An Introduction to Syntactic Analysis and Theory

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A Short Introduction

Linguistics is a domain in which language or languages are studied. The notion of language or languages is a common sense notion. In general, it is not sufficient or very informative to define a field of inquiry by naming the common sense entities it studies. There may be many different fields studying more or less the same common sense entities. For example one can study the oceans from the point of view of a biologist, a climate oceanographer, a plate tectonics physicist, a zoologist, a botanist, a chemist... It is useful and necessary to give an idea of the type of questions that one is asking about these entities.

If one tries to name as precisely as possible the entity that a large portion of modern linguistics studies, one could say it is the "language faculty" in humans. This attribute includes among other things the capacity that humans have to physically or mentally manifest their thoughts, to express linguistically new and original ideas, in principle in infinitely many ways. This attribute also underlies the ability to understand others, to have coherent conversations, to deduce other people's intentions from their utterances etc...

Investigating this complex and in many ways mysterious language faculty looks like a daunting task. One initial problem is to try to formulate sensible questions about it, that provides a framework within which incremental knowledge about this faculty can be gained.

We can start with the observation of a simple case of linguistic behavior. We use language. An acoustic wave hits our ear. This vibration is transformed into nerve impulses which reach our brains, where this nervous signal is somehow transformed into an idea, a thought: this is speech perception or recognition. Inversely, an idea starts forming in our mind which we may begin to manifest physically through speech or signs: this is speech production. These simple observations evoke the following questions:

What exactly goes on when we produce or recognize speech? How does perception or production unfold in real time, and what is its material substrate?

In the case of language, the nervous system, particularly the brain, seems to possess algorithmic properties of information management and processing: it can store and manipulate information. These properties somehow emerge from the organization of cerebral matter. It is customary nowadays to think that this accomplished by brain circuitry.

How does the brain do it, exactly??

In engineering jargon, we are faced with a problem of "reverse engineering", a common problem for industrial spies. We have a machine - a body, particularly a brain - capable of accomplishing a certain task and we try to understand how it works and how it could be built. This type of question is typical of the general domain of Cognitive Science. It is important to note that asking how the brain works (e.g. in the area of language), a question about the structure of an object in the natural world, is different from asking the question of how we could build a machine that reproduces a particular human behavior such as language production and perception. The latter is not a question about the natural world, it is an engineering problem (which may well illuminate and be illuminated by the former question.

Tackling this problem directly is very difficult. First, it seems easier to understand what the brain is doing at the neurological/chemical level once we have a road map of what it is trying to accomplish: for example, the Broca and Wernicke areas of the brain have for a long time been assumed to be directly implicated in the treatment of linguistic information. This piece of information - that these areas are perhaps primarily devoted to these tasks - will surely help make sense of the brain circuitry of these areas and its chemical substrate. This is no different from getting a head start on trying to understand how, say, a martian artefact works, once we know that it is a pocket calculator, supposed to perform certain mathematical operations.

This is why we approach the problems of production and perception abstractly, in terms of higher order units (more abstract than neurons but probably reducible to neural configurations) that linguists have discovered to be relevant.

It starts with the hypothesis that we have in our mind, stored in some unknown fashion, a repository of atomic elements - let us say words for concreteness - which correspond to bits of thoughts (such as table, or book, or eat, or before).

Let us think first about production: When I want to express a thought, I search in my mind for the words corresponding to what I want to talk about and I string them together in a particular way to express this thought. Of course, this string of words has to be physically manifested e.g. through speech, which means that it has to be sent, for example, to some component dealing with physical gestures of the mouth.

The perception side of it is similar but works somewhat in reverse. When I successfully perceive a sentence, this sentence is segmented by my brain into words each corresponding to a bit of thought. As my brain knows the particular temporal arrangement of these words, it is able to calculate what the combination of the words composing it mean as a whole.

We can schematize these processes with the following flow chart:

Sounds <-> ordered sets of words <-> meaning

If we go from left to right, we have a crude model of (normal)language perception, from right to left a crude model of (normal)language production. If we replaced "sounds" by "signs", we would have crude models of sign language perception and production.

Even trying to resolve this more abstract and apparently much more manageable problem is difficult. For example, it imaginable that the way sounds are composed into ordered sets of words in a particular situation depends on what the hearer is looking at when hearing these sounds. This could mean that we would have to worry about the brain visual system and how it communicates with the brain linguistic system. This is why we decide to worry about an even more abstract problem: we will not investigate how the flow chart above really works, how it unfolds in real time. Instead, we will ask:

What kind of **necessary linguistic** properties does this information processing task have?

The two important words here are linguistic and necessary. The first one means that we are not going to worry about visual clues for example. The second means that we will concentrate on general properties that this algorithm must have given what we observe about it. In effect , we are primarily (although not exclusively) concerned with constructing a **theory** of this algorithm rather than discovering the way it is implemented.

Here is a sample of more precise questions we may ask ourselves:

1. Can a particular subset of words be freely stringed whichever way we like?
2. Must these strings of words structured in any way or is it just a temporally ordered string of words?
3. Are there constraints on what we can do, if yes, what are they and why do they exist?
4. How does the meaning of a sentence arise from the meaning of its component parts?

Perhaps one of the most far reaching discoveries humans made was the discovery that speech can be symbolically transcribed, can be written down. The consequential capacity to transmit experience through writing has had phenomenal consequences for human development and knowledge. What is less obvious is that this discovery is also a theoretical discovery about human psychology: it is a discovery about the way in which human languages, which are particular brain manifestations, are structured. One fundamental aspect of this discovery can be stated as follows: the speech signal - even though it is a continuous physical phenomenon, namely a continuous variation of air pressure for normal speech, or continuous motion for sign language - can be represented with a finite (sometimes small) number of discrete units. A particular striking example of this property is illustrated by alphabetic writing systems: with a small number of symbols - letters - they can very effectively (partially) code speech.

Informally speaking, it is clear that this segmentation of the speech signal occurs at various levels of "graininess". Alphabetic writing systems segment the speech signal in very small units of writing, while hieroglyphic writing systems segment it in somewhat larger units for example.

That this segmentation can occur at various degrees of "magnification" can be illustrated with the following string:

these books burned

It can be segmented in the following ways (where units are separated by the symbol "-"):

1. th - i: - z - b - oo - k - s - b - u - r -n - d
2. Demonstrative - Plural - Noun - Plural - Verb-past
3. DemonstrativePlural - Nounplural - Verbpast
4. These books - burned

Linguists have extensively documented the relevance of such segmentations for our understanding of language structure. This means that translates they are hypotheses that these different kinds of segmentation are involved in the mental calculus performed by humans when producing or understanding language. They correspond to different levels of computations.

1. Level 1 is the level of phonetic/phonological units
2. Level 2 is the level of morphemes
3. Level 3 is the level of words
4. Level 4 is the level of phrases

Note that this is not meant to be exhaustive (there may be further ways of segmenting strings, e.g. as a sequence of syllables)

Hypothesizing that these modes of segmentation, these different "levels of magnification", correspond to real psychological properties of the speech signal (as indeed some do), we will need to at least answer the following questions about each level as part of understanding how our flow chart above really works:

What is the inventory of the smallest pieces, the atomic elements, that are assembled at each level? What are the rules or principles that govern how these atoms can be assembled?

(We may also ask whether there are reasons why the atoms are what they are at each level, and what emerging properties do these assembly of atoms have, etc...)

Traditionally, linguists have postulated the following divisions: The investigation of level 1, its atoms and properties is considered a well defined subdomain of linguistic theory: Phonetic/Phonology. The investigation of how level 2 units combines to provide level 3 units is also considered a well defined subdomain of linguistic theory called Morphology. Finally, Syntax is traditionally defined as the set of rules or principles that govern how words (level 3 units) are put together to form phrases, well formed sequences of words.

Before proceeding, it is important to note that it is far from obvious a priori that this division into such subdomains is theoretically justified. It may well be for example that the atoms of syntax are not words but morphemes as well and that the rules of combinations for morphemes are the same as the rules of combination for words. If this were the case, there would really be no real, analytically justified distinction between morphology and syntax. Or it may be that some division is justified but not this one. Thus it may be part of "morphology"is part of phonology, but not all of it etc.. A priori possible variations are many.

We will start by assuming this traditional picture, modifying it as needed as we go along.

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Morphology: Starting with words

Our informal characterization defined syntax as the set of rules or principles that govern how words are put together to form phrases, well formed sequences of words. Almost all of the words in it have some common sense meaning independent of the study of language. We more or less understand what a rule or principle is. A rule or principle describes a regularity in what happens. (For example: "if the temperature drops suddenly, water vapor will condense"). This notion of rule that we will be interested in should be distinguished from the notion of a rule that is an instruction or a statement about what should happen, such as "If the light is green, do not cross the street." As linguists, our primary interest is not in how anyone says you should talk. Rather, we are interested in how people really talk.

In common usage, "word" refers to some kind of linguistic unit. We have a rough, common sense idea of what a word is, but it is surprisingly difficult to characterize this precisely. It is not even clear that the notion is one that allows a precise definition. It could be like the notion of a "French language." There is a central idea to this vague notion but as we try to define it, we are led to making arbitrary decisions as to whether something is part of French or not. Furthermore, as we will see, we may not need any precise version of this notion at all. Nevertheless, these commonsense notions provide a reasonable starting point for our subject. So we will begin with the usual ideas about words, objects of the kind that are represented by the strings of letters on this page separated by blank spaces. When we become literate in a language, we learn the conventions about what is called a word, and about spacing these elements in texts. Who decides these conventions, and how do we learn them? We will gradually get to some surprising perspectives on this question.

As we will see, some reasons have been put forth to the effect that words are *not* the basic units of phrases, not the atomic units of syntax. Accordingly, the atoms, or "building blocks" that syntax manipulates would be smaller units, units that we will see later in this chapter. We will also see that that there are reasons to think that the way these units are combined is very regular, obeying laws very similar to those that combine larger units of linguistic structure.

We begin by looking at properties of words informally characterized and see where it leads. As mentioned above, the subdomain of linguistics dealing with word properties, particularly word structure, is called *morphology*. Here we will concentrate on just a few kinds of morphological properties that will turn out to be relevant for syntax. We will briefly introduce these basic ideas:

1 Words come in categories

1 Words can be made of smaller units (morphemes)

1 Morphemes combine in a regular, rule-governed fashion.

   a. To define the regularities we need the notions of head and selection

   b. The regularities exhibit a certain kind of locality

1 Morphemes can be silent

2.1 Words come in categories

The first important observation about words is that they come in different kinds. This is usually stated as the fact that words belong to different categories, where categories are nouns, verbs, adjectives, prepositions, adverbs, determiners, complementizers, and other things. Some of these are familiar from traditional grammar (e.g. nouns, verbs), others probably less so (complementizers, or determiners).

Open class categories:	(new words can be freely created in these categories)
Noun (N)	table, computer, event, joy, action
Verb (V)	run, arrive, laugh, know, love, think, say, spray
Adjective (A)	big, yellow, stable, intelligent, legal, fake
Adverb (Adv)	badly, curiously, possibly, often

Closed categories:	
Preposition (P)	on, of, by, through, into, from, for, to
Determiner (D)	the, a, this, some, every
Numerals (Num)	one, two, three, ten, thirteen
Complementizers (C)	that, if, whether, for
Auxiliaries (V)	have, be
Modals (v or M)	will, would, can, could, may, might, shall, should
Coordinators (Coord)	and, or, but
Negation/Affirmation (Neg/Aff)	no ,too

Each of these categories will need to be refined. For example, there are many different "subcategories" of verbs some of which are distinguished in the dictionary: transitive, intransitive, and so on. Most dictionaries do not specify refinements of the other categories, but they are needed there too. For example, there are many different kinds of adverbs:

manner adverbs	slowly, carefully, quickly
degree adverbs	too, enough
frequency adverbs	often, rarely, always
modal adverbs	possibly, probably

(Notice also that the degree adverb *too* in *This is too spicy* is not the same word as the affirmative *too* in *That is too*, which was mentioned earlier. Similarly, the complementizer *for* in *For you to eat it would be a mistake* is often distinguished from the preposition *for* in *He cooked it for me*.)

There are even important distinctions among the determiners:

articles	a, the
demonstratives	that, this, these, those
quantifiers	some, every, each, no

In fact, there are important subcategories in all of the categories mentioned above.

This classification of words into categories raises the fundamental questions:

- What are these categories, that is, what is the fundamental basis for the distinctions between categories?
- How do we know that a particular word belongs to a particular category?

Traditionally, the categories mentioned above are identified by semantic criteria, that is, by criteria having to do with what the words mean. A noun is sometimes said to be the name of a person, a thing or a place; a verb is said to be the name of an action; an adjective the name of a quality; etc. There is some (probably very complicated) truth underlying these criteria, and they can be useful. However, a simple minded application of these criteria is not always reliable or possible. Sometimes words have no discernible meaning (the complementizer *that*), nouns can name actions (e.g. Bill's repeated *betrayal* of his friends), verbs and adjectives can denote states (John *fears* storms = John is *fearful* of storms), etc.

It is important to keep meaning in mind as a guide but in many cases we will need more reliable criteria. The most fundamental idea we will use is this one: **a category is a set of expressions that all "behave the same way" in the language.** And the fundamental evidence for claims about how a word behaves is the distribution of words in the language: where can they appear, and where would they produce nonsense, or some other kind of deviance.

2.1.1 Word affixes are often category and sub-category specific

In morphology, the simplest meaningful units, the "semantic atoms," are often called *morphemes*. Meaning in this characterization can be taken either to be "paraphrasable by an idea" (such as the plural morpheme -s which stand for the idea of plurality, i.e. more than one); but it can also be "indicating a grammatical property" such as an accusative Case ending in Latin or Japanese (such as Japanese -o) which marks a direct object. We will mostly concentrate on the former sort here. Then a distinction is often drawn between morphemes which can occur independently, *free morphemes*, and those that can only appear attached to or inside of another element - call it its host, *bound morphemes* or *affixes*. An Affixe that is attached at the end of its host is called a *suffix*; at the beginning of its host, a *prefix*, inside its host an *infix*; at the beginning and end a *circumfix*.

Words can have more than one morpheme in them. For example, English can express the idea that we are talking about a plurality of objects by adding the sound [s] or [z] or [iz] at the end of certain words:

book	book-s
table	table-s
friend	friend-s
rose	rose-s

Nouns can do this (as well as small number of other items: demonstratives, pronouns): in English, the ability to be pluralized comes close to being a distinctive property of Nouns. If a word can be pluralized (and is not a demonstrative or a pronoun), it is a noun.

Notice that the characterization of this suffix is partly semantic. So for example, we know that the [s] sound at the end of *reads* in the following sentence is not the plural affix, but some kind of agreement marker:

She read-s the newspaper

This sentence does not refer to a plurality of readings. In English, there is no plural version of any verb, or of any preposition, or of any adjective. If a word can be pluralized (and is not a demonstrative or a pronoun), then it is a noun. The reverse does not seem to always hold. There are some nouns which cannot be easily pluralized, such as the so-called mass nouns like *furniture* or *milk* or *rice*. In fact, they can be pluralized too, but when they are, their meaning shifts in a subtle way. Thus *the books* just refers to a group of books but the *rices* refers to a set of **types** of rice. Thus the ability to accept the plural suffix seem to be a reasonable diagnostic of "Nounhood". But there clearly is more to say about the difference between mass nouns and count nouns (Chierchia, 1998) . Other affixes pick out other kinds of categories. English can modify the way in which a verb describes the timing of an action by adding affixes:

I dance	present tense (meaning habitually, or at least sometimes)
I danc-ed	past tense
I am danc-ing	present *am* progressive *-ing* (meaning I'm dancing now)

In English, only verbs can have the past tense or progressive affixes. That is, if a word has a past or progressive affix, it is a verb. Again, it is important to notice that there are some other -ing affixes, such as the one that lets a verb phrase become a subject or object of a sentence:

His liking anchovies a lot surprises me

Clearly, in this last example, the -ing does not express that the liking of anchovies is going on now, as we speak. Going back to the progressive -ing, note that although even the most irregular verbs of English have -ing forms (being, having, doing), some verbs sound very odd in progressive constructions:

?He is liking you a lot *She is knowing the answer

Should we conclude that *like* or *know* are not verbs? No. This situation is similar to the situation we encountered earlier when we saw that some nouns did not seem to pluralize. This kind of situation holds quite frequently. Remember the slogan:

Negative results are usually **uninformative**.

This is a slogan (and only a slogan) to help you remember that it is difficult to interpret experimental failure per se. The reason is that we do not know where the failure comes from; it could be due to factors having nothing to do with what we are investigating. (For example, Newton's gravitation law would not be disconfirmed by a dropped object not falling vertically: a priori, there may be wind, or a magnetic field if the object is ferromagnetic, etc..). For the same reason, it is difficult for experimental methodology to simply predict: no change. If one found no change, this could be because nothing changed, or it could be because the experimental methods did not suffice to detect the change.

2.1.2 Syntactic contexts are sensitive to the same categories

Surprisingly, the categorization of words that is relevant for affixation is also relevant for simply determining where the word can appear, even without affixes – a "syntactic" property. Consequently, we can use considerations about where a word appears to help determine its category. This method is very useful but is not always easy to manipulate. For example, consider this context, this "frame":

This is my most ______ book

Suppose we try to plug in single words in the ______ slot. Certain choices of words will yield well formed English phrases, others will not.

ok: interesting, valuable, linguistic
* John, slept, carefully, for

This frame only allows adjectives (A) in the space, but not all adjectives can appear there. For example, we cannot put *alleged* or *fake* there. (Remember: negative is uninformative.)

One property that (some) nouns have is that they can appear in a slot following a determiner such as *the*:

the ______ is here
ok: book, milk ,furniture
* big, grow, very

As another example the following context seems to allow single words only if they are verbs:

When will John ______ ?

Here is an example of a context in which we could be misled:

John is ______
ok: nice *nices
ok: president ok: presidents

Both *nice* and *president* can occur in this context, but as indicated, *president* unlike *nice* can be pluralized. So *nice* is an A, while *president* is an N. We must be careful: this context allows both adjectives and nouns (and other things too)!

The possibility of occurring in a frame like the ones listed here is a very simple distributional property, and it can help us classify words into categories that will be relevant to syntax and morphology. In morphology, we will see that affixes are sensitive to category, compounding is also sensitive to category. Why should the possibility of having a certain affix correlate with the possibility of occurring in a certain frame? We will get some insight into fundamental questions like this in the next chapters.

2.1.3 Modifiers

The options for modification provide another way to identify the categories that are relevant for both word formation (morphology) and phrase formation (syntax). Here we use a mix of semantic and syntactic factors to figure out what modified what, in a familiar way. For example, a word that modifies a verb is probably an adverb of some kind, and similarly for other categories:

category	modifier	example
V	Adv	$[_V$ stop] → stop suddenly (a way of stopping)
N	A(djective)	$[_N$ stop] → sudden stop (a type of stop)
P	Intensifier	$[_P$ in] the middle → right in the middle, smack in the middle
A	Degree	$[_A$ sad] → very sad, too sad, more sad
Adv	Degree	$[_{Adv}$ sadly] → very sadly, too sadly, more sadly

For example, we can observe that the following sentence allows a modifier to be introduced:

John was shooting → John was shooting accurately

Assume we have independently established that *accurately* is an adverb; since shooting accurately is a way of shooting, we can conclude that in this sentence, shooting is a verb (V). Similarly, in:

I resent any unnecessary shooting of lions

we conclude from the fact that *unnecessary* is an adjective, and from the fact that an unnecessary shooting is a type of shooting that in this sentence, shooting is a noun (N). The reverse may hold true:

John shot → John shot accurately

Since *shot* is the past tense of *shoot*, we know that shot is a verb in this sentence. Since *accurately* modifies it, we may conclude that *accurately* is an adverb.

2.1.4 Complementary distribution

Another perhaps more surprising kind of evidence for two words having the same category is available when the two words have *complementary distribution,* by which we mean that in a given context, either one of two elements may occur but not both. This is a good indication (but certainly not foolproof) that these two items belong to the same category.

For example, in the frame:

______ books

only certain words can occur:

ok	the
ok	these
*	the these
*	these the

We see that *the* and *these* are in complementary distribution: if one appears, the other cannot. This is evidence that they are both the same category, and in this case it is the category we call determiners (Ds). On the other hand, we have

ok:	the book
ok:	blue books
ok:	the blue books

So we see that *the* and *blue* are not in complementary distribution, and nothing much follows from this.

Like our other tests for category, this one is not fool proof. Consider for example, this data:

ok: John's book
* the John's book
* John's the book

We see that *the* and *John's* are in complementary distribution, but later we will provide reasons to reject the view that they are the same category – something slightly more complicated explains the complementary distribution in this case. Note however that meaning can be a guide here: *John's* expresses a kind of meaning that seems quite unlike the meaning expressed by *the* or *these*.

Do categories really exist and if yes what are they? In what follows, we will continue using categorial labels, both traditional ones such as N, V, etc.. and less traditional ones such as C, D, etc.. We should however be aware that this shorthand may just be a convenient approximation of the truth but may not be scientifically justified. For everything we will discuss, this approximation will suffice. What kind of issues arise? First, there is the question of whether categories are primitives of linguistic analysis or are derived concepts. If the latter, they can be entirely defined on the basis of other properties and in a sense, they have no real theoretical status: they are just convenient shorthand. If the former - the traditional, but by no means the obviously correct, view - they cannot be defined. The problem that arises then is to explain how speakers infer category membership for words on the basis of their observed behavior. Secondly there is the related question of whether the labels that we use meaningfully characterize analytically relevant subset of words. It is quite possible (in fact likely), that the inventory of categories we have is far too crude. Thus, it may be that categories are like chemical compounds: they are made up of smaller pieces (like molecules or atoms in chemistry, which combine to form more complex structures). Under such a view Ns could be like a class of chemicals (say metals) but with many subclasses (e.g. ferromagnetic metals) and cases in which an item could both have metal and nonmetal properties (an "intermediate" category)e.g. conductive plastic polymers.

Note on linguistics as cognitive science. In making our judgments about phrases, labeling them "ok" or "*" as we have done above, we are conducting quick, informal psychological experiments on ourselves. To decide what to conclude (e.g., are these two words of the same category?), we are constantly asking ourselves whether this string or that string is acceptable. These are simple psychological experiments. We are relying on the fact that people are pretty good at judging which sequences of words make sense to them and to other people with similar linguistic background, and we rely on this ability in our initial development of the subject.

Obviously, physics is not like this. Useful experiments about electromagnetic radiation or gravitational forces typically require careful measurements and statistical analysis. Many linguistic questions are like physics in this respect too. For example, questions about how quickly words can be recognized, questions about word frequencies, questions about our ability to understand language in the presence of noise – these are things that typical speakers of a language will not have interesting and accurate judgments about. But questions about the acceptability of a phrase are different: we can make good judgments about this. Of course, we require our linguistic theory to make sense of our linguistic judgments *and* ordinary fluent speech in "natural" settings *and* the results of careful quantitative study. In this text, we will occasionally make note of ways in which our account of syntax has been related to aspects of human abilities which have been studied in other ways.

In this sense, linguistics is an experimental science trying to uncover something about knowledge of language somehow stored in our mind. When we start with our judgments about language, though, there are at least three respects in which we must be especially careful. *First,* we want a theory of our judgments about the language and every speaker of the language has access to an enormous range of data. It is unreasonable to expect linguistic theory to explain all this data at the outset. As in other sciences, we must start with a theory that gets some of the facts right, and then proceed to refine the theory. This is particularly important in introductory classes: there will be (apparent) counterexamples to many of our first proposals! We will carefully set aside some of these, to come back to them later. A *second* thing that requires some care is that sometimes our judgments about the acceptability of particular examples are not clear. When this happens, we should look for clearer examples to support our proposals. A *third* problem facing our development of the theory is that there are at least slight differences in the linguistic knowledge of any two speakers. Ultimately, our linguistic theory should account for the variation that is found, but initially, we will focus on central properties of widely spoken languages. For this reason, we will often speak as if there is one language called "English," one language called "French," and so on, even though we recognize that each individual's language is different.

