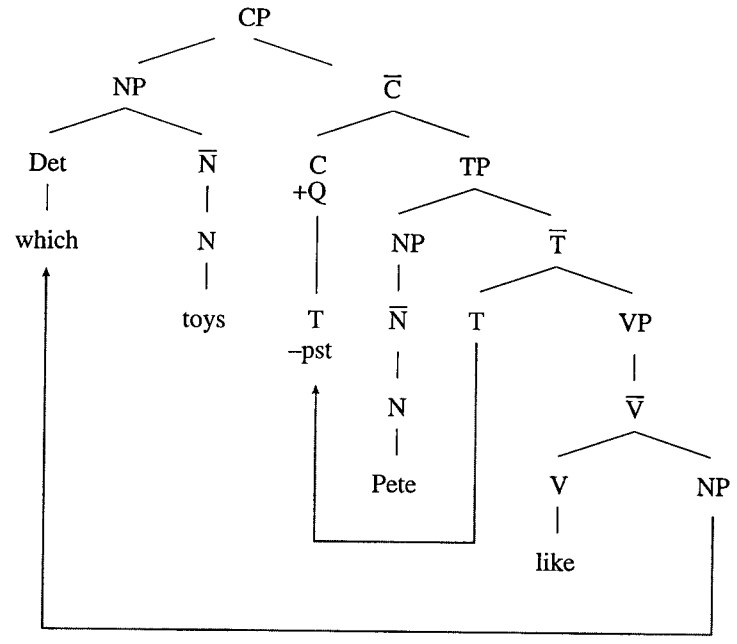
The specifier of CP is the "landing site" for the *wh* word *what*, while the head of CP will hold the T, as with yes-no questions. The result of the two applications of Move is:



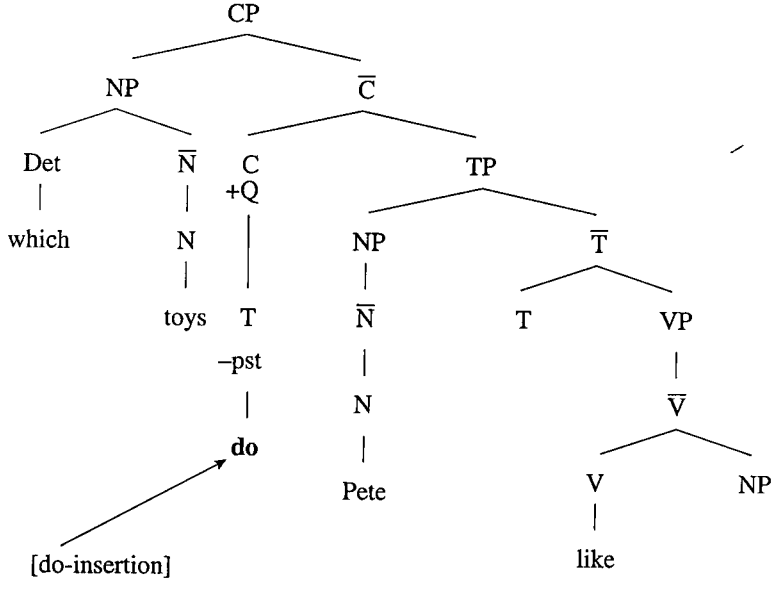
The derivation of *Which toys does Pete like?* has two additional features: The *which* is a determiner of *toys*; and when a derivation produces a T that lacks a lexical element AND is separated from the main verb by an NP, a rule inserts the "dummy" verb *do*. Here is the d-structure of *Which toys does Pete like?*



After Move has done its work we have this near s-structure:



Although T lacks a lexical element, and carries only the present tense, Move moved it anyway because Move is *structure dependent* and not dependent on the presence or absence of a word. With T separated from the main verb by an NP, something is needed to carry the tense. That something is the "dummy" word *do*, and it is put in place by a transformational rule of *do-insertion*, yielding the final s-structure:



Do combines with [–pst] to yield the present tense *does*. Rules that convert inflectional features such as *past tense* or *third-person present tense* into their proper phonological forms are called **spell-out rules**. They apply to the syntactic output of s-structures.

Before concluding we should mention two other auxiliary verbs that participate in question formation in English. These are the auxiliaries *have* and *be* that we find in sentences such as:

