

4 CHAPTER

Syntax: The Sentence Patterns of Language

To grammar even kings bow.

J. B. Molière, *Les femmes savantes*, II, 1672

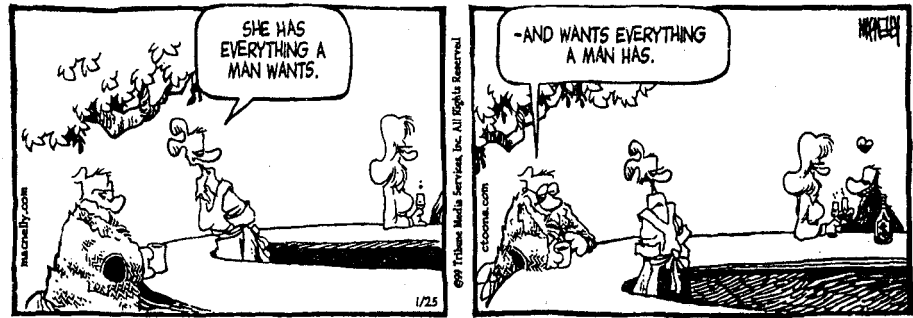


Any speaker of a human language can produce and understand an infinite number of sentences. We can show this quite easily through examples such as the following:

The kind-hearted boy had many girlfriends.
The kindhearted, intelligent boy had many girlfriends.
The kindhearted, intelligent, handsome boy had many girlfriends.

John went to the movies.
John went to the movies and ate popcorn.
John went to the movies, ate popcorn, and drank a coke.

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.



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In each case the speaker could continue creating sentences by adding an adjective, or a noun connected by *and*, or a relative clause. In principle this could go on forever. All languages have mechanisms such as these — modification, coordination, and clause insertion — that make the number of sentences limitless. Obviously, the sentences of a language cannot be stored in a dictionary format in our heads. 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 the 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 structure is and what the rules that determine syntactic structure are like. Most of the examples will be from the syntax of English, but the principles that account for syntactic structures are universal.

Part of what we mean by *structure* is word order. As suggested by the "Shoe" cartoon, the meaning of a sentence depends largely on the order in which words occur in a sentence. Thus,

She has what a man wants

does not have the same meaning as

She wants what a man has.

Sometimes, however, a change of word order has no effect on meaning.

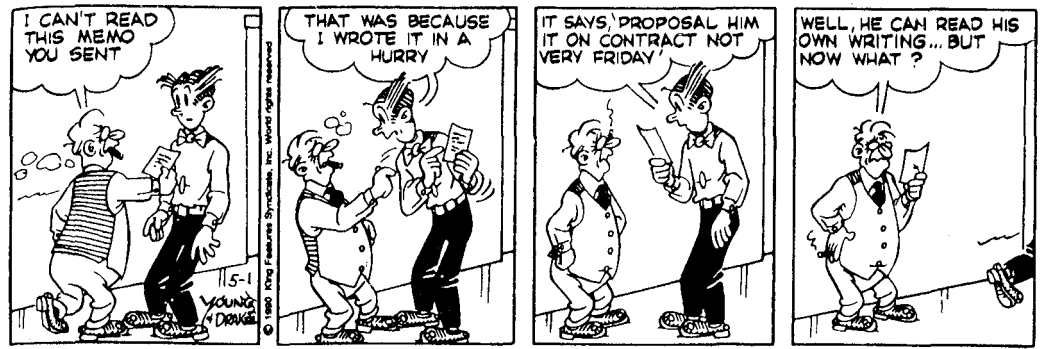
The Chief Justice swore in the new President.

The Chief Justice swore the new President in.

The grammars of all languages include **rules of syntax** that reflect speakers' knowledge of these facts.

Grammatical or Ungrammatical?

Although the following sequence consists of meaningful words, the entire expression is without meaning because it does not comply with the syntactic rules of the grammar.



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Chief swore president the Justice the in new

In English and in every language, every sentence is a sequence of words, but not every sequence of words is a sentence. Sequences of words that conform to the rules of syntax are **well formed** or **grammatical**, and those that violate the syntactic rules are **ill formed** or **ungrammatical**.

What Grammaticality Is Based On

In chapter 1 you were asked to indicate strings of words as grammatical or ungrammatical according to your linguistic intuitions. Here is another list of word sequences. Disregarding the sentence meanings, use *your* knowledge of English and place an asterisk in front of the ones that strike you as peculiar or funny in some way.

1. (a) The boy found the ball
(b) The boy found quickly
(c) The boy found in the house
(d) The boy found the ball in the house
2. (e) Disa slept the baby
(f) Disa slept soundly
3. (g) Zack believes Robert to be a gentleman
(h) Zack believes to be a gentleman
(i) Zack tries Robert to be a gentleman
(j) Zack tries to be a gentleman
(k) Zack wants to be a gentleman
(l) Zack wants Robert to be a gentleman
4. (m) Jack and Jill ran up the hill
(n) Jack and Jill ran up the bill
(o) Jack and Jill ran the hill up
(p) Jack and Jill ran the bill up
(q) Up the hill ran Jack and Jill
(r) Up the bill ran Jack and Jill

We predict that speakers of English will “star” (b), (c), (e), (h), (i), (o), and (r). If we are right, this shows that grammaticality judgments are neither idiosyncratic nor capricious, but are determined by rules that are shared by the speakers of a language.

The syntactic rules that account for the ability to make these judgments include other constraints in addition to rules of word order. For example:

- The rules specify that *found* must be followed directly by an expression like *the ball* but not by *quickly* or *in the house* as illustrated in (a) through (d).
- The verb *sleep* patterns differently than *find* in that it may be followed solely by a word like *soundly* but not by other kinds of phrases such as *the baby* as shown in (e) and (f).
- Examples (g) through (l) show that *believe* and *try* function in opposite fashion while *want* exhibits yet a third pattern.
- Finally, the word order rules that constrain phrases such as *run up the hill* differ from those concerning *run up the bill* as seen in (m) through (r).

Sentences are not random strings of words. Some strings of words that we can interpret are not sentences. For example, we can understand example (o) even though we recognize it as ungrammatical. We can fix it up to make it grammatical. To be a sentence, words must conform to specific patterns determined by the syntactic rules of the 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: Program One*

The 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.

Grammaticality judgments do not depend on whether the sentence is meaningful or not, 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 they differ in their “funniness” from the following strings of words:

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

You may understand ungrammatical sequences even though you know they are not well formed. Most English speakers could interpret

*The boy quickly in the house the ball found

although they know that the word order is irregular. On the other hand, grammatical sentences may be uninterpretable if they include nonsense strings, that is, words with no agreed-on meaning, as shown by the first two lines of “Jabberwocky” by Lewis Carroll:

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

Such nonsense poetry is amusing 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 does not depend on the truth of sentences. If it did, lying would be impossible. Nor does it depend on whether real objects are being discussed, nor on whether something is possible. Untrue sentences can be grammatical, sentences discussing unicorns can be grammatical, and sentences referring to pregnant fathers can be grammatical.

Our unconscious knowledge of the syntactic rules of grammar permits us to make grammaticality judgments. These rules are not the prescriptive rules that are taught in school. Children develop the rules of grammar long before they attend school, as is discussed in chapter 8.

What Else Do You Know about Syntax?

Syntactic knowledge goes beyond being able to decide which strings are grammatical and which are not. It accounts for the multiple meanings, or **ambiguity**, of expressions like the one illustrated in the cartoon on page 122. The humor of the cartoon depends on the ambiguity of the phrase *synthetic buffalo hides*, which can mean “buffalo hides that are synthetic,” or “hides of synthetic buffalo.”

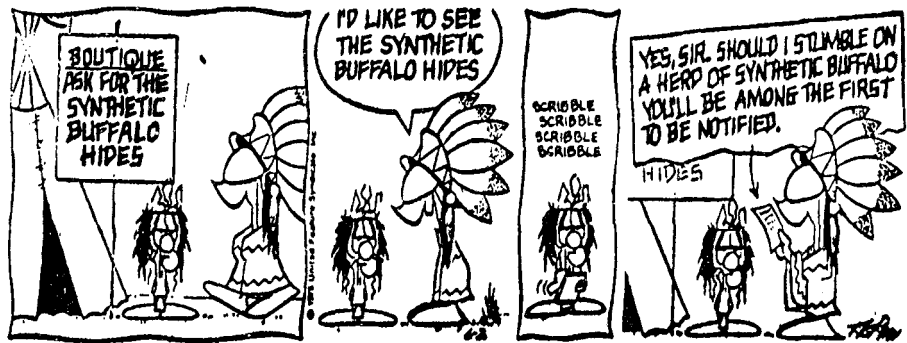
This example illustrates that within a phrase, certain words are grouped together. Sentences have **hierarchical structure** as well as word order. The words in the phrase *synthetic buffalo hides* can be grouped in two ways. When we group like this:

synthetic (buffalo hides)

we get the first meaning. When we group like this:

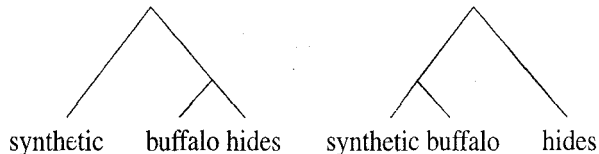
(synthetic buffalo) hides

we get the second meaning.



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The rules of syntax allow both these groupings, which is why the expression is ambiguous. The following diagrams illustrate the two structures:



This is similar to the rules of morphology that allow multiple structures for words such as *unlockable*, as we saw in chapter 3.

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 . . . (*for lady with thick legs and large drawers*) as opposed to the intended . . . (*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” or “burning sensation.” Such lexical or word-meaning ambiguities, as opposed to structural ambiguities, will be discussed in chapter 5.

Syntactic knowledge also enables us to determine the **grammatical relations** in a sentence, such as **subject** and **direct object**, and how they are to be understood. Consider the following sentences:

1. Mary hired Bill.
2. Bill hired Mary.
3. Bill was hired by Mary.

In (1) *Mary* is the subject and is understood to be the employer that did the hiring. *Bill* is the direct object and is understood to be the employee. In (2) *Bill* is the subject and *Mary* is the direct object, and as we would expect, the meaning changes so that we understand Bill to be Mary's employer. In (3) the grammatical relationships are the same as in (2), but we understand it to have the same meaning as (1), despite the structural differences between (1) and (3).

Syntactic rules reveal the grammatical relations among the words of a sentence and tell us when structural differences result in meaning differences and when they do not. Moreover, the syntactic rules permit speakers to produce and understand a limitless number of sentences never produced or heard before—the creative aspect of language use.

Thus, the syntactic rules in a grammar account for at least:

1. The grammaticality of sentences
2. Word order
3. Hierarchical organization of sentences
4. Grammatical relations such as subject and object
5. Whether different structures have differing meanings or the same meaning
6. The creative aspect of language

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.

Sentence Structure

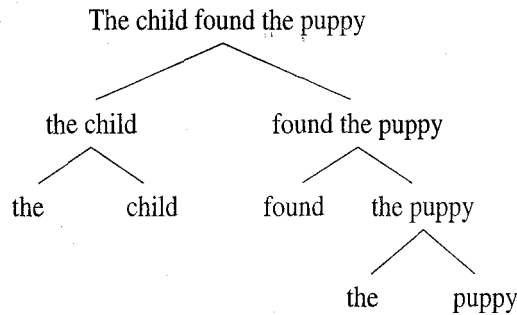
I really do not know that anything has ever been more exciting than diagramming sentences.

Gertrude Stein

Syntactic rules determine the order of words in a sentence, and how the words are grouped. The words in the sentence

The child found the puppy

may be grouped into (*the child*) and (*found the puppy*), corresponding to the subject and predicate of the sentence. A further division gives (*the child*) ((*found*)(*the puppy*)), and finally the individual words: ((*the*)(*child*)) ((*found*)(*the*) (*puppy*)). It is easier to see the parts and subparts of the sentence in a **tree diagram**:



The “tree” is upside down with its “root” being the entire sentence, *The child found the puppy*, and its “leaves” being the individual words, *the, child, found, the, puppy*. The tree conveys the same information as the nested parentheses, but more clearly. The groupings and subgroupings reflect the hierarchical structure of the tree.

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

The natural groupings of a sentence are called **constituents**. Various linguistic tests reveal the constituents of a sentence. For example, the set of words that can be used to answer a question is a constituent. So in answer to the question “what did you find?” a speaker might answer, *the puppy*, but not *found the*.

Pronouns can also substitute for natural groups. In answer to the question “where did you find the puppy?” a speaker can say, “I found *him* in the park.” There are also words such as *do* that can take the place of the entire expression *found the puppy*, as in “John found the puppy and so *did* Bill,” or “John found the puppy and Bill *did* too.”

Constituents can also be “relocated” as in the following examples.

It was *the puppy* the child found
The puppy was found by the child

In the first example the constituent *the puppy* is relocated; in the second example both *the puppy* and *the child* are relocated. In all such rearrangements the constituents *the puppy* and *the child* remain intact. *Found the* does not remain intact, because it is not a constituent.