2.2 Words are made of smaller units: morphemes

We defined a *morpheme* as a semantic atom: it has no meaningful subparts. For our purposes here, this will be a good enough approximation (but we should be aware that there are many questions lurking in the background, e.g. there exist some morphemes which do not seem to have a meaning attached to them). A word will be called *complex* if it contains more than one of these atoms. The part of a word that an affix attaches to is called a *stem*, and the *root* of the word is what you start with, before any affixes have been added.

English morphology is not very rich compared to most of the world's languages, but it has prefixes:

pre-test, post-test, ex-husband, dis-appear, un-qualified, re-think, in-accurate

It has suffixes:

test-s, test-ed, test-able, nation-al-iz-ation

It seems to have a few infixes:

Fan-fucking-tastic	Means ’really fantastic’
Edu-ma-cation	Ghetto speak for ’education‘

Many other languages (apparently) also have infixes. For example, in Tagalog, a language spoken in the Philippines by some 10 million speakers, one use of *-um-* is illustrated by forms like these (Schachter and Otanes, 1972, 310):

ma-buti	b-um-uti	ma-laki	l-um-aki	ma-tanda	t-um-anda
‘good’	‘become good’	‘big’	‘get big, grow’	‘old’	‘get old, age’

English also seems to lack circumfixes, which we seem to find for example in Dutch participles which use the circumfix *ge- -d*:

ge-genereer-d	ge-werk-t	ge-hoor-d
‘generated’	‘worked’	‘heard’

English does have some verb forms exhibiting sound changes in the base (*run/ran, swim/swam, come/came, meet/met, speak/spoke, choose/chose, write/wrote*), but other languages like the Semitic languages (Arabic, Hebrew), make much heavier and more regular use of this kind of change. For example, in Arabic, the language of some 250 million speakers (Ratcliffe, 1998, p77),

qalbun	quluubun	najmun	nujuumun	kalbun	kilaabun
‘heart’	‘hearts’	‘star’	‘stars’	‘dog’	‘dogs’

English also has some affixes which are “supra-segmental,” applying prosodic changes like stress shift above the level of the linguistic segments, the phonemes: (pérmit/permít, récord/recórd). English does not have regular reduplication in its morphology, repetition of all or part of a word, but many of the world's languages do. For example, in Agta, another Philippine language spoken by several hundred people (Healey, 1960, p.7):

takki	taktakki	ulu	ulaluda	mag-saddu	mag-sadsaddu
‘leg’	‘legs’	‘head’	‘heads’	‘leak’	‘leak in many places’

Although there are many kinds of affixes, we find that they have some properties in common, across languages.

Note on orthography. We will almost always use the standard Roman alphabet and conventional spelling (when there are any such conventions), sometimes augmented with diacritics and phonetic characters, to denote the expressions of various languages, even when those languages are conventionally written with non-Roman alphabets. For example, we will usually write *Cleopatra* because that is the conventional spelling of the word in English, rather than the phonetic [kliopætrə] or the Egyptian hieroglyphic . Always, it is important to remember that our primary focus is each individual's knowledge of his or her own *spoken* language. We use our own conventional English orthography to denote the words of each individual's language.

2.3 Morphemes combine in regular ways

Morphology addresses the many questions that come up about these linguistic units. What kind of affixes are there? What kind occur in English? What are their combinatory properties? Do complex words have any form of internal organization?

2.3.1 Compositionality

The *Oxford English Dictionary* has an entry for the following word:

> **denationalization**: 1. The action of denationalizing, or the condition of being denationalized. 2. The action of removing (an industry, etc.) from national control and returning it to private ownership.

This word is not very common, but it is not extremely rare either. People with a college education, or regular readers of the newspapers, are likely to be familiar with it. But even a speaker who is not familiar with the word is likely to recognize that it is a possible word, and can even make a good guess about what it means. How is this possible? We can identify 5 basic and familiar building blocks, 5 morphemes in this word:

de-nation-al-ize-ation

The word *nation* is a free morpheme, and we can see that it is an N, since it can be modified by adjectives, and it can bear plural morphology The meaning of this word is built progressively from the meaning of its part:

Nation-al characterizes a property that a **nation** can have. **National -ize** means make **national.** **De-nationalize** means undo the **nationalizing.** **Denationaliz-ation** is the process or the result of **denationalizing**.

This property is called compositionality. Roughly it means that meaning of parts is progressively computed by general rules so that once that we have computed the meaning of say *nationalize*, *nationaliz-ation* is just going to add the meaning of *-ation* (whatever that is) to the already computed meaning of *nationalize* by a general rule of meaning combination. For example, in general, we do not expect *de-nationalize* to mean undo a personalization (as in *depersonalization*)

Sometimes however, this rule governed behavior fails and we have an **idiom.** Thus a *blueberry* is not a berry that is blue. In such a case, it seems that we still have two morphemes, *blue* and *berry*, but their meaning is idiomatic, that is do not conform to the general rules of meaning combination. Some other times, it is less clear how to decide how many morphemes there are, e.g. as in: speedometer, or ????????????? Investigating this problem in depth is beyond the scope of this chapter.

2.3.2 Affixation

When we look closely, the situation seems even more remarkable. There are 5!=120 different orderings of these 5 morphemes, but only this one forms a word. That's a lot of possible orders, all given in Figure 2.1, but somehow, speakers of English are able to recognize the only ordering that the language allows. That is, we claim:

(1) A speaker of English, even one who is unfamiliar with this word, will only accept one of these sequences as a possible English word.

This is an empirical claim which we can see to be true by checking over all the orderings in Figure 2.1. (In making this check, we use our "intuition," but we expect that the claim would also be confirmed by studies of spontaneous speech and texts, and by psychological studies looking for "startle" reactions when impossible morpheme sequences occur, etc.)

What explains the fact that English speakers only accept one of these possible orderings? First it cannot be simply be memorization (like having encountered denationalization but none of the others) since we assume that the speakers are unfamiliar with this word. If they are familiar with it, we could try another one, even a non existing word (e.g. denodalization.. from node - nodal -nodalize, etc...). Our theory is that English speakers, and speakers of other human languages, (implicitly) know some regularities about word formation. What are the regularities that a speaker needs to know in order to accept *denationalization* and reject the other 119 forms?

1. The speaker needs to know each of the five morphemes, *de-, nation, -al, -ize, -ation.*
2. The speaker needs to know what kind of morpheme each one is. Is it free? If not, then is it a prefix, suffix, etc?

ok: nation-al	*-alnation	-al is a suffix
ok: pre-test	*test-pre	pre- is a prefix

de- nation -al -ize -ation	* nation de- -al -ize -ation	* nation -al de- -ize -ation
* nation -al -ize de- -ation	* nation -al -ize -ation de-	* de- -al nation -ize -ation
* -al de- nation -ize -ation	* -al nation de- -ize -ation	* -al nation -ize de- -ation
* -al nation -ize -ation de-	* de- -al -ize nation -ation	* -al de- -ize nation -ation
* -al -ize de- nation -ation	* -al -ize nation de- -ation	* -al -ize nation -ation de-
* de- -al -ize -ation nation	* -al de- -ize -ation nation	* -al -ize de- -ation nation
* -al -ize -ation de- nation	* -al -ize -ation nation de-	* de- nation -ize -al -ation
* nation de- -ize -al -ation	* nation -ize de- -al -ation	* nation -ize -al de- -ation
* nation -ize -al -ation de-	* de- -ize nation -al -ation	* -ize de- nation -al -ation
* -ize nation de- -al -ation	* -ize nation -al de- -ation	* -ize nation -al -ation de-
* de- -ize -al nation -ation	* -ize de- -al nation -ation	* -ize -al de- nation -ation
* -ize -al nation de- -ation	* -ize -al nation -ation de-	* de- -ize -al -ation nation
* -ize de- -al -ation nation	* -ize -al de- -ation nation	* -ize -al -ation de- nation
* -ize -al -ation nation de-	* de- nation -ize -ation -al	* nation de- -ize -ation -al
* nation -ize de- -ation -al	* nation -ize -ation de- -al	* nation -ize -ation -al de-
* de- -ize nation -ation -al	* -ize de- nation -ation -al	* -ize nation de- -ation -al
* -ize nation -ation de- -al	* -ize nation -ation -al de-	* de- -ize -ation nation -al
* -ize de- -ation nation -al	* -ize -ation de- nation -al	* -ize -ation nation de- -al
* -ize -ation nation -al de-	* de- -ize -ation -al nation	* -ize de- -ation -al nation
* -ize -ation de- -al nation	* -ize -ation -al de- nation	* -ize -ation -al nation de-
* de- nation -al -ation -ize	* nation de- -al -ation -ize	* nation -al de- -ation -ize
* nation -al -ation de- -ize	* nation -al -ation -ize de-	* de- -al nation -ation -ize
* -al de- nation -ation -ize	* -al nation de- -ation -ize	* -al nation -ation de- -ize
* -al nation -ation -ize de-	* de- -al -ation nation -ize	* -al de- -ation nation -ize
* -al -ation de- nation -ize	* -al -ation nation de- -ize	* -al -ation nation -ize de-
* de- -al -ation -ize nation	* -al de- -ation -ize nation	* -al -ation de- -ize nation
* -al -ation -ize de- nation	* -al -ation -ize nation de-	* de- nation -ation -al -ize
* nation de- -ation -al -ize	* nation -ation de- -al -ize	* nation -ation -al de- -ize
* nation -ation -al -ize de-	* de- -ation nation -al -ize	* -ation de- nation -al -ize
* -ation nation de- -al -ize	* -ation nation -al de- -ize	* -ation nation -al -ize de-
* de- -ation -al nation -ize	* -ation de- -al nation -ize	* -ation -al de- nation -ize
* -ation -al nation de- -ize	* -ation -al nation -ize de-	* de- -ation -al -ize nation
* -ation de- -al -ize nation	* -ation -al de- -ize nation	* -ation -al -ize de- nation
* -ation -al -ize nation de-	* de- nation -ation -ize -al	* nation de- -ation -ize -al
* nation -ation de- -ize -al	* nation -ation -ize de- -al	* nation -ation -ize -al de-
* de- -ation nation -ize -al	* -ation de- nation -ize -al	* -ation nation de- -ize -al
* -ation nation -ize de- -al	* -ation nation -ize -al de-	* de- -ation -ize nation -al
* -ation de- -ize nation -al	* -ation -ize de- nation -al	* -ation -ize nation de- -al
* -ation -ize nation -al de-	* de- -ation -ize -al nation	* -ation de- -ize -al nation
* -ation -ize de- -al nation	* -ation -ize -al de- nation	* -ation -ize -al nation de-

Figure 2.1: 120 orderings, only 1 is intelligible

This is something which, by convention, we often indicate with preceding or following hyphens, as we have done here.

3. Since an affix is a morpheme that is not "complete," it must attach to something. Let's call the thing it needs a *complement.* So the speaker needs to know what kind of thing the affix can attach to, what kind of "complement" it requires. For example,

   ok: national-ize symbol-ize *speak-ize *in-ize

   The *-ize* suffix combines with adjectives or nouns of a certain kind, but not with verbs or prepositions. This property is called *c-selection* for category selection. The affix *-ize* needs to combine with a certain category, namely A or N. This is actually the property that we used earlier with the past tense or the progressive suffix to determine membership to the category V: they c-select V. There may be other kinds of selection too, as we will see later.

4. The speaker knows that affixes must combine with something "next to it," something adjacent. For example, it is only slightly odd to say that some territory or other should *nation-ize*, meaning: become a nation. But it is impossible to combine *-ize* with *nation* after *nation* has already combined with *-al.*

   ok: nation nation-ize nation-al nation-al-ize *nation-iz-al

   We cannot pair up *-al* with *nation* after *-ize* has attached in this way.

5. The speaker needs to know what kind of thing results from combining an affix with a complement, in order be able to decide what the result is allowed to combine next with:

nation-al is an adjective	*-al* turns a N into an A
	(N-al meaning roughly, of or having to do with N)
nation-al-ize is a verb	*-ize* turns an A into a V
	(meaning make V – a causative reading)

   How do we know *nation-al* is an A? If we have established that *-ize* generally suffixes to adjectives, one reason is that *-ize* can suffix to it. But there are of course other reasons: the other tests mentioned above converge on this conclusion.

In sum, a speaker who knows the following things will only find one analysis of *nation-al-iz-ation*:

nation:	free, N		
-al :	suffix,	c-selects N,	to form an A (X-al means pertaining to X)
-ize:	suffix,	c-selects A,	to form a V (A-ize means cause to be A)
de-:	prefix,	c-selects V,	to form a V (de-V means roughly do the reverse of Ving
-ation:	suffix,	c-selects V,	to form a N (V-ation refers to an event of V-ing)

We will call this kind of specification of these basic properties of morphemes *lexical entries*.

We will elaborate our lexical entries in various ways as we proceed. Notice that the third column of the entries above, the specification of what the affixes select, is only approximate. It is true that *-al* can combine with the noun *nation* to form that adjective *national*, but this affix cannot select just any noun:

$[_N$neighborhood]	*neighborhoodal	$[_N$honesty]	*honestial

It appears that this suffix will only attach to nouns that are either simple roots- that is atomic nouns, nouns that have no morphological parts, or else nouns that end in *-ion, -ment* or *-or* (but not necessarily to all such nouns viz. **city-al, *sister-al*:

natur-al	relation-al	environment-al	mayor-al
season-al	exception-al	fundament-al	behavior-al

We see that *-al* is very particular about which nouns it can select. It selects roots and non-roots, but only certain ones. So our lexical entry for this suffix needs to be augmented, and it is not clear how to specify its requirements exactly. One proposal is that nouns ending in *-ion, -or, -ment* are in a special family of "latinate" nouns, and these are what are selected. Adopting this view, we could say:

-al : suffix, c-selects $N_{latinate}$ to form an A (X-al means pertaining to X)

Rather than name the families of nouns in this way, we will simply annotate our entries with the range of accepted kinds of nouns:

-al : suffix, c-selects N (-ion,-or,-ment) to form an A (X-al means pertaining to X)

Surveying the suffixes in English, (Fabb, 1988) finds that a number of them have special "latinate" requirements:

-al :	c-selects N to form A (-ion,-or,-ment)	natur-al
-ion	c-selects V to form N (-ize, -ify, -ate)	realizat-ion, relat-ion
-ity	c-selects A to form N (-ive, -ic, -al, -an, -ous, -able)	profan-ity
-ism	c-selects A to form N (-ive, -ic, -al, -an)	modern-ism
-ist	c-selects A to form N (-ive, -ic, -al, -an)	formal-ist
-ize	c-selects A to form V (-ive, -ic, -al, -an)	special-ize

Other suffixes select roots only in certain categories:

-an,-ian	c-selects root N to form N	librari-an, Darwin-ian
	c-selects root N to form A	reptil-ian
-age	c-selects root V to form N	steer-age
	c-selects root N to form N	orphan-age
-al	c-selects root V to form N	betray-al
-ant	c-selects root V to form N	defend-ant
	c-selects root V to form A	defi-ant
-ance	c-selects root V to form N	annoy-ance
-ate	c-selects root N to form V	origin-ate
-ful	c-selects root N to form A	peace-ful
	c-selects root V to form A	forget-ful
-hood	c-selects root N to form N	neighbor-hood
-ify	c-selects root N to form V	class-ify
	c-selects root A to form V	instens-ify
-ish	c-selects root N to form A	boy-ish
-ism	c-selects root N to form N	Reagan-ism
-ive	c-selects root V to form A	restrict-ive
-ize	c-selects root N to form V	symbol-ize
-ly	c-selects root A to form A	dead-ly
	c-selects root N to form A	ghost-ly
-ment	c-selects root V to form N	establish-ment
-ory	c-selects root V to form A	advis-ory
-ous	c-selects root N to form A	spac-eous
-y	c-selects root A to form N	honest-y
	c-selects root V to form N	assembl-y
	c-selects root N to form N	robber-y

And some English suffixes select a range of root and non-root forms:

-er	c-selects V to form N	kill-er, dry-er, classifi-er
-able	c-selects V to form A	manage-able, redo-able, classifi-able
-ist	c-selects N to form N	art-ist, unifi-cation-ist
-ary	c-selects N to form A (-ion)	revolut-ion-ary, legend-ary
-er	c-selects N to form N (-ion)	vacat-ion-er, prison-er
-ic	c-selects N to form A (-ist)	modern-ist-ic, metall-ic
-(at)ory	c-selects V to form A (-ify)	class-ifi-catory, advis-ory
-y	c-selects N to form A (-ence)	resid-ence-y, heart-y

The whole collection of knowledge that a speaker has about the morphemes, the collection of lexical entries, is called a *lexicon*. It will contain information about morphemes of the sort shown here and more. We can think of the lexicon as the place in memory where all this information is stored. If our description is correct, the lexicon is a mental storage area of some sort in which information about morphemes (and perhaps other things) is found.

The mental representation of the lexicon. Note that if lexical information is placed in memory as we describe it, other evidence should confirm that it is stored there in the form that we propose.

In fact, this question is getting a lot of attention from quite a variety of perspectives now. There is some evidence that frequently used words, even if they can be decomposed into a sequence of 2 or more morphemes, are represented in their complete forms (Baayen, Dijkstra, and Schreuder, 1979; Bertram, Baayen, and Schreuder, 2000), and so there is increasing interest in how people figure out the meanings of rare and novel complex words. Novel forms are often studied with various kinds of "wug" tests (Berko, 1958), which are tasks designed to indicate how subjects interpret word forms that they have never seen or heard before. A recent review is provided by McQueen and Cutler (1998), and an entertaining discussion of related topics can be found in Pinker (1999).

2.3.3 Word structure

The last section made the claim

(1) only one ordering of the five morphemes in *de-nation-al-ize-ation* produces a possible English word.

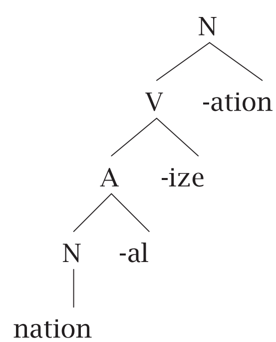
The proposal was that (1) is explained by the assumption that English speakers know some basic facts about the five morphemes, facts that are represented in lexical entries like this:

nation:	free		
-al :	suffix,	c-selects N,	to form an A (X-al means pertaining to X)
-ize:	suffix,	c-selects A,	to form a V (A-ize means cause to be A)
de-:	prefix,	c-selects V,	to form a V (de-V means roughly "make not V")
-ation:	suffix,	c-selects V,	to form a N (V-ation refers to an event of V-ing)

With these lexical entries, we get the following derivation, and no other:

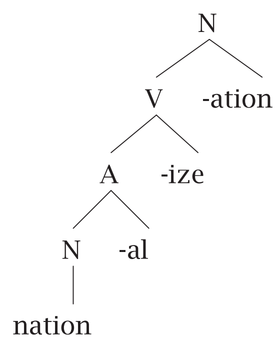
nation → national → nationalize → nationalization

Derivations like this are standardly represented by a *tree*.



Linguists traditionally draw 'trees' like this, upside-down, with all branching going out in the downward direction. Each point that is labeled with a word or a category is called a *node*, and the node at the top of the tree is called the *root of the tree*. So the tree shown above has 8 nodes, and the one at the top is the root. The 4 *nodes* along the bottom of the tree are called *leaves*. The 4 nodes that are not leaves are *internal nodes*. When a node has a branche downward to another node, it is called a *parent* or *mother* node, and the node at the end of this branch is called its *children* or *daughters*. A node is said to dominate another node if the second one is a descendant of the first one in the obvious sense (i.e. daughter of, or daughter of daughter of etc..). Two nodes with the same parent are called *siblings* or *sisters*.

We can read a lot of information off of the tree, repeated here:



- We can see that anything dominated by a single node is a unit of some kind (e.g. a word)
- we can see that *-al* takes N as a complement (that is as something that "completes" it) on its left to form an A
- we can see that *-ize* takes a (non-root) A on its left to form a V
- we can see that *-ation* takes a (non-root) V on its left to form a N
- We can see that the node V dominates all the nodes (A, -ize, N, -al, nation)

It is important to realize that the information in this tree is just a compact way to include all of the information given by the following set of trees:

An equivalent way of representing the information given in this tree is by means of the more compact labeled bracket notation:

[$_N$[$_V$[$_A$[$_N$ nation] -al] -ize] -ation]

These structural representations are useful in that they represent many claims at once in a compact way.

2.3.4 Selection and locality

Section §2.3.2 proposes that a speaker who can make sense of the word *denationalization*, especially a speaker who can make sense of the word even seeing it for the first time, must know 5 things, briefly repeated here:

1. how each morpheme is pronounced
2. what kind of morpheme it is (free, or else prefix, suffix,…)
3. if an affix, what it c-selects
4. if an affix, that the c-selected element must be adjacent
5. if an affix, what kind of thing results after c-selection

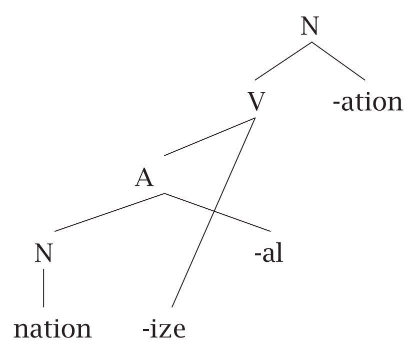
And we can see these things in the proposed lexical entries:

1	2	3	5
nation:	free		
-al :	suffix,	c-selects N,	to form an A (X-al means pertaining to X)
-ize:	suffix,	c-selects A,	to forms a V (A-ize means cause to be A)
de-:	prefix,	c-selects V,	to forms a V (de-V means roughly “make not V”)
-ation:	suffix,	c-selects V,	to form a N (V-ation refers to an event of V-ing)

But notice that the lexical entries leave something out. The lexical entries leave out the piece of knowledge 4, that the selected element must be next to the selecting affix! Why is this left out?

Notice that, from the perspective of our trees, 4 amounts to the requirement that the branches of a tree cannot cross. That is, we do not allow trees like this:

Never draw this!

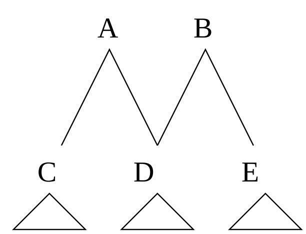


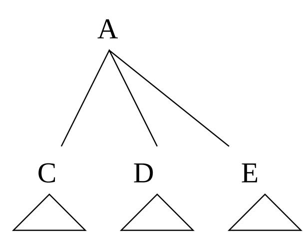
Branches cannot cross. What is this property? Our trees implicitly encode two distinct type of information. First they tell us what morphological subunits there may be to a given word. Anything dominated by a single node is a unit of some kind. But they also implicitly tell us that the leaves of the tree are temporally ordered. The prohibition against branches crossing is a principle about how complex units, i.e. elements made up of parts, can have their parts temporally realized. The requirement that branches do not cross is tantamount to the requirement that morphological structure be respected by the temporal ordering.

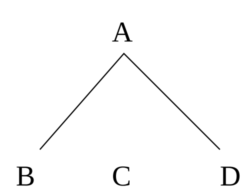
Infixes, circumfixes and supra-segmental morphemes, if there really are any, look like they might be counterexamples to this idea that branches cannot cross, that is the idea that morphological structure must be respected by temporal ordering, but really they are not, since infixes go inside the element they select, not on one side or the other. That is, they are never ordered between already combined morphemes. Infixes usually seem to want to be close to one edge or the other, and their temporal position seems conditioned **not by morphological properties or boundaries but by phonological ones.** Some recent theories claim that these elements are actually suffixes or prefixes which get pronounced "inside" their complements for phonological reasons (Prince and Smolensky, 1993).

There is another property that seems related to the relationship between morphological structure and temporal order. It seems that we never find morphological trees in which i. a given node has more than one mother ii. more than one node lacks a mother iii. A mother has more than two daughters

These situations would be exemplified by the following trees:







The non existence of these trees could be derived if temporal ordering "mirrors" morphological structure: A node with two mothers cannot be linearly ordered with respect to the rest of the structure in a consistent way. And the two nodes without mothers cannot be ordered with respect to each other.

Trees in general then obey the following conditions: i. Every node but one (the "topmost") has a mother ii. No node has more than one mother

At any rate, the idea that branches cannot cross appears to be correct.