1. Spot has chased a squirrel.
2. Nellie is snoring.

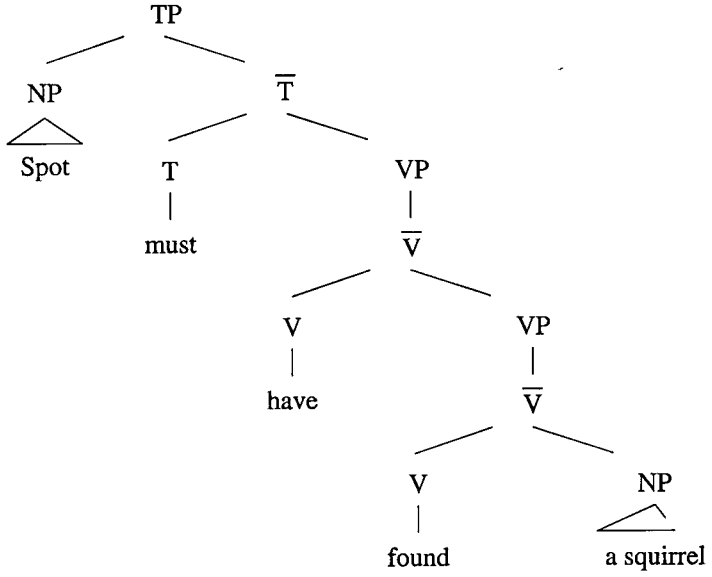
Like the modals, the auxiliaries *have* and *be* move to the position preceding the subject in both yes-no questions and *wh* questions.

Has Spot ___ chased a squirrel?
Is Nellie ___ snoring?
What has Spot ___ chased ___?

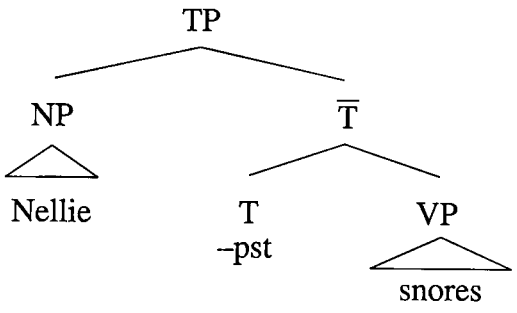
The question is: where do *have* and *be* originate in the d-structure? Note that *have* and *be* can occur in the same sentence with a modal:

Nellie may be snoring.
Spot must have found a squirrel.

We can conclude therefore that they do not originate in T (which may be occupied by a modal). Like other verbs in English, however, *have* and *be* inflect for tense (and agreement): *am, is, are, was, were, have, has, had.* Our analysis leads us to conclude that *have/be* originate under V in a recursive $\overline{V}$ structure, as follows. (An additional rule, 20. $\overline{V} \rightarrow$ V VP, joins rules 5, 6, and 7 in providing phrasal complements to the verb.)

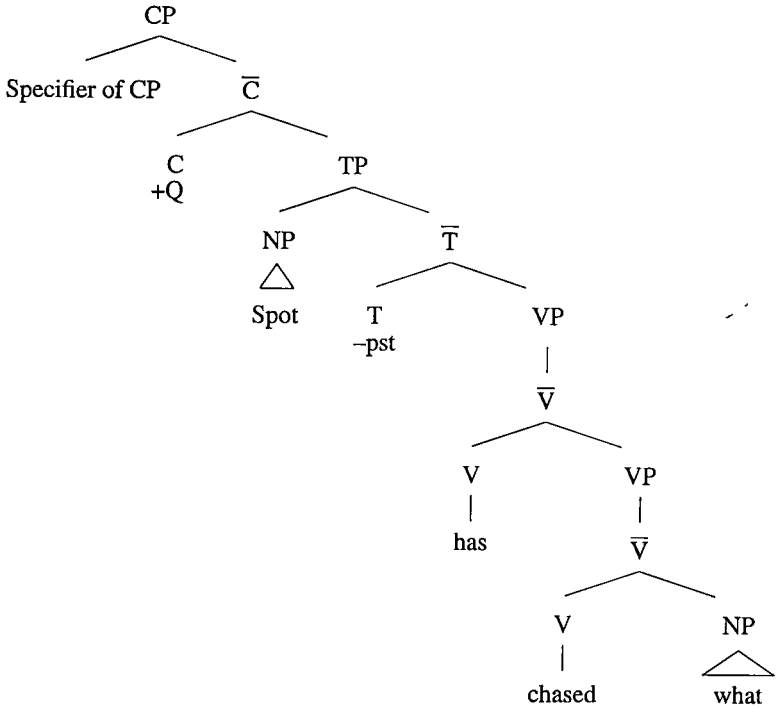


When there is no modal, T is occupied by a tense feature, which is realized on *have/be*, as would be the case for other verbs like *snore*:

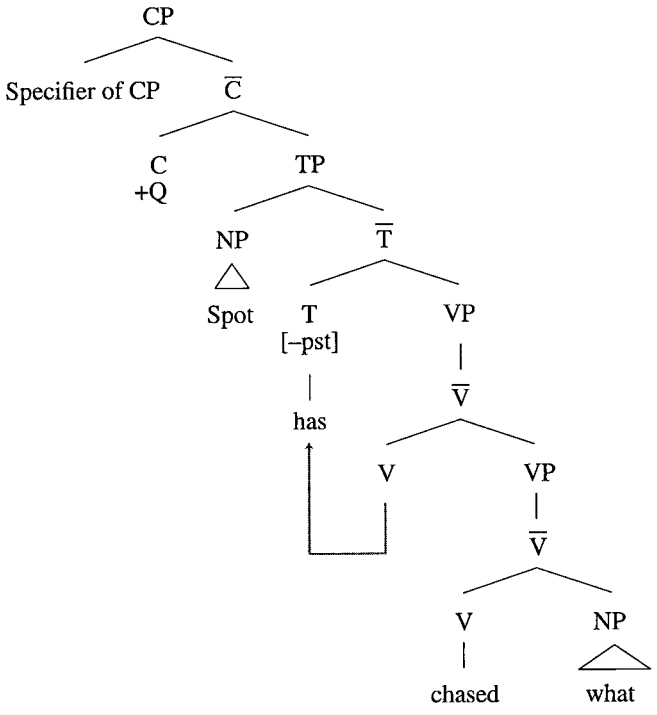


The auxiliaries *have* and *be* are special in one important respect, however. They can undergo a movement that is not available to other verbs: they can "raise" to T, and from this position they undergo a second movement to C to form a question. To illustrate this process, we have given several structural steps in deriving *What has Spot chased?* This derivation is shown below:

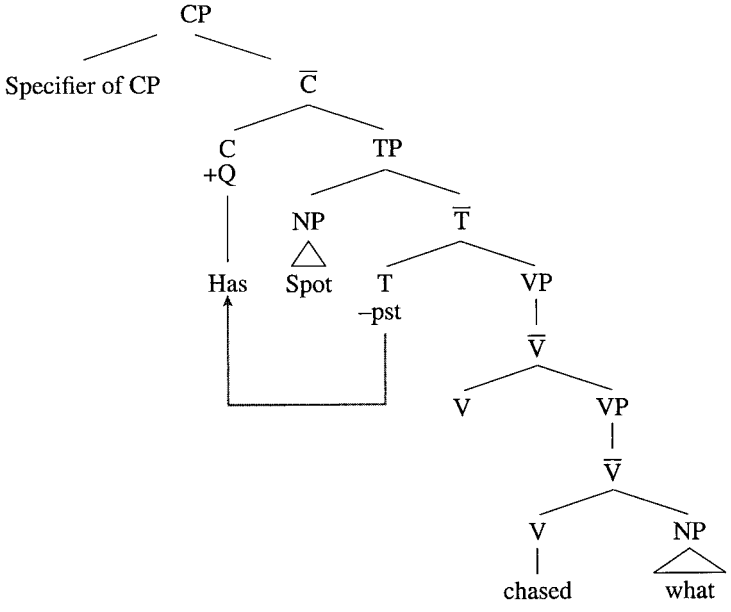
Here is the d-structure (from the X-bar derived phrase structure rules):



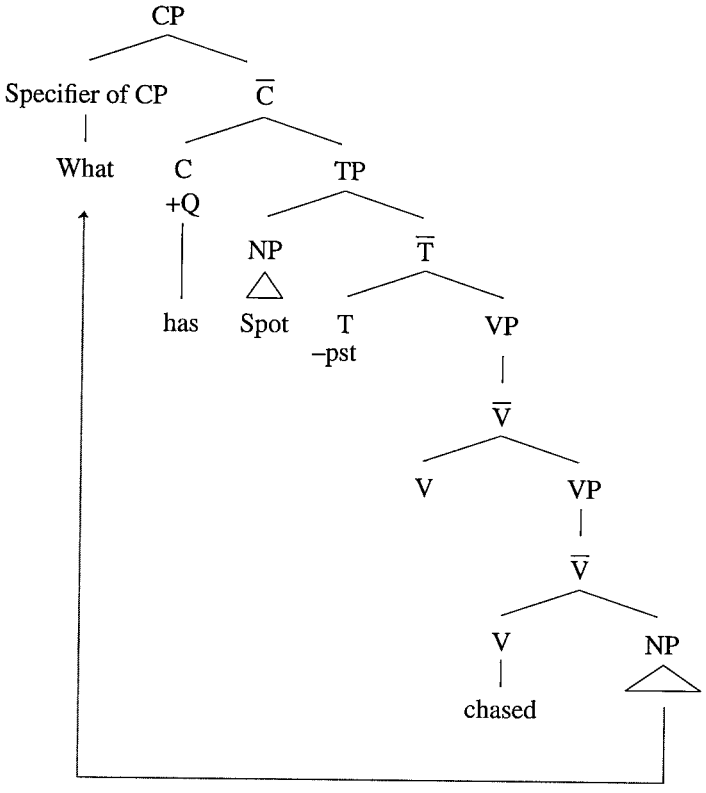
With T unoccupied by a modal and adjacent to *has* (if *has* were *is*, we'd be deriving *What is Spot chasing?*), the *has* is raised to T as shown in this tree:



The transformational rule that raises V to T when V is *have* or *be* allows us to explain the unique behavior of *have/be* in English questions.
The transformational rule for questions now moves *has* to the front of the sentence into the head of CP position, C:



And finally, *wh* movement brings *what* to the front of the sentence into the specifier of CP position:



APPENDIX C

This appendix contains the PS rules used in this chapter, but excluding TP and CP X-bar rules, which are applied implicitly by showing their tree structure.