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

Some verbs take a direct object and a prepositional phrase.

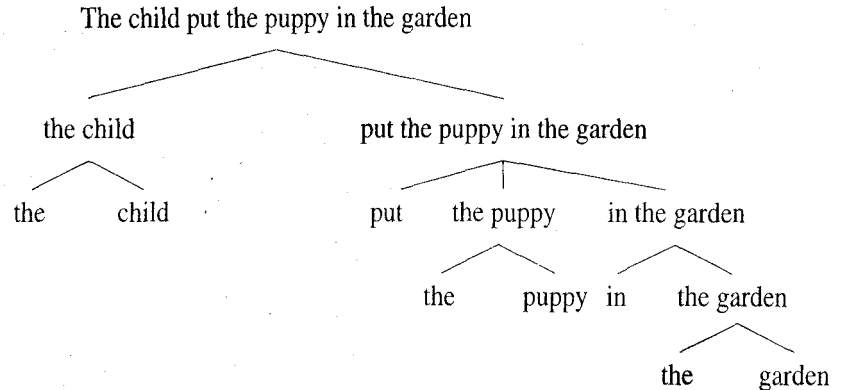
The child put the puppy in the garden.

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

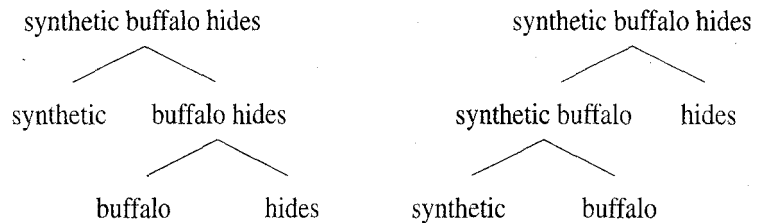
1. Where did the child put the puppy? *In the garden.*
2. The child put the puppy *there.*
3. *In the garden* is where the child put the puppy.
4. It was *in the garden* that the child put the puppy.

In (1) *in the garden* is an answer to a question. In (2) the word *there* can substitute for the phrase *in the garden*. In (3) and (4) *in the garden* has been relocated.

Our knowledge of the **constituent structure** may be graphically represented as a tree structure. The tree structure for the sentence *The child put the puppy in the garden* is as follows:



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. Multiple tree structures can account for structural ambiguity, as in the following examples:



Syntactic Categories

Each grouping in the tree diagram of *The child put the puppy in the garden* 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*, 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 the puppy in the garden.
 Your neighbor found the puppy in the garden.
 This yellow cat found the puppy in the garden.

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

The child, *a police officer*, and so on belong to the syntactic category **Noun Phrase (NP)**, one of several syntactic categories in English and every other language in the world. NPs may function as the subject or as an object in a sentence. They often



"I MISS THE GOOD OLD DAYS WHEN ALL WE HAD TO WORRY ABOUT WAS NOUNS AND VERBS."

Copyright © S. Harris.

contain some form of a noun or proper noun, but may consist of a pronoun alone, or even contain 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 slot.

John found the puppy.
 He found the puppy.
 The puppy loved him.
 The puppy loved John.

NPs that are more complex are illustrated by:

Romeo who was a Montague loved *Juliet who was a Capulet*.

The NP subject of this sentence is *Romeo who was a Montague* and the NP object is *Juliet who was a Capulet*.

Part of the syntactic component of a grammar is the specification of the syntactic categories in the language, since this constitutes part of a speaker's knowledge. That is, speakers of English know that only items (a), (b), (e), (f), (g), and (i) in the following list are Noun Phrases even if they have never heard the term 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
- (i) that the earth is round

As we discussed earlier, you can test this claim by inserting each expression into three contexts: “Who discovered _____?”, “_____ was heard by everyone,” and “What I heard was _____.” Only those sentences into which NPs can be inserted are grammatical, because only NPs can function as subjects and objects.

There are other syntactic categories. The expression *found the puppy* is a **Verb Phrase (VP)**. Verb Phrases always contain a **Verb (V)** and they may contain other categories, such as a Noun Phrase or **Prepositional Phrase (PP)**, which is a preposition followed by a Noun Phrase. 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) is smart
- (f) found the cake
- (g) found the cake in the cupboard
- (h) realized that the earth was round

Inserting (a), (c), (e), (f), (g), and (h) will produce grammatical sentences, whereas the insertion of (b) or (d) would result in an ungrammatical string. Thus, in list 2 (a), (c), (e), (f), (g), and (h) are Verb Phrases.

Other syntactic categories are **Sentence (S)**, **Adjective Phrase (AP)**, **Determiner (Det)**, **Adjective (Adj)**, **Noun (N)**, **Preposition (P)**, **Adverb (Adv)**, and **Auxiliary Verb (Aux)**, but this is not a complete list. Some of these syntactic categories have traditionally been called “parts of speech.” All languages have such syntactic categories. In fact, categories such as Noun, Verb, and Noun Phrase are present in the grammars of all human languages. Speakers know the syntactic categories of their language, even if they do not know the technical terms. Our knowledge of the 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 just discussed.

In addition to syntactic tests, there is experimental evidence for constituent structure. 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, for example, between the subject NP and the VP. In other sentences, the click is inserted in the middle of a constituent, for example, between a determiner and an NP. The subjects are then asked to report where the click occurred. There were two important results: First, subjects noticed the click and recalled its location best when it occurred at a constituent boundary. Second, clicks that occurred inside the constituent were reported to have occurred between constituents. In other words, subjects displaced the clicks and put

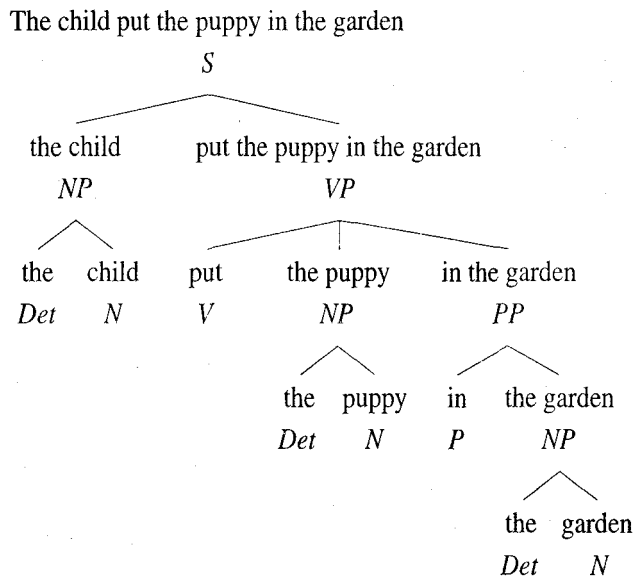
them at constituent boundaries. These results show that speakers perceive sentences in chunks corresponding to grammatical constituents. This argues for the psychological reality of constituent structure.¹

Phrase Structure Trees

Who climbs the Grammar-Tree distinctly knows
Where Noun and Verb and Participle grows.

John Dryden, "The Sixth Satyr of Juvenal"

The following tree diagram provides labels for each of the constituents of the sentence *The child put the puppy in the garden*. These labels show that the entire sentence belongs to the syntactic category of Sentence, that *the child* and *the puppy* are Noun Phrases, that *put the puppy* is a Verb Phrase, that *in the garden* is a Prepositional Phrase, and so on.



A tree diagram with syntactic category information is called a **phrase structure tree**, sometimes called a **constituent structure tree**. This tree shows that a sentence is both a linear string of words and a hierarchical structure with phrases nested in phrases. Phrase structure trees are graphic representations of a speaker's knowledge of the sentence structure in their language.

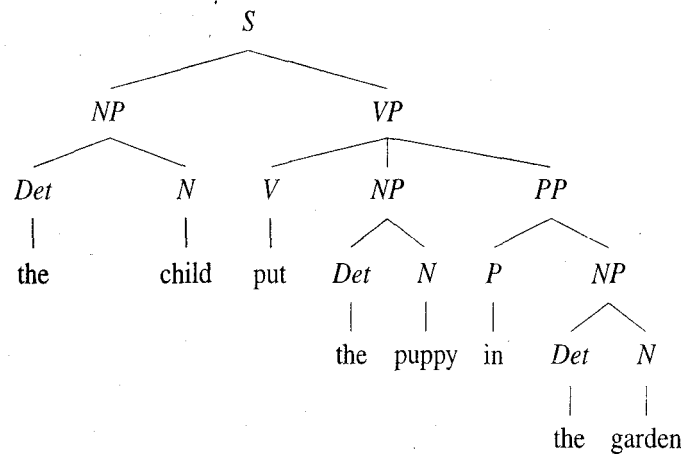
Three aspects of a speaker's syntactic knowledge are represented in phrase structure trees:

1. the linear order of the words in the sentence,
2. the groupings of words into syntactic categories,

¹ J. Fodor and T. Bever. 1965. "The Psychological Reality of Linguistic Segments," *Journal of Verbal Learning and Verbal Behavior* 4:414-20.

3. the hierarchical structure of the syntactic categories (e.g., a Sentence is composed of a Noun Phrase followed by a Verb Phrase, a Verb Phrase is composed of a Verb that may be followed by a Noun Phrase, and so on).

A phrase structure tree that explicitly reveals these properties can represent every sentence of English and of every human language. Notice, however, that the phrase structure tree above is correct, but redundant. The word *child* is repeated three times in the tree, *puppy* is repeated three times, and so on. We can streamline the tree by writing the words only once at the bottom of the diagram. Only the syntactic categories to which the words belong need to remain at the higher levels.



No information is lost in this simplified version. The syntactic category of each word appears immediately above it. In this way, *the* is shown to be a Determiner,² *child* a Noun, and so on. In chapter 3 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 occur in trees under labels that correspond to their syntactic category. Nouns are under N, prepositions under P, and so on.

We have not given definitions of these syntactic categories. Traditional definitions usually refer to meaning and are either imprecise or wrong. For example, a noun is often defined as “a person, place, or thing.” However, in the sentence *Seeing is believing*, *seeing* and *believing* are nouns but are neither persons, nor places, nor things. Syntactic categories are better defined in terms of the syntactic rules of the grammar. For example, defining a noun as “the head of an NP,” or “a grammatical unit that occurs with a determiner,” or “can be relocated in passive sentences” are more accurate characterizations.

The larger syntactic categories, such as Verb Phrase, are identified as consisting of all the syntactic categories and words below that point, or **node**, in the tree. The VP in the above phrase structure tree consists of syntactic category nodes V and NP, PP, and the words *put*, *the*, *puppy*, *in*, *the*, and *garden*. Since *the puppy* can be traced up the tree to the node NP, this constituent is a Noun Phrase. Since *in the garden* can be traced up

² The category Determiner includes the Articles *the* and *a* as well as a number of expressions such as *these*, *every*, *five*, *my*, *your cousin Mabel's*, and so forth.

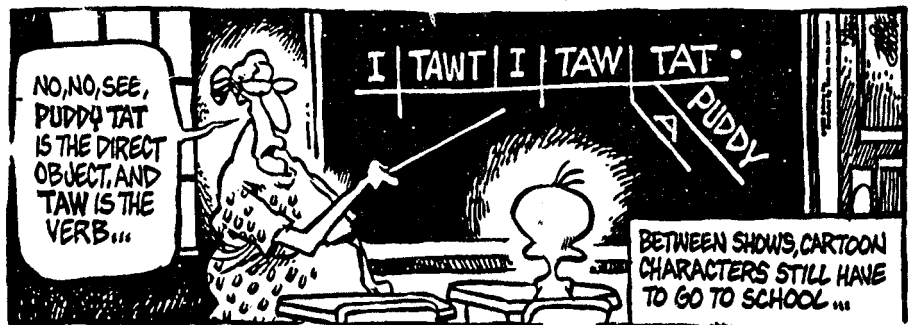
the tree to a PP, this constituent is a Prepositional Phrase. The phrase structure tree reflects the speaker's intuitions about the natural groupings of words in sentence.

The phrase structure tree also states implicitly what combinations of words are not syntactic categories. For example, since there is no node above the words *put* and *the* to connect them, the two words do not constitute a syntactic category, reflecting our earlier judgments.

The phrase structure tree also shows that some syntactic categories are composed of other syntactic categories. The sentence *The child put the puppy in the garden* consists of a Noun Phrase, *the child* and a Verb Phrase, *put the puppy in the garden*. The Verb Phrase consists of the Verb *put*, the Noun Phrase *the puppy*, and the Prepositional Phrase *in the garden*. Together, the Determiner *the* and the Noun *puppy* constitute a Noun Phrase, but individually neither is an NP. The Prepositional Phrase contains a Preposition *in* and the NP *the garden*. Every higher node is said to **dominate** all the categories beneath it. VP dominates V, NP, and PP, and also dominates Det, N, P, and PP. A node is said to **immediately dominate** the categories one level below it. VP immediately dominates V, NP, and PP. Categories that are immediately dominated by the same node are **sisters**. V, NP, and PP are sisters in the sentence *the child put the puppy in the garden*.