We began with the observation that this property was not included in the lexicon, and now it is easy to see why. This property is not specific to any lexical item. Rather, it is a general property of how these linguistic structures are assembled.

There is another, related fact that is very important:

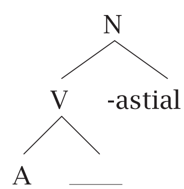
Affixes cannot c-select for something that they are not sisters of.

This is an empirical claim, but one that is slightly more abstract than the claim like (1) made previously. We can see that this one is true by what kind of information we needed to provide in all the lexical entries listed above. No lexical entry ever imposes a requirement on some part of the word structure that it is not a sister to. Because this claim is more abstract, depending on the correctness of our claims about lexical information, it is a little more difficult to defend, especially since, as we observed earlier, our proposed lexical entries are only approximate.

It may help to consider an affix that would clearly violate this locality claim. Let’s construct a hypothetical case. It would be an suffix, say *-astial* (very much like *-ation*) that could combine with a verb to yield a noun, but only if this verb was itself derived from an adjective.

-astial: suffix, c-selects V derived from A to form an N

Here is a diagram illustrating what such a suffix would do:



Such affixes do not seem to exist: to check whether c-selection is satisfied, we never need to look very far in the tree. Selection is checked in a **local environment**. Affixes never need to look down into the structure of the selected category. (We will get further confirmation for this idea below, in section §2.3.7.) As we will see in the following chapters, this simple hypothesis can be maintained through a surprising range of data, and has far-reaching consequences for our theory:

Locality of Selection Hypothesis (to be revised): Selection is *local* in the sense that an item can only select properties of its sister(s).

If this is true, as it seems, then we would like to know why this very general property is true. Informally speaking, it suggests that the information inside a unit, inside a constituent of a tree is opaque to the outside, as if it had been compiled. We will return to such questions much later (cf. e.g. cyclicity, strict cyclicity, super strict cyclicity and phases).

We always start by asking such questions as: how are things organized? Is it true that they are organized this way, or that way? Can we confirm that they are by types of experiments other than speaker's judgments? These are basic descriptive questions. Then we turn to questions of explanation: Why are these true things true? How should language be structured so that these true things must be true by consequences of the basic design?

2.3.5 Exercises

(1) **Word structure and lexical entries.** Consider these words:

(i) undeniability (ii) remagnetize
(iii) post-modernism (iv) disassembled

For <u>each</u> of these words

a. list all the morphemes in the word

b. give lexical entries for each morpheme in the simple style shown on page 20

c. draw the tree representation of the word structure

d. say how many nodes are in the tree

e. say how many leaves are in the tree

(In this and all problems, briefly comment on anything that seems especially tricky or unclear.)

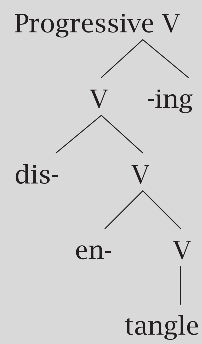
Example. For the word *disentangling*.

a. Four morphemes: dis- en- tangle -ing

b. Lexical entries:

dis-: prefix, modifies V, stays V (dis-V means to make not V)
en-: prefix, modifies V, stays V (en-V means to make V)
tangle: free, V
-ing: suffix, c-selects V, forms a progressive V (V-ing signifies happening now)

c. Here is a tree:



d. This tree has 8 nodes

e. This tree has 4 leaves

(2) **Plurals, affix order, and locality.**

a. We might call someone who thought that the most important thing in linguistics was classification, a "classificationist." There are three Ns in the structure of *class-ifi-cation-ist*, the noun *class*, the noun *classificiation* and the noun *classificationist*. Draw a tree structure for this word that has three nodes labeled N.

b. The plural morpheme *-s* c-selects for N, as we see for example in:

$[_N$boy] -s   *$[_A$angry] -s

So we might expect that in *class-ifi-cation-ist*, any of the three Ns could either be plural or not. That is, we would expect all of the following eight forms to be good, but in fact, only two of them are possible:

ok: class -ifi -cation -ist	(singular,singular,singular)
ok: class -ifi -cation -ist -s	(singular,singular,plural)
*: class -ifi -cation -s -ist	(singular,plural,singular)
*: class -ifi -cation -s -ist -s	(singular,plural,plural)
*: class -es -ifi -cation -ist	(plural,singular,singular)
*: class -es -ifi -cation -ist -s	(plural,singular,plural)
*: class -es -ifi -cation -s -ist	(plural,plural,singular)
*: class -es -ifi -cation -s -ist -s	(plural,plural,plural)

That is, we can only pluralize the whole word, and when we do that, the plural morphology must of course attach to the whole word and appear at the right edge, since branches cannot cross. We should be able to explain why can't we pluralize the nouns *class* or *classification* in this word.

One possible explanation could be this: The impossible forms would be excluded if *class -es* and *classification-s* were not nouns, but some other category, say Pl (for Plural). So then *-s* would be a suffix taking a N as sister and turning it into a category called Pl. Since -al takes a N as sister, it could not affix to nation-s.

Draw the tree for *class-ifi-cation-ist-s* using the category Pl, and write the lexical entries for all the morphemes in this word structure.

c. List at least 4 other possible English words (words formed from a root and affixes) that have more than one noun in them, and for each, say which nouns can be pluralized. (If you are not an English speaker, check with an English speaker to make sure your claims about the possibilities for plurals are right.)

d. Is it plausible that plural nouns and singular nouns are really different categories? To answer this,

   i. list at least two different frames where plural nouns but not singular nouns can occur.

   ii. Are there any suffixes that select Pl?

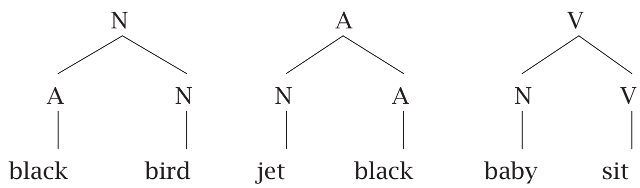
2.3.6 Compounds

We have switched from talking about words to talking about morphemes. Now we can see that many of the things that we pre-theoretically call words are actually complex. We do not call the affixes words because they are bound morphemes, while words are "free." That is, they are relatively independent of the morphemes that occur on either side of them. Some words are simple, that is, free morphemes, but many other words are complexes of roots and affixes.

It is also possible to obtain words by combining words. These are called *compounds*. In English, compounds are sometimes written with spaces or hyphens between the elements, and sometimes there are no spaces or hyphens. Sometimes the meanings of the compounds are *idiomatic* (not predicted in regular ways by the meanings of their parts), and sometimes they are compositional (meanings determined in the usual way by their parts).

compound	category	idiomatic?
babysit	V	yes
bartend	V	no
part supplier	N	no
anti-missile missile	N	no
kitchen towel rack	N	no
writer club address list	N	no
boron epoxy rocket motor chamber instruction manual	N	no

When we look at these English compounds, we notice a striking pattern:



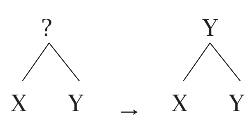
The category of the compound word is determined by the category of the right hand member: thus *blackbird* is an N, not a A, by virtue of the fact that the right hand member of the compound is N. This property is referred to as the Right Hand Head Rule(Williams, 1981) . We call the element that determines the category of the compound the head:

Definition: The head of a constituent is the element that determines the properties of this constituent.

Informally speaking, we can say that the properties of the head are the properties of the whole. This notion of head plays a central role in morphology and in syntax.

The English right hand head rule (RHHR): the rightmost element of a compound is the head of the compound.

More abstractly, then, in a structure of compound, the properties of the compound word are predictable from the right-hand head rule, as illustrated below:



Thus, the language learner does not have to learn for each new compound what category it has: this is determined by the basic property of the morphology that we have expressed in the RHHR.

The rightmost element determines not only the category of the compound, but in fact, other properties of the compound as well. Notice that the right hand element determines whether the compound is singular or plural in English:

towel racks, sail boats	(plural)
parts supplier, salesman	(singular)

In languages in which nouns are marked for gender, like German, it is the right hand member of a compound that determines the gender.

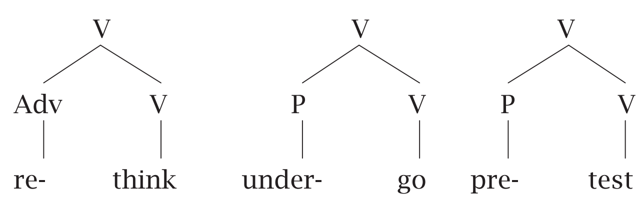
der Tisch	'the table, the desk'	(masc)
die Lampe	'the lamp'	(fem)
die Tisch Lampe	'the desk lamp'	(fem)

The right hand element also determines the basic semantic properties of the compound. For example, an apple pie is a type of pie, and jetblack is a type of black, and a blackbird is a type of bird. This takes us again to the distinction between modifiers and modifiees. In all these cases, the rightmost element is the head, that is what is being modified, while the leftmost element modifies it and acts as a satellite of this head.

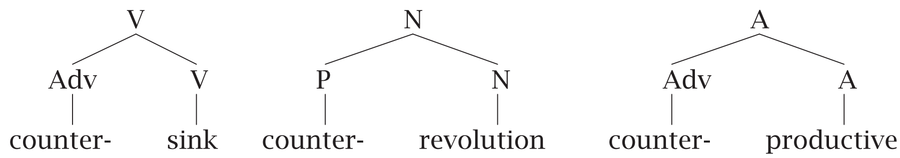
2.3.7 The categorial status of affixes

We might ask if the Right Hand Head Rule is specific to compounds, or if it applies more generally, to all complex words. Suppose we have a complex (=non-root) word whose rightmost morpheme is a suffix. If the RHHR applied, this suffix should determine the properties of the derived word and in particular its category. If it is a prefix, it should never determine the properties of the complex word. Reviewing all the English examples discussed above, this seems to be the case. Consider the lists of English suffixes on pages 21-22. We see that many suffixes change category, and those that do not change category often change meaning significantly. For example, *-er* changes V to N in *killer*, and while *-hood* does not change category in *neighborhood*, the meaning is changed significantly. A neighbor is a person, but a neighborhood is not.

With prefixes, on the other hand, the situation is quite different. Prefixes seem not to change the category of the stem that they attach to, and it is for this reason that it is difficult to determine their category. Perhaps *re-* is an adverb; its meaning is similar to *again*. And *pre-* which may be a P, similar to *before*.



Another example is the following:

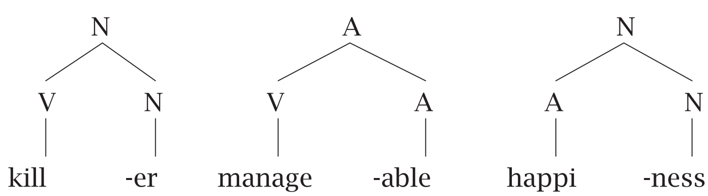


In each case the category of the result is entirely determined by the rightmost element, not by the prefix.

de-	combines with V, stays V	de-activate, de-generate, de-foliate
re-	combines with V, stays V	re-do, re-elect, re-subscribe, re-invent
anti-	combines with N, stays N	anti-Democrat, anti-climax, anti-matter
un-	combines with V, stays V	un-do, un-wrap, un-tie, un-
post-	combines with A, stays A	post-modern, post-graduate
dis-	combines with V, stays V	dis-entangle, dis-bar, dis-believe
under-	combines with V, stays V	under-go, under-coat, under-expose
ex-	combines with N, stays N	ex-marine, ex-husband
pre-	combines with A, stays A	pre-mature, pre-natal

It is reasonable to conclude that prefixes stand in a different relation to the stems they attach to than suffixes do. So let's say that prefixes are "modifiers" of those stems, in a sense that we should come back to explore further.

Suffixes, on the other hand, are able to change the category, and they occur on the right side. So they seem to obey the Right Hand Head Rule. This strongly suggests that each suffix is of a particular category and transmits its category to the whole word, exactly as in compounds: If these suffixes themselves have categorial features as well , i.e. suffixes are bound lexical categories (*-er* is a N, *-able* an A, and *-ness* a N) , since they occur in the head position of the derived word they form when affixed to a stem, the resulting word will have the same category as the affix by the Right Hand Head Rule:

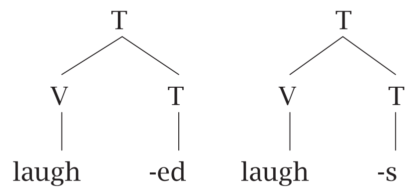


We conclude that suffixes are like words: they belong to particular categories. Thus *-er* is a noun, which is a bound morpheme, meaning something like "who Xes", or "what Xs", not a free morpheme like [$_N$book]. And *-able* is a bound A (meaning something like "which can be V-ed", and *-ness* is a bound N (the fact of being A). We accordingly extend the RHHR from compounds to all words:

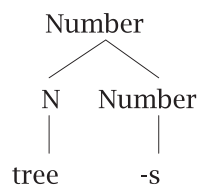
The English right hand head rule (RHHR): the rightmost element of a word is the head of the word.

This perspective on affixes extends even to the so-called *inflectional affixes*, those that mark singular/plural, and tense. (Some other languages have inflectional affixes marking case (nominative/accusative/genitive/etc.), agreement, noun class, etc.) These affixes tend to appear outside of the other, "derivational affixes" which were the focus of attention in the previous sections. But it appears that our account of derivational affixes extends straightforwardly to inflectional affixes. For English, the Right Hand Head Rule, if fully general, predicts:

- past tense *-ed* is of a certain category (say, the category T for Tense)
- a past tense verb is of also of this same category (T)



Similarly, we are led to postulate that plural -s is of the category Number



We can now put the account of affixes together. Suffixes like *-er* can be given the following simplified lexical entries (leaving the meaning specification aside):

er,	bound,	N,	c-selects for V,	(meaning)
able,	bound,	A,	c-selects for V,	(meaning)
s,	bound,	Number,	c-selects for N,	(meaning)

It is a property of heads that they determine the environment in which they occur: heads c-select for their sisters. In words and compounds, heads occur in the rightmost position, it follows that complex words with *-er* will surface as V-er (*manag-er*, and not like **er-manage*, *manag-able*, not **able-manage*).

The lexicon no longer needs to say what category is formed by the suffixes, since it is always just the category of the suffix itself. Note an asymmetry between c-selectors. A suffix S c-selects its complement C and S is the head of the resulting C+S combination. A prefix P may c-select its complement C but it is the complement which is the head of the result of P+C.

On page 27, we promised some additional support for the locality of selection hypothesis in this section. Consider again the properties that English suffixes select for. These include not only the category of the sister, but also whether the sister is a root, or whether it is the member of a a particular subcategory. For example, *-al* selects a N that is a root or a latinate noun ending in *-ion,-or,-ment*. Notice that these are properties determined by the head of the N, when it is complex, and never properties of the non-head constituents of the N. Consequently, it is plausible that these are properties of the N as the locality of selection requires.

2.4 Apparent exceptions to the RHHR

There are some apparent exceptions to the RHHR which deserve attention. Some may turn out to be real once we understand how they work, but others are only apparent. We discuss a few cases here.

2.4.1 Conversion

Probably the most frequent single method of forming words in English is by conversion or zero derivation. Conversion creates new words without the use of a "visible", or "pronounced" affix.

noun	derived verb
father	father
butter	butter
ship	ship
nail	nail

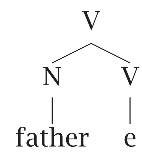
What is the relation between the noun *father* and the verb *to father*? The noun *father* is one morpheme and a noun. It therefore has the same representation as other nouns. The word *to father* is also a *verb*. Following our conventions, we can write:

$$\begin{array}{c} \text{N} \\ | \\ \text{father} \end{array} \qquad\qquad \begin{array}{c} \text{V} \\ | \\ \text{father} \end{array}$$

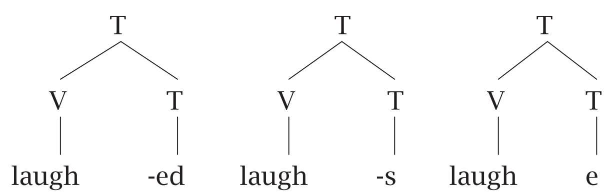
As we have done before, we can combine these two representations into one, giving an equivalent representation of these two trees:

$$\begin{array}{c} \text{V} \\ | \\ \text{N} \\ | \\ \text{father} \end{array} \qquad\qquad \begin{array}{c} \text{N} \\ | \\ \text{V} \\ | \\ \text{father} \end{array}$$

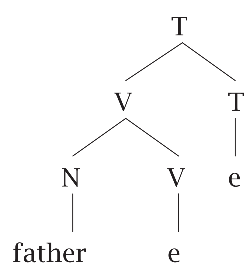
Each of these say that the word *father* is either a N or a V, or a verb that is a noun or a noun that is a verb, that is both a verb and and a noun. An alternative is to suppose that the verb is derived from the noun (or vice versa - this needs to be argued for) by postulating a silent affix: We can suppose that the verb *father* has a verbal head, but one that is silent. By the right-hand head rule, this head must be a suffix; it must be in the right-hand position. We will represent this silent verb head by *e*, where by convention, *e* denotes something that is phonetically *empty*, not pronounced.



The alternatives are to say that *father* can be a verb, or both a verb and a noun simultaneously without any affixation. Why say that there is a silent V in these cases, rather than these alternatives? First, it seems eminently reasonable to suppose there are silent morphemes in other cases as it allows us to simplify our picture of word structure in a number of respects. One such case is the present tense morpheme. Postulating a silent present tense morpheme allows us to say that just as *laugh-ed* and *laugh-s* have the category tense (T), the present tense form *laugh* has the same category:



The same would go for the present tense form of the verb *father*: the empty V c-selects for N as its sister, and then T c-selects the V as its sister, as we see in in the tree representation below:



Note that *-ed*, as a bound morpheme, needs to be affixed to something that is pronounced. As long as the V sister of *-ed* above has some phonetic material in it somewhere, the *-ed* suffix counts as bound.

But the strongest reason we will give here is the following: If verbs such as *father*, *wet*, *dry* etc which are respectively related to the noun *father*, or the adjectives *wet* and *dry* are derived by affixation of a silent morpheme, it means that they are not roots: they are complex. This makes a prediction: no affixes that attach only to verb roots should be able to attach to these elements. This seems to be true:

steer-age	*wet-age	*dry-age	*father-age
betray-al	*wet-al	*dry-al	*father-al
defi-ant	*wet-ant	*dry-ant	*father-ant
annoy-ance	*wet-ance	*dry-ance	*father-ance
forget-ful	*wet-ful	*dry-ful	*father-ful
restrict-ive	*wet-ive	*dry-ive	*father-ive
establish-ment	*wet-ment	*dry-ment	*father-ment
advis-ory	*wet-ory	*dry-ory	*father-ory
assembl-y	*wett-y	*dry-y	*father-y

These results are all "negative", in the sense discussed earlier. That is, they are cases where a certain kind of combination turns out not to be possible. What is important here is that this failure is **predicted** by the silent affix proposal. Failure by itself is uninformative but a theory that predicts this failure is (although it is of course not demonstrative, it is not a proof in a mathematical sense, but rather a strong presumption).

If we adopt the silent affix approach, many facts make sense. For example, silent affixes often contribute to the meaning of a word in exactly the same way as pronounced affixes. We find, for example, both silent and pronounced causative affixes:

wet	‘to make wet’
dry	‘to make dry’
empty	‘to make empty’
short-en	‘to make short’
normal-ize	‘to make normal’
domestic-ate	‘to make domestic’

What makes this comparison even more interesting is that adjectives like *wet, dry, empty*, which combine with the empty causative, never also combine with pronounced causatives (Beard, 1998):

* wett-en	* wet-ize	* wet-ate
* dry-en	* dry-ize	* dry-ate
* empty-en	* empty-ize	* empty-ate

And furthermore, the words that take pronounced, “overt” causative affixes typically do not also allow the empty causative affix (though *short* occurs as a V with another meaning):

* She shorts the dress
* She normals the distribution
* She domestics the animals

These latter facts can be explained by the assumption that words rarely allow two different causative affixes, just as they rarely allow two different plurals, or two different past tense forms.

Another question that we may ask is why we do not start with the verb *father* and derive the noun father by adding a silent head noun as affix. *A priori*, this is an equally viable option and one that is also consistent with the RHHR. Other reasons need to be brought to bear on this choice. For example, perhaps the meaning of the verb is more complex, seems to include that of the noun but not vice versa. Thus, the noun concept may be more primitive that the verb concept (for example, the buttering literally means spreading butter; while butter need not be defined in terms of buttering: the object butter can exist without there being any buttering but the converse is not possible).

Another reason is that the verbs would be roots and some of them should sometimes allow the affixation of root taking affixes, contrary to what we just saw.

For some compounds in English, none of the audible morphemes appear to determine the properties of the compounds as a whole (These are referred to as bahuvrihi compounds or as exocentric compounding):

cutthroat daredevil redhead

The word *cutthroat* is a either a N (meaning a killer), or an A (meaning aggressive, murderous), but it is not a kind of throat. And the word *redhead* does not mean a type of red, nor a type of head, but rather a person with red hair. The question is how these compounds should be represented. We could assume that they have the following representations (to be revised below):

The idea that some parts of language structure may be unpronounced is a theoretically important one, and we will use it in the syntactic theory of the following chapters as well, so it is worth reflecting on the role this hypothesis plays in the theory.

2.4.2 Exercises

(1) **Compounds.** Consider these words:
(i) noun compound formation rules (ii) heavy metal superstar
(iii) web browser software monopoly (iv) fish-food-like

For <u>each</u> of these words

a. what is the category of the whole word?

b. give one distributional justification supporting your answer to the previous question

c. draw the tree representation of the word structure in the style shown in sections §§2.3.6-2.3.7, showing categories for suffixes.

(2) **AHHR.** Consider a language called Ahenglish which maximally resembles English except that

(AHHR): If head X c-selects Y and Y is complex, then X and Y are not adjacent (they are "on opposite sides").

Translate the following 4 words into Ahenglish:
(i) undeniability (ii) remagnetize
(iii) fish-food-like (iv) web browser software monopoly

2.5 Morphological Atoms

We have reached rather abstract conclusions about the nature of the morphological atoms, namely that they are morphemes - minimal units of meaning - and they can sometimes be silent.

First, it may turn out that defining morphemes as minimal units of meaning is not right. For example, Case endings such as nominative or accusative in languages such as Latin or German, or Case particles such as Japanese -ga or -no do not obviously have meanings attached to them. If true, this may leave us without a definition of the atoms of Morphology. Is this a problem? Not necessarily: we are constructing a psychological theory, not a mathematical theory. One burden that a psychological theory must meet is the following: it must explain how speakers come to discover what the relevant units are which are used by their language system. As long as we provide a reasonable procedure for speakers to discover what the minimal units of morphology are, even if some of them are silent, we are meeting this burden. For example, silent morphemes can be immediately inferred from the RHHR and the alternation *father* as a Noun vs. *father* as a verb. A speaker can immediately (unconsciously) conclude that one of them is suffixed with a silent morpheme providing it with its categorial properties. Similarly, **paradigmatic variation** (i.e. the fact that the "same" noun can appear with either Nominative or Accusative case) probably suffices to infer the existence of Case suffixes even if they lack any meaning of their own. Similar considerations apply to the learning of category membership for bound affixes: this can immediately be inferred from the RHHR.

It should be kept in mind that the atoms of morphology can sometimes be quite opaque (but this is not a problem as long as there is a reasonable procedure to discover them). For example, the past of the verb *go*, which is *went*, is plausibly composed of a verbal root V and a past Tense suffix: **went = Vroot + Past.**

This combination just happens to be irregular. It is an **idiom** and is pronounced without audible subparts. The existence of such idioms makes the task of discovering the ultimate atoms of Morphology much harder: they show that there is no one to one correspondence between sound units and meanings or morphological units. Since we now know that it is in principle possible for any word which does not look or sound composed of more than one unit to be so composed nevertheless (just like *went*). A number of current proposals suggest that the verb *kill* actually **is** composed of (at least) two morphemes.