1. S → NP VP
2. NP → Det $\bar{N}$
3. $\bar{N}$ → N
4. VP → $\bar{V}$
5. $\bar{V}$ → V NP
6. $\bar{V}$→ V PP
7. $\bar{V}$ → V AP
8. $\bar{N}$ → N PP
9. PP → $\bar{P}$
10. $\bar{P}$ → P NP
11. AP → $\bar{A}$
12. $\bar{A}$ → A
13. $\bar{A}$ → A PP
14. $\bar{N}$ → A $\bar{N}$
15. $\bar{A}$ → Int $\bar{A}$

16. $\overline{V} \rightarrow \overline{V}$ PP
17. $\overline{N} \rightarrow \overline{N}$ PP
18. $\overline{V} \rightarrow$ AdvP $\overline{V}$
19. $\overline{V} \rightarrow \overline{V}$ AdvP
20. $\overline{V} \rightarrow$ V VP (in Appendix B)

Summary

Speakers of a language recognize the grammatical sentences of their language and know how the words in a sentence must be ordered and grouped to convey a certain meaning. All speakers are capable of producing and understanding an unlimited number of new sentences that have never before been spoken or heard. They also recognize ambiguities, know when different sentences mean the same thing, and correctly interpret the grammatical relations in a sentence, such as **subject** and **direct object**. This kind of knowledge comes from their knowledge of the **rules of syntax**.

Sentences have structure that can be represented by **phrase structure trees** containing **syntactic categories**. Phrase structure trees reflect the speaker's mental representation of sentences. Ambiguous sentences may have more than one phrase structure tree.

Phrase structure trees reveal the linear order of words and the constituency of each syntactic category. There are different kinds of syntactic categories: **Phrasal categories**, such as NP and VP, are composed of other syntactic categories; **lexical categories**, such as Noun and Verb, and **functional categories**, such as Det and T, often correspond to individual words. The hierarchical structure of the phrasal categories is universal and is specified by the **X-bar schema**, consisting of a **specifier**, a **head**, and its **complements** and **adjuncts**. NPs, VPs, and so on are headed by nouns, verbs, and the like. The sentence (S or TP) is headed by T, which carries such information as tense and modality.

The particular order of elements within the phrase is subject to language-particular variation and can be expressed through the **phrase structure rules** of each language, which conform to the X-bar Schema.

A grammar is a formally stated, explicit description of the mental grammar or the speaker's linguistic competence. The **lexicon** represents the knowledge that a speaker has about the vocabulary of his or her language. This knowledge includes the syntactic categories of words as well as the **subcategorization** or **c-selection** properties of particular lexical items that specify the complements they can take, for example whether a verb is **transitive** or **intransitive**. The lexicon also contains semantic information, including the kinds of NPs that can function as semantically coherent subjects and objects: **s-selection**. Selectional restrictions must be satisfied in the **d-structure** representation of the sentence.

Transformational rules such as Move and *do*-insertion account for relationships between sentences such as declarative and interrogative pairs, including *wh* questions. Transformations such as Move can relocate constituents. The output of the transformational rules is the **s-structure** of a sentence, the structure that most closely determines how the sentence is to be pronounced (or signed). Inflectional information, such as tense, may be represented as

abstract features in the phrase structure tree. After the rules of the syntax have applied, these features are sometimes spelled out as affixes such as *-ed* or as function words such as *do*.

The basic design of language is universal. Universal Grammar specifies that syntactic rules are **structure-dependent** and that movement rules may not move phrases out of certain structures such as certain types of clauses, among many other constraints, including a need to not violate the X-bar schema. These constraints exist in all languages—spoken and signed—and need not be learned. UG also contains parameters of variation, such as the order of heads and complements, and the variations on movement rules. A child acquiring a language must fix the parameters of UG for that language.

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Exercises

1. Besides distinguishing grammatical from ungrammatical sentences, the rules of syntax account for other kinds of linguistic knowledge, such as:
   a. when a sentence is structurally ambiguous. (Cf. *The boy saw the man with a telescope.*)
   b. when two sentences with different structures mean the same thing. (Cf. *The father wept silently.* and *The father silently wept.*)
   c. systematic relationships of form and meaning between two sentences, like declarative sentences and their corresponding interrogative forms. (Cf. *The boy can sleep.* and *Can the boy sleep?*)

   Draw on your linguistic knowledge of English to come up with an example illustrating each of these cases. (Use examples that are different from the ones in the chapter.) Explain why your example illustrates the point. If you know a language other than English, provide examples in that language, if possible.

2. Consider the following sentences:
   a. I hate war.
   b. You know that I hate war.
   c. He knows that you know that I hate war.
      i. Write another sentence that includes sentence (c).
      ii. What does this set of sentences reveal about the nature of language?
      iii. How is this characteristic of human language related to the difference between linguistic competence and performance? (Hint: Review these concepts in chapter 1.)