Heads and Complements

Phrase structure trees also show relationships among elements in a sentence. One kind of relationship is the relationship between the **head** of a phrase and the other members of the phrase. We said earlier that every VP contains a verb. The verb is the head of the VP. The VP may also contain other categories, such as a Noun Phrase or Prepositional Phrase. Loosely speaking, the entire phrase refers to whatever the head verb refers to. For example, the verb phrase *put the puppy in the garden* refers to event of "putting." The other constituents contained in the VP that complete its meaning are called **complements**. The direct object *the puppy* is a complement, as is the PP *in the garden*. A sentence can also be a complement to a verb, as in the sentence *I thought that the child found the puppy*.



Every phrasal category has a head of its same syntactic type. NPs are headed by nouns, PPs are headed by prepositions, Adjective Phrases (APs) are headed by adjectives, and so on; and every category can have complements. In the sentence *The man with the telescope smiled at me*, the PP *with the telescope* is the complement to the head noun *man*. Other examples of NP complements are shown in the following examples:

The destruction of Rome
 A picture of Mary
 A person worthy of praise
 A boy who pitched a perfect game

Each of these examples is an NP containing a head noun followed by a PP (*of Rome, of Mary*), an AP (*worthy of praise*), or a sentence complement (*who pitched a perfect game*). The head-complement relation is universal. All languages have phrases that are headed and that contain complements.

However, the order of the two constituents may differ in different languages. In English, for example, we see that the head comes first, followed by the complement. English is an SVO (Subject-Verb-Object) language; the verb precedes its object in the VP. In the preceding examples, the noun *picture* precedes its PP complement *of Mary*, *destruction* comes before *of Rome*, *boy* before *who pitched a perfect game*, and the head noun *person* precedes its AP complement *worthy of praise*. In Japanese, on the other hand, complements precede the head, as shown in the following examples:

Taro-ga	inu-o	mituketa	
Taro	dog	found	(Taro found a dog)
Taro-ga	inu-o	isu-ni	oita
Taro	dog	chair	put (Taro put the dog on the chair)
Piza-o	tabeta	otoko	
Pizza	ate	man	(the man who ate pizza)

In the first sentence, the direct object *dog* precedes the verb *found*. In the second, both objects *dog* and *chair* precede the verb, while in the third the relative clause *piza-o tabeta*, "pizza eating," precedes the head noun *otoko*, "man," that it modifies.

SELECTION

Whether a verb takes one or more complements depends on the properties of the verb. For example, the verb *find* is a **transitive verb**. A transitive verb requires a Noun Phrase direct object complement. This additional specification, called **selection**, is included in the lexical entry of each word.

The boy found the ball.
 *The boy found quickly.
 *The boy found in the house.

The examples where *found* does not have a direct object are not grammatical. Verbs select different kinds of complements, and the complements they select must be present. The verb *put* occurs with both an NP and a PP, and cannot occur with either alone:

Sam put the milk in the refrigerator.

*Sam put the milk.

*Disa put in the refrigerator.

Sleep is an **intransitive verb**; it cannot take an NP complement. Thus, if a verb fails to select a complement, it must not be present.

Michael slept.

*Michael slept a fish.

Some verbs such as *think* select a sentence as complement. Other verbs such as *tell* select an NP and an S, while *feel* selects an AP or an S:

I think that Sam won the race.

I told Sam that Michael was on his bicycle.

They felt strong as oxen.

They feel that they can win.

*They feel

Other categories besides verbs also select their complements. For example, the noun *belief* selects either a PP or an S, as shown by the following two examples:

the belief in freedom of speech

the belief that freedom of speech is a basic right

The noun *sympathy*, however, selects a PP, but not an S:

their sympathy for the victims

*their sympathy that the victims are so poor

The adjective *tired* selects a PP:

tired of stale sandwiches

Some selectional properties are optional. For example, the nouns *belief* and *sympathy* can also appear without complements, as can the adjective *tired*:

John has many beliefs.

The people showed their sympathy.

The students were tired.

In addition, many verbs such as *eat* are optionally transitive:

John ate a sandwich

John eats regularly.

The information about whether a complement is optional or obligatory is contained in the lexical entry of particular words.

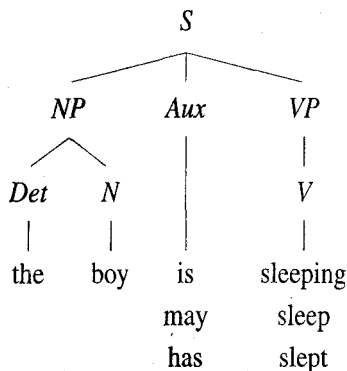
The well-formedness of a phrase depends on at least two factors: whether the phrase conforms to the phrase structure requirements of the language, and whether the phrase conforms to the selectional requirements of the head.

WHAT HEADS THE SENTENCE?

We said earlier that all phrases have heads. One category that we have not yet discussed in this regard is Sentence (S). For uniformity's sake, we want all the categories to be headed, but what would the head of S be? To answer this question, let us consider sentences such as the following:

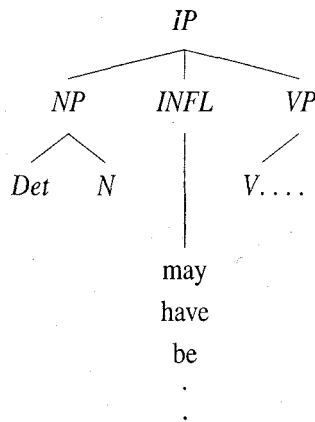
Sam will kick the ball.
 Sam has kicked the ball.
 Sam is kicking the ball.
 Sam may kick the ball.

Words like *will*, *have*, *is*, and *may* are in a class of Auxiliary Verbs (Aux), which includes *might*, *would*, *could*, *can*, and several others. The auxiliaries other than *be* and *have* are also referred to as **modals**. Auxiliaries are function words, as discussed in chapter 3. They occur in structures such as the following:



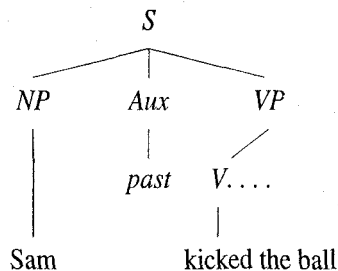
Auxiliary verbs specify a time frame for the sentence, whether the situation described by the sentence will take place, already took place, or is taking place now. A modal such as *may* contains “possibility” as part of its meaning, and says it is possible that the situation will occur at some future time. The category Aux is a natural category to head S. Just as the VP is about the event 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.

To better express the idea that Aux is the head of S, the symbols **INFL (=Inflection)** and **IP (=Inflection Phrase)** are often used instead of Aux and S, as in the following phrase structure tree:



We will continue to use the symbols S and Aux, but you should think of Aux and S as having the same relationship to each other as V and VP, N and NP, and so on.

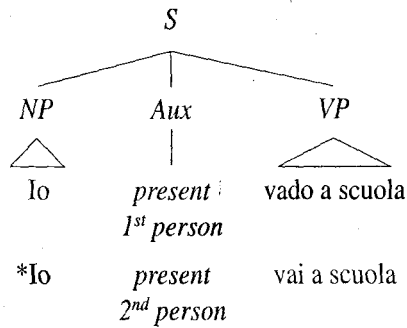
Not all sentences have auxiliaries. For example, the sentence *Sam kicked the ball* has no modal, *have* or *be*. There is, however, a time reference for this sentence, namely, the past tense on the verb *kicked*. In sentences without auxiliaries, the tense of the sentence is its head. Instead of having a function word under the category Aux (or INFL), we have a tense specification, *present* or *past*, as in the following tree. The verb in the VP must agree with the tense in Aux. For example, if the tense of the sentence is *past* then the verb must have an *-ed* affix (or must be an irregular past tense verb such as *ate*).



A property of English and many languages is that the head of S may contain only an abstract tense specification and no actual word as is the case for English past tense. But for English future tense, the word *will* occurs as the Aux. The word *do* is a tense-bearing word that is found in negative sentences such as *John did not go* and questions such as *Where did John go?* In these sentences *did* means “past tense.”

In addition to specifying the time reference of the sentence, Aux specifies the agreement features of the subject. For example, if the subject is “we,” Aux contains the features first-person plural; if the subject is “he” or “she,” Aux contains the features third-person singular. Thus, another function of the syntactic rules is to use Aux as a “matchmaker” between the subject and the verb. When the subject and the verb bear the same features, Aux makes a match; when they have incompatible features, Aux cannot

make a match and the sentence is ungrammatical. This matchmaker function of syntactic rules is more obvious in languages such as Italian, which have many different agreement morphemes, as discussed in chapter 3. Consider the Italian sentence for “I go to school.”

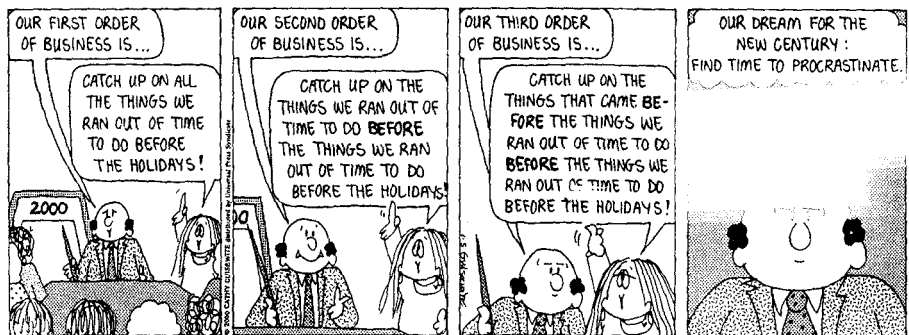


The verb *vado*, “go,” in the first sentence bears the first-person singular morpheme, *-o*, which matches the agreement feature in Aux, which in turn matches the subject *Io*, “I.” Hence, the sentence is grammatical. In the second sentence, there is a mismatch between the first-person subject and the second-person features in Aux (and on the verb), and so the sentence is ungrammatical.

The Infinity of Language

So, naturalists observe, a flea
Hath smaller fleas that on him prey;
And these have smaller fleas still to bite 'em,
And so proceed ad infinitum.

Jonathan Swift, “On Poetry, A Rhapsody”



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As we noted earlier, the number of sentences in a language is infinite, because speakers can lengthen any sentence by various means, such as adding an adjective or, as in the

“Cathy” cartoon, including sentences within sentences. Even children know how to produce and understand very long sentences, and know how to make them even longer, as illustrated by the children’s rhyme about the house that Jack built.

This is the farmer sowing the corn,
 that kept the cock that crowed in the morn,
 that waked the priest all shaven and shorn,
 that married the man all tattered and torn,
 that kissed the maiden all forlorn,
 that milked the cow with the crumpled horn,
 that tossed the dog,
 that worried the cat,
 that killed the rat,
 that ate the malt,
 that lay in the house that Jack built.

The child begins the rhyme with *This is the house that Jack built*, continues by lengthening it to *This is the malt that lay in the house that Jack built*, and so on.

You can add any of the following to the beginning of the rhyme and still have a grammatical sentence:

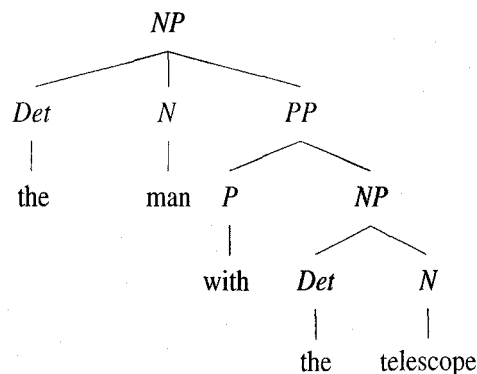
I think that . . .

What is the name of the unicorn that noticed that . . .

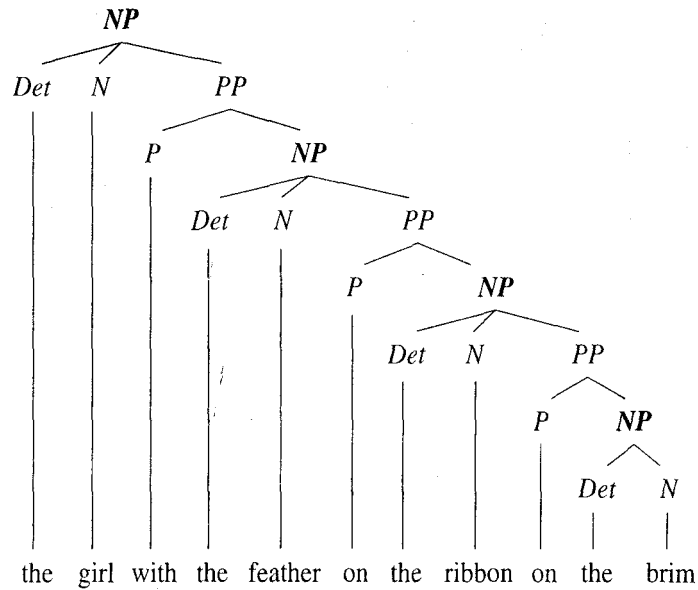
Ask someone if . . .

Do you know whether . . .