2.6 Conclusions

We have proposed that speakers can understand complex words like *re-write*, *un-natur-al*, *de-nation-al-iz-ation* even if they have never heard them before, if they know the meanings of the morphemes and if they understand how morphemes can be assembled in English. This is a kind of "compositionality," an idea about the importance of considering what words are composed of. We can express the hypothesis this way:

Compositionality in morphology: the properties (morphological, syntactic, semantic) of (at least some) complex words are determined by their parts and how those parts are assembled.

When we put morphemes together, we have seen that some morphemes like *-al* are very precise about what they will combine with, while others like *-er* and *re-* are not very demanding at all. A morpheme that can combine with a wide range of things is said to be *productive*. The English affix *-al* is not very productive, while English noun compounding is very productive: almost any sequence of nouns can be a compound.

The existence of productive affixes in a language opens the possibility for *recursion* in the morphology of the language. That is, there can be words of a given category that have other words of exactly the same category as a proper part; the category can *recur* more than once in a single word. This happens in English noun compounds, obviously, but it also happens to a slightly more limited extent in affixation. For example, you can *re-do* something, and sometimes you have to *re-re-do* it. After that, it begins to sound silly, but one might even say that you have to *re-re-re-do* it. Similarly, from *denationalization*, we could form *denationalizational* (pertaining to a denationalization), and *denationalizationalize* (making it so) and *denationalizationalization* (the process or result of making it so) and so on... It seems that the language does not have any kind of rule that draws a sharp line that says that two prefixes is allowed, but three is not, or anything like that. Rather, the language seems to allow any number of affixes, or any number of words in a compound, and the reason that we do not find words with a billion prefixes or a billion nouns in them is explained not by rules of grammar but rather by non-linguistic factors like the limitation of human memory, human attention span, limitations in human life, or just limitations in human sense of humor. In any case, we have this very powerful kind of structure in words:

Recursion in morphology: Morphology can have recursive affixation and recursive compounding. When this happens, the language has infinitely many words.

How can this be? If humans are finite, how can they know languages with infinitely many words? This is possible because complex words can be understood compositionally, on the basis of lexical entries for finitely many morphemes. This very important idea applies even in the theory of word structure.

2.7 Summary

Here are some important conclusions in a nutshell.

1. The linguistic signal is discrete at various levels phonology, morphology, syntax. At each level, we have (perhaps different) atoms and rules combining these atoms.

The rules of morphological combination, the morphological combinatorics, have the following properties:

2. they are recursive: they can be produce infinitely long strings 3. they are compositional 4. they produce tree like structures 5. they use notions such as head and selection 6. The notion of selection used is local: it is sisterhood in a tree

To get to these conclusions, we started by looking at words, but this notion does not play much of a role in the end. This is fortunate since we do not know exactly what words are. What matters more, it seems, are morphemes. Morphemes are (mostly) semantic atoms that have categories. Morphemes can c-select and modify other elements. In a string formed from more than one morpheme, the morpheme that is the head of this string plays a determining role.

You should know what we mean by *morpheme*, and what we mean by *bound* and *free* morphemes. You do not need to memorize the suffixes of English, but given examples of words containing (derivational or inflectional) suffixes or prefixes, you should be able to provide the *lexical entries* for their morphemes, and explain why certain morphological forms turn out the way they do. You should be able to draw the hierarchical, compositional structures of words with *tree diagrams*. You should understand the notion of *head*, and the properties of heads. Heads determine the properties of the constituents they form. Know the *right-hand head rule (RHHR)* for English. Heads c-select for their dependents (i.e. heads select for the category of the element they combine with). You should know what *selection* and *c-selection* mean, how to determine the *(c-)selection* property of a particular morpheme, and how *(c-)selection* translates into a local tree configuration. You should understand the reasons for concluding that some morphemes are silent.

As we will see, syntax builds units in much the same way as morphology (selection is local, heads determine the category and properties of the constituents/phrases they are part of), but superficially differ in the following ways:

- syntax builds and manipulates phrases
- morphology uses stems and roots, not phrases: *[[the bar] tend]
- the c-selected element in morphology precedes the head (*baby sit*), while in the syntax, it follows. (*I saw my little sister*, and not **I my little sister saw*).
- finally, syntax is slightly more opaque than morphology because various kinds of "distortions" can make it appear that selection is not local.

There is much more to say about morphology, and we will have to return to some of these issues later, but we now turn our attention to more these complex syntactic objects: phrases. If you want to read more about morphology, the following works provide some good starting places: Baker (1988), Di Sciullo and Williams (1987), Fabb (1988), Gordon (1986), Selkirk (1983), Spencer and Zwicky (1998), Williams (1981).

3

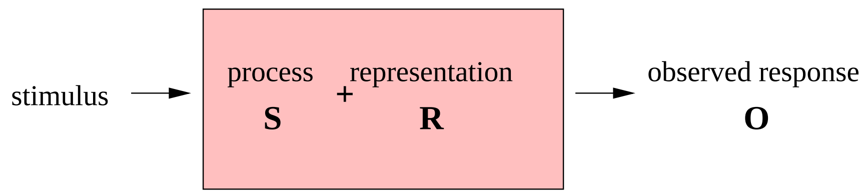
Syntactic analysis introduced

Typical human language users have a remarkable ability to analyze sounds and other gestures in a certain very sophisticated way. One of our main goals in studying language is to understand how this is done, and how this ability arises in the human mind. This conception defines our field of linguistics as a branch of cognitive psychology. Of course, cognition depends on neurophysiology, and neurophysiology depends on the physics of organic matter, and so linguistics is ultimately part of the scientific study of the natural world. Like these other sciences, it is experimental.

One of the ways to study language is to look first at an organism's linguistic "input" and "output." Examining the input we can explore, in the first place, the physical properties of linguistic signals. The relevant output includes our linguistic behavior, but also all the other changes and behavior that are caused by language: what we say, how we say it, how we react to what we hear, etc. From these, we can infer something about the distinctive contribution made by the organism, and ultimately something about how the distinctive biological and cognitive properties of the organism make the acquisition and use of language possible.

From this perspective, our first assumptions about morphological structure are already surprising. For example, suffixes are not readily detectable in the input, when they are there at all. When suffixes are pronounced, they are always pronounced with other things, and in fluent speech there is no generally present acoustic boundary between stems and affixes. To make matters worse, there is reason to say that some suffixes are not pronounced at all. So any properties of affixes must be inferred by some kind of analysis of the linguistic input that we can perform. Recall that auditory input is just a slight variation in air pressure that can be detected by the eardrum, and visual input is a pattern of light hitting the retina. Neither air pressure variations nor arrays of light intensities and colors explicitly present words, affixes, nouns or adjectives, tense or plural affixes. The step from the perceived signal to the linguistic description is a very significant one. The same is true in vision generally: the step from an array of light colors and intensities to the recognition of object edges and shapes and movements is a very significant one, and it is something we can do effortlessly even when parts of the objects are not visible.

The basic strategy for studying language and other cognitively mediated behavior is roughly as follows. Suppose that we think that the cognitive agent has some internal representation or state R that is causally involved in the production of certain behaviors. We can only study such a thing by looking at how it influences or is influenced by other things; so we look for or set up some situation in which we think R will interact with other systems or processes S, the choice of which is only limited by our ingenuity in designing informative experiments. In that setting, we observe what happens, call it O. Our conclusions about R come from reasoning about what it must be in order to explain the fact S+R⇒O. Clearly, this reasoning is indirect, and so it is very important to look for converging evidence on the nature of R, evidence coming from a wide range of interactions S and results O. Little by little, we get an idea of how the R is structured, and we can then consider why R would be structured in that way.



3.1 Word order

The experiments we conduct here are perhaps surprising at first. We will take a linguistic string, say a word, or a phrase of several words, and we ask speakers certain questions about it. Then we continue by distorting it in some way and we ask speakers what they think of the result, what they think of the distorted string? We then try to attribute structure to this string in order to have an explanation of why speakers have the judgment that they have, and we consider as wide a range of strings and distortions as possible.

We have already seen this in the judgments about morpheme sequences used in the last section. When speaking English, a native speaker of English produces words and morphemes in a particular order. The affix *-al*, of category A, must follow the N, say *nation*, to which it affixes. Distorting the structure by reversing the stem and affix results in something unacceptable, something that would not occur in a typical conversation, something that would produce a "startle" reaction in a typical English-speaking listener if it were placed in an otherwise ordinary context:

ok: national * alnation

Even though speakers recognize words and sentences without really thinking about them, it is easy to make them aware of the fact that they know that words must occur in a certain order. To take another example, consider a typical English speaker confronted with the following strings:

(1) a. The clever snake disappeared into a hole in the ground
 b. Hole into disappeared ground the the in clever a little
 c. The snake clever disappeared into a hole in the ground
 d. Le serpent malin disparut dans un trou dans le sol

An English speaker will judge a as fine i.e. fully acceptable, b as incomprehensible, c as possibly comprehensible but not quite well formed, and d as human speech but not much else (for speakers who do not know French: d is a translation of a into French). The differences between a, b and c are (possibly among other things) judgments about word order, and they are the kind of thing that our theory of syntax should explain. How do we account for the fact that only certain linear orders of words are acceptable? What is it that speakers know, perhaps tacitly, unconsciously, that explains this?

There is a familiar line of reasoning about this, which can be expressed in the following point-counterpoint fashion:

First idea: People remember things, and so there is no particular mystery about their language abilities. They have heard many words, and many word sequences, and they can remember them, or at least a very large number of them. Whenever they speak, they pick one of them that corresponds to what they want to say. They will judge a sentence as unacceptable if they think it is not something they have heard (or at least not very similar to something they have heard). An extreme form of this reasoning would postulate that speakers have somewhere in mental storage all of the sentences of their language (and perhaps even of all languages ever spoken).

Rebuttal: There are infinitely many well-formed phrases in the language. We can see this by the fact that, given any acceptable phrase, we can make a longer one that still conforms to the grammar:

the book
the book on the chair
the book on the chair in the library
the book on the chair in the library on the hill
the book on the chair in the library on the hill by the quad
…
I am happy
I think I am happy
you say I think I am happy
Bill knows you say I think I am happy

I heard Bill knows you say I think I am happy
...
John left
John and Bill left
John, Harry and Bill left
John, Bill, Harry and the Frenchman who painted the living room left
...

All strings could not be stored in memory because we would need infinite storage capacity, and we usually assume that humans are finite discrete (that is not infinitely fine grained) creatures, with finite memories.

Unconvinced: We can agree that speaking or understanding is not just a matter of selecting the right strings in a mental storage containing all possible strings of a given language (or of all possible languages). This would indeed seem to require infinite storage capacity. But the phrases that any human could actually speak or understand are bounded in length. No human will ever be capable of even listening to a sentence that is a billion words long, let alone making any meaningful judgment about whether it is acceptable or not; so can we really draw an important conclusion about human language abilities based on the idea that language is infinite? Any human never manipulates more than a finite number of strings in a lifetime; it is in principle imaginable that speakers have in mental storage at least all the strings used in their lifetime perhaps because they have heard them before (otherwise, this state of affairs looks suspiciously like a colossal coincidence).

Better rebuttal: When you look at human language use, it is true that some utterances are repeated frequently (like *How are you?*, and *I'm fine thank you*). But when we study the matter more carefully, we find that the number of sentences that people actually produce is very large, so large that if you count all the sentences people say, well over half of them are sentences that will only ever be spoken or written once.

One way to see this is in studies of the large bodies of texts which are electronically accessible. These texts are not literal transcriptions of what people say, of course, but they provide a reasonable representation of the kinds of things people might say or read and judge to be acceptable. For example, one collection of texts that linguists have studied is called the "Penn Treebank 2" (Marcus, Santorini, and Marcinkiewicz, 1993), a collection of more than 1 million words of text, mainly from the *Wall Street Journal*. It turns out that in this large collection of articles and other texts, more than 99% of the sentences occur only once. In spite of that, in spite of the fact that most sentences you read in the newspaper are ones that you have never seen before (and ones that you will never see again), they are acceptable, and indeed intelligible.

So the idea that the acceptable sentences are the ones you remember hearing before does not even close to right.

Convinced, but with another proposal: OK, so let's agree that speakers do not judge acceptability or understand sentences just by remembering them. But we have already seen that words fall into categories, so maybe, instead of remembering the sequences of words that they have heard, they remember frames e.g. the sequences of categories that they have heard before. For example, hearing

The dog chased the cat

the speaker remembers that a sentence can be formed from the sequence D N V D N, and from

The cat scratched the dog on the nose

the speaker remembers that a sentence can be formed from the sequence D N V D N P D N, and so on. A sentence is judged acceptable only if it has a sequence of categories that has been heard before. Note first that this does not reduce the number of strings to remember (this can be proved) so it would help for the know-all-strings-of-all-languages hypothesis.

Not good enough. This idea cannot be right either. First of all, it is just not true that any sequence D N V D N is an acceptable sentence:

*Those air put a compliments.

And in the second place, there are many sequences of categories that are so rare that you will hear them only once if at all, and nevertheless they can be acceptable and meaningful (this is bound to happen since there are infinitely many such sequences).

Furthermore, we want to explain not only judgments of acceptable vs. unacceptable, our ability to interpret these structures and recognize relations between them, but we also want to explain the gradient in between perfectly acceptable and totally unacceptable. No theory with any hope of explaining these things starts with the assumption that judgments are based on remembered category sequences!

What seems to be required as a minimum is the hypothesis is that linguistic knowledge involves recursive rules that are not sensitive to properties like length: among the properties of the linguistic engine, there exists finite devices that allow strings of morphemes to be infinitely long **in principle** even though there are finitely many morphemes in a language and even though this does not happen in reality.

From the simple ideas of this argument, we will now try to work our way towards a more adequate account of what each speaker knows about his or her language. We proceed incrementally, beginning with relatively simple ideas and then developing them as necessary. Our focus will be on syntax, which is, roughly, matters having to do with the order of words and morphemes in phrases.

3.2 Constituency

One idea that comes up in the little argument above is that, in acceptable English sentences, certain types of strings can be iterated any number of times. For example, watch the sequence of categories in these sentences:

I saw the book	pronoun V D N
I saw the book on the chair	pronoun V D N P D N
I saw the book on the chair in the library	pronoun V D N P D N P D N
I saw the book on the chair in the library on the hill	pronoun V D N P D N P D N P D N

It seems the sequence [P D N] can be repeated, iterated, any number of times. As far as the structure of the language is concerned, we can always add one more. (Of course, we will always stop before a billion words, but this is for reasons that are not linguistic.) Note that we cannot iterate just P D or D N.

I saw the book	pronoun V D N
* I saw the book the chair	pronoun V D N D N
* I saw the book on the chair in the	pronoun V D N P D N P D
* I saw the book on the in the chair	pronoun V D N P D P D N

What explains this? It seems that P D N forms a kind of unit that has special properties, such as the possibility of being repeated in certain contexts.

One of the fundamental discoveries about the syntax of natural languages is that languages are *chunky*: words are organized into chunks or blocks or units that "rules" (such as the iteration rule we just mentioned) can manipulate as blocks. We have already encountered chunkiness: the spoken linguistic signal – a complex, slight fluctuation in air pressure – is segmented into chunks by our nervous system.

The *phonemes* are relatively small chunks; *morphemes* tend to be bigger (but they are sometimes pronounced with just 0 or 1 phoneme!); a *word* can be a complex of many morphemes; and a *phrase* like *P D N* is bigger still. In the previous chapter (chapter **??**), we depicted the morphological structure of complex words by putting the morphemes that form a unit under a single node in a tree representation. We can depict the composition of syntactic elements into larger ones in the same way, as we will see.

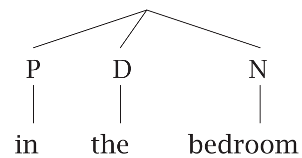
This will be our initial focus: constituent structure, what ingredients go into building constituents, how to test for constituency, and how to interpret problems with the constituency tests. Here, we take the first step of trying to get a first idea of what there is, how sequences of morphemes get organized into constituents, "chunks." In subsequent chapters we will try to understand why the complexes are organized in these ways.

We begin with a simple, preliminary definition:

Definition: a *constituent* is a string that speakers can manipulate as a single chunk

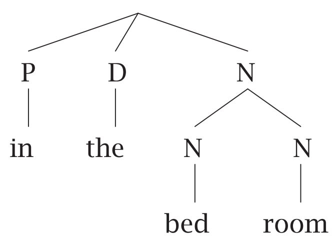
Notation: if a string of words or morphemes is a constituent, we will represent this constituency by grouping all the words of morphemes in this constituent as daughters of a single mother node in a tree representation.

Example:



equivalently: $[[_P\text{in}][_D\text{the}][_N\text{bedroom}]]$

There is structure here that we are not representing. One thing we have seen is that *bedroom* is morphologically complex:



equivalently: $[[_P\text{in}][_D\text{the}][_N[_N\text{bed}][_N\text{room}]]]$

This is not an innocent difference. One question which will become relevant later is this: which of the two trees is relevant for syntactic analysis. If the first, then it would mean that syntax does not care that *bed room* is composed of two nouns, it never needs to look inside this kind of words or inside words in general. If the second, then syntax does care. We will see that at least in some cases, syntax does care about the morphemes that are inside of what we usually regard as single words.

To begin the search of how things are, we will try to partially answer some of the following questions:

- What are the constituents and how do we determine what they are? What are the basic elements of syntax, the "syntactic atoms"? How do we go about deciding? In the case of morphemes and words, we had access to fairly reliable judgments about where the boundaries between constituents were. These judgments were supported by distributional properties of words and morphemes. Judgments are less secure when it comes to larger syntactic constituents (although with practice, things improve). We will use all sorts of tools to discover constituency.
- Do constituents cluster into subgroups, and how do we determine subgroup membership? In the case of morphology, we saw that both

morphemes and stems or words cluster in subgroups according to which category they belong. In the present case, we have the same question. Do syntactic constituents fall into nameable subgroups with significant common properties? A further question is whether these categories are new or if they are the categories we have already seen in morphology. Anticipating our conclusion, we will discover that there is a small set of syntactic constituent types, and that new labels are needed, as syntactic constituents do not behave like word or morpheme level categories. We will see that coresponding to the word level categories A, N, V, P, D, C, T, Numb,.. there are syntactic constituents of type AP, NP, VP, PP, DP, CP, TP, NumbP, .. (in which the P is read *phrase*, so that a DP is a Determiner Phrase). We will need to explain why we have such a correspondence, and we will also discover that there may be other other constituent types.

Note on syntactic productivity. In the previous chapter (chapter **??**), to get a sense of how constraining the rules of morphology are, we observed that there is only one ordering of the morphemes in *denationalization* that yields a possible word of English. To get an analogous perspective on the syntactic restriction on phrases, consider the following sentence:

this girl in the red coat will put a picture of Bill on your desk before tomorrow

This sentence has 17 words. There are 17!=355,687,428,096,000 possible reorderings of these words. How many reorderings of these words are also good sentences? It might seem at first that there are only a handful.

For each length n, the number of well-formed expressions with n morphemes is called the *density* of a language, and the study of this mathematical notion has a long history (Salomaa and Soittola, 1978). A language is sometimes said to be *slender* if there is some fixed number k such that for every number n, the number of well formed expressions of length n is no more than k. With a moment's reflection, it is easy to see that English and other human languages are not at all slender! In human languages, the number of sentences increases exponentially with the length of the strings.

It is easy to show that English has exponential density. We already have an easy way to show this, because we observed in chapter **??** that English noun compounding is very productive. For example, the nouns *bulletin* and *board* combine to form *bulletin board* = 'a board for posting bulletins' but they can also combine to form the less usual *board bulletin* = 'a bulletin about the board'.

There can also be a *bulletin bulletin* = 'a bulletin about bulletins', and even a *board board* = 'a board having to do with other boards in some way, for example, a board that has lists of other boards on it.' And so on. In general, English allows free noun compounding. Suppose there were just 2 nouns. Then we could make 4 noun compounds of length 2, 8 compounds of length 3, and so on. With 2 nouns, there are 2^n compounds of length n. Human vocabulary sizes are difficult to estimate, but certainly every reader of this text knows many thousands of different nouns. Suppose you know $10,000$ nouns. Then your language would let you consider $10,000^n$ compounds of length n. And so now if we consider just singular noun compounds, and put them into just the following frame, all the results will be syntactically acceptable (though they will often be semantically and pragmatically very odd!):

the ______ appeared.

If you know at least $10,000$ nouns, then each one can go in this frame, so there are at least $10,000$ sentences that are 3 words long. Using all the 2-word noun compounds, there are at least $10,000^2$ sentences that are 4, words long. And in general, for any $n > 1$ there are actually many more than $10,000^n$ different sentences of length $n + 2$, since the ones formed by this frame are a tiny fraction of the whole English language. This is an exponential number of sentences!

Noun compounding is usually regarded as morphological, forming compounds whose internal structure is not relevant to phrase structure, but syntax is much more like English noun compounding than it is like English affix-stem morphology: it is very productive. Estimating the number of reorderings of a particular sentences like

this girl in the red coat will put a picture of Bill on your desk before tomorrow

is a little more complicated than estimating the number of noun compounds, because the principles restricting the combinations are much more complex, as we will see. However, making rather conservative assumptions about the possible combinations allowed, we can use a "parsing algorithm," a program that finds the syntactic structures of a sequence of morphemes, to calculate that more than 29,859,840 reorderings of this sentence are syntactically acceptable (though they might be pragmatically and semantically odd). We will consider various of these reorderings in the next few pages. This represents about 8.4 millionth per cent (the corresponding ratio for the word *denationalization* from the chapter **??** is 1 out of 5!, about 0.83 percent, but with only 5 morphemes). This is indeed a very small proportion which indicates that syntax imposes very significant restrictions on how the words in sentences must be ordered. Still it is quite a remarkable property that such a large number of possible orderings exist with only 17 words. This shows that syntax is both very constraining but also shows amazing productivity! This productivity allows language to be a very flexible and expressive tool, as we will see.

3.3 Substitution

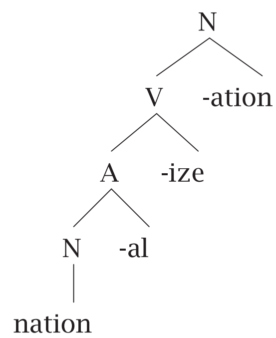
We now start to address the question of determining constituency: what strings behave as chunks? We need to set up experiments that will help us answer this question. One possible way of determining whether a string of words forms a unit is to show that it behaves like something which we have good reasons to believe is also a unit. A reasonable candidate is a word. Perhaps we can show that certain strings behave like a single word. If such a string does, then it is reasonable to conclude that it is a constituent, because it behaves like a single word and it is plausible to assume that a single word is a constituent.

To be as safe as possible (we cannot be totally safe), we want the substituting words to have no internal structure. That is, it is preferable to use single words that are roots (otherwise we would not be as sure that we are not substituting our string by more than one unit).

- Given a well formed string S which we are trying to analyze
- Select a substring SUB
- Replace SUB in kind by (what looks like) a monomorphemic word (a word with no internal structure)
- If the result R is well formed, we conclude that SUB is a constituent
- As usual, if the result is ill formed, we conclude nothing at all, although we may want to understand why the substitution failed

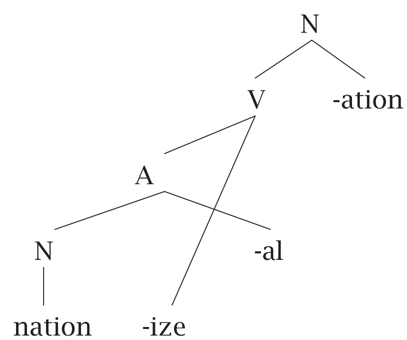
First, note that we say *replace SUB* ***in kind***. Like in any other experiment, there is a danger that the experimental result is sensitive to several different variables. In general we want to minimize as much as possible interference by factors not relevant for establishing constituency. One way of trying to minimize noise is to select our substitution so that it introduces as little perturbation as possible. In particular, we will want that to make sure that S and R be as similar in meaning as possible. We will try to make this a little bit more precise below.