3. Paraphrase each of the following sentences in two ways to show that you understand the ambiguity involved:

   Example: Smoking grass can be nauseating.

   i. Putting grass in a pipe and smoking it can make you sick.
   ii. Fumes from smoldering grass can make you sick.

   a. Dick finally decided on the boat.
   b. The professor's appointment was shocking.
   c. The design has big squares and circles.
   d. That sheepdog is too hairy to eat.
   e. Could this be the invisible man's hair tonic?
   f. The governor is a dirty street fighter.
   g. I cannot recommend him too highly.
   h. Terry loves his wife and so do I.
   i. They said she would go yesterday.
   j. No smoking section available.
   k. We will dry clean your clothes in 24 hours.
   l. I bought cologne for my boyfriend containing 25% alcohol.

4. i. Consider the following baseball joke (knowledge of baseball required):

   CATCHER TO PITCHER: "Watch out for this guy, he's a great fastball hitter."
   PITCHER TO CATCHER: "No problem. There's no way I've got a great fastball."

   Explain the humor either by paraphrasing, or even better, with a tree structure like the one we used early in the chapter for *old men and women* (without the syntactic categories).

   ii. Do the same for the advertising executive's (honest?) claim that the new magazine "has between one and two billion readers."

5. Draw two phrase structure trees to represent the two meanings of the sentence *The magician touched the child with the wand.* Be sure you indicate which meaning goes with which tree. (Note: Be sure your trees conform to the X-bar schema.) (Hint: *with the wand* is an adjunct, not a complement.)

6. Draw the NP subtrees for the italicized NPs in the following sentences:
   a. *Every mother* hopes for good health.
   b. *A big black dog is* barking.
   c. *Angry men in dark glasses* roamed the streets.
   d. We saw *the destruction of the house.* (Hint: *. . . and the one of the garage)

7. In all languages, sentences can occur within sentences. For example, in exercise 2, sentence (b) contains sentence (a), and sentence (c) contains sentence (b). Put another way, sentence (a) is embedded in sentence (b), and sentence (b) is embedded in sentence (c). Sometimes embedded sentences appear slightly changed from their normal forms, but you should be able to recognize and underline the embedded sentences in the following examples. Underline in the non-English sentences, when given, not in the translations (the first one is done as an example):

   a. Yesterday I noticed <u>my accountant repairing the toilet</u>.
   b. Becky said that Jake would play the piano.
   c. I deplore the fact that bats have wings.
   d. That Guinevere loves Lorian is known to all my friends.
   e. Who promised the teacher that Maxine wouldn't be absent?
   f. It's ridiculous that he washes his own Rolls-Royce.
   g. The woman likes for the waiter to bring water when she sits down.
   h. The person who answers this question will win $100.
   i. The idea of Romeo marrying a 13-year-old is upsetting.
   j. I gave my hat to the nurse who helped me cut my hair.
   k. For your children to spend all your royalty payments on recreational drugs is a shame.
   l. Give this fork to the person I'm getting the pie for.
   m.

khăw	chyâ	waă	khruu	maa. (Thai)
He	believe	that	teacher	come

   He believes that the teacher is coming.

   n.

Je	me	demande	quand	il	partira. (French)
I	me	ask	when	he	will leave

   I wonder when he'll leave.

   o.

Jan	zei	dat	Piet	dit	boek	niet	heeft	gelezen. (Dutch)
Jan	said	that	Piet	this	book	not	has	read

   Jan said that Piet has not read this book.

8. Adhering to the X-bar schema, draw phrase structure trees for the following sentences (TPs): (Hint: place any adverbs directly under AdvP without concern for the internal structure of the adverbial phrase. Also, you may assume possessive terms like *my* and *her* are determiners and that there are no "small clauses.")

   a. The puppy found the child.
   b. A surly passenger insulted the attendant.
   c. The house on the hill collapsed in the earthquake.
   d. The ice melted quickly.
   e. The hot sun melted the ice.
   f. The old tree swayed in the wind.
   g. My guitar gently weeps.

9. Create five phrase structure trees of 6, 7, 8, 9, and 10 words. Use your mental lexicon to fill in the bottoms of the trees. (Note: make sure your trees conform to the X-bar schema and be especially cautious to distinguish adjuncts from complements.)

10. We stated that the rules of syntax specify all and only the grammatical sentences of the language. Why is it important to say *only*? What would be wrong with a grammar that specified as grammatical sentences all of the truly grammatical ones plus a few that were not grammatical?

11. In this chapter we introduced the X-bar schema, according to which each phrasal category without $\overline{X}$ recursion has three levels of structure. Draw the subtree corresponding to the phrasal category NP (noun phrase) and give an example of the four possibilities: head only; specifier and head only; head and complement only; and specifier, head, and complement only. (Hint: Make sure your complement is not an adjunct using the *one*-replacement test.)

12. Using one or more of the constituency tests (i.e., stand alone, move as a unit, replacement by a pronoun, *one*-replacement) discussed in the chapter, determine which of the boldfaced portions in the sentences are constituents. Provide the grammatical categoryof the constituents.

    a. Martha found **a lovely pillow** for the couch.
    b. The **light in this room** is terrible.
    c. I wonder **whether Bonnie has finished packing her books.**
    d. Melissa slept **in her class.**
    e. **Pete and Max** are fighting over the bone.
    f. I gave a bone to Pete **and to Max** yesterday.
    g. I gave a bone to **Pete and** to Max yesterday.