Phrase structure trees also capture this limitless aspect of language. An NP may appear immediately under a PP, which may occur immediately under a higher NP, as in *the man with the telescope*:



The complex (but comprehensible) Noun Phrase *the girl with the feather on the ribbon on the brim*, as shown in the following phrase structure tree, illustrates that one can repeat the number of NPs under PPs under NPs without a limit.



The NP diagrammed above, though cumbersome, violates no rules of syntax and is a grammatical Noun Phrase. Moreover, it can be made even longer by expanding the final NP — *the brim* — by adding a PP — *of her hat* — to derive the longer phrase — *the girl with the feather on the ribbon on the brim of her hat*.

The repetition of categories within categories is common in all languages. It allows speakers to use the same syntactic categories several times, with different functions, in the same sentence. Our brain capacity is finite, able to store only a finite number of categories and rules for their combination. Yet, these finite means place 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 have as part of their linguistic competence — their mental grammars — the ability to put NPs in PPs in NPs ad infinitum. However, as the structures grow longer they become increasingly more difficult to produce and understand. This could be due to short-term memory limitations, muscular fatigue, breathlessness, or any number of performance factors. (We will discuss performance factors more fully in chapter 9.)

Thus, while such rules give a speaker access to infinitely many sentences, no speaker utters or hears an infinite number in a lifetime; nor is any sentence of infinite length, although in principle there is no upper limit on sentence length. This property of grammars also accounts for the creative aspect of language use, since it permits speakers to produce and understand sentences never spoken before.

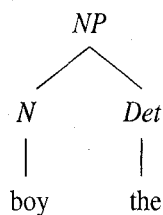
Phrase Structure Rules

Everyone who is master of the language he speaks . . . may form new . . . phrases, provided they coincide with the genius of the language.

A phrase structure tree is a formal device for representing the knowledge that a speaker has of the structure of sentences in his language. When we speak, we are not aware that we are producing sentences with such structures, but controlled experiments show that we use them in speech production and comprehension, as we will see in chapter 9.

When we look at phrase structure trees that represent the sentences of English, certain patterns emerge. In ordinary sentences, the S always subdivides into NP Aux VP. As we said earlier, NPs always contain Nouns; VPs always contain Verbs; PPs consist of a Preposition followed by a Noun Phrase; and APs consist of an Adjective possibly followed by a complement.

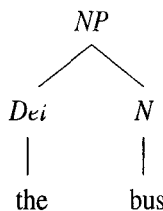
Of all logically possible tree structures, few actually occur, just as not all word combinations constitute grammatical phrases or sentences. For example, a non-occurring tree structure in English is:



The speaker of a language knows whether any sentence or phrase is a possible or impossible structure in her language. The structure given in the preceding tree is not possible in English.

Just as a speaker cannot have an infinite list of sentences in her head, so she cannot have an infinite set of phrase structure trees in her head. Rather, a speaker's knowledge of the permissible and impermissible structures must exist as a finite set of rules that "generate," or provide a tree for, any sentence in the language. These are **phrase structure rules**. Phrase structure rules specify the structures of a language precisely and concisely. They express the regularities of the language, such as the head complement order, and other relationships.

For example, in English a Noun Phrase may simply contain a Determiner followed by a Noun. One of the several allowable NP subtrees looks like this:



The phrase structure rule that makes this explicit is:

$NP \rightarrow Det N$

This rule conveys two facts:

A Noun Phrase can contain a Determiner followed by a Noun.
 A Determiner followed by a Noun is a Noun Phrase.

To the left of the arrow is the category whose components appear on the right side. The right side of the arrow also shows the linear order of these components. Phrase structure rules make explicit speakers' knowledge of the order of words and the grouping of words into syntactic categories.

An NP may also contain a complement, as in the example *a picture of Mary* or *the destruction of Rome*. We can accommodate this fact by revising the rule to include an optional Prepositional Phrase. The parentheses around the PP indicate that it is optional. Not all NPs in the language have PPs inside them.

$NP \rightarrow Det\ N\ (PP)$

This revised rule says that an NP can contain a Det followed by a Noun followed by an optional PP.

The phrase structure trees of the previous section show that the following phrase structure rules are also part of the grammar of English.

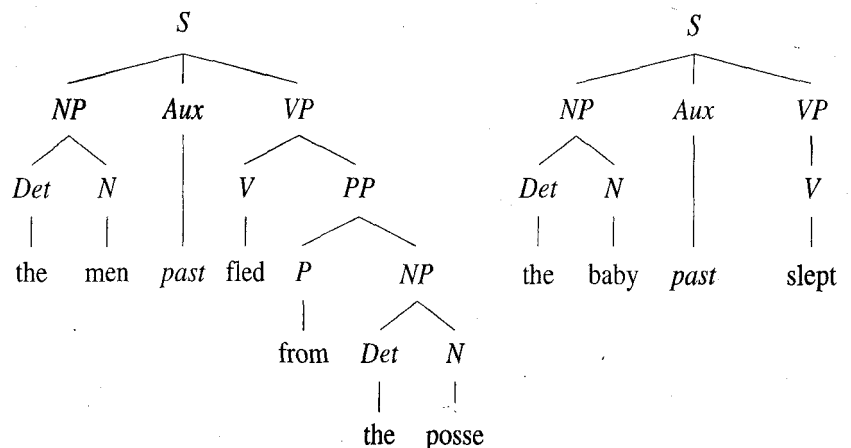
1. $VP \rightarrow V\ NP$
2. $VP \rightarrow V\ NP\ PP$

Rule 1 states that a Verb Phrase can consist of a Verb followed by a Noun Phrase. Rule 2 states that a Verb Phrase can also consist of a Verb followed by a Noun Phrase followed by a Prepositional Phrase. These rules are general statements, which do not refer to any specific Verb Phrase, Verb, Noun Phrase, or Prepositional Phrase.

Rules 1 and 2 can be summed up in one statement: A Verb Phrase may be a Verb followed by a Noun Phrase, which may or may not be followed by a Prepositional Phrase. By putting parentheses around the optional element, we can abbreviate rules 1 and 2 to a single rule:

$VP \rightarrow V\ NP\ (PP)$

In fact, the NP is also optional, as shown in the following trees:



In the first case we have a Verb Phrase consisting of a Verb plus a Prepositional Phrase, corresponding to the rule $VP \rightarrow V PP$. In the second case, the Verb Phrase consists of a Verb alone, corresponding to the rule $VP \rightarrow V$. All the facts about the Verb Phrase we have seen so far are explicit in the single rule:

$$VP \rightarrow V (NP) (PP)$$

This rule states that a Verb Phrase may consist of a Verb followed optionally by a Noun Phrase and/or a Prepositional Phrase.

Other rules of English are:

$$S \rightarrow NP \text{ Aux } VP$$

$$PP \rightarrow P NP$$

$$AP \rightarrow \text{Adj } (PP)$$

Growing Trees: The Relationship between Phrase Structure Rules and Phrase Structure Trees

I think that I shall never see
A poem lovely as a tree

Joyce Kilmer, "Trees"

Phrase structure trees may not be as lovely to look at as the trees Kilmer was thinking of, but if a poem is written in grammatical English, its phrases and sentences can be represented by trees, and those trees can be specified by phrase structure rules.

The rules that we have discussed, repeated here, define some of the phrase structure trees of English.

$$S \rightarrow NP \text{ Aux } VP$$

$$NP \rightarrow \text{Det } N (PP)$$

$$VP \rightarrow V (NP) (PP)$$

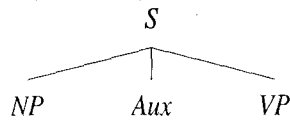
$$PP \rightarrow P NP$$

$$AP \rightarrow \text{Adj } (PP)$$

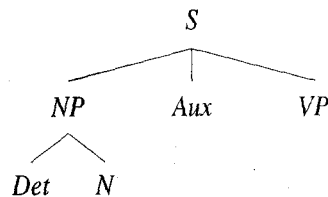
There are several possible ways to view phrase structure rules. We can regard them as tests that trees must pass to be grammatical. Each syntactic category mentioned in the tree is examined to see if the syntactic categories immediately beneath it agree with the phrase structure rules. If we were examining an NP in a tree, it would pass the test if the categories beneath it were Det N, or Det N PP, in that order, and fail the test otherwise, insofar as our (incomplete) set of phrase structure rules is concerned. (In a more comprehensive grammar of English, the NP rule would include many more structures, as would other rules.)

We may also view the rules as a way to construct phrase structure trees that conform to the syntactic structures of the language. This is by no means suggestive of how speakers actually produce sentences. It is just another way of representing their knowledge, and it applies equally to speakers and listeners.

In generating or specifying trees, certain conventions are followed. The S occurs at the top of the tree despite being called "the root." Another convention specifies how the rules are applied: First, find a rule with an S on the left side of the arrow, and put the categories on the right side below the S, as shown here:



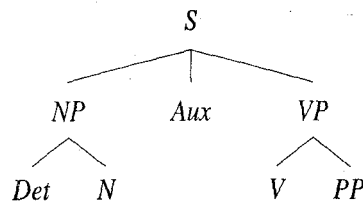
Once started, continue by matching any syntactic category at the bottom of the partially constructed tree to a category on the left side of a rule, then expand the tree with the categories on the right side. For example we may expand the tree by applying the NP rule to produce:



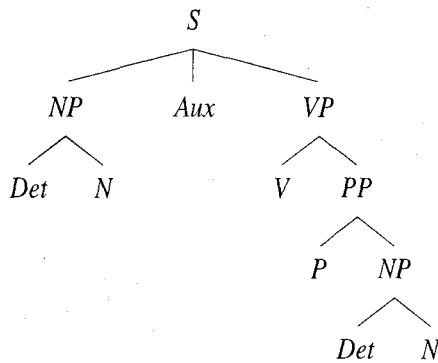
The categories at the bottom are Det, N, and VP, but only VP occurs to the left of an arrow in the set of rules and so needs to be expanded. The VP rule is actually four rules abbreviated by parentheses. They are:

- VP → V
- VP → V NP
- VP → V PP
- VP → V NP PP

Any of them may apply next; the order in which the rules appear in the grammar is irrelevant. (Indeed, we might equally have begun by expanding the VP rather than the NP.) Suppose VP → V PP is next. Then the tree has grown to look like this:



Convention dictates that we continue in this way until none of the categories at the bottom of the tree appears on the left side of any rule. The PP must expand into a P and an NP, and the NP into a Det and an N. We can use a rule as many times as it can apply. In this tree, we used the NP rule twice. After we have applied all the rules that can apply, the tree looks like this:

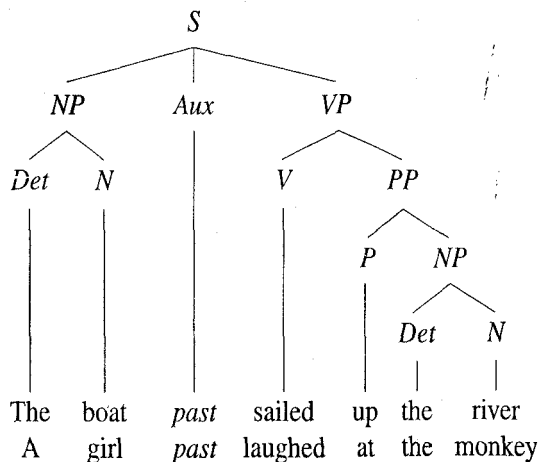


By following these conventions, we can generate only trees specified by the phrase structure rules. By implication, any tree not so specified will be ungrammatical. Whether we choose to use the rules to generate only well-formed trees or use the rules to test the grammaticality of all possible trees is immaterial. Both methods achieve the goal of revealing syntactic knowledge. Most books on language use the rules to generate trees.

Categories such as NP, VP, AP, IP (= S) are **phrasal categories**. The categories N, V, P, Adj, and Adv are **lexical categories**. The categories such as Det and Aux that house function words are **functional categories**. Phrase structure trees always have lexical and functional categories at the bottom since the rules must apply until no phrasal categories remain. The lexical and functional categories are “the parts of speech” in a traditional “grammar” book. You may know some of them by other names. Members of Aux are sometimes called “helping verbs.” Members of Det may be called “articles,” “demonstrative pronouns,” and so on.

The previous tree structure corresponds to a very large number of sentences because there are numerous combinations of nouns, verbs, prepositions, and so on that conform to this structure. Here are just a few:

The boat sailed up the river.
 A girl laughed at the monkey.
 The sheepdog rolled in the mud.
 The lions roared in the jungle.



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. At the point where we chose the rule $VP \rightarrow V PP$, we could equally well have chosen $VP \rightarrow V$ or $VP \rightarrow V NP PP$. This would have resulted in different structures corresponding to sentences such as:

The boys left. ($VP \rightarrow V$)

The wind swept the kite into the sky. ($VP \rightarrow V NP PP$)

Since there is an infinite number of possible sentences in every language, there are limitless numbers of trees, but only a finite set of phrase structure rules that specify the trees allowed by a grammar of the language.