It is important to remember that the interpretation we offer to the results of such psychological experiments are hypotheses. As a result, we may wonder whether we have some a priori grounds to think that such an hypothesis is warranted. Here is a consideration that seems to lend support to this interpretation: Recall the type of morphological trees we came across:



In such a tree, there are several constituents, namely *nation*, *national*, *nationalize* and *nationalization*. We also saw that such trees seem disallowed:

Never draw this!



This illustrates a correlation between "being a constituent" and "forming a temporally continuous string". For example, in the first tree, *national* is both a constituent and a continuous string, while in the second tree the non constituent *nation + ize* cannot be realized as a continuous string. One conclusion this suggests is that constituents **normally** form continuous strings (we should be careful because of the existence of circumfixes and infixes).

Now if a test seems to apply equally well to continuous strings as to non continuous strings, it would not seem like a very promising test for constituency. If on the other hand such a test only applies to continuous strings, it would look like a good candidate for picking out those strings that form constituents. Substitution by a single (monomorphemic) word does seem to have this property: it always applies to continuous strings. Thus our interpretation of the substitution experiment seems a priori reasonable.

We are now ready to experiment on our sentence above. We will try to see whether we can replace any string of words by a single word and still get a sentence which is both acceptable and a close synonym. We will call this *substitution by a single word*. Here are some acceptable substitutions:

a. $\left\{\begin{matrix}\cancel{\text{This girl in the red coat}}\\ \text{she}\\ \text{Mary}\end{matrix}\right\}$ will put a picture of Bill on your desk before tomorrow.

b. This girl in the red coat will put $\left\{\begin{matrix}\cancel{\text{a picture of Bill}}\\ \text{it}\end{matrix}\right\}$ on your desk before tomorrow.

c. This girl in the red coat will put a picture of Bill $\left\{\begin{matrix}\cancel{\text{on your desk}}\\ \text{there}\end{matrix}\right\}$ before tomorrow.

d. This $\left\{\begin{matrix}\cancel{\text{girl in the red coat}}\\ \text{one}\end{matrix}\right\}$ will put a picture of Bill on your desk before tomorrow.

e. This girl in the red coat will put a picture of Bill on $\left\{\begin{matrix}\cancel{\text{your desk}}\\ \text{it}\end{matrix}\right\}$ before tomorrow.

f. This girl in the red $\left\{\begin{matrix}\cancel{\text{coat}}\\ \text{one}\end{matrix}\right\}$ will put a picture of Bill on your desk before tomorrow.

Consider the first substitution of *the girl in the red coat* by *she.* Recall that we want to introduce as little perturbation as possible. One requirement that we would like to impose is the following: substitution should preserve truth values.

We can explain this as follows: Suppose the first sentence is true, that is suppose that it is an accurate description of a particular state of affairs. We will want substitution to preserve this character of truth, this truth value. This means that the pronoun *she* should be understood to mean the same as *the girl in the red coat*, that is to refer to the same person. Conversely, if the sentence was false to start with, it should remain false after substitution.
These observations provide some support for the idea that the sequences that were replaced are units, constituents. That is,

a. *This girl in the red coat* is a constituent

b. *a picture of Bill* is a constituent

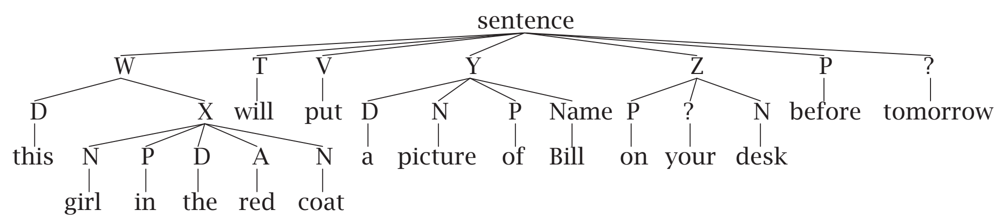
c. *on your desk* is a constituent

d. *girl in the red coat* is a constituent

e. *your desk* is a constituent

f. *coat* is a constituent (we knew this already)

Given these hypotheses, we can draw a tree with some structure above the words:



(Notice that we have labeled the new constituents W, X, Y, Z. We will introduce conventional names for these units later.)

The structure in this tree can also be represented by bracketing:

$[_W$D	$[_X$N	P	D	A	N]]	T	V	$[_Y$D	N	P	Name]	$[_Z$P	?	N]]	P	?
this	girl	in	the	red	coat	will	put	a	picture	of	Bill	on	your	desk	before	tomorrow

This is a first idea about the structure of the sentence, an idea that we can attempt to confirm with converging evidence from other types of experiments.

It is important to realize that such substitutions do not unambiguously tell us that whatever can be replaced by a single word is necessarily a constituent. Whether this is the correct interpretation can only be determined *a posteriori*. When evidence from many such experiments is interpreted and we have succeeded in constructing an overall coherent picture, we will be more secure that this interpretation of this experiment is the right one. As we will see, this interpretation does seem to be correct in most cases.

Notice that successful substitutions indicate that the initial phrase and its substitution share a distributional property, and so we have some evidence for expanding our previous hypotheses as follows:

(2) a. *This girl in the red coat, she, Bill, Mary,* have the same category
b. *a picture of Bill, it,* have the same category
c. *on your desk, there,* have the same category
d. *your desk, it,* have the same category
e. *girl in the red coat, one,* have the same category
f. *coat, one,* have the same category.

By the transitivity of identity, we can conclude from b and d that *a picture of Bill, your desk,* and *it,* all constituents, belong to the same category. We could indicate this in the tree by labeling the three relevant nodes with the same label. For reasons that will become clear later, we choose this label to be DP, for "determiner phrase." We can replace the Y in our tree above by DP.

The last two types of constituent, e and f are interesting because, by transitivity, *coat* and *girl in the red coat* belong to the same category as well. This category cannot be N, since we can show that the latter string does not behave like an N. For example: we cannot pluralize the whole expression, **[girl in the red coat]-s* even though this expression would be like a count noun. We can put the plural affix *-s* after *coat*, but that pluralizes just the noun *coat*. We can indicate this in the tree by labeling the three relevant nodes with the same label. For reasons that will become clear later, we choose this label to be NP for "noun phrase".

Note also that since *Bill* and *this girl in the red coat* belong to the same category, they should share some property, for example some distributional property. This seems correct as we can substitute one for the other and get an acceptable string:

(3) a. This girl in the red coat will put a picture of Bill on your desk before tomorrow
   b. Bill will put a picture of this girl in the red coat on your desk before tomorrow

Note that this swapping is possible as a consequence of the fact that we have established independently that these two strings were constituent of the same category. It is **not** true that swappability by itself allows the conclusions that the swapped strings are constituents and of the same kind. By (2a), we might expect to be able to do the same with *she*, but something makes this impossible:

(4) a. She will put a picture of Bill on your desk before tomorrow
   b. *Bill will put a picture of she on your desk before tomorrow

We could conclude from this that our hypothesis (2a) is false, but this is not necessary without further analysis. This observation does show that *Bill* and *she* do not have exactly the same distribution, but they may still have enough in common to be in the same category. As we observed in the chapter **??**: we typically cannot draw strong conclusions from negative results. "Negative results are uninformative." This is because there are many possible explanations for why they arise.

Notice that the acceptable pronoun in the place of *Bill* is *her*:

(5) a. She will put a picture of Bill on your desk before tomorrow
   b. Bill will put a picture of her on your desk before tomorrow

In fact, in these contexts, *she* and *her* are in complementary distribution: where one occurs, the other cannot (and of course we cannot have both at once):

a. She will put a picture of Bill on your desk before tomorrow
b. *Her will put a picture of Bill on your desk before tomorrow
c. *She her will put a picture of Bill on your desk before tomorrow
d. Bill will put a picture of her on your desk before tomorrow
e. *Bill will put a picture of she on your desk before tomorrow
f. *Bill will put a picture of she her on your desk before tomorrow

Since they also make the same contribution, picking out a salient female referent, this suggests the conclusion:

(6) *she* and *her* are not only the same category, but are tokens of the same morpheme. Which one can occur depends on syntactic context.

We should make this more precise, defining when one form or the other is required, and we would like to know why we have this alternation. This turns out to be enormously important, but we postpone further discussion of it until we have understood more about constituency.

Substitution by a word can take us quite far regarding the structure of our example sentence, and now we have considered swapping constituents too, which is really just doing two replacements at once. If two sequences of words can be swapped, that provides some evidence that these sequences have the same category. For example,

(7) a. This girl in <u>the red coat</u> will put a picture of Bill on <u>your desk</u> before tomorrow

b. This girl in <u>your desk</u> will put a picture of Bill on <u>the red coat</u> before tomorrow

c. This girl <u>in the red coat</u> will put a picture of Bill <u>on your desk</u> before tomorrow

d. This girl <u>on your desk</u> will put a picture of Bill <u>in the red coat</u> before tomorrow

We could conclude by transitivity that:

on your desk, there, in the red coat belong to the same category (called PP).

We can accordingly replace the label Z in our tree on page 55 by PP.

Similarly, we have substitutions and swapping to indicate that *Bill* and *your desk* are of the same category, which we have called DP:

(8) a. This girl in the red coat will put a picture of Bill on { ~~your desk~~ / Bill } before tomorrow

b. This girl in the red coat will put a picture of <u>Bill</u> on <u>your desk</u> before tomorrow

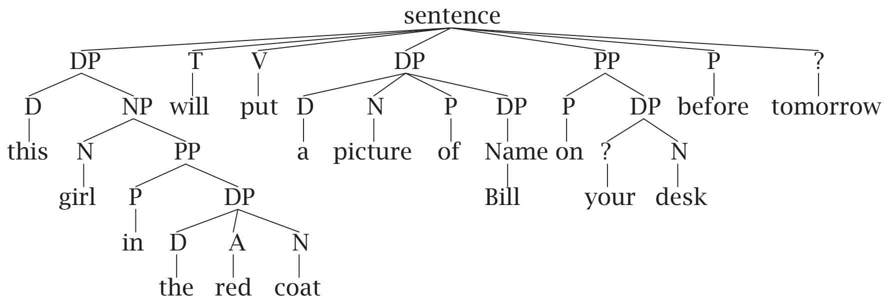
c. This girl in the red coat will put a picture of <u>your desk</u> on <u>Bill</u> before tomorrow

We can conclude by transitivity that all of the following have the category we are calling DP:

your desk, it, Bill, this girl in the red coat, a picture of Bill, the red coat, she, her

It would be very easy to show by exactly the same reasoning that the category DP includes pronouns such as *I, me, you, she, her, he, him, it, they, them, we, us.* Substitution by a pronoun is, as you would expect, often called *pronominalization*.

We can now redraw our tree with more labels and more structure:



It is important to note that there are many substitutions that we are not interested in because they change the meaning of the constituents (and thus the truth value of the sentence under consideration) in some subtle or fundamental way. Consider for example the following substitution:

(9) a. This girl in the red coat will put a picture of Bill on your desk before tomorrow

b. This girl there will put a picture of Bill on your desk before tomorrow

The resulting sentence is fine but the meaning has changed. *There* does not really replace *in the red coat*. *There* suggests that we are talking about a girl in a certain location, while *in the red coat* does not. Because of this, we are thus not sure that the swapping works for principled reasons rather than accidentally. The conclusion may be correct (and in fact it is) but the reasoning leading to it is perhaps not sound.

As another example, we can replace the whole string *girl put a picture of Bill on your desk before tomorrow* by *did*:

(10) a. This girl will put a picture of Bill on your desk before tomorrow

b. This did

The sentence that results is acceptable, but it is unlike the original in a fundamental way: the word *did* does not play the same role in the sentence as the string it replaces. Similarly for the replacement

(11) a. This girl will put a picture of Bill on your desk before tomorrow

b. Clean your desk before tomorrow

These substitutions of substrings by a word are not ones we are interested in.

Note finally that we can try the reverse operation.

(12) a. This girl will put a picture of Bill on your desk before tomorrow

b. This girl will put a picture of Bill on your desk before the day after tomorrow

This may be taken to suggest the strings *tomorrow* and *the day after tomorrow* belong to the same category, and actually they do: they both are DPs. However, this kind of substitution is not so easy to interpret. So for example although the substitution below yields a perfectly good sentence, the two indicated substrings do *not* belong to the same category:

(13) a. This girl will put a picture of Bill on your desk before tomorrow

b. This girl will put a picture of Bill on your desk before Monday because it is important

What goes wrong here is that we have not replaced *tomorrow* with a word that plays the same kind of role in the sentence *tomorrow* does. *Tomorrow* and *the day after tomorrow* both designate a particular day. But the string *Monday because it is important* does not designate a particular day. The meaning of the sentence has been much more radically altered and it now means:

> This girl will put a picture of Bill on your desk before tomorrow, and she will do so because it is important that she does so.

In sum, we have drawn these conclusions about substitution and related matters:

- The substitutions we are interested in replace a substring by a word, where that word plays the same kind of role in the sentence as the original string did, as we saw when we considered example (13). To try to guarantee this sameness of role, we require that the substitution be structured so as to preserve the truth value of the original sentence.
- Strings that can be manipulated as chunks under substitution are constituents
- Substitution of a string by a word seems to indicate constituency
  - substitution by a pronoun indicates that the constituent may be a DP
  - substitution by *one* or *ones* can indicate that the constituent may be a NP
  - substitution by *do* or *do so* indicates that the constituent may be a VP (or if *do* must be tensed, perhaps T', pronounced T-bar, as we will see below)
  - substitution by *there* in its locative sense can indicate that the constituent may be a PP
- String substitution failure is not a test for non-constituency
- Substitution by a string longer than one word is not necessarily one that preserves constituency
- The pronunciation of certain elements depends on their surroundings (for example, the 3rd person plural pronoun can be pronounced either *they* or *them* or - as we will see - even *their*).

3.4 Exercises

We will introduce many other ways to explore constituent structure, but substitution by itself is very powerful. It is worth getting some practice with it.

(1) The following sentence has 15 words, but *the* occurs 2 times, so there are only 14 different words (i.e. different word "types").

(i) The software will prevent the worst computer threats for American companies and regular internet users.

a. Label the parts of speech of all the words in (i).

b. Specify all the subsequences of words in (i) which can be replaced by a single word (where, as usual, the word plays the same kind of role in the sentence as what it replaces)

c. On the basis of the results of the previous step, put brackets around each sequence of words that you had a substitution for.

d. Draw the tree corresponding to the brackets you drew in step c, which also shows the parts of speech for the words from step a.

Example. Let's do the previous exercise, but use the following sentence:

> The entire airline industry became an extension of their electronic networks and the network processes.

This sentence has 15 words, but *the* appears 2 times, so there are only 14 different words.

a. The categories of the 14 words in this sentence:

the	D	entire	A	airline	N
industry	N	became	V	an	D
extension	N	of	P	their	?
electronic	A	networks	N	and	coord
network	N	processes	N		

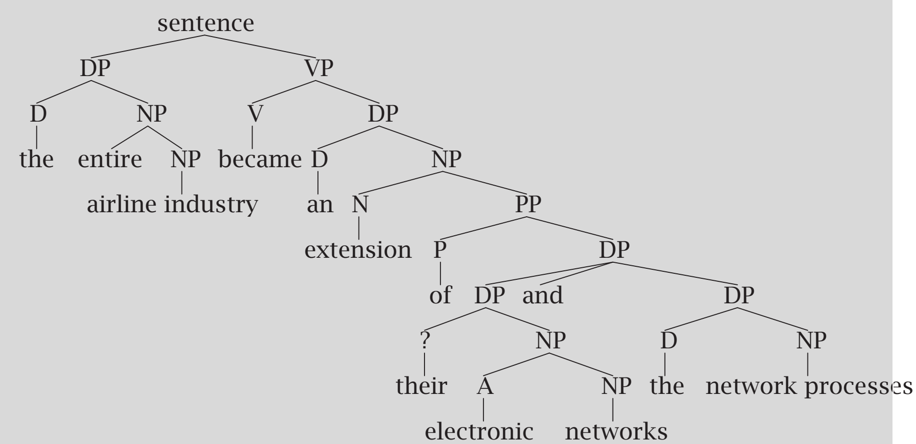
b. Substitutions:

the entire airline industry → it (DP)
entire airline industry → one (NP)
airline industry → one (NP)
industry → one (NP)
became an extension …and the network processes → did so (VP)
an extension …and the network processes → it (DP)
their electronic networks and the network processes → it (DP)
their electronic networks → it (DP)
the network processes → it (DP)
electronic networks → ones (NP)?
network processes → ones (NP)?
of their electronic networks → there (PP)?

c. Bracketing:

[$_{sentence}$ [$_{DP}$The [$_{NP}$entire [$_{NP}$airline industry]]] [$_{VP}$became [$_{DP}$an extension [$_{PP}$of [$_{DP}$ [$_{DP}$their [$_{NP}$electronic [$_{NP}$networks]]] and [$_{DP}$the [$_{NP}$network processes]]]]]]]

d. Tree:



3.5 Ellipsis

Now we look at a different kind of substitution that seems to treat strings of words as chunks, namely substitution by the null string, also known as *ellipsis*. An illustration of this is given in the following exchanges between A and B:

A says: That girl in the red coat will not put a picture of Bill on your desk before tomorrow.

B replies: Yes, but this girl in the red coat will put a picture of Bill on your desk before tomorrow.

Alternatively, B could have replied with either of the following:

(14) a. Yes, but this girl in the red coat will.

b. Yes, but this girl in the red coat will before tomorrow.

What is interesting in that answer is the nature of what is understood, even if it left unsaid. We can indicate it as follows:

a. Yes, but this girl in the red coat will ~~put a picture of Bill on your desk before tomorrow~~

b. Yes, but this girl in the red coat will ~~put a picture of Bill on your desk~~ before tomorrow

One way of interpreting what has happened here is to say that, under certain discourse conditions, substitution of some string by a null string or silent string is felicitous. Such a substitution is called deletion or ellipsis (ellipsis just means omission of understood material) As usual, since we want to control as much as possible what we are doing, we want to restrict the experimental variables as much as possible. One condition that we impose is that ellipsis be done in these discourse contexts in which an antecedent sentence is present and we want to keep the same intended meaning, that is, with the crossed out parts first **necessarily understood**, and second **understood in the same way** as in the antecedent sentence. In other words, we again require that the pair of sentences be true or false in the same situations, that is have the same truth value.

When is ellipsis possible? Note that none of the following replies by B would be acceptable (there are many more that would not be acceptable) with the intended meaning, that is with the crossed out parts understood:

a. * this girl ~~in the red~~ coat will put a picture of Bill on your desk before ~~tomorrow~~
b. * ~~this~~ girl in the red coat will ~~put a~~ picture of Bill on your desk before tomorrow
c. * this girl ~~in the red coat will~~ put a picture of Bill on your desk before tomorrow
d. * this girl in the red coat will put ~~a picture~~ of Bill on your ~~desk before~~ tomorrow
e. * this girl in the red coat ~~will put a picture of Bill~~ on your desk before ~~tomorrow~~

A simple generalization we can make over these impossible cases of ellipsis is that ellipsis only seems to be able to affect a continuous string, that is a string of words or morphemes that is not interrupted (linearly, or more precisely, temporally) by another string.

Why should this be true? We can reason as we have before. We have seen when we looked at our morphological trees that branches are not allowed to cross. This has the effect that elements that are part of a constituent cannot be separated by elements that are not part of this constituent. In other words, elements in a constituent must form a continuous string. Whenever we see that some process can only affect a continuous string, it is natural to think that it is *because* it can only affect constituents.

There are of course other restrictions too, if we want to keep the intended meaning, that is, with the crossed out parts understood:

a. * this girl in the red coat will ~~put a picture of Bill~~ on your desk before tomorrow
b. * this girl in the red ~~coat will put a picture~~ of Bill on your desk before tomorrow
c. * this girl ~~in the red coat~~ will put a picture of Bill on your desk before tomorrow
d. * this girl in the red coat will put ~~a picture of Bill on your desk~~ before tomorrow
e. * this girl in the red coat will put a picture ~~of Bill on your desk before tomorrow~~

In these cases, the crossed out elements are continuous, but still do not form constituents. Substitution by a null string seems to be possible only when it replaces continuous substrings which are constituents. Again, this is a reasonable interpretation, but we will only know that this was the right interpretation when we have constructed a coherent picture taking into account lots of such experiments. As we will see, this interpretation is actually well supported, even in some cases where the results of certain ellipsis experiments would seem to indicate otherwise (e.g., gapping, to which we will return).

For the moment however, let us proceed under the assumption that this interpretation is correct. Then from the previous examples of successful ellipsis in (14), we conclude:

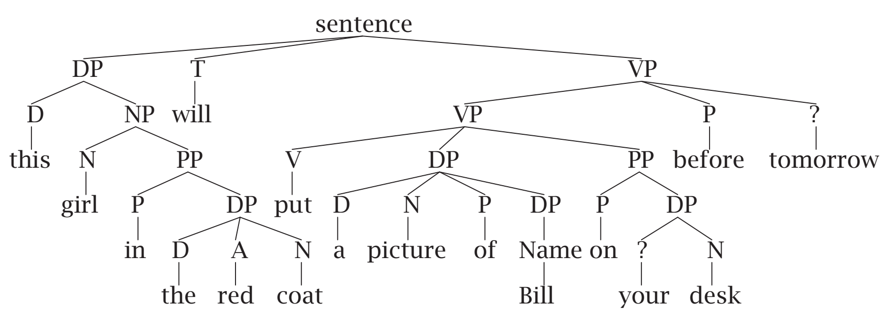
a. *will put a picture of Bill on your desk before tomorrow* is a constituent.

b. *will put a picture of Bill on your desk* is a constituent.

The possibilities for ellipsis seem extremely restricted. This suggests that this ellipsis process is restricted to applying to particular types of constituents. For reasons that are not immediately apparent, we will suppose that the ellipsis process at work here only applies to one type of constituent that we call a VP, for "verb phrase."

Putting all these observations together, we get the following additional constituent structure for our example:

this girl in the red coat will [$_{VP}$[$_{VP}$put a picture of Bill on your desk] before tomorrow]



VP ellipsis (or VP deletion) is found in discourse contexts that are different from the one we have been considering. Here are some other examples:

a. **This girl** will buy bread and **that one** will ~~buy bread~~ too

b. **This girl** will not buy bread and neither will **that one** ~~buy bread~~

c. **This boy** must not go to school, and his father must not ~~go to school~~ either

d. **This boy** must not go to France, but **his father** must ~~go to France~~

e. This actress **must** play in this movie and she **will** ~~play in this movie~~

f. Can **Mary** win the race and will **Sue** ~~win the race~~ too?

g. **This girl** will buy bread and so will **that one** ~~buy bread~~

Example f is called a yes/no question because it is a question that can be answered by yes or no. This is an interesting construction to which we will return. In b and g, the string following the coordination looks like a yes/no question preceded by *neither* or *so*.

A quick note on yes/no questions. It is not difficult to see the basics of how to form a yes/no question corresponding to a declarative sentence. We see examples in the following pairs:

(15) a. The tourists will go to the park.
b. Will the tourists go to the park?

(16) a. Some student from Australia speaks Warlpiri.
b. Does some student from Australia speak Warlpiri?

(17) a. They would have been walking for hours.
b. Would they have been walking for hours?

Although the basic idea is clear, we can see that the details will be a little complex. Notice what happens to the present tense marking on the verb in (16). Also, consider what happens when you try to make a question from a topicalized sentence. We will come back to some of these issues later.

Note that in each case, the string following the coordination (*and* or *but*) contains some element that is contrasted with some element in the string preceding the coordination. We note them both in bold. Note also that the elided material can sometimes be pronounced. When it is, it must be pronounced with a very flat intonation (we represent this by double underlining):

This girl will buy bread and **that one** will too, buy bread

Another example of VP ellipsis is found in "tag questions." Here are some illustrations:

a. This girl will not buy bread, will she ~~buy bread~~?

b. Sean Penn can act well in many kinds of movies, can't he ~~act well in many kinds of movies~~?