13. The two sentences below contain a **verbal particle:**

    i. He ran *up* the bill.
    ii. He ran the bill *up.*

    The verbal particle *up* and the verb *run* depend on each other for the unique idiosyncratic meaning of the phrasal verb *run up.* (*Running up a bill* involves neither running nor the location up.) We showed earlier that in such cases the particle and *object* do not form a constituent, hence they cannot move as a unit:

    iii. *Up the bill, John ran. (Compare this to *Up the hill John ran.*)

    a. Using adverbs such as *completely,* show that the particle forms a constituent with the *verb* in [*run up*] *the bill,* while in *run* [*up the hill*], the preposition and NP object form a constituent.
    b. Now consider the following data:

        i. Michael ran up the hill and over the bridge.
        ii. *Michael ran up the bill and off his mouth.
        iii. Michael ran up the bill and ran off his mouth.

    Use the data to argue that expressions like *up the bill* and *off his mouth* are not constituents.

14. In terms of C-selection restrictions, explain why the following are ungrammatical:

a. *The man located.
b. *Jesus wept the apostles.
c. *Robert is hopeful of his children.
d. *Robert is fond that his children love animals.
e. *The children laughed the man.

15. The complement of V may be a single NP direct object as for *find*. English also has **ditransitive verbs**, ones whose complement may be two NPs, such as *give*:

The emperor gave the vassal a castle.

Think of three other ditransitive verbs in English and give example sentences. (Note: The analysis of ditransitive verbs in X-bar theory is controversial. See Exercise 27.)

16. Tamil is a language spoken in India by upward of 70 million people. Others, but not you, may find that they talk "funny," as illustrated by word-for-word translations of PPs from Tamil to English:

Tamil	to English Meaning
the bed on	'on the bed'
the village from	'from the village'

i. Based on these data, is Tamil a head initial or a head final language?
ii. What would the PS tree for a Tamil PP look like? (Note: Make sure your tree conforms to the X-bar schema.)

17. Here are three more word-for-word glosses in Tamil:

a story tell	'tell a story'
the boy a cow saw	'the boy saw a cow'
woman this slept	'this woman slept'

Do these further data support or detract from your analysis in exercise 16? What would the pertinent VP and NP trees look like in Tamil, based on these data? (Hint: Just give the three levels. You may need to look at Appendix B.)

18. All *wh* phrases can move to the left periphery of the sentence.

a. Invent three sentences beginning with *what*, *which*, and *where*, in which the *wh* word is not in its d-structure position in the sentence. Give both the s-structure and d-structure versions of your sentences. For example, using *when*:

When could Marcy catch a flight? from *Marcy could catch a flight when?* (Hint: see Appendix B.)

b. Draw the phrase structure tree for one of your sentences. (Hint: See the Appendices.) (Note: As always, make sure your trees conform to the X-bar schema.)

19. There are many systematic, structure-dependent relationships among sentences similar to the one discussed in the chapter between declarative and interrogative sentences. Here are some example sentences based on ditransitive verbs (see exercise 15):

The boy wrote the senator a letter.
The boy wrote a letter to the senator.
A philanthropist gave the animal rights movement $1 million.
A philanthropist gave $1 million to the animal rights movement.

a. Describe the relationship between the first and second members of each pair of sentences.
b. State why a Move transformation deriving one of these structures from the other is plausible.

20. State at least three differences between English and the following languages, using just the sentence(s) given. Ignore lexical differences (i.e., the different vocabulary). Here is an example:

Thai:	Dèg	khon	níi	kamlang	kin.
	boy	*classifier*	this	*progressive*	eat

'This boy is eating.'

	Mǎa	tua	nán	kin	khâaw.
	dog	*classifier*	that	eat	rice

'That dog ate rice.'

Three differences are (1) Thai has "classifiers." They have no English equivalent. (2) The words (determiners, actually) *this* and *that* follow the noun in Thai, but precede the noun in English. (3) The "progressive" is expressed by a single separate word in Thai. The verb does not change form. In English, the progressive is indicated by the presence of the verb *to be* and the adding of *-ing* to the verb.

a. French

Cet	homme	intelligent	comprendra	la question.
this	man	intelligent	will understand	the question

'This intelligent man will understand the question.'

Ces	hommes	intelligents	comprendront	les questions.
these	men	intelligent	will understand	the questions

'These intelligent men will understand the questions.'

b. Japanese

Watashi	ga	sakana	o	tabete	iru.
I	*subject marker*	fish	*object marker*	eat (*ing*)	am

'I am eating fish.'

c. Swahili

Mtoto		alivunja			kikombe.	
m-	toto	a-	li-	vunja	ki-	kombe
class marker	child	he	*past*	break	*class marker*	cup

'The child broke the cup.'