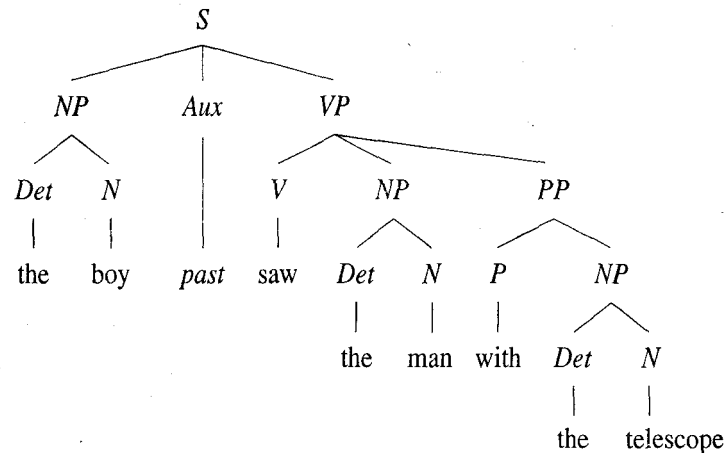
Structural Ambiguities

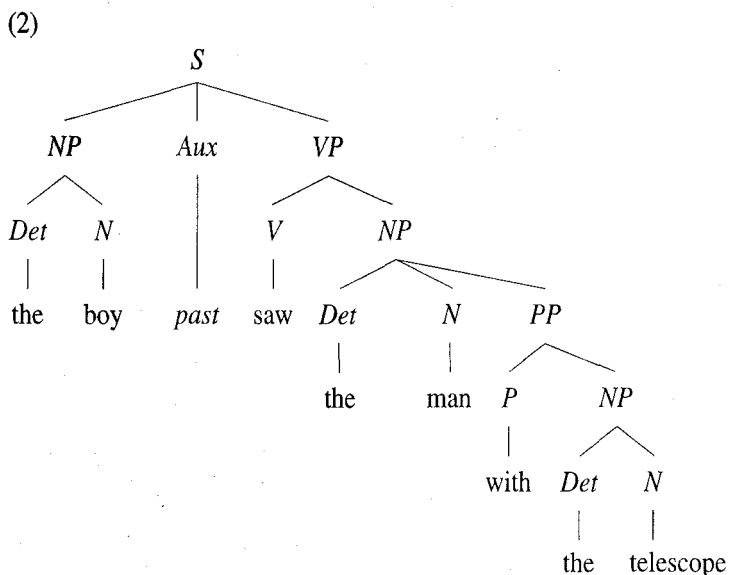
The structure of every sentence is a lesson in logic.

John Stuart Mill, Inaugural address at St. Andres

As mentioned earlier, certain 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 ambiguous. Its two meanings correspond to the following two phrase structure trees.

(1)





One meaning of this sentence is "the boy used a telescope to see the man." The first phrase structure tree represents this meaning. The key element is the position of the PP directly under the VP. Although the PP is under VP, it is not a complement because it is not selected by the verb. The verb *see* selects an NP only. In this sentence, the PP has an adverbial function and modifies the verb.

In its other meaning, "the boy saw a man who had a telescope," the PP *with the telescope* occurs under the direct object NP, where it modifies the noun *man*. In this second meaning, the complement of the verb *see* is the entire NP—the man *with the telescope*.

The PP in the first structure is generated by the rule:

$$VP \rightarrow V \text{ NP PP}$$

In the second structure the PP is generated by the rule:

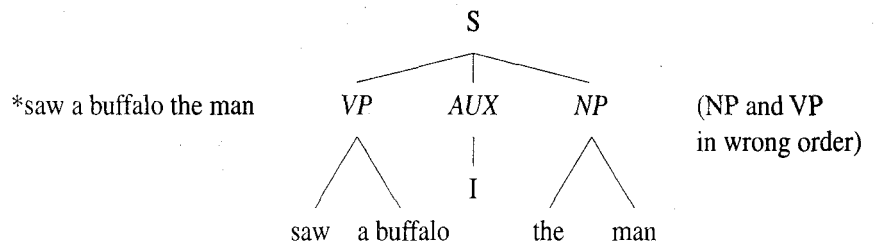
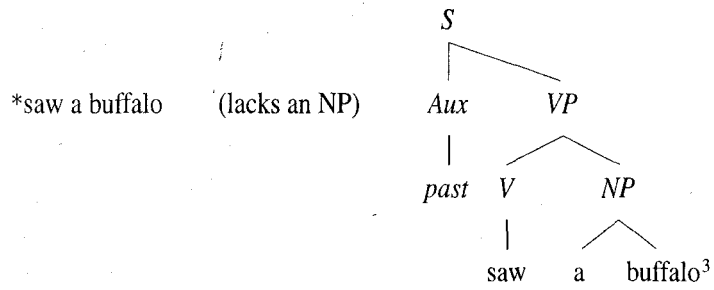
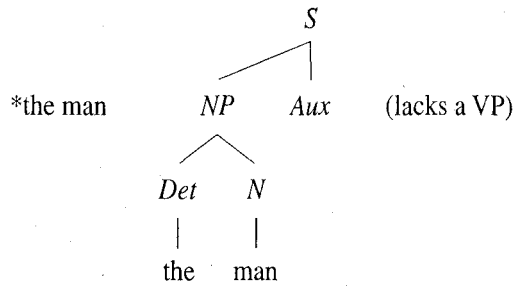
$$NP \rightarrow \text{Det N PP}$$

Two interpretations are possible because the rules of syntax permit different structures for the same linear order of words.

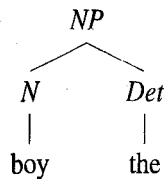
Trees That Won't Grow

Just as speakers know which structures and strings of words are permitted by the syntax of their language, they know which are not. The phrase structure rules specify this knowledge implicitly.

Since the rule $S \rightarrow \text{NP Aux VP}$ is the only S rule in our (simplified) grammar of English, the following word sequences and their corresponding structures do not constitute English sentences.



Similarly, *boy the*



cannot be an NP in English because none of the NP rules of English syntax allows a Determiner to follow a Noun.

³ Nonpertinent parts of the tree are sometimes omitted, in this case the Det and N of the NP, *a buffalo*.



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More Phrase Structure Rules

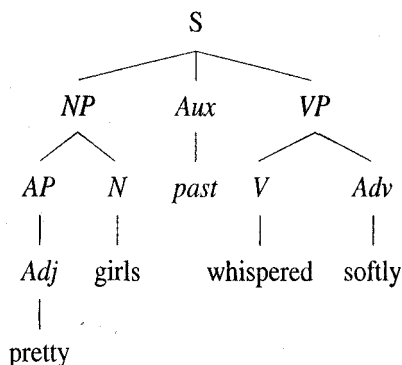
Normal human minds are such that . . . without the help of anybody, they will produce 1000 (sentences) they never heard spoke of . . . inventing and saying such things as they never heard from their masters, nor any mouth.

Huarde De San Juan, c. 1530–1592

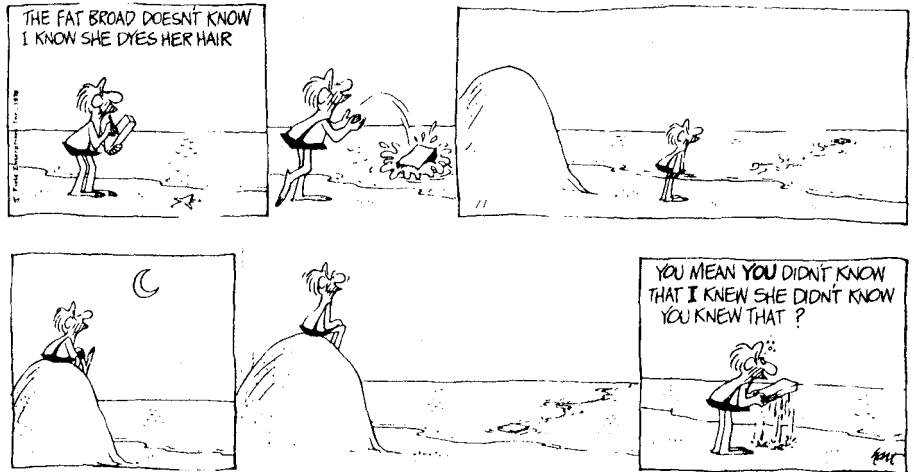
Many English sentences have structures that are not accounted for by the phrase structure rules given so far, including:

1. Pretty girls whispered softly.
2. The cat and the dog were friends.
3. The teacher believes that the student knows the answer.

Sentence 1 may be represented by this phrase structure tree:



From this example we see that a Determiner is optional in the NP. Moreover, a new phrasal category, and two new lexical categories appear in the tree: Adjective Phrase



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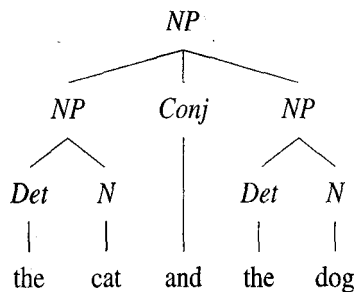
(AP), Adjective (Adj), and Adverb (Adv). All this suggests modifications to both the NP and the VP rules:

- NP → (Det) (AP) N (PP)
- VP → V (NP) (PP) (Adv)
- AP → Adj (PP)⁴

The addition of an optional Adverb to the VP rule allows for four more sentence types:

- The wind blew softly.
- The wind swept through the trees noisily.
- The wind rattled the windows violently.
- The wind forced the boat into the water suddenly.

The NP in sentence 2, *The cat and the dog*, is a **coordinate structure**. A coordinate structure results when two constituents of the same category (in this case, two NPs) are joined with a conjunction such as *and* or *or*. The NP has the following structure:



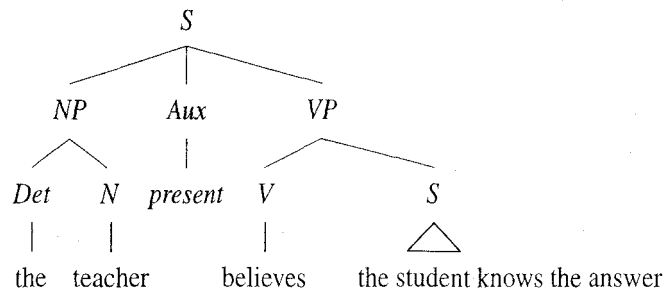
⁴ As pointed out earlier, any number of adjectives may be strung together. For simplicity our rules will allow only one adjective and would need to be changed to fully account for the English speaker's knowledge.

The phrase structure rule that generates this coordinate structure is:

$$\text{NP} \rightarrow \text{NP conj NP}$$

Sentence 3 is particularly interesting. It includes another sentence within itself. The inside sentence, *the student knows the answer*, is **embedded** in the larger sentence *The teacher believes that the student knows the answer*. What is the structure of such sentences?

Recall that verbs (like other heads) take complements. These complements can be of different categories, for example, a PP or an AP. In sentence 3 the complement to the verb *believe* is a sentence — S. The embedded sentence *that the students know the answer* bears the same local relationship to the verb that a simple direct object does in a sentence such as *The teacher believes the student*. We know therefore that the embedded sentence is inside the VP with the verb:



However, the structure is incomplete. It is missing a piece of the sentence, the word *that*. The word *that* belongs to the class of **complementizers**, which also includes words such as *if* and *whether* in sentences like:

I don't know whether I should talk about this.

The teacher asked if the students understood the syntax lesson.

A complementizer is an element that turns a sentence into a complement. In English, the word *that* is not always required in embedded sentences. The sentence *I know John is happy* is as grammatical as *I know that John is happy*. In many languages, a sentence can be a complement (that is, it can be embedded in another sentence) only if it is accompanied by a word like *that*. In English the other complementizers *if* and *whether* cannot be omitted, as illustrated by the ungrammaticality of the B sentences:

A

Sam asked if he could play soccer.

I wonder whether Michael walked
the dog.

B

*Sam asked he could play soccer.

*I wonder Michael walked the dog.

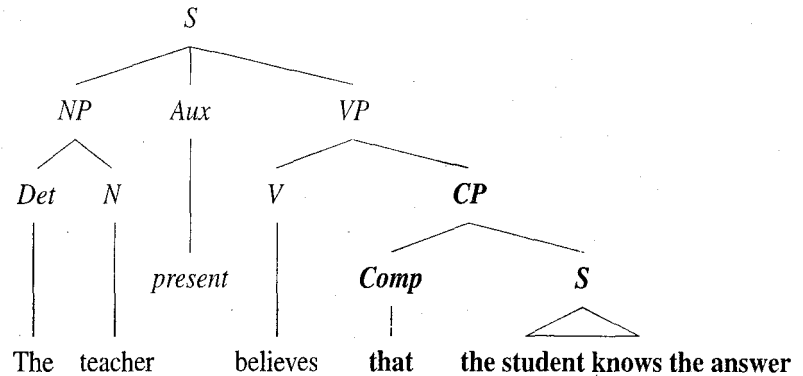
So the structure of the embedded sentence must contain an S, and it must contain a position for a complementizer. But how are these two elements situated with respect to each other? If we do some constituency tests, as we did earlier for NP and VP, we see that the complementizer and the S form a constituent. For example, the question test, the relocation test, and the pronoun test all show that the embedded S and the complementizer act together as a constituent.