The tag part is what comes after the comma. Informally, the way it is formed is as follows:

i. Take the yes/no question equivalent of the statement preceding the comma,

ii. Change the polarity of the statement (make it negative if it was positive, positive if it was negative)

iii. Pronominalize its subject. (we need to return to the question: what is a "subject"?)

iv. Apply VP-ellipsis to the VP after the comma

There are other types of ellipsis too, besides VP ellipsis. One kind of ellipsis applies to what we have called NPs:

$$\text{John liked the wide red carpets he saw yesterday but I preferred these} \left\{\begin{array}{c}\text{wide red carpets}\\ \text{red carpets}\\ \text{carpets}\\ \text{ones}\end{array}\right\}$$

$$\text{John liked the wide red carpets he saw yesterday but I preferred these} \left\{\begin{array}{c}\cancel{\text{wide red carpets}}\\ \cancel{\text{red carpets}}\\ \cancel{\text{carpets}}\\ \cancel{\text{ones}}\end{array}\right\}$$

Because ellipsis here applies to something we know independently to be a constituent (since it can be replaced by the single word ones), this kind of ellipsis suggests that

- the strings *ones, carpets, red carpets, wide red carpets* all belong to the same category (which we may assume for the moment to be NP).

As a consequence we are led to postulate the following structures for the following strings:

these [$_{NP}$ carpets]

these [$_{NP}$red [$_{NP}$carpets]]

these [$_{NP}$wide [$_{NP}$red [$_{NP}$carpets]]]

Note that it is not true that this kind of ellipsis can apply every time that a constituent is an NP. as we have discussed earlier. (Incidentally, the cases in which this kind of NP-ellipsis can apply are not fully elucidated. We should return to them later.)

Another example of ellipsis occurring inside DPs or NPs is illustrated below:

John liked Mary's {wide red carpets / red carpets / carpets} but I preferred Bill's {~~wide red carpets~~ / ~~red carpets~~ / ~~carpets~~}

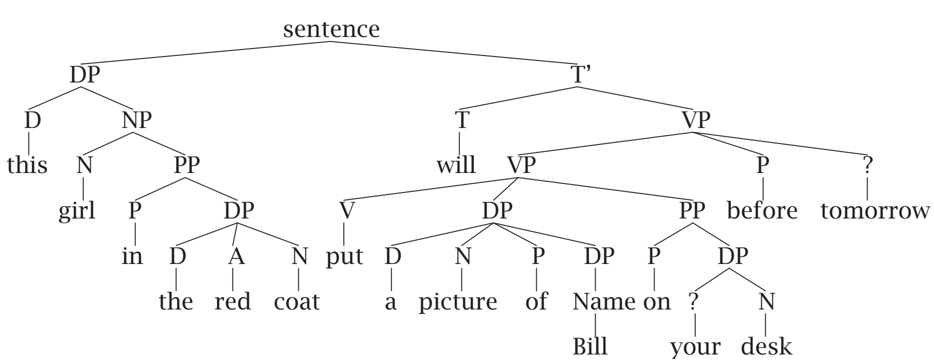
Strings like *Mary's wide red carpets* or *Mary's carpets* behave like DPs (they can be replaced by the pronoun *they* for example). Exactly these strings that could be replaced by *one* earlier can be elided if they follow a string like *Bill's* within a DP. We conclude that this case of deletion targets the strings we have called NPs.

One last type of ellipsis (which not all speakers accept) is illustrated below :

a. That boy will buy a picture of Bill before tomorrow and *this girl in the red car will buy a picture of Bill before tomorrow* too

b. That boy will buy a picture of Bill before tomorrow and this girl in the red car ~~will buy a picture of Bill before tomorrow~~ too

This suggests that the string *will buy a picture of Bill before tomorrow* is a constituent in the italicized sentence. As a result, we have to modify our tree to include this new constituent, which we will call T'. We will see later that the label has something to do with T (tense):



There is another kind of ellipsis called **gapping**: which seems to lead to entirely new conclusions

John will go to the movies and **Sue** ~~will go~~ to the theater

In this case, there are two pairs of elements that contrast with each other.

Suppose we interpreted gapping as straightforwardly revealing constituency, in the sense that what appears to be elided is a constituent, as we have done so far. First, applying what we have discovered so far, we would get the following structure.

Sue [will [go [to [the theater]]]

Next, we should conclude that the second occurrence of the string *will go* is a constituent, because it is elided. The tree representation we would obtain would include:

Sue [will go] [to [the theater]]]

This would seem to indicate that such a sentence can have two different syntactic constituent analyses. This kind of constituency cannot be represented in a single tree of the type we have used for morphology. But it is easy enough to represent what is going on by saying that this sentence is associated with **two** trees: the sentence would be structurally ambiguous.

All sorts of new questions now arise. For example this may mean that this sentence has these two structures simultaneously. Or else it may mean that sometimes the sentence has the structure indicated with the curly brackets, and other times it has the structure indicated by the straight brackets, but not both at the same time:

Sue [will [go [to [the theater]]]

Sue {will go} [to [the theater]]]

Are there systematic relations between these tree structures or not? Can sentences have more than two tree structures? How about other sentences, etc..

To understand what happens in the case of gapping, we need to understand a lot more about syntactic organization. Note that the curly bracket structures involved in Gapping requires that we contrast pairs. This suggests something special is happening. So we will leave these questions aside for the moment and **systematically ignore the curly bracket structures**.

3.6 Coordination

We now turn to a different kind of way to determine constituent structure. Again, we distort sentences in particular ways, trying to locate those substrings that seem to behave as chunks and interpret the effects of the distortion as indicating that these chunks are units.

We have looked at various distortions of this sentence:

This girl in the red coat will put a picture of Bill on your desk before tomorrow

Among the conclusions we have reached about this sentence and variants of it are these:

- *put a picture of Bill on your desk before tomorrow* and *put a picture of Bill on your desk* both are VPs
- *your desk, it, Bill, this girl in the red coat, a picture of Bill, the red coat, she, her, I, us, me, you, him, he* all are DPs
- *on your desk, there, in the red coat,* are PPs

The fact that both *this girl in the red coat* and *you* belong to the same category is what allows us to perform the following substitution successfully:

$\left\{\begin{matrix}\text{This girl in the red coat}\\ \text{you}\end{matrix}\right\}$ will put a picture of Bill on your desk before tomorrow.

Now if we wanted to say these two sentences, there would be more economical ways to convey the content without having to repeat most of it twice. One way could be to use VP ellipsis, but this is appropriate only under certain conditions in which we want to contrast certain types of information. What if there were no contrast? A very simple way, used to an enormous extent, is coordination. We could say:

This girl in the red coat and you will put a picture of Bill on your desk before tomorrow.

This immediately raises the question: when are we allowed to use coordination? A natural answer immediately suggests itself: in the case above we see that we have coordinated two constituents of the same kind (we know this because *you* can be substituted for *This girl in the red coat.* We can make the following hypothesis:

i. we can say each of the two sentences independently
ii. these two sentences have identical parts and dissimilar parts
iii. we can substitute one dissimilar part for the other, preserving acceptability.

Point iii indicates that the two dissimilar parts both are constituents of the same kind if on eof them is a constituent (the substitution test). This suggest the following interpretation of the possibility of doing string coordination, which generalizes this reasoning:

Coordination test: If we have two acceptable sentences of the form *A B D* and *A C D* and the string *A B and C D* is acceptable with the same meaning as *A B D and A C D*, this is evidence that *B* and *C* are both constituents, and constituents of the same kind.

To perform this test on our example, let

A= ∅ (that is the null string, also noted *e*)

B= this girl in the red coat

C= you

D= will put a picture of Bill on your desk before tomorrow.

Note that the test is stated for the coordinator *and*, but it is also true for the coordinator *or*, as we see in the following sentence, for example:

(18) a. This girl in the red coat will put a picture of Bill on your desk before tomorrow.
b. You will put a picture of Bill on your desk before tomorrow.
c. This girl in the red coat or you will put a picture of Bill on your desk before tomorrow.

In fact, *but* is also a coordinator, one that indicates some contrast:

(19) a. This girl in the red coat will put a picture of Bill on your desk before tomorrow.
b. No boys will put a picture of Bill on your desk before tomorrow.
c. This girl in the red coat but no boys will put a picture of Bill on your desk before tomorrow.

Here are a few more examples of the reasoning that we can do:

(20) a. This girl in the red coat will put a picture of Bill on your desk before tomorrow
b. This girl in the red coat will put it on your desk before tomorrow
c. This girl in the red coat will put it and a picture of Bill on your desk before tomorrow
d. This girl in the red coat will put a picture of Bill on your desk before tomorrow and This girl in the red coat will put it on your desk before tomorrow

The last two examples have the same meaning: we conclude that *a picture of Bill* and *it* are constituents of the same kind. (We had previously concluded that they were both DPs, so we are glad to see it confirmed.)

(21) a. This girl in the red coat will put a picture of Bill on your desk before tomorrow
b. This girl in the red coat will put a picture of Bill in the mailbox before tomorrow
c. This girl in the red coat will put a picture of Bill in the mailbox and on your desk before tomorrow

We conclude that *on your desk* and *in the mailbox* are constituents of the same kind. (We had previously concluded that one of them was a PP, so again we have confirmation.)

(22) a. This girl in the red coat will put a picture of Bill on your desk before tomorrow

b. This girl in the red coat will put a picture of Bill on your desk after the dinner

c. This girl in the red coat will put a picture of Bill on your desk after the dinner and before tomorrow

d. This girl in the red coat will put a picture of Bill on your desk before tomorrow and this girl in the red coat will put a picture of Bill on your desk after the dinner

The last two examples have the same meaning: we conclude that *before tomorrow* and *after the dinner* are constituents of the same kind. They also are PPs of a certain kind called temporal PPs, because they say something about time.

(23) a. This girl in the red coat will put a picture of Bill on your desk before tomorrow

b. This girl in the red coat will eat her breakfast before tomorrow

c. This girl in the red coat will eat her breakfast before tomorrow and put a picture of Bill on your desk before tomorrow

The last example means the same as the conjunction of the first two: we conclude that the strings *eat her breakfast before tomorrow* and *put a picture of Bill on your desk before tomorrow* are constituents of the same kind. (We knew this already and have called them VPs.)

(24) a. This girl in the red coat will put a picture of Bill on your desk before tomorrow

b. This girl in the red coat will eat her breakfast before tomorrow

c. This girl in the red coat will eat her breakfast and will put a picture of Bill on your desk before tomorrow.

The last example means the same as the conjunction of the first two: we conclude that the strings *will eat her breakfast* and *will put a picture of Bill on your desk* also are constituents of the same kind. This corroborates the conclusion we had earlier reached with Ellipsis (for some speakers). This is the constituent we called T' (pronounced: "T-bar").

It would seem a priori that the coordination experiment is a variation of the substitution experiment but it is in fact more general. The reason is that we may be able to coordinate two strings, neither of which is replaceable by a single word. One such example is coordination of T's or VPs seen above.

The coordination experiment and its interpretation described above is an extremely powerful investigative tool because it seems to rarely fail. (It is actually conceivable, given what we know, that it never really fails). It is also perhaps the only experiment in which failure seems to be straightforwardly meaningful. So we will tentatively suppose that the following is true (and it is probable that for everything we will see here, it will work).

Before we formulate how to interpret coordination failure, we need to take care of two problems.

First, in many cases, coordination will fail because of an interference with agreement: coordination of two singular DPs yields a plural DP. When we coordinate DPs, we must make sure that we "fix" agreement. This usually very easy to do (but in some cases it is not entirely obvious). Here is an illustration:

John is sick
Bill is sick
* John and Bill is sick
fixed agreement: John and Bill are sick

Second, coordination of parts of words often fails (but not always):

(25) a. pre-test, anti-nuclear, en-large, nation-al, redd-en, electron-ic, inventive-ness

b. post-test, pro-nuclear, en-able, government-al, black-en, magnet-ic, clever-ness

c. pre or post -
test, [anti or pro]-nuclear, *en-[large and able], *[nation and governement]-al, *[red and black]-en, *[electron and magnet]-ic, *[inventive and clever]-ness

It would be interesting to investigate what causes these failures. Here, we will simply exclude from consideration cases involving bound morphemes.

(26) **Interpreting Coordination Test Failure.** If we have two acceptable sentences of the form *A B D* and *A C D* where none of A, B, C and D are bound morphemes, and the string *A B and C D* is not acceptable (even after we have fixed agreement), then it is not true that: *B* and *C* are both constituents and constituents of the same kind. That is, coordination failure means that one or more of the following is true:

i. B is not a constituent, or

ii. C is not a constituent, or

iii. B and C are not of the same kind.

Here are some examples:

(27) a. This girl in the red *coat will* put a picture of Bill on your desk.

b. This girl in the red *dress must* put a picture of Bill on your desk.

c. *This girl in the red *coat will* and *dress must* put a picture of Bill on your desk.

We conclude that the strings *coat will* and *dress must* must satisfy one of the conditions i-iii in (26). (Actually, neither *coat will* nor *dress must* is a constituent).

(28) a. This girl in the red coat will put a picture of Bill on your desk.

b. This girl on the red coat will put a picture of Bill on your desk.

c. *This girl in the or on the red coat will put a picture of Bill on your desk.

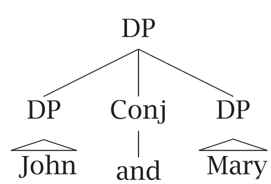
We conclude that the strings *in the* and *on* satisfy one of the conditions i-iii in (26). (Actually, *in the* is not a constituent).

3.6.1 Structure of Coordinated Constituents

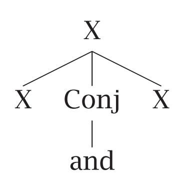
How would we draw the tree structure of a sentence like:

(29) a. John and Mary will play with Henry and with Sue

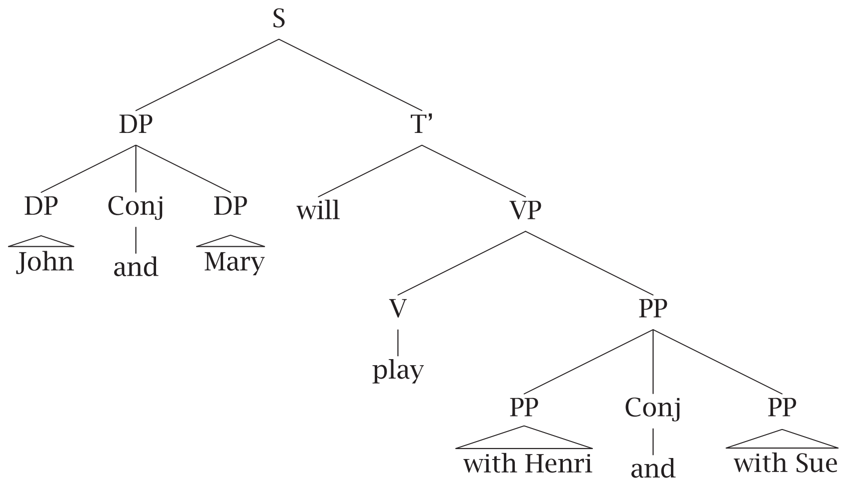
We know that John is a DP, and so is Mary. John and Mary is also a constituent of course of the same kind as John or Mary. This means that the string John and Mary in this sentence would have the following structure (where Conj is an abbreviation for the category Conjunction):



More generally the coordination of two constituents of some arbitrary type X will yield a larger constituent of type X:



In the case of the sentence above, we would get:



Question: How many ways are there to draw the tree for the string John and Mary and Sue? (There are three ways: try to draw them all).

3.6.2 Right node raising

For the daring, let's briefly consider right node raising. Anyone using coordination as a constituency test is likely to run into this puzzling construction, and so it is useful to have seen it before.

Sometimes it appears that a constituent can be shared by two coordinated constituents to its left:

(30) a. They play unusual music, and I listen to unusual music
  b. They play and I listen to unusual music

(31) a. I love boba ice milk tea but you hate boba ice milk tea
  b. I love but you hate boba ice milk tea

(32) a. She may have defrosted the roast and should have defrosted the roast
  b. She may have and should have defrosted the roast

The underlined element is said to be "right node raised." Concerning, the shared portion, the right node raised string, it will appear rather natural after we have looked at movement later in this chapter to suggest that:

(33) Right node raised elements are constituents.

The analysis of right node raising constructions is controversial, and even this claim (33) is controversial (Abbott, 1976; McCawley, 1982; Postal, 1998; Runner, 1998). Assuming it to be correct would lead us to the unsurprising conclusions that *unusual music* and *boba ice milk tea* and *defrosted the roast* are constituents, but the test is controversial because of examples like the following (in which the constituency of each underlined string is debated):

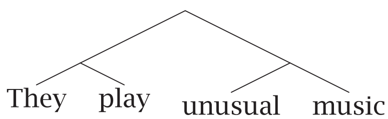
(34) a. Smith loaned a valuable collection of manuscripts to the library, and his widow later donated a valuable collection of manuscripts to the library

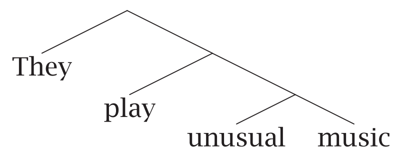
b. Smith loaned and his widow later donated a valuable collection of manuscripts to the library

(35) a. I borrowed large sums of money from the bank, and my sister stole large sums of money from the bank

b. I borrowed and my sister stole large sums of money from the bank.

We will not discuss this question here. Another, more directly relevant question is whether the coordinated portions are each constituents of the same kind. Given what we have said so far about coordination, we have no choice but accept this conclusion even though it leads to the first constituency instead of the more "conventional" second bracketing:





We find ourselves in the same situation as that we had encountered when we discussed Gapping. This sentence and other sentences seem to have two possible structural analyses. This is a correct conclusion. We will not pursue this here. Later, we will learn how these kinds of problems can be tackled. Note that, just as in the case of Gapping, a special intonational contour is required for Right Node Raising to sound natural. In order to avoid confusion with "standard" coordination, intonation can be used as a guide.

3.7 Movement and other distortions

We now turn to other classes of experiments to determine constituent structure. They involve various kinds of distortions that we impose on strings.

3.7.1 Topicalization

Consider the following pair of sentences:

a. This girl in the red coat will put a picture of Bill on your desk before tomorrow

b. Before tomorrow, this girl in the red coat will put a picture of Bill on your desk ~~before tomorrow~~.

Both sentences are acceptable. Their conditions of use are different of course. The first one could be a natural answer to the question: what do you think will happen? The second less so. However the second could be a natural answer to the question: what do you think will happen before tomorrow? Saying this sentence assumes that the topic of the exchange is about *before tomorrow* and it provides a comment about it. This is why this construction is called topicalization. It is said with a special intonation encoded here by the comma between *tomorrow* and *this girl*. We informally refer to the string *before tomorrow* as having been topicalized. We will not explore this construction as thoroughly as we did ellipsis but the same conclusion applies: topicalization only can affect continuous strings and thus, it is reasonable to conclude,

Topicalization can only affect constituents.

As usual, we have no guarantee *a priori* that what counts as a constituent for topicalization is what counts as a constituent for ellipsis, coordination, pronominalization etc. Constituency just means “behave as a unit with respect to the experimental conditions we are presently observing.” We return to this point at the end of this chapter.

Here is a sample of cases in which we have successfully topicalized various constituents (respectively DP, PP, VP, NP).

(36) a. This girl in the red coat will put the picture of Bill on your desk before tomorrow

b. The picture of Bill, this girl in the red coat will put ~~the picture of Bill~~ on your desk before tomorrow

c. On your desk, this girl in the red coat will put a picture of Bill ~~on your desk~~ before tomorrow

d. Put a picture of Bill on your desk, this girl in the red coat will ~~put a picture of Bill on your desk~~ before tomorrow

e. Put a picture of Bill on your desk before tomorrow, this girl in the red coat will ~~put a picture of Bill on your desk before tomorrow~~

The topicalization found in the last two case is sometimes called **VP-preposing**, for obvious reasons.

The following example is a case of topicalization of a constituent type we have not yet seen which we will call CP, for “complementizer phrase”:

(37) a. Mary should know that you must go to the station

b. That you must go to the station, Mary should know ~~that you must go to the station~~

And here is a sample of cases in which it fails: all the following examples are deviant because we tried to topicalize discontinuous strings:

(38) a. * This your, ~~this~~ girl in the red coat will put a picture of Bill on ~~your~~ desk before tomorrow

b. * Will Bill, this girl in the red coat ~~will~~ put a picture of ~~Bill~~ on your desk before tomorrow

c. * Red picture desk, this girl in the ~~red~~ coat will put a ~~picture~~ of Bill on your ~~desk~~ before tomorrow

d. * Before your, this girl in the red coat will put a picture of Bill on ~~your~~ desk before ~~tomorrow~~

Here are some cases in which topicalization fails even though we have concluded that the topicalized strings are constituents:

(39) * Girl in the red coat, this ~~girl in the red~~ coat will put a picture of Bill on your desk before tomorrow

(40) * Will put a picture of Bill on your desk before tomorrow, this girl in the red coat ~~will put a picture of Bill on your desk before tomorrow~~

(41) * Picture of Bill, this girl in the red coat will put a ~~picture of Bill~~ on your desk before tomorrow

What can we conclude from this regarding constituency?? – No significant conclusions follow from what we know so far. Trying to understand the reasons for this set of failures under topicalization is an advanced and fascinating topic. Hopefully you will have a chance to explore this later.

Finally, here are some cases in which topicalization fails because we tried to topicalize non-constituents (remember however that these sentences do not allow us to conclude that these strings are not constituents; this conclusion will be reached by other means):

(42) * The red, this girl in ~~the red~~ coat will put a picture of Bill on your desk before tomorrow

(43) * Of Bill on, this girl in the red coat will put a picture ~~of Bill on~~ your desk before tomorrow

(44) * Will put, this girl in the red coat ~~will put~~ a picture of Bill on your desk before tomorrow

(45) * Your desk before, this girl in the red coat will put a picture of Bill on ~~your desk before~~ tomorrow

To conclude, remember that English Topicalization is useful to determine constituency of DP's, VP's,CP's and PP's

3.7.2 Cleft constructions

Here are some examples of the cleft construction.

(46) a. John wants to look at your notes after class

b. It is your notes that/which John wants to look at after class

c. It is after class that John wants to look at your notes

d. It is John who wants to look at your notes after class

(47) a. Ann bought a first edition of Richard III for $1000

b. It was Ann who bought a first edition of Richard III for $1000

c. It was a first edition of Richard III that Ann bought for $1000

d. It was for $1000 that Ann bought a first edition of Richard III

In this construction, the word *it* appears as subject, *be* as the verb, and more material follows. Consider the following pair:

a. This girl in the red coat will put a picture of Bill on your desk before tomorrow

b. It is before tomorrow that *this girl in the red coat will put a picture of Bill on your desk* ~~before tomorrow~~

Both sentences are acceptable. Their conditions of use are different of course. The first one could be an answer to the question: *what do you think will happen?* The second could not be. However the second could be a reaction to the statement *This girl in the red coat will put a picture of Bill on your desk before Tuesday*. Saying this sentence roughly assumes agreement between the discourse participants that: this girl in the red coat will put a picture of Bill on your desk. What the speaker of this sentence contributes is the information that this will take place before tomorrow. The underlined constituent is called a *focus*, and the italicized portion the *presupposition* (because the speaker of this sentence presupposes that the discourse participants know about it). There are many constructions involving a notion of focus. This is just one of them. (We will see two more shortly: so-called "pseudo cleft" and "association with focus" constructions). It is called a *cleft construction* and the *focus* is also called the *clefted string*. As is now familiar, we will interpret the fact that clefting can only affect continuous strings as an indication that the focus must be a constituent:

The focus of a cleft construction is a constituent

The experiment takes the following form:

i. starting from some acceptable string *ABC* we form the new string:
it BE B that AC.
Where BE stands for any form of the verb *be* such as *is* or *was*.

ii. if the result is acceptable, this is evidence that B is a constituent of ABC;
if the result is unacceptable, we conclude nothing (but we might want to investigate further to find out what went wrong).

Here are some more examples, where we perform the test above, letting the underlined string be the focus B:

(48) a. Mary saw the tall man coming from England

b. it is the tall man coming from England that Mary saw ~~the tall man coming from England~~

This result is fine, so we conclude that *the tall man coming from England* is a constituent. (You should be able to verify this conclusion in other ways: substitution, coordination, etc.)