Watoto		wanavunja			vikombe.	
wa-	toto	wa-	na-	vunja	vi-	kombe
class marker	child	they	*present*	break	*class marker*	cup

'The children break the cups.'

d. Korean

Ki	sonyɔn-iee		wiyu-lil		masi-ass-ta.		
ki	sonyɔn-	iee	wiyu-	lil	masi-	ass-	ta
the	boy	*subject marker*	milk	*object marker*	drink	*past*	*assertion*

'The boy drank milk.'

Ki-nin		muɔs-il		mɔk-ass-ninya.		
ki	nin	muɔs-	il	mɔk-	ass-	ninya
he	*subject marker*	what	*object marker*	eat	*past*	*question*

'What did he eat?'

e. Tagalog

Nakita	ni	Pedro-ng		puno	na	ang	bus.
nakita	ni	Pedro	-ng	puno	na	ang	bus
saw	*article*	Pedro	that	full	already	*topic marker*	bus

'Pedro saw that the bus was already full.'

21. Transformations may delete elements. For example, the s-structure of the ambiguous sentence *George wants the presidency more than Martha* may be derived from two possible d-structures:

a. George wants the presidency more than he wants Martha.
b. George wants the presidency more than Martha wants the presidency.

A deletion transformation either deletes *he wants* from the structure of example (a), or *wants the presidency* from the structure of example (b). This is a case of **transformationally induced ambiguity**: two different d-structures with different semantic interpretations are transformed into a single s-structure.

Explain the role of a deletion transformation similar to the ones just discussed in the following humorous dialogue between "two old married folks."

HE: Do you still love me as much as you used to?

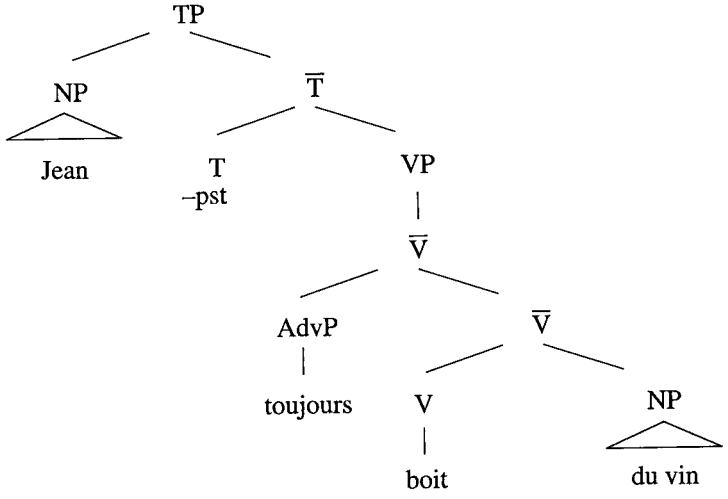
SHE: As much as I used to what?

22. **Challenge exercise:** Compare the following French and English sentences:

French	English
Jean boit toujours du vin.	John always drinks some wine.
Jean drinks always some wine	*John drinks always some wine
(*Jean toujours boit du vin)	
Marie lit jamais le journal.	Mary never reads the newspaper.
Marie reads never the newspaper	*Mary reads never the newspaper.
(*Marie jamais lit le journal)	
Pierre lave souvent ses chiens.	Peter often washes his dogs.
Pierre washes often his dogs	*Peter washes often his dogs.
(*Pierre souvent lave ses chiens.)	

a. Based on the above data, what would you hypothesize concerning the relative positions of adverbs of frequency (e.g., *toujours, jamais, souvent, always, never, often*) and the verbs they modify in French and English?

b. Now suppose that UG specifies that in *all languages* the adverbs of frequency must precede $\overline{V}$, as in the tree below. What transformational rule would you need to hypothesize to derive the correct surface word order for French? (Hint: Think about the auxiliaries *have* and *be* in English and the movements they can make by referring to appendix B.)



c. How are English and French alike; how are they different?

23. Refer to the tree structures on p. 108.

a. Give the tree corresponding to the VP *cursed the day I was born the day I was born.*

Which must come first, the AdvP or the NP? (You needn't concern yourself with the internal structure of the AdvP or the NP.)

b. How would you draw tree structures (i.e., modify the PS rules) to account for NPs that contain multiple adjective phrases with intensifiers such as *the extremely intelligent, happy-about-his-grade boy.*

24. Show that an embedded CP (a CP inside a TP) is a constituent by applying the constituency tests (stand alone, move as a unit, and replace with a pronoun). Consider the following sentences in formulating your answer, and provide further examples if you can. (The boldfaced words are the CPs.)

Sam asked **whether he could play soccer.**

I wonder **whether Michael walked the dog.**

Cher believes **that the students know the answer.**

It is a problem **that Sam broke his arm.**

25. **Challenge exercise** (if you've read Appendices A and B):

a. Give the d-structure tree for *Which dog does Michael think loves bones?* (Hint: The complementizer *that* must be present.)

b. Give the d-structure tree for *What does Michael think that his dog loves?*

c. Consider these data:

i. *Which dog does Michael think that loves bones?

ii. What does Michael think his dog loves?