Sam asked if he could play soccer.
 What did Sam ask? If he could play soccer.
 I wonder whether Michael walked the dog.
 Whether Michael walked the dog is always a question
 The teacher believes that the students know the answer.
 The teacher believes it.
 That the students know the answer is believed by the teacher.
 It is a problem that Sam lost his watch.
 That Sam lost his watch is a problem.

It is not possible to leave the complementizer behind or omit it.

- *What did Sam ask if.
- *Michael walked the dog is always a question.
- *The students know the answer is believed by the teacher (that).
- *Sam lost his watch is a problem.

We now have all the information we need to determine the structure of the embedded sentence. The embedded sentence is a complement to the verb, therefore inside the VP. The complementizer *that* forms a constituent with S, which means there must be a category dominating both *that* and S that is inside the VP. The relevant structure is:



The complementizer (*that, if, whether*) appears under a node *Comp*, which, like *Det* and *Aux*, is a functional category. *Comp* is the head of a category *CP* (Complementizer Phrase). *CP* is the complement to the verb. The structure is parallel to a simple structure with an *NP* complement, such as *The teacher believes the student*, except that there is a *CP* instead of an *NP*.

We have omitted the internal structure of the embedded *S* in the preceding tree because it is the same as the internal structure of a root sentence, as described by the phrase structure rule for *S*. This suggests a rule for the category *CP*:

$$CP \rightarrow \text{Comp } S$$

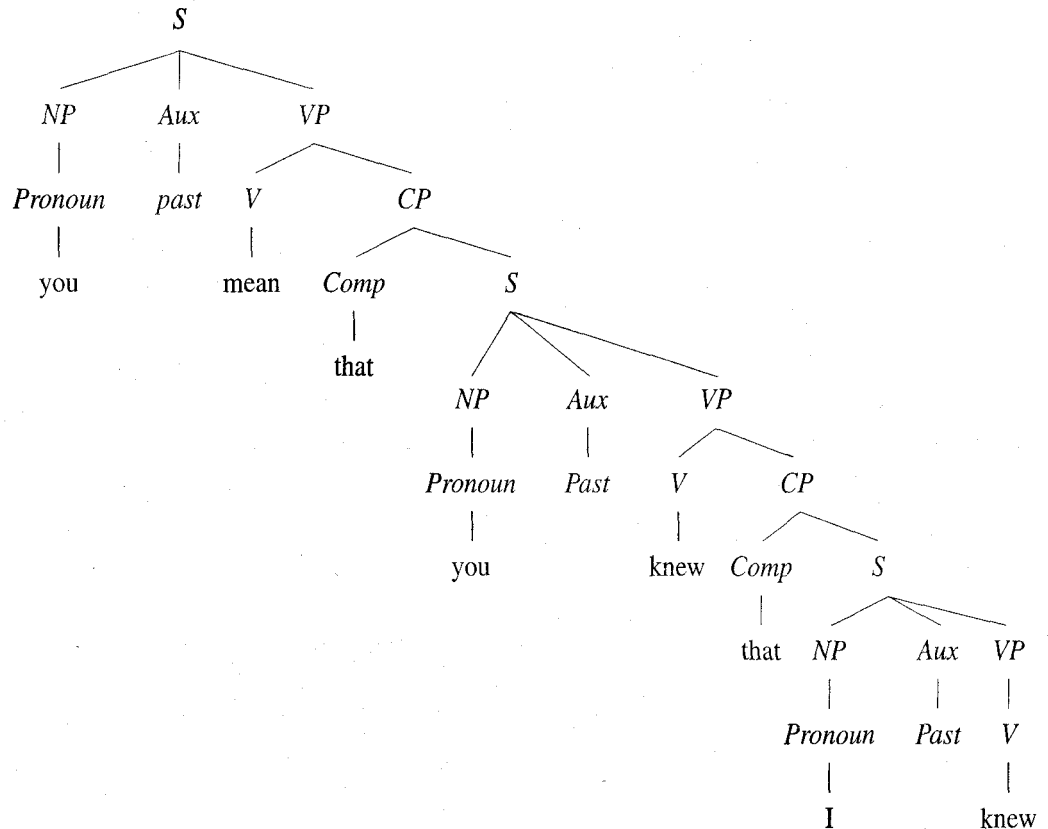
In addition, we need another *VP* rule:

$$VP \rightarrow V \text{ } CP$$

If we combine this with the previous VP rules, we get:

$$VP \rightarrow V (NP) (PP) (CP)$$

We now see how the grammar reflects the knowledge that all speakers have to embed sentences in sentences, as illustrated by the cartoon at the beginning of this section. Here is an illustrative phrase structure tree:



Here are the phrase structure rules we have discussed so far. These are all the phrase structure rules we will present in this chapter.

1. $S \rightarrow NP \text{ Aux } VP$
2. $NP \rightarrow (\text{Det}) (\text{AP}) N (\text{PP})$
3. $VP \rightarrow V (NP) (PP) (\text{Adv}) (CP)$
4. $PP \rightarrow P NP$
5. $AP \rightarrow \text{Adj} (\text{PP})$
6. $CP \rightarrow \text{Comp } S$

A complete grammar of English would have more rules. However, even this mini-grammar can specify an infinite number of possible sentences because several categories (S, NP, VP) appear on both the left and right sides of several rules. Thus, the rules

explain our observations that language is creative and that speakers with their finite brains can still produce and understand an infinite set of sentences.

Many structures of English remain unaccounted for by our mini-grammar. For example, many types of Determiners besides the articles *the* and *a* may precede the noun in a Noun Phrase, such as *each*, *several*, *these*, *many of The Grateful Dead's*, and so on.

Each boy found several eggs.

They sang *many of The Grateful Dead's* songs.

Also, rules 3 and 5 show that a whole sentence (preceded by a complementizer) may be embedded in a VP. There are other forms of embedded sentences such as the following:

Hilary is waiting *for you to sing* (Cf. You sing.)

The host regrets *the president's having left early*. (Cf. The president has left early.)

The host wants *the president to leave early*. (Cf. The president leaves early.)

The host believes *the president to be punctual*. (Cf. The president is punctual.)

Although, the detailed structure of these different embedded sentences is beyond the scope of this introduction, you should note that an embedded sentence may be an **infinitive**. An infinitive sentence does not have a tense. The embedded sentences *for you to sing*, *the president to leave early*, and *the president to be punctual* are infinitives. Such verbs as *want* and *believe* among many others can take an infinitive complement. This information, like other selectional properties, belongs to the lexical entry of the selecting verb (the higher verb in the tree).

We noted earlier that Aux is the head of S, and that the tense features of the sentence are in Aux. In sentences without tense, Aux is specified as "infinitive." Whether the sentence is tensed or infinitive has consequences for other aspects of the sentence. For example, reflexive pronouns can be subjects of infinitives but not of embedded tensed sentences:

Frank believes himself to be a superstar.

*Frank thinks himself is a superstar.

Also, the subject of an infinitive can be questioned while the subject of a tensed clause cannot:

Paul believed Melissa to be his wife.

Who did Paul believe to be his wife?

Sam thinks that Michael is his cousin.

*Who does Sam think that is his cousin?

These sentences provide further evidence of the central role that Aux plays in the structure of the sentence, and of its "headlike" properties.

Sentence Relatedness

Most wonderful of all are . . . [sentences], and how they make friends one with another.

O. Henry, as modified by a syntactician

Sentences may be related in various ways. For example, they may have the same phrase structure, but differ in meaning because they contain different words. We saw this earlier in sets of sentences such as *The boat sailed up the river* and *A girl laughed at the monkey*.

Two sentences with different meanings may contain the same words in the same order, and differ only in structure, like *the boy saw the man with the telescope*. These are cases of structural ambiguity.

Two sentences may differ in structure, possibly with small differences in grammatical morphemes, but with no difference in meaning:

The father wept silently.	The father silently wept.
The astronomer saw a quasar with a telescope.	With a telescope the astronomer saw a quasar.
Mary hired Bill.	Bill was hired by Mary.
I know that you know.	I know you know.

Two sentences may have structural differences that correspond systematically to meaning differences.

The boy is sleeping.	Is the boy sleeping?
The boy can sleep.	Can the boy sleep?
The boy will sleep.	Will the boy sleep?

Earlier we discussed auxiliaries. Auxiliaries are very important in forming certain types of sentences in English, including questions. In questions, the auxiliary appears at the beginning of the sentence. This difference in position is not accounted for by the phrase structure rules we have presented, which specify that in a sentence the NP comes first, followed by Aux, followed by VP.

We could easily add a phrase structure rule to our mini-grammar that would generate the questions above. It would look like the following:

$$S \rightarrow \text{Aux NP VP}$$

Although such a rule might do the job of producing the right word order, it would fail to capture the generalization that interrogatives are systematically related (in both form and meaning) to their declarative counterparts. For example, the declarative sentence *John is sleeping* is well formed, as is the question *Is John sleeping?* The declarative sentence *The rock is sleeping* is semantically odd, as is the question *Is the rock sleeping?* A speaker of English will be able to immediately provide the interrogative counterpart to any declarative sentence that we present.

Phrase structure rules account for much syntactic knowledge, but they do not account for the fact that certain sentence types in the language relate systematically to other sentence types.

Since the grammar must account for all of a speaker's syntactic knowledge, we must look beyond phrase structure rules.

Transformational Rules

Method consists entirely in properly ordering and arranging the things to which we should pay attention.

René Descartes, *Oeuvres*, Vol. X

A way to capture the relationship between a declarative and a question is to allow the phrase structure rules to generate the structure corresponding to the declarative sentence, and have another formal device, called a **transformational rule**, move the auxiliary in front of the subject.

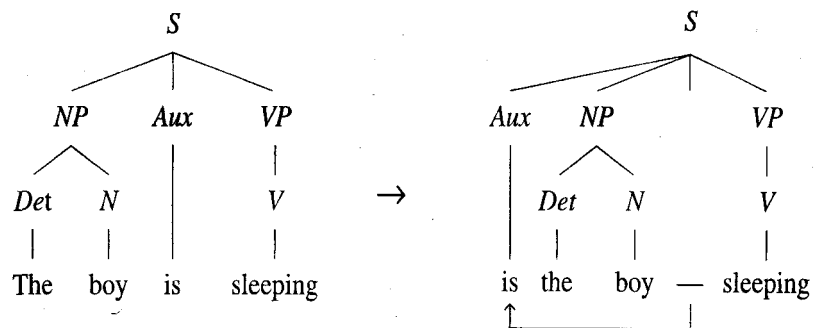
The rule "Move Aux" is formulated as follows:

Take the first auxiliary verb following the subject NP and move it to the left of the subject.

For example:

The boy is sleeping → Is the boy ___ sleeping

The rule takes a basic structure generated by the phrase structure rules and derives a second tree (the dash represents the position from which a constituent has been moved):



Questions are generated in two steps.

1. The phrase structure rules generate a basic structure.
2. Aux movement applies to produce the derived structure.

The basic structures of sentences, also called **deep structures**, are specified by the phrase structure rules. Variants on those basic sentence structures are derived via transformations. By generating questions in two steps, we are claiming that for speakers

there is a relationship 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 relationship.

The structures that result from the application of transformational rules are called **surface structures**. The phonological rules of the language (pronunciation rules) apply to surface structures. If no transformations apply, then deep structure and surface structure are the same. If transformations apply, then surface structure is the result after all transformations have had their effect. Much syntactic knowledge that is not expressed by phrase structure rules is accounted for by transformations, which can alter phrase structure trees by moving, adding, or deleting elements.

Other sentence types that are transformationally related are:

active- passive

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

there sentences

There was a man on the roof → A man was on the roof

PP preposing

The astronomer saw the quasar with the telescope → With the telescope, the astronomer saw the quasar.

Structure Dependent Rules

Transformations act on structures without regard to the words that they contain. They are **structure dependent**. The transformational rule of PP preposing moves any PP as long as it is immediately under the VP, 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 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 phrase structure in which the PP is immediately dominated by the VP shown on page 143. 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 tree on page 144. The PP preposing transformation does not move a PP that is part of a complement. (Recall that *the man with a telescope* is a complement to the verb *saw*).

Another rule allows *that* to be omitted when it precedes a sentence complement but not in subject position, as illustrated by these pairs:

I know that you know.	I know you know.
That you know bothers me.	*You know bothers me.

This is a further demonstration that rules are structure dependent.

Agreement rules are also structure dependent. In many languages, including English, the verb must agree with the subject. The verb has an "s" added whenever the subject is third-person singular.

The guy seems kind of cute.
 The guys seem kind of cute.