(49) a. Mary saw the tall man come from the back

b. it is the tall man come from the back that Mary saw ~~the tall man come from the back~~

This result is not acceptable. We cannot conclude anything.

The cleft construction will help identify DPs and PPs. Consider this application of our test, for example:

(50) a. This girl in the red coat will put a picture of Bill on your desk before tomorrow

b. It is a picture of Bill that this girl in the red coat will put —— on your desk before tomorrow

c. *It is put a picture of Bill on your desk before tomorrow that this girl in the red coat will ——

3.7.3 Pseudoclefts

In the pseudocleft construction, what looks like an interrogative clause appears in subject position, and a focused element appears following a form of the verb *be*.

(51) What John wants to look at —— now is your notes

(52) What Mary bought —— was a first edition

(53) *What Mary gave —— was a book to John

(54) *What Mary donated —— was a lot of money to KPFK

The underlined elements are said to be focused and pseudoclefted here. Cleft and pseudocleft constructions fulfill similar functions of "focusing" a constituent of the correspondingly simpler sentence, though the two constructions differ considerably with regard to the class of cases in which they can be employed. For many speakers the pseudo-cleft construction is only possible with *what*, and correspondingly the focused element is restricted to constituents of types that can serve as answers to a question with *what* (the symbol % is used to indicate that there is some variation in judgment across speakers):

(55) a. It's Alice that John was talking to

b. % Who John was talking to was Alice

(56) a. It is to Cleveland that John drove the truck

b. % where John drove the truck is to Cleveland

(57) a. It's because he was tired that Mary yelled at you

b. % Why John yelled at you is because he was tired

In this respect the cleft construction is less restricted than the pseudocleft construction: all types of DPs and PPs cleft freely. However, the cleft construction and the pseudocleft construction do not test for the same types of constituents. The cleft construction only works well for DPs and PPs, the pseudocleft construction works well for a variety of other constituents as well: A(djectivals) P (APs), VPs and CPs (infinitival or tensed):

(58) a. John became deadly afraid of flying

b. What John became was deadly afraid of flying (AP)

c. ?* It is deadly afraid of flying that John became

(59) a. John told us that he wants to quit school

b. ??It is that he wants to quit school that John told us

c. What John told us is that he wants to quit school. (CP)

(60) a. John promised us to be gentle

b. ?* It is to be gentle that John promised

c. What John promised is to be gentle (CP)

(61) a. Mary will arrive tomorrow

b. *It is arrive tomorrow that Mary will

c. What Mary will do is arrive tomorrow (VP)

Cleft and pseudocleft constructions can be used to determine constituent structure, since, as is now familiar, we will interpret the fact that pseudoclefting can only affect continuous strings as an indication that the focus must be a constituent:

The focus of a pseudocleft construction is a constituent

The pseudo cleft experiment takes the following form:

i. starting from some acceptable string *ABC* we form the new string:
what AC BE B.
(The verb *be* can also be in the past or the future.)

ii. if the result is acceptable, this is evidence that B is a constituent of ABC;
if the result is unacceptable, we conclude nothing (but we might want to investigate further to find out what went wrong).

Here is an example, where we perform the test above, letting the underlined string be the focus B:

(62) a. Henri wants <u>the book which is on the top shelf</u>

b. What Henri wants is <u>the book which is on the top shelf</u>

This result is acceptable, so we conclude that *the book which is on the top shelf* is a constituent (here a DP). (You should be able to verify this conclusion in other ways: substitution, coordination, etc.)

The pseudocleft experiment is useful to isolate DPs. For many speakers, it can also be used to isolate a kind of constituent we have not seen before which we will call an AP, for "adjective phrase."

(63) a. The spy became <u>too friendly with his new contacts</u>
b. What the spy became was <u>too friendly with his new contacts</u>

This result is fine, so we conclude that *too friendly with his new contacts* is a constituent. (You should be able to verify this conclusion in other ways: substitution, coordination, etc.)

A variant of the pseudo cleft experiment can be used to isolate VPs. It goes (approximately) as follows:

i. starting from some acceptable string *ABC* we form the new string:
What A DO C BE B.
(The notation DO and BE means that the verbs *do* and *be* can also be in the past or the future.)

ii. if the result is acceptable, this is evidence that B is a VP constituent of ABC;
if the result is unacceptable, we conclude nothing (but we might want to investigate further to find out what went wrong).

For example:

(64) a. This girl in the red coat will <u>put a picture of Bill on your desk before tomorrow</u>
b. What this girl in the red coat will do is <u>put a picture of Bill on your desk before tomorrow</u>

This result is fine, so we conclude that *put a picture of Bill on your desk before tomorrow* is a constituent, a VP. (You should be able to verify this conclusion in other ways: substitution, coordination, etc.)

Note finally that there is a construction closely related to pseudo clefts which we may call Inverted Pseudoclefts. It is identical to Pseudoclefting except that the two strings around the verb BE are inverted. It could be stated as follows:

i. starting from some acceptable string *ABC* we form the new string:
B BE what AC.
(The verb *be* can also be in the past or the future.)

ii. if the result is acceptable, this is evidence that B is a constituent of ABC;
if the result is unacceptable, we conclude nothing (but, as always, we might want to investigate further to find out what went wrong).

The following sentences are the inverted pseudoclefted counterpart of the examples above. Often the judgments on the % marked sentences are better:

(65) a. It's Alice that John was talking to

b. % Alice was who John was talking to

(66) a. It is to Cleveland that John drove the truck

b. % To Cleveland is where John drove the truck

(67) a. It's because he was tired that Mary yelled at you

b. % Because he was tired is why John yelled at you

3.8 Some more complex distortion experiments, briefly

There are many other distortion experiments, some of which will be used and investigated in the following chapters. Here we quickly mention a few of them.

3.8.1 Wh-movement

Wh-questioned strings are constituents. Consider, for example, the sentence:

a. Henri wants to buy these books about cooking.

Is the string *these books about cooking* a constituent? Notice that a determiner like *these* can often be replaced by a wh-determiner like *which* (with appropriate, "echo question" stress):

b. Henri wants to buy *which* books about cooking?

However, the questioned element can now be fronted, moved to the front of the expression, with adjustment in the verb (adding tensed *do*, removing tense from *buy*):

c. *which* books about cooking does Henri want to buy?

Semantically, it's clear that we have questioned what Henri wants to buy here, and so so it is plausible that *which books about cooking* has the same category as *these books about cooking*. We conclude that both are constituents, supposing as usual, that the affected subsequence of words must form a constituent in order to be moved as a unit like this.

3.8.2 Heavy constituent shift

One more distortion which can be useful for identifying constituents, but which has some surprising properties is heavy constituent shift. This construction has the surprising property that it seems to be sensitive to the "size" or "weight" of the constituent involved, placing "heavy" enough ones on the right. Consider the following sentences, in which we try to move all the way to the right the phrase that refers to what is sent:

(68) a. I sent it to you

b. * I sent to you it

c. * I sent to you recipes

d. ? I sent to you the recipes from the paper

e. I sent to you the recipes from the paper that I told you about yesterday

The underlined element is said to be "heavy shifted" What we would like to propose is the following, which should seem totally unsurprising given the previous proposals:

(69) Heavy shifted elements are constituents.

Again, this idea is slightly controversial, with some linguists reasonably arguing that because of its weight sensitivity, heavy shift must have some special status. Perhaps it is not part of the syntax of human languages at all, but maybe something to do with phonology (or perhaps some theory of "rules of pronunciation" that goes beyond what phonology traditionally encompasses?), but then the fact that it does seem to affect what other constituency tests identifies as syntactic constituents would call for some special explanation.

3.9 Modification by *only, even*

Consider the following example:

(70) This cook will only put pepper on these tomatoes

Only places one element of the sentence, which we also call the focus, in contrast with implicit alternatives. In the first sentence below, focus may be on *put, pepper* or *tomatoes*, depending on stress (the element in focus must be stressed). These possibilities are exemplified below, where we underline the focused element.

a. This cook will only put pepper on these tomatoes

b. This cook will only put pepper on these tomatoes

c. This cook will only put <u>pepper</u> on these tomatoes

d. This cook will only put pepper <u>on</u> these tomatoes

e. This cook will only put pepper on <u>these</u> tomatoes

f. This cook will only put pepper on these <u>tomatoes</u>

For example, the last case, which must be read with primary stress on *tomatoes*, means:

f' = 'it is only these tomatoes that this cook will put pepper on, not these pizzas or anything else'

This process of associating an element with *only* is not free. Focus may not be put on *cook*, on *will* or on *this*.

g. * This <u>cook</u> will only put pepper on these tomatoes

h. * This cook <u>will</u> only put pepper on these tomatoes

i. * <u>This</u> cook will only put pepper on these tomatoes

That is, this last sentence does not mean that only this cook will put pepper on these tomatoes.

How can we explain this "rule of association of *only* with focus." As can be seen easily for yourself, *only* seems to precede its focus: all elements to the right of *only* can be interpreted as focused, but elements to the left cannot. However, precedence is not sufficient, as we see in the following (in which we underline the string that we are **trying** to interpret as focus):

(71) This cook will only put pepper on these tomatoes <u>and the maid burnt the food</u>

(72) This cook will put only pepper <u>on these tomatoes</u>

Both of these examples are fine, but the focus may not be part of anything that is underlined, even though in both cases, the underlined portion is preceded by *only*.

The reason for this difference is of course constituent structure. Note that if we apply VP ellipsis:

(73) This cook will only put pepper on these tomatoes, and that cook will ~~only put pepper on these tomatoes too~~,

We see that *only* forms a VP constituent with the VP *put pepper on these tomatoes*. The structure of (73) looks like this:

(74) the cook will [$_{VP}$only [$_{VP}$ put pepper on the tomatoes]]

This suggests immediately the following rule:

(75) the focus associated with *only* must be contained in a constituent sister to *only*.

In (73), *put pepper on the tomatoes* is a constituent (a VP) sister to *only*. This is why *only* may take all these elements as focus: *only* cannot take the subject as its focus, because *only* is not sister to a constituent containing the subject. Similarly given the constituent structure of (71) – you should draw it – rule (75) will prevent *only* from associating with anything that is underlined.

But now, we seem to have a problem. If (75) is the correct rule, why is association of *only* with underlined material forbidden in (72)? This result would follow if *only* is part of the DP *pepper*, and thus is not sister to the constituent *on these tomatoes*, i.e. as below in a and not in b:

(76) a. the cook will put [only pepper] on these tomatoes

b. the cook will [put only [pepper] [on these tomatoes]].

Why is the option b not possible? The answer to this is that English basically leaves no other option. Adverbs are not allowed to intervene in this position in English:

(77) a. the cook will (carefully) put (*carefully) pepper on the tomatoes

b. the cook will (frequently) put (*frequently) pepper on the tomatoes

In these sentences *carefully pepper* is not a possible DP. Only adverbs that can form a constituent with a DP will be allowed: *only*, or *even* for example, but not *carefully* or *frequently*. *Only* differs from manner or frequency adverbs, and can combine with different types of constituents:

(78) a. only John (only DP)

b. only with John (only PP)

c. only happy (only AP)

d. only put pepper on the tomatoes (only VP)

Note that *only* cannot combine with the whole sentence. If it could, the focus could be anything in the sentence, but we see for example that in the following, the focus can only be *John*:

(79) a. Only <u>John</u> drinks beer

b. * Only John <u>drinks</u> beer

c. * Only John drinks <u>beer</u>

Exercise: Experiment with sentences with *only* and see what the focus can be. If you speak another language than English, try in that language with the word corresponding to *only* if there is one. Think about what it suggests for constituent structure.

3.10 Some more practice

The general mode of investigation we follow is this: We select a string of words (say a sentence, but it does not have to be). We manipulate the string with various processes (such as substitution, movement, coordination, ellipsis), we find that some results are well formed (and some even mean almost exactly the same thing as the original) while some are not well formed (or they have meanings totally unlike the original sentence). To explain this, we postulate that the manipulated subsequences form parts or constituents, pieces of the structure.

Example. Take a sentence like the following:

(80) Bill's mother's friends are waiting at the restaurant

Once we are practiced with the constituency tests, we can quite quickly get to some hypotheses about the structure of this sentence. Just to take the first step, notice for example that the string *Bill's mother's friends* must be a constituent: the subject of the sentence: we can substitute the pronoun *they*, which is a single word and is thus plausibly a single unit with respect to phrase structure.

(81) they are waiting at the restaurant

It can be coordinated with single items:

(82) [Bill's mother's friends] and [John] are waiting at the restaurant

It can be clefted:

Cleft: It was [Bill's mother's friends] [that were waiting at the restaurant]

Notice that the focus position in a cleft can only hold a single constituent, though the single constituent can be complex, like a coordinate structure:

(83) a. It was John [that was waiting at the restaurant]
b. *It was John Bill [that were waiting at the restaurant]
c. It was John and Bill [that were waiting at the restaurant]

Some speakers also accept pseudoclefts or inverted pseudoclefts like this:

Pseudocleft: [who were waiting at the restaurant] were [Bill's mother's friends]

Inverted Pseudocleft: [Bill's mother's friends] were [who were waiting at the restaurant]

Proceeding in this way, we can and will dissect the structures of sentences like this further in the next chapters.

Some other evidence of constituency: We have seen how various kinds of substitution, deletion and distortion manipulations suggest that language has a chunky structure. These tests can be applied by any speaker in just the moment or two it takes to reflect on the matters. Since it is quite challenging to make sense of the results of these tests, as we will see in the next chapters(!), tests like these have been one of the main concerns of linguists. However, when these tests became well recognized in the 1960's, it was important to explore whether the tests actually provided indications of structural properties that other sorts of linguistic tasks could also evidence. These early explorations were by and large successful, and are worth remembering here. They can be found in Fodor, Bever, and Garrett (1976).

In the first place, one constituent that has been taken for granted in the way we have approached language is the *sentence* itself! Almost all of our examples have been these things we call "sentences," but is there really evidence that this unit is a valid one for theories of how we acquire and use our language? It is conceivable that this notion is just taught to us in school, and although we can learn how to use the notion there, maybe it does not really play any significant role in models of human language acquisition, perception, or production.

In fact, there is abundant evidence that a structural unit very close to the one we call a "sentence" is important in a wide variety of linguistic tasks. For example, even the simple task of remembering a sequence of words is significantly easier if the sequence forms a sentence, even if the sentence is semantically and pragmatically nonsensical (Marks and Miller, 1964). For much more evidence, see the studies reviewed, for example, in Fodor, Bever, and Garrett (1976) or Townsend and Bever (2001).

What about the particular structures we seem to find inside the boundaries of sentences. At least for the main outlines of our proposals, the evidence again is abundant that these structures play an important role in memory, perception, production and acquisition of language. We will briefly mention just a few kinds of studies.

Perception of click position. One important kind of study was developed by Ladefoged and Broadbent (1960) and Fodor and Bever (1965). They found that if short bursts of noise, clicks, were played in the background while a sentence is being perceived, the click will often sound like it is in a position different from its actual, acoustic position. In particular, the click will sound like it is closer to a major constituent boundary than it really is.

sentence: that he was happy was evident from the way he smiled
structure, by our tests: [that he was happy] [was evident from the way he smiled]

spoken sentence:	that he was happy was evident from the way he smiled
click position:	*
perceived position:	*

In fact, the researchers discovered that this illusion persists even if you know exactly where the click is, having put it there yourself!

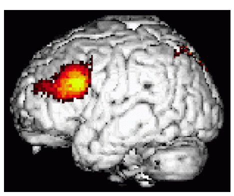
Memorization errors. After having subjects memorize lists of sentences, Johnson (1965) measured the probability that a particular word is incorrectly recalled, and showed that the probability of these errors increased substantially at the beginning of each phrase in the sentence:

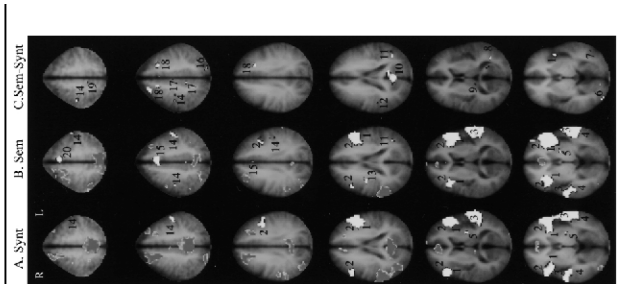
sentence:	the tall boy saved the dying woman
structure, by our tests:	[the tall boy] [saved [the dying woman]]
probability of error:	

sentence:	the house across the street is burning
structure, by our tests:	[the house] [across the street] [is burning]
probability of error:	

The vertical bars indicate the probability of error at the place in the string right above it. The higher the bar is, the higher the probability of error. The correlation between probability of error and phrase boundaries is clear. Many other studies of sentence recall show similar effects.

Neurophysiological correlates of syntactic analysis. It is not surprising that certain distinctive kinds of events occur in the brain during language processing tasks of various kinds. What is more surprising is that some of these brain events produce distinctive electrical potentials detectable by sensors placed on the scalp (ERP), or by magnetic resonance imaging (MRI), and that they are localized in certain parts of the brain. On the left, below is an image of the left side of the brain showing the active prefrontal area (Indefrey et al., 2001), and on the right, each figure is a "slice" through the brain at a certain depth, showing activation at a certain depth in both the the prefrontal and other areas (Embick et al., 2001):





Studies of activity in these areas show that distinctive neurophysiological events occur when you notice a syntactic anomaly (Kang et al., 1999), and when syntactic complexity increases (Featherston et al., 2000), where these notions of anomaly and complexity are defined in structural terms like those developed in this and the following chapters.

3.11 Exercises

(1) Using VP ellipsis and "do so" substitution in as many ways as you can, indicate what conclusions can be drawn about the following examples.

  a. I will fix the computer for Karyl

  b. I will eat spaghetti on Sunday with Marco

  c. I will speak to Hector about this

  d. Smith loaned a valuable collection of manuscripts to the library.

  (If you are not a native English speaker, you should check your judgments with one. As usual briefly mention anything that seems especially tricky or difficult.)

(2) The discussion of right node raising (RNR) earlier states that (33-34) make right node raising a controversial constituency test, but even (60) is puzzling.

  a. Why is (60) puzzling? (hint: compare what the coordination test suggests about this structure with what other tests tell us)

  b. Why exactly does (33) make RNR controversial as a constituency test?

(3) The sentence below is syntactically ambiguous; it has two different structures:

  I will watch the man with binoculars

  a. Draw two different trees for this sentence. Assuming that *will* has category T – don't worry if you are not sure about how to label all the nodes.

  (You should be able to defend your trees using constituency tests, but you only need to explain the tests requested in b)

  b. Explain how at least one of our tests supports the the structure in the first tree but not the second, and how at least one test supports the structure in the second tree but not the first.

3.12 Summary and Conclusion

Substitution: if a string S can be replaced by a single word, this is some evidence that S is a constituent. In particular:

Pronominalization: if a string S can be replaced by a pronoun, this is some evidence that S is a DP

One **substitution:** if a string S can be replaced by *one*, this is some evidence that S is a NP

Do so **substitution:** if a string S can be replaced by *do so*, this is some evidence that S is a VP

Ellipsis: if a string S can be deleted, this is some evidence that S is a constituent

Coordination: if a string S can be coordinated with a word (or phrase), this is some evidence that S is a constituent, a constituent of the same category as the word (or phrase) it is coordinated with

Movements: if a string S can be moved to another position (typically, all the way to the right or to the left), this is some evidence that S is a constituent. In particular:

Topicalization: DPs, PPs, VPs (VP preposing)

Clefting: DPs, PPs

Pseudo Clefting: VPs, APs, DPs,…

Wh-movement: DPs, PPs

Right node raising:

Heavy shift:

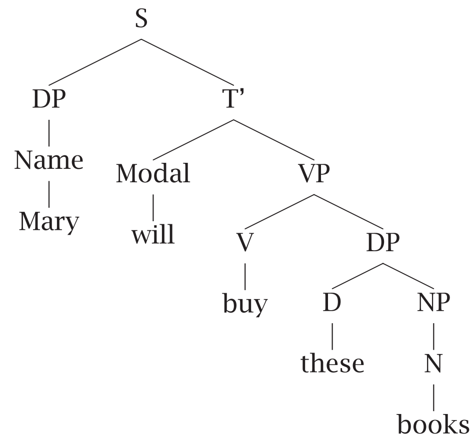
Important caveat: When an experiment does not successfully apply to S, the reasons for failure could be extremely varied. In particular it does not show that S is not a constituent.

When we consider the results of all of the constituency tests we have introduced, a remarkable conclusion emerges: in general, we do not find contradictions. The tree structures that we are led to postulate **for a given string** by using any one of these tests are consistent with the tree structures for that very string that we found in the other experimental conditions. We understand consistency here in the following sense stated informally: no node has more than one mother node. This convergence is a strong indication that the interpretation that we give to each experiment is on the right track.

There are however two cases which seem not to fit with these conclusions: Gapping and Right Node Raising. Let us exemplify the problem with the sentence:

a. Mary will buy these books

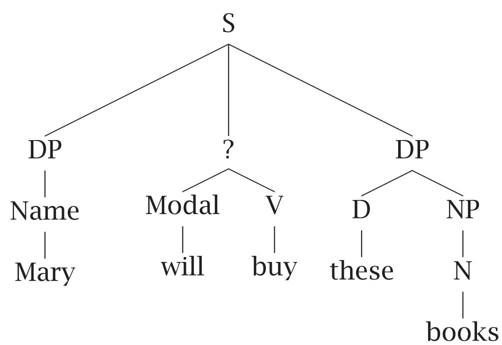
Every test except Gapping or Right Node Raising would suggest the following constituent structure:



But Gapping as in:

a. Mary will buy these books and Sue these magazines

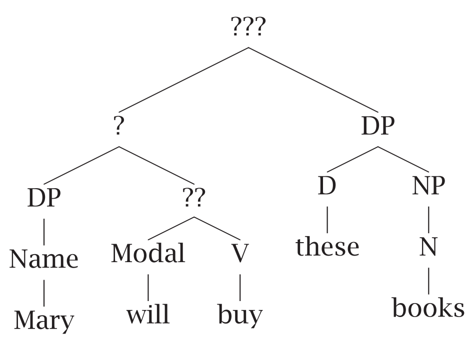
would suggest the following constituency:



And Right Node Raising as in:

a. Mary will buy and Sue will sell, these books

would suggest the following constituency:



We see for example that the node DP which dominates the string *these books* has several mother nodes: in the first tree, this node is VP, in the second it is S and in the third, it is ???. This is why we put Gapping and Right Node Raising aside for the moment until we have developed analytical tools to understand what is is happening here.

4

Clauses

We now examine the structure of various types of constituents in more detail, beginning with structures near the level that are commonly called "clauses:" sentence-like structures that are commonly described as having a "subject" and a "predicate."

Through the procedures, the tests, that we used to detect constituency, we have established the existence of all sorts of higher order units in sentences, units larger than single words. We have labelled some DPs, or VPs etc.. To a certain extent this is justified. Just as we called N all the words or morphemes sharing some properties (e.g. the ability to be put in the plural), it seems legitimate to call DP anything that can be replaced by a pronoun such as *she*, *he* or *it*. In another sense however, we have not offered any justification for the choice of particular names: would it have made sense to call what we call DPs VPs instead? As we will see the answer is negative. In fact, it is difficult to fail to see that such labels are related to word level categories - DP to D, VP to V, PP to P etc. In this chapter we will discuss this question. The notion of **head** we introduced in chapter **??** will play an important role, so this may be a good time to go back to chapter **??** and check again what this concept means.