In (ii), a complementizer deletion rule has deleted *that.* The rule is optional because the sentence is grammatical with or without *that.* In (i), however, the complementizer must be deleted to prevent the ungrammatical sentence from being generated. What factor governs the optionality of the rule?

26. Dutch and German are Germanic languages related to English, and as in English, *wh* questions are formed by moving a *wh* phrase to sentence-initial position.

In what way are the rules of question formation in Dutch and German different from those in English? Base your answer on the following data:

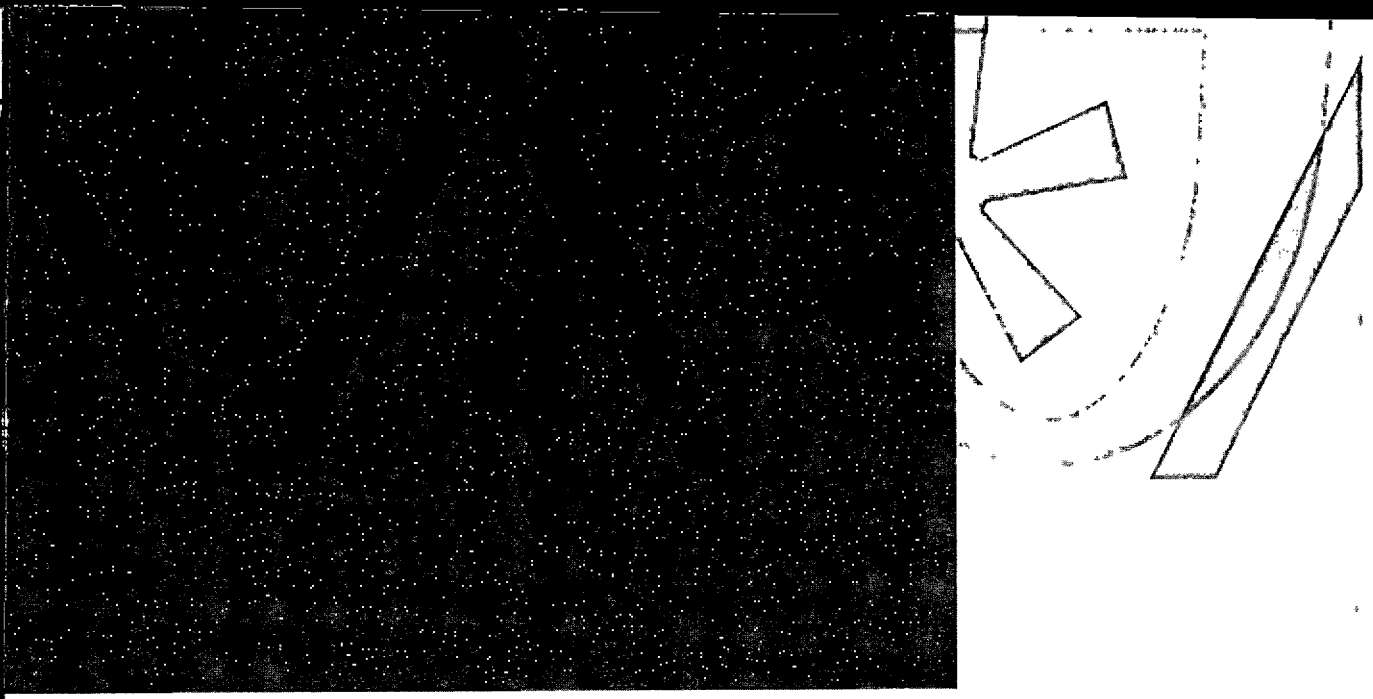
	German				**Dutch**			
i.	Was	hat	Karl	gekauft?	Wat	heeft	Wim	gekocht?
	what	has	Karl	bought	what	has	Wim	bought
	'What has Karl bought?'				'What has Wim bought?'			
ii.	Was	kauft	Karl?		Wat	koopt	Wim?	
	What	buys	Karl		what	buys	Wim	
	'What does Karl buy?'				'What does Wim buy?'			

iii.

Kauft	Karl	das	Buch?	Koopt	Wim	het	boek?
buys	Karl	the	book	buys	Wim	the	book
'Does Karl buy the book?'				'Does Wim buy the book?'			

27. **Challenge research exercise:** X-bar theory demands binary branching and that a head may have one and only one complement. Ditransitive verbs such as *write, give,* etc. (they are numerous) pose problems insofar as fitting into the strict (dare we say "Procrustean") strictures of X-bar. This research project asks you to examine the work that has been done to accommodate the facts of ditransitive verbs with X-bar theory.

28. The *one*-replacement test is an excellent way to determine whether an expression that follows a noun is a complement or an adjunct. Here are four examples of complements and four of adjuncts. Apply the *one*-replacement test to determine which is which:
    a. the man with the golden arm
    b. a voter for proposition eighteen
    c. my cousin's arrival at his home
    d. the construction of a retaining wall
    e. the boat in the river
    f. the ocean white with foam
    g. the desecration of the temple
    h. the betrayal of Julius Caesar



An Introduction to Language 10e

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