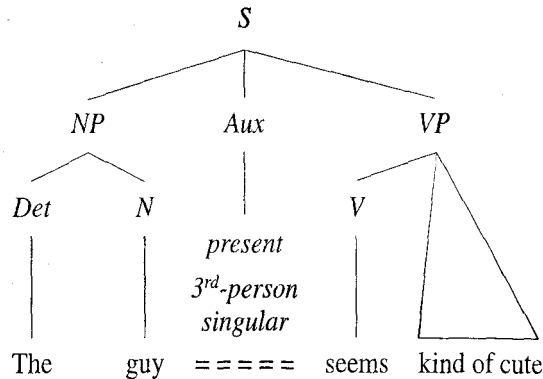
Now consider these sentences:

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, as the following sentence illustrates:

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

The phrase structure tree of such a sentence explains this aspect of linguistic competence:

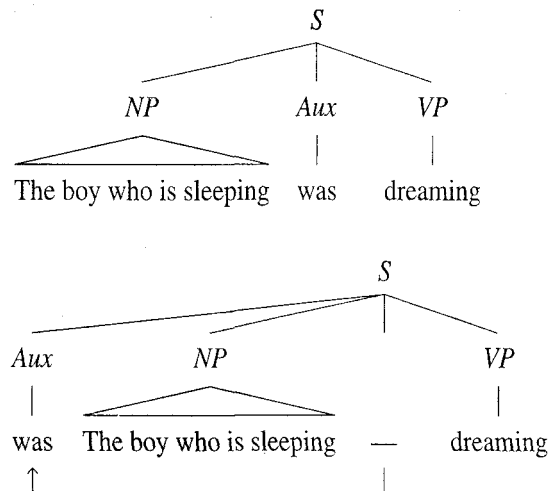


In the tree, “====” represents the intervening structure, which may, in principle, be indefinitely long and complex. But speakers of English know that agreement depends on sentence structure, not the linear order of words. Agreement is between the subject and the main verb, where the subject is structurally defined as the NP immediately below the S, and the main verb is structurally defined as the Verb in the VP. The agreement relation is mediated by Aux, which contains the tense and agreement features that match up the subject and verb. Other material can be ignored as far as the rule of agreement is concerned, although in actual performance, if the distance is too great, the speaker may forget what the head noun was.

A final illustration of structure dependency is found in the declarative-question pairs discussed above. Consider the following sets of sentences:

The boy who is sleeping was dreaming.
 Was the boy who is sleeping dreaming?
 *Is the boy who sleeping was dreaming?
 The boy who can sleep will dream.
 Will the boy who can sleep dream?
 *Can the boy who sleep will dream?

The ungrammatical sentences show that to form a question, it is the Auxiliary of the top-most S, that is, the one following the entire first NP, that moves to the position before the subject, not simply the *first* Auxiliary in the sentence. We can see this in the following simplified phrase structure trees.



To produce the correct results, transformations such as Move Aux must refer to phrase structure, not to the linear order of elements.

Structure dependency is a principle of Universal Grammar, and is found in all languages. For example, in languages that have subject-verb agreement, the dependency is between the verb and the head noun, and never some other noun such as the closest one, as shown in the following examples from Italian, German, Swahili, and English, respectively (the third-person singular agreement morpheme is in boldface):

- La madre con tanti figli lavora molto.
 Die Mutter mit den vielen Kindern arbeitet viel.
 Mama anao watoto wengi.
 The mother with many children works a lot.

Syntactic Dependencies

Sentences are organized according to two basic principles: constituent structure and syntactic dependencies. As we discussed earlier, constituent structure refers to the hierarchical organization of the subparts of a sentence. The second important property is that there are dependencies among elements in the sentence. In other words, the presence of a particular word or morpheme can depend on the presence of some other word or morpheme in a sentence. We have already seen at least two examples of syntactic dependencies. Selection is one kind of dependency. Whether there is a direct object in a sentence depends on whether the verb is transitive or intransitive. More generally, complements depend on the properties of the head of the phrase. Agreement is another kind of dependency. The features in Aux (and on the verb) must match the features of the subject.

WH QUESTIONS

Whom are you? said he, for he had been to night school.

George Ade, *Bang! Bang!: The Steel Box*

The following sentences illustrate another kind of dependency:

1. (a) What will Max chase?
- (b) Where has Pete put his ball?
- (c) Which dog do you think loves bones?

There are some 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) selects a direct object and a prepositional phrase, yet there is no PP following *his ball*. Finally, we note that the embedded verb *loves* in sentence (c) bears the third-person *-s* morpheme, yet there is no obvious subject to trigger this agreement. Normally these omissions would result in ungrammaticality, as in the examples in (2):

2. (a) *Max will chase ____.
- (b) *Pete has put his ball ____.
- (c) *Do you think ____ loves bones.

The possibility of a gap in the sentence 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 object in (a), the prepositional phrase object in (b), and the embedded subject in (c).

We can capture the relationship 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:

3. (a) Max will chase what?
- (b) Pete has put his ball where?
- (c) You think which dog loves bones?

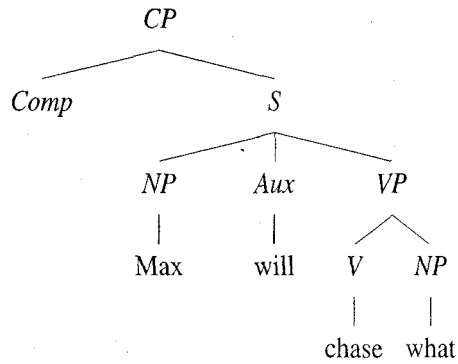
The *wh* phrase is then moved to the beginning of the sentence by a transformational rule: *Move wh*.

If we allow the phrase structure rules to apply so that *wh* questions are CPs, then the *wh* phrase can move to the empty Comp position at the beginning of the sentence.

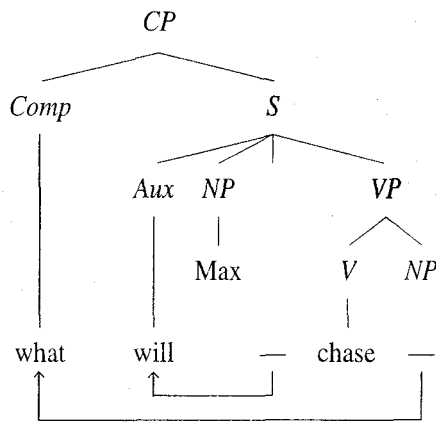
Wh questions are generated by the grammar in three steps:

1. The phrase structure rules generate the basic (deep) structure with the *wh* phrase occupying an NP position: direct object in 3(a); prepositional object in 3(b); and subject in 3(c).
2. Move Aux moves the auxiliary to beginning of the sentence.
3. Move *wh* moves the *wh* phrase to Comp.

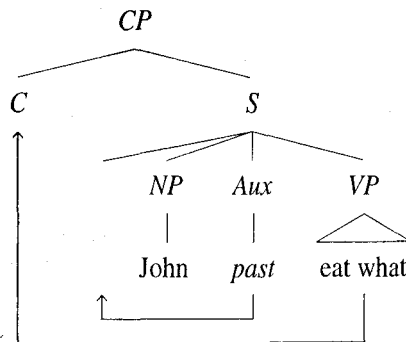
The following tree shows the deep structure in the sentence *What will Max chase?*



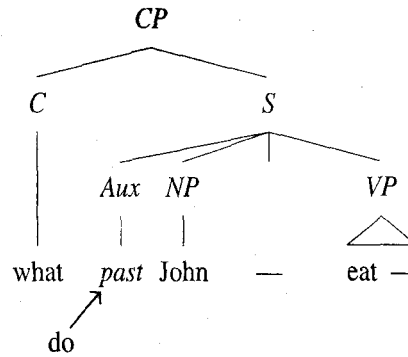
The surface structure representation of this sentence is:⁵



In question 1(c), there is an auxiliary "do." Unlike the other auxiliaries (e.g., *can*, *have*, *be*, etc.), *do* is not part of the deep structure of the question *Which dog do you think likes bones* is "you think which dog likes bones." Like all transformations, the rule of Move Aux is structure dependent and ignores the content of the category. It will move Aux even when Aux contains only a tense feature such as *past*. In this case another transformational rule, called "do support," inserts *do* into the structure to carry the tense:



⁵ For ease of exposition we have presented Comp with only a single slot to accommodate moved constituents. In fact, Comp may have two positions, one for *wh* and one for the Aux.



The first tree represents the deep structure to which Move Aux and *wh* movement apply. The second tree shows the output of those transformations and the insertion of “do.” “Do” combines with past to yield “did.”

Unlike the other rules we have seen, which operate inside a phrase or clause, *wh* movement can move the *wh* phrase outside of its own clause. In fact there is no limit to the distance that a *wh* phrase can move, as illustrated by the following sentences. The dashes indicate the position from which the *wh* phrase has been moved.

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 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 the sentence as well as their relation to other sentences in the language.

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*

As we emphasize throughout this book, Universal Grammar provides the basic design for human language. Individual languages are variations on this basic design. Imagine a development of new houses. 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 structure and then there are points of variation.

All languages have phrase structure rules. In all languages, phrases consist of heads and complements, and sentences are headed by Aux (or INFL), which houses notions such as tense, agreement and modality. However, languages may have different word orders within the phrases and sentences. The word order differences between English and Japanese, discussed earlier, illustrate the interaction of general and language-specific properties. UG specifies the structure of a phrase. It must have a head and may take one or more complements. However, each language gets to decide 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 seem to have movement rules. The transformational rule Move Aux is a version of a more general rule that exists in languages such as Dutch, in which the auxiliary moves, if there is one:

Aux Raising

Zal Femke fiesten?	(Will Femke ride her bicycle?)
will Femke bicycle ride	
Kan Elmer basketballen?	(Can Elmer play basketball?)
can Elmer play basketball	

And otherwise, the main verb moves:

Verb Raising

Hoeveel studenten onderwijst Els?	(How many students does Els teach?)
how many students teaches Els	
Leest Meindert veel boeken?	(Does Meindert read many books?)
reads Meindert many books	

In English main verbs other than *be* do not move. Instead, English has “do” support to carry the tense, as noted earlier.

All languages have expressions for requesting information about *who*, *when*, *where*, *what*, and *how*. Even if the question words do not always 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 deep structure position. In Japanese the sentence is marked with a question morpheme, *no*:

Taro-ga	nani-o	mituketa-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 does not move to Comp:

Ulipatia	nani	kitabu
you gave	who	a book

However, in all languages with *wh* movement (that is, movement of the question phrase), the moved element goes to Comp. 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, whereas in English the preposition can be “stranded” behind:

A chi ha dato il libro?
To whom (did) you give the book?

*Chi hai dato il libro a?
Who did you give the book to?

In some dialects of German, “long-distance” *wh* movement leaves a trail of *wh* phrases in the Comp position of the embedded sentence:⁶

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 a *wh* phrase such as *what*, *who*, *which boy* can be inserted into any NP position, and it is then free in principle to move to Comp, there are specific instances in which *wh* movement is blocked. For example, the rule cannot move a *wh* phrase out of a relative clause such as “. . . the senator that wanted to hire who” as in 1(b), or a clause beginning with *whether* or *if* as in 2(c) and (d). (Remember that the position from which the *wh* phrases have been 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 ____?

⁶Other languages such as Romani, the language of Roma, once called gypsies, exhibits similar properties.

The only difference between the grammatical 2(b) and the ungrammatical 2(c) and (d) is that in the former case the *wh* phrase originates in the higher clause, whereas in the latter cases 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.

In fact 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 3(b) it is of course okay to question the whole direct object, and prepose the *wh* word. In 3(c) it is even okay to question a piece of the possessive NP, providing the entire *wh* phrase is moved. But 3(d) shows that it is not permitted to move the *wh* word alone out of the possessive NP.

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

The constraints on *wh* movement are not specific to English. Such constraints operate in all languages that have *wh* movement. Like the principle of structure dependency and the principles governing the organization of phrases, the constraints on *wh* movement are part of Universal Grammar. These aspects of grammar need not be learned. They are part of what 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 what is correct for their language. The Japanese child must determine that the verb comes after the object in the VP, and the English-speaking child acquires the VO order. The Dutch-speaking child acquires a rule that moves the verb, while the English-speaking child must restrict his rule to auxiliaries. Italian, English, and Czech children learn that to form a question the *wh* phrase moves, while Japanese and Swahili children determine that there is no movement. We will have more to say about how children "fix" the parameters of UG in chapter 8.

Sign Language Syntax

All languages have rules of syntax similar in kind, if not in detail, to those of English, and sign languages are no exception. Signed languages have phrase structure rules that provide hierarchical structure and order constituents. A signer is as capable as an oral speaker of distinguishing *dog bites man* from *man bites dog* through the order of sign-

ing. The basic order of ASL is SVO. Unlike English, however, adjectives follow the head noun in ASL.

ASL has a category Aux, which expresses notions such as tense, agreement, modality, and so on. In Thai, to show that an action is continuous, the auxiliary verb *kamlang* is inserted before the verb. Thus *kin* means “eat” and *kamlang kin* means “is eating.” In English a form of *be* is inserted and the main verb is changed to an -ing form. In ASL the sign for a verb such as *eat* may be articulated with a sweeping, repetitive movement to achieve the same effect. The sweeping repetitive motion is a kind of the auxiliary.

Many languages, including English, have a transformation that moves a direct object to the beginning of the sentence to draw particular attention to it, as in:

Many greyhounds, my wife has rescued.

The transformation is called **topicalization** because an object to which attention is drawn generally becomes the topic of the sentence or conversation. (The deep structure underlying this sentence is *my wife has rescued many greyhounds*.)

In ASL a similar reordering of signs accompanied by raising the eyebrows and tilting the head upwards accomplishes the same effect. The head motion and facial expressions of a signer function as markers of the special word order, much as intonation does in English, or the attachment of prefixes or suffixes might in other languages.

There are constraints on topicalization similar to those on *wh* movement illustrated in a previous section. In English the following strings are ungrammatical:

- *Henchman, Sam Spade insulted the fat man’s.
- *This film, John asked Mary whether she liked.
- *Cheese, John ate bologna and for lunch.

Compare this with the grammatical:

The fat man’s henchman, Sam Spade insulted.
 This film, John asked Mary to see with her.
 Bologna and cheese, John ate for lunch.

Sign languages exhibit similar constraints. An attempt to express in ASL sequences like **Henchman, Sam Spade insulted the fat man’s* or the other starred examples would result in an ungrammatical sequence of signs.

ASL has *wh* phrases. The *wh* phrase in ASL may move or it may remain in its deep 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 topicalization, *wh* questions are accompanied by a non-manual marker. For questions, this marker is a facial expression with furrowed brows and the head tilted back. Non-manual markers are an integral part of the grammar of ASL, much like intonation in spoken languages.

ASL and other sign languages show an interaction of universal and language-specific properties, just as spoken languages do. The grammatical rules of sign languages are structure dependent, and movement rules are constrained in various ways, as illustrated above. Other aspects are particular to sign languages, such as the facial gestures, which are part of the grammar of sign languages but not of spoken languages. The fact that the

principles and parameters of UG hold in both the spoken and manual modalities shows that the human brain is designed to acquire and use language, not simply speech.



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 never before spoken or heard. They also recognize ambiguities, know when different sentences mean the same thing, and correctly perceive 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 decomposed into other syntactic categories; **lexical categories**, such as Noun and Verb, and **functional categories**, such as Det, Aux, and Comp. The internal structure of the phrasal categories is universal. It consists of a **head** and its **complements**. The particular order of elements within the phrase is accounted for by the **phrase structure rules** of each language. The sentence is headed by Aux, which carries such information as tense, agreement, and modality.

A grammar is a formally stated, explicit description of the mental grammar or speaker's linguistic competence. Phrase structure rules characterize the basic phrase structure trees of the language, the **deep structures**.

Some categories that appear on the left side of a phrase structure rule may also occur on the right side. Such rules allow the same syntactic category to appear repeatedly in a phrase structure tree, such as a sentence embedded in another sentence. These rules reflect a speaker's ability to produce an infinite number of sentences.

The **lexicon** represents the knowledge that speakers have about the vocabulary of their language. This knowledge includes the syntactic category of words and what elements may occur together, expressed as **selectional restrictions**.

Transformational rules account for relationships between sentences such as declarative and interrogative pairs including *wh* questions. Transformations can move constituents or insert function words such as *do* into a sentence. Much of the meaning of a sentence is interpreted from its deep structure. The output of the transformational rules is the **surface structure** of a sentence, the structure to which the phonological rules of the language apply.

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 coordinate structures. 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 any particular language.

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Exercises

1. Besides distinguishing grammatical from ungrammatical strings, 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 of different structure mean the same thing. (Cf. The father wept silently and The father silently wept.)
 - c. when two sentences of different structure and meaning are nonetheless structurally related, like declarative sentences and their corresponding interrogative form. (Cf. The boy can sleep and Can the boy sleep?)

In each case, draw on your linguistic knowledge of English to provide an example different from the ones in the chapter, and 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.
 - A. Write another sentence that includes sentence (c).
 - B. What does this set of sentences reveal about the nature of language?
 - C. 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.
4. Draw two phrase structure trees representing the two meanings of the sentence *The magician touched the child with the wand*. Be sure you indicate which meaning goes with which tree.
5. Write out the phrase structure rules that each of the following rules abbreviate. Give an example sentence illustrating each expansion.

(Hint: Do not mix the rules. That is, $VP \rightarrow V \text{ Det } N$ is not one of the rule expansions of the VP rule. There are 16 rules altogether.)

$VP \rightarrow V \text{ (NP) (PP) (Adv)}$

$NP \rightarrow \text{(Det) (AP) N (PP)}$
6. 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" form, but you should be able to recognize and underline the embedded sentences in the examples below. Underline in the non-English sentences, when given, not in the translations. (The first one is done as an example):
 - a. Yesterday I noticed my accountant repairing the toilet.
 - 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. khǎw chyâ wǎa 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.
7. Following the patterns of the various tree examples in the text, draw phrase structure trees for the following sentences:
- a. The puppy found the child.
 - b. A frightened passenger landed the crippled airliner.
 - c. The house on the hill collapsed in the wind.
 - d. The ice melted.
 - e. The hot sun melted the ice.
 - f. A fast car with twin cams sped by the children on the grassy lane.
 - g. The old tree swayed in the wind.
 - h. The children put the toy in the box.
 - i. The reporter realized that the senator lied.
 - j. Broken ice melts in the sun.
 - k. The guitar gently weeps.
 - l. A stranger whispered to the Soviet agent on the corner quietly that a dangerous spy from the CIA lurks in the alley by the old tenement.
8. Use the rules on page 150 to create five phrase structure trees of sentences not given in the chapter of 6, 7, 8, 9, and 10 words. Use your mental lexicon to fill in the bottom of the tree.
9. 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?

10. Here is a set of made-up phrase structure rules. The “initial” symbol is still S, and the “terminal symbols” (the ones that do not appear to the left of an arrow) are actual words:

- i. $S \rightarrow A B C$
- ii. $A \rightarrow the$
- iii. $B \rightarrow children$
- iv. $C \rightarrow ran$
- v. $C \rightarrow C \text{ and } D$
- vi. $D \rightarrow ran \text{ and } D$
- vii. $D \rightarrow ran$

A. Give three phrase structure trees that these rules characterize.

B. How many phrase structure trees could these rules characterize? Explain your answer.

11. Using one or more of the constituency tests (question word substitution, pronoun substitution, and relocation) discussed in the chapter, determine which boldfaced portions in the sentences are constituents. Provide the grammatical category of the constituents.

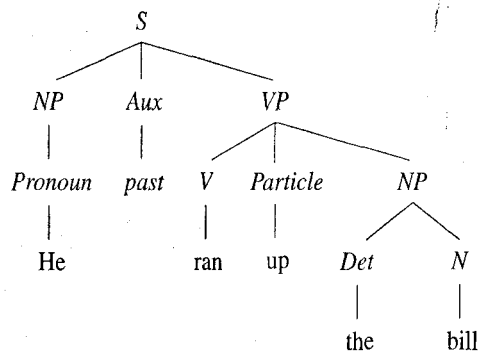
- a. Martha found **a lovely pillow** for the couch.
- b. The **light in this room** is terrible.
- c. I wonder **if Bonnie has finished packing her books**.
- d. Melissa hated the students **in her class**.
- e. **Pete and Max** are fighting over **the bone**.

12. The two sentences below contain a **verbal particle**.

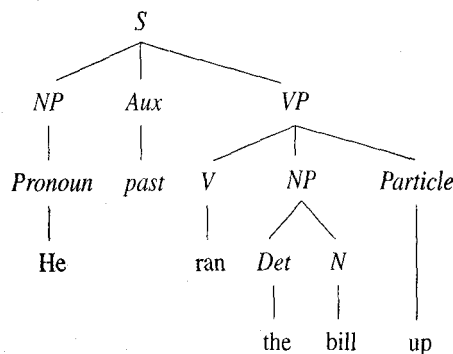
- i. He ran *up* the bill.
- ii. He ran the bill *up*.

The verbal particle *up* and the verb *run* depend on each other for the unique meaning of the phrasal verb *run up*. We know this because *run up* has a meaning different from *run in* or *look up*.

Sentences (i) and (ii) have the same deep structure:



The surface structure of (ii), however, illustrates a **discontinuous dependency**. The verb is separated from its particle by the direct object NP.



A particle movement transformation derives this surface structure from the deep structure.

- A. Explain why the particle movement transformation would not derive **he ran the hill up from the deep structure of he ran up the hill*.
- B. Many of the transformations encountered in this chapter are **optional**. Whether they apply or not, the ultimate surface structure is grammatical. This is true of the particle movement transformation in most cases, but there is one condition under which the particle movement transformation is obligatory. That is, failure to apply the rule will lead to ungrammatical results. What is that condition? (This exercise may require native English competency.)
13. In terms of selectional restrictions, explain why the following are ungrammatical.
- *The man located.*
 - *Jesus wept the apostles.*
 - *Robert is hopeful of his children.*
 - *Robert is fond that his children love animals.*
 - *The children laughed the man.*
14. In the chapter, we considered only transitive verbs, ones that select an NP direct object like *chase*. English also has **ditransitive verbs**, ones that may be followed by two NPs, such as *give*:
- The emperor gave the vassal a castle.
- Think of three other ditransitive verbs in English and give example sentences.
15. For each verb, list the different types of complements it selects and provide an example of each type:
- want
 - force
 - try
 - believe
 - say
16. All of the *wh* words exhibit the “long-distance” behavior illustrated with *who* in the chapter. Invent three sentences beginning with *what*, *which*, and *where*, in which the *wh* word is not in its deep structure position in the sentence. Give both versions of your sentence. Here is an example with the *wh* word *when*: *When could Marcy catch a flight out of here? from Marcy could catch a flight out of here when?*

17. There are many systematic, structure-dependent relationships among sentences similar to the one discussed in the chapter between declarative and interrogative sentences. Here is another example, based on ditransitive verbs (see exercise 14):

The boy wrote the senator a letter.

The boy wrote a letter to the senator.

A philanthropist gave the Animal Rights movement \$1,000,000.

A philanthropist gave \$1,000,000 to the Animal Rights movement.

- A. Describe the relationship between the first and second members of the pairs of sentences.
- B. State why a transformation deriving one of these structures from the other is plausible.
18. State at least three differences between English and the following languages, using just the sentence(s) given. Ignore lexical differences—that is, the different vocabulary. Here is an example:

Thai:	dèg	khon	nǐ	kamlang	kin.
	boy	<i>classifier</i>	this	<i>progressive</i>	eat
	“This boy is eating.”				
	mǎa	tua	nán	kin	khâaw.
	dog	<i>classifier</i>	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 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	<i>subject</i>	fish	<i>object</i>	eat (<i>ing</i>)	am
	<i>marker</i>		<i>marker</i>		
“I am eating fish.”					

c. Swahili

mtoto	alivunja	kikombe.			
m-	toto	a-	li-	vunja	ki- kombe
<i>class</i>	child	he	<i>past</i>	break	<i>class</i> cup
<i>marker</i>					<i>marker</i>
“The child broke the cup.”					

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

"The children break the cups."

d. Korean

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

"The boy drank milk."

ki-nin muos-il mok-ass-ninya.
 ki- nin muos- il mok- ass- ninya
 he subject what object eat past question
 marker marker

"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 bus
 marker

"Pedro saw that the bus was already full."

19. Transformations may delete elements. For example, the surface structure of the ambiguous sentence *George wants the presidency more than Martha* may be derived from two possible deep 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 deep structures with different semantic interpretations are transformed into a single surface structure.

Explain the role of a deletion transformation similar to the ones just discussed in the following cartoon:



20. (advanced) Compare the following French and English sentences:

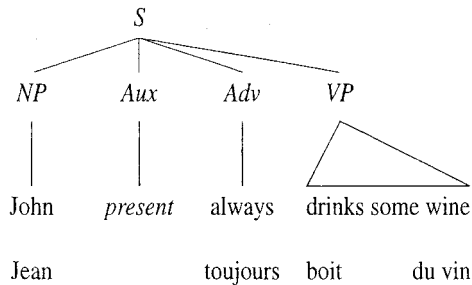
French

Jean boit toujours du vin.
 Jean drinks always some wine
 Marie lit jamais le journal.
 Marie reads never the newspaper
 Pierre lave souvent ses chiens.
 Pierre washes often his dogs

English

John always drinks some wine.
 *John drinks always some wine
 Mary never reads the newspaper.
 *Mary reads never the newspaper.
 Peter often washes his dogs.
 *Peter washes often his dogs.

- A. Based on the above data, what would you hypothesize concerning the position of adverbs in French and English?
- B. Now suppose that UG specifies that *in all languages* adverbs of frequency (e.g., *always, never, often, sometimes*) are between the Aux and VP constituents, as in the tree below. What rule would you need to hypothesize to derive the correct surface structure word order for French? (*Hint*: adverbs are not allowed to move.)



- C. Are there any verbs in English that follow the same pattern as the French verbs?
21. In this chapter we proposed that there is a category Aux that is a separate constituent from the subject NP and the VP. One source of evidence that Aux is a separate constituent is that it undergoes movement in questions:

Have you seen John?

Will John come to the party?

Think of at least two other sentence types in English that demonstrate the constituency of Aux.