4.1 Full clauses: CPs

We begin with the category we call a complementizer phrases, CP. These are phrases that contain a complementizer C like *that*, followed by a constituent which we will call a tense phrase, TP. For the moment, the name CP is meant to evoke some connection with complementizer, but we have not seen why this is a good name. Consider a few examples of CPs:

(1) you will see [that the girl will put a picture on your desk]

(2) I doubt [that Mary reads mysteries]

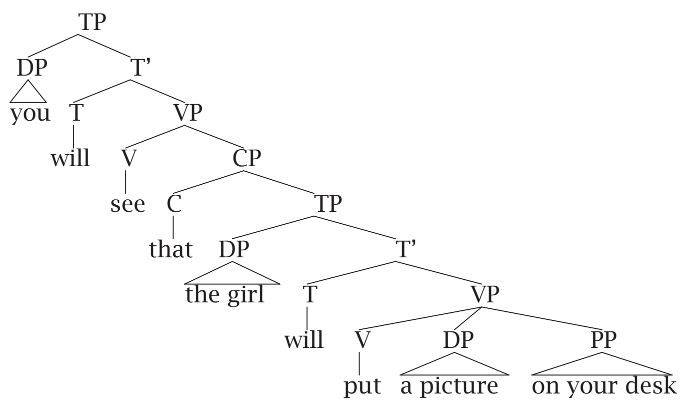
(3) He muttered [that the visitors will leave]

(4) The fact [that John is snoring] is informative

(5) The man [that Mary saw] knew me

(6) [That the visiting team won the race] could surprise them

The constituency tests identify these bracketed strings as constituents: we see that some can be replaced by a pronoun (*it*); they can be coordinated; in some contexts they can be elided. Looking inside these CPs, we see familiar structures too. The sentence in the CP indicated in (1) is much like the ones investigated in the previous chapter. Now we will be more careful in our labeling of the clause-level constituents. To begin, we seem to have this kind of structure:



The sister of C is what we called a "sentence" in the previous chapters, and we labelled it S, but we now call TP - the same label as for the entire sentence. For the moment, these names are not justified but we will justify them. In the previous discussion we mentioned that we would call the constituent that contains T and VP a T' (read "T-prime" or "tee-bar").

Notice that the complementizer *that* is different from what is usually called a "demonstrative" *that*:

(7) I like that student

(8) That is what you should see

Notice that the demonstrative occurs in a position where other determiners can occur (*the*, *a*, *this*,…), but no determiners can go in the position of *that* in the tree drawn above.

The complementizer *that* is also different from the *that* in sentences like this one:

(9) *That* is a complementizer, a word with 3 phonemes in it.

Here the italics signify that we are using *that* to refer to itself, to the very word *that*. In this sentence, *that* is a special kind of name, sometimes called a “quotation name” because quotes are often used instead of italics to signal this use. Notice that the quotation name can be replaced by a pronoun like *it*, but the complementizer shown in the tree above cannot be replaced by *it*.

The complementizer *that* has a special role which we will understand better once we compare it with some other complementizers. First recall that we already saw reasons to support the idea that the string dominated by CP is indeed a constituent. For example, it is easy to verify that this string can be topicalized, or conjoined with a comparable string. It is also easy to verify that this CP constituent above forms a constituent with the verb *see*, as our tree structure assumes (VP topicalization, VP ellipsis or coordination with another VP would show this easily). This makes it reasonable to assume, as we done, that this constituent that we are calling a CP can occur as the sister to a verb like *see* in (1). Various other verbs can occur here too, but the range is restricted:

(10) $$\text{You will} \left\{\begin{array}{c}\text{see}\\ \text{believe}\\ \text{hope}\\ \text{say}\\ \text{claim}\\ \text{whisper}\\ \text{*kick}\\ \text{*sleep}\\ \text{*run}\end{array}\right\} \text{that the girl will put a picture there}$$

The verbs that occur most naturally in this context seem to be “verbs of saying and believing,” verbs that describe a relation between a subject and a proposition of some kind. Informally speaking, a proposition describes a state of affair that can be true or false. For example the sentence *John is here* describes a state of affair that can be true or false. One can say or have an attitude toward these propositions (such as believing it or doubting it). These "attitude" verbs are different from verbs that denote physical actions or states.

Some verbs allow a different elements to seemingly occur in the complementizer position, but this possibility varies with the choice of verb:

(11) $$\text{John knows} \left\{\begin{array}{c}\text{that}\\ \text{if}\\ \text{whether}\end{array}\right\} \text{she left}$$

(12) John wonders $\left\{\begin{array}{c}\text{*that}\\ \text{if}\\ \text{whether}\end{array}\right\}$ she left

(13) John thinks $\left\{\begin{array}{c}\text{that}\\ \text{*if}\\ \text{*whether}\end{array}\right\}$ she left

First, it would be easy to establish that the strings following the verbs *knows, wonders and thinks* form a VP constituent with these verbs and also are constituents. Are these constituents CP?

How do we determine the identity of a constituent? One way is to use an experiment that unambiguously applies to a known constituent type. We have assumed that VP-preposing or VP-ellipsis is like this. Substitutability by a personal pronoun is characteristic of DPs while *one*-replacement identifies NP. Another powerful option is coordination, since successful coordination seems to require categorial identity of the conjuncts.

This last approach immediately allows us to draw the conclusion that the strings *that she left* and *whether she will come back* are both CPs, if the first one is:

(14) John knows that she left

(15) John knows whether she will come back

(16) John knows that she left and whether she will come back

(17) John knows that she left and John knows whether she will come back

This does tell us that we are dealing with two CPs but we do not yet know why we call them CPs, with a C reminiscent of Complementizer. There are other, important ways to which we now turn, of trying to establish the identity of a constituent which will answer this question. First note that very roughly, (11) shows that you can know the content of a proposition (*that she left*) or the answer to some kind of question (*whether she left*); (12) shows that while you can wonder about a question, you cannot wonder a proposition; and (13) shows that you can think a proposition, but not a question. That is, it seems that the complementizers play some role in specifying whether the constituent that follows is a question (an "indirect question") or an assertion of some kind. They seem to play the same role, namely typing the constituent that follows them. This suggests they belong to the same category.

The idea that *that, if,* and *whether* play a similar role and thus are the same category also receives some support from the fact that only one of these elements can occur at a time, even with verbs like *know* or *say* which allow any one of the three to occur:

(18) You should say $\left\{\begin{array}{c}\text{that}\\ \text{if}\\ \text{whether}\\ \text{* if whether}\\ \text{* that if}\\ \text{* whether that}\end{array}\right\}$ she left

This fits with the idea that there is a single structural position that can be filled with any one of these elements, but not more than once.

In these examples, we begin to see the justification for calling expressions like *that she left* a CP. This constituent has a pronoun and a verb in it too – why not call the constituent a NP, or DP, or VP? We see in the previous examples that, surprisingly, the little words we are calling complementizers C play the critical role in determining the distribution of what we are calling CPs. The constructions above are not sensitive to changes in their subjects:

(19) a. John knows $\left\{\begin{array}{c}\text{that}\\ \text{if}\\ \text{whether}\end{array}\right\} \left\{\begin{array}{c}\text{she}\\ \text{the student}\\ \text{all ten of the people I know}\end{array}\right\}$ left

b. John wonders $\left\{\begin{array}{c}\text{*that}\\ \text{if}\\ \text{whether}\end{array}\right\} \left\{\begin{array}{c}\text{she}\\ \text{the student}\\ \text{all ten of the people I know}\end{array}\right\}$ left

c. John thinks $\left\{\begin{array}{c}\text{that}\\ \text{*if}\\ \text{*whether}\end{array}\right\} \left\{\begin{array}{c}\text{she}\\ \text{the student}\\ \text{all ten of the people I know}\end{array}\right\}$ left

The distribution of the CPs is not sensitive to changes in the VP either:

(20) a. John knows $\left\{\begin{array}{c}\text{that}\\ \text{if}\\ \text{whether}\end{array}\right\}$ she $\left\{\begin{array}{c}\text{left}\\ \text{wants to visit Paris}\\ \text{kicks a perfect goal every time}\end{array}\right\}$

b. John wonders $\left\{\begin{array}{c}\text{*that}\\ \text{if}\\ \text{whether}\end{array}\right\}$ she $\left\{\begin{array}{c}\text{left}\\ \text{wants to visit Paris}\\ \text{kicks a perfect goal every time}\end{array}\right\}$

c. John thinks $\left\{\begin{array}{c}\text{that}\\ \text{*if}\\ \text{*whether}\end{array}\right\}$ she $\left\{\begin{array}{c}\text{left}\\ \text{wants to visit Paris}\\ \text{kicks a perfect goal every time}\end{array}\right\}$

If a CP is a well formed string, changing something in its VP to yield another well formed string is not (in general) going to change where this CP is going to occur. The element that determines which CP can occur in all of these constructions is the C! This is a property that we have already encountered in Morphology with the notion **head.** Recall that the head of a constituent had the following properties:

(21) a. The **head** of a constituent tells us the category of the constituent

b. The **head** of a constituent tells us the distribution of the constituent (where it can occur, the grammatical context in which it can appear).

c. The **head** of a constituent also selects certain constituents to combine with.

The relation that we have identified between C and CP is this second property: This is why we call the phrase a CP. The C is the **head** of the CP because it has these properties, similar to the heads of words we saw in morphology.

In all the examples above, the complementizers seem to combine with the constituent that we called a "sentence" in the previous chapters, but if we extend our survey of clauses a little further we find that there may be some variation here too. That is, we will find some complementizers that combine with clauses that are not usually called "sentences."

So far we have seen that CPs can occur as the sister of V:

(22) a. John asked [whether she left]

b. I doubt [if she kicks perfect goals every time]

c. They think [that she can do it]

The same CPs can occur as subjects of sentences, as we see in examples like these:

(23) a. [whether she left] is most unclear

b. [That the girl put a picture there] proves her guilt

So it looks like both CPs or DPs can be the subject of a sentence (Note that both the notion of sentence and the notion of subject are used informally until we define them later).

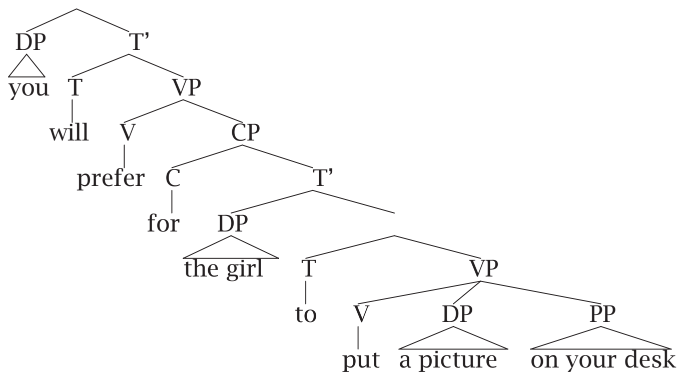
Now compare the following examples to the structures above:

(24) I prefer <u>for the girl to put a picture there</u>

(25) <u>For the girl to put a picture there</u> is what I prefer

(26) <u>For the girl to put a picture there</u> would surprise you

In (24), it seems that a certain kind of attitude "preference" is being described as holding between the subject and the proposition, or state of affairs, of the girl putting a picture there. In (25), we see that the constituent following the verb can be pseudoclefted, and we see that the constituent can occur as the subject of other sentences too, sentences similar to those in (23). This suggests that the structure of (24) is very similar to the structure of (1), so we propose the following tree for (24), similar to the tree for (1) that is displayed on page 94:



Here the verb *prefer* has a CP with the complementizer *for*, while in the tree on page 94 we had the verb *see* with the complementizer *that*. The only surprising idea here is that *to* should be labeled *T*, the way *will* is in the earlier tree. If we take *for* to be a complementizer, it should be in complementary distribution with other complementizers. It is not so easy to see right away (because the other complementizers seem to occur with different sentence type - tensed instead of infinitive) but we will see later that this is correct. Furthermore, we would expect that such CPs which have *for* as complementizer should occur in environment in which other CPs do not and we will see this later as well.

Let us now turn to the fact that we labeled *to* as *T*. We can support this idea, by noticing that when this *to* occurs, neither *will* nor any other tense (future, present, past) can occur:

(27) a. I prefer for the girl to win
b. * I prefer for the girl to will win
c. * I prefer for the girl to wins
d. * I prefer for the girl to won

Furthermore, the verb *to win* is the infinitive, tenseless form of the verb, and so from this perspective, it is not unnatural to think that *to* fills the tense position as a kind of "zero" value. If T is filled with *to*, the clause is *infinitival.*

VP ellipsis provides further support for the view that the position of *to* is outside of the VP, exactly the way *will* is. Like the *will* in that-clauses, the *to* cannot be elided:

(28) a. that Ann will go out every night is expected, but I cannot believe that Sophie will ~~go out every night~~
b. * that Ann will go out every night is expected, but I cannot believe that Sophie ~~will go out every night~~

(29) a. For Ann to go out every night is expected, but I wouldn't like for Sophie to ~~go out every night~~

b. * For Ann to go out every night is expected, but I wouldn't like for Sophie ~~to go out every night~~

We are led to distinguish two types of clauses: tensed clauses, in which there is an indication of the relative time at which what the clause talks about takes place; and tenseless or infinitival clauses in which there is no overt indication. In a simple clause, the content of the T node indicates how the event we are talking about is placed in time. For example, *John will leave* means John's leaving will take place in the future. In infinitival clauses, there is no indication of how to place the event in time. This is why infinitivals are called "tenseless," even though they have a constituent of category T. Just like there are different kinds of nouns (say mass and count), there are different kinds of Ts. To distinguish the T found in tensed clause and the T found in tenseless or infinitival clauses, we will tag the first with the feature +tense and the second with the feature -tense.

Like the complementizer *that*, the infinitival *to* could be confused with other words that sound the same – we should avoid this! For example, in (30), we see that *to* can occur as a preposition, in a position where other prepositions could occur:

(30) Let's walk $\left\{\begin{array}{c}\text{to}\\ \text{on}\\ \text{near}\end{array}\right\}$ the beach

Notice that none of these other prepositions could replace the T *to* in (24). There are also other words that sound the same but are spelled differently, words which clearly cannot appear in the structural position T:

(31) I run on the beach $\left\{\begin{array}{c}\text{too}\\ \text{also}\end{array}\right\}$

(32) He works $\left\{\begin{array}{c}\text{too}\\ \text{extremely}\end{array}\right\}$ hard

(33) The $\left\{\begin{array}{c}\text{two}\\ \text{three}\end{array}\right\}$ sunbathers went swimming

The infinitival *to* has a special role in the grammar, a role that it places in the T position which is related to the tense of the clause.

Summarizing, we see now that there is a range of complementizers (*that, if, whether, for*) which combine with certain clausal constituents:

(34) a. I hope [that [Mary wins]]

b. They know [if [Mary won]]

c. I wonder [whether [Mary will win]]

d. They prefer [for [Mary to leave]]

We notice that the subject *Mary* can be replaced by other subjects like:

(35) I hope that $\left\{\begin{array}{c}\text{the student}\\ \text{some exciting person}\\ \text{no one from Antarctica}\end{array}\right\}$ wins

And the verb phrase *win* can be replaced by other verb phrases:

(36) I hope that Mary $\left\{\begin{array}{c}\text{wins}\\ \text{kicked a perfect goal}\\ \text{gets a chance to have a vacation in Antarctica}\end{array}\right\}$

What the complementizers care about is not what the subject is or what the VP is, but what the tense is:

(37) They hope [that [Mary $\left\{\begin{array}{c}\text{will win}\\ \text{won}\\ \text{wins}\\ \text{*to win}\end{array}\right\}$]]

(38) They prefer [for [Mary $\left\{\begin{array}{c}\text{*will win}\\ \text{*won}\\ \text{*wins}\\ \text{to win}\end{array}\right\}$]]

So what should we call the constituents like *Mary will win* or *Mary to win*? We call them TPs, because their distribution is primarily governed by their tense. They can occur as a main sentence or with *that, if, whether* only if they have non-zero “finite” tense, +tense (future, present, past), and they can occur occur with *for* only if they are infinitival, -tense.

While *that* and *if* require finite +tense TP, and *for* requires a -tense TP, we can see that *whether* allows either one:

(39) a. John wonders whether Mary will win

b. John wonders whether to win

(40) a. Whether she will win is a question Mary never considered

b. Whether to win is a question Mary never considered

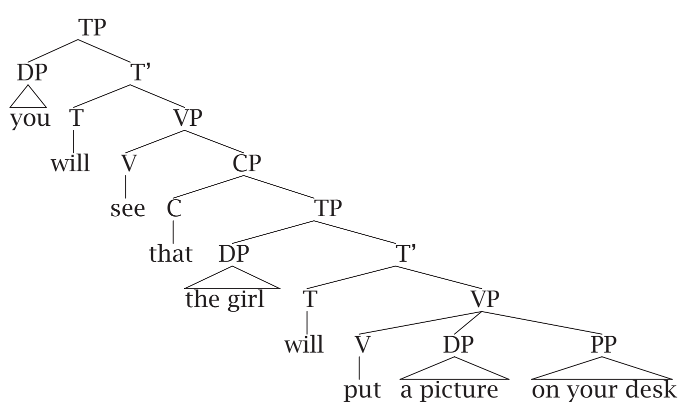
We will return to explore more of the properties of these different structures later, but some of the basic outlines of clause structure are becoming clearer and simpler than they may have seemed at first.

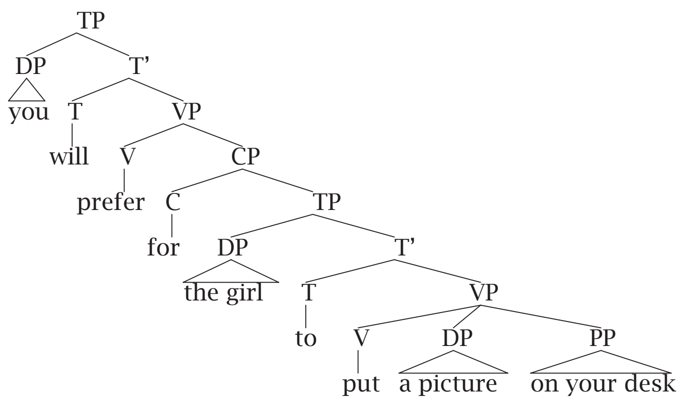
Given that the complementizer *that* only cooccurs with tensed clauses and the complementizer *for* only cooccurs with tenseless clauses, we could have entertained another hypothesis, namely that a verb like *think* selects a +tense T, which in turn selects a complementizer like *that*, while a verb like *hope* selects a -tense T which in turn would select a complementizer like *for*. This would mean the complement of V is a TP not a CP, and that this TP would contain a C as initial element. Such an alternative hypothesis would run into problems however. First note that certain verbs do not care about the tense of their complement clause, e.g. *wonder* (*I wonder whether you left early* , *I wonder whether to leave early*), but they very much care about the complementizer they allow, here *whether* but not *that*. Secondly, note that what happens with the verb *think* or similar verbs would be surprising: they allow tensed clauses as complements but disallow certain complementizers (e.g. *if*) that are allowed to occur with tensed clauses. Again, it seems that the verb does care about the complementizer itself. The hypothesis that the complement of a verb is a CP headed by C seems more justified.

Our constituency tests showed that the TPs have a structure like this:

$$\text{DP T V } [_{CP} \text{ C } [_{TP} \text{ DP [T VP]]]}$$

We now have the label TP, because the T determines the distribution of the phrase, but what should we call the constituent [T VP]? This element contains the T that we would like to regard as the head of the TP, and so we call this constituent a T' (tee-bar). So we have justified the labels for many of the constituents in the trees shown earlier in this chapter:





Notice that we have labelled the roots of these trees TP. One simple reason for this reason is that these sentences behave much the same way as the TP they include. For example, they can be embedded as sisters of a the complementizer *that* as in:

(41) I think that *you will see that the girl will put a picture on your desk*

(42) They understand that *you will prefer for the girl to put a picture on your desk*

4.2 Summary: the general results so far

Now we can return to consider the role of heads of phrases. Repeating (21) from page 97:

(43) the **head** of a constituent

a. determines the category of the constituent,

b. determines the distribution of the constituent (where it can occur), and

c. selects certain constituents to combine with

In CPs, we see now that the head C does not simply combine with sentences, but rather it cares about the tense of the constituent it combines with, and so we call these constituents TPs. The complementizer *that* selects +tense TPs, and the complementizer *for* selects -tense TPs.

In sum, both CPs and TPs are constituents with syntactic heads that have these properties:

(44) the heads are word level categories (remember the word level categories are: C,T,N,V,P,D,…)

(45) if an element is the head of a string, the maximal string whose distribution is "controlled" by this element is a constituent

(46) there is only one head per constituent

(47) since constituents are continuous strings, the maximal string under the distributional control of a head must be a continuous string.

None of these properties are necessary. These are empirical claims about how human languages work.

In general, our convention for labeling constituents will be this:

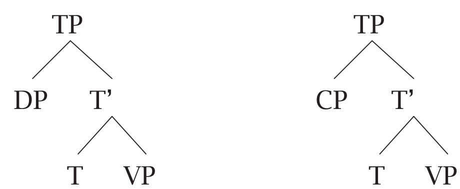
> A head of category X sometimes combines with certain other constituents and controls the distribution of the whole complex. The maximal extension of the string that is controlled by the head in this way is called the *maximal projection* or *phrasal projection* of this head and is labeled XP.

(Sometimes the head X of a phrase is labeled X0, and sometimes the maximal projection XP is called X^{max} or X2 or $\overline{\overline{X}}$.)

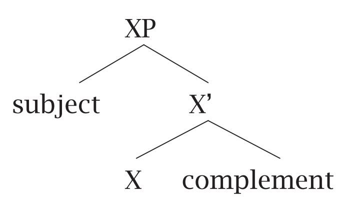
TPs and CPs are both called *clauses*, and we have seen that the term "sentence" usually refers to a tensed TP. A clause that is not contained in any other, the topmost one, is called the *main clause* (or *root* clause, or *matrix* clause). The verb of this clause is the main verb. A clause that is contained in another is said to be an *embedded* or *subordinate* clause.

In examples (1), (23) and the others considered above, we have seen TPs with the following internal structures:

$[_{TP}$ DP $[_{T'}$ T VP]] $\quad$ $[_{TP}$ CP $[_{T'}$ T VP]]



The DP or CP sister of T' is called the *subject* or *specifier* of T. We use these notions in the structural sense: the subject of the TP is the constituent which is a sister of T' and a daughter of TP. The VP sister of T is called the *complement* of T. We will use these structural, configurational terms to refer to constituents like this for all categories X:



A constituent that is a sister of X is called a complement of X or XP. A constituent that is a daughter of XP and sister of X' is called a specifier or subject of X or XP.

Various notions of "subject." In this discussion, the subject of a clause is a DP or CP that occurs in a particular configuration, as sister to T'. One property that subjects have in English is agreement with the finite verb (with regular verbs of English, this is visible only in the 3rd person singular present tense). We will see a number of other properties of the structural subject position later.

In the linguistic literature, the term *subject* is used in many different ways, and so it is important to pay attention to what is meant. The notion just defined is a purely structural one, and one that is much less common than the different notion of "logical subject" or "agent" of a sentence, roughly, the person or thing that does the action described by the verb.

For example, in our sense of "subject," *Mary* is the subject of (48), but *the paper* is the subject of (49), even though the agent of the action is the same:

(48) Mary cuts the paper easily

(49) The paper is cut by Mary

(50) The paper cuts easily

In (50), *the paper* is again the subject, even though the agent of the action is not mentioned at all. Constructions like (48) are called "active." Constructions like (49) are called "passives," and constructions like (50) are called "middles." We will have more to say about passive and middle constructions later.

In the clauses we have considered so far, T almost always has a subject (the single exception we have seen are in CPs such as *whether to win* to which we will return later). T always has a complement VP (though we have already seen that this VP can be "deleted" in VP-ellipsis constructions). A +tense T requires a nominative subject, while a -tense T requires an accusative subject. (This is the *case* property we mentioned earlier, which is visible on pronouns in English: *he* is in the nominative case, *him* is in the accusative case.)

(51) a. [That he won the race] could surprise them

b. * [That him won the race] could surprise them

c. [For him to win the race] would surprise them

d. * [For he to win the race] would surprise them

Some of the results of this section be summarized as follows.

- English has various **complementizers:** *that, if, whether, for.*
- The complementizers *that* and *if* differ from *for* in that the former can only occur with a +tense TPs while the latter can only occur with -tense TPs. To code this fact, let us mark *that* and *if* as +tense and *for* as -tense. As for *whether*, it is compatible with either +tense or -tense TPs so let us leave as unmarked for the feature tense. The complementizers *if, whether* form CPs that express "indirect questions." To distinguish them from the others, we can mark them with the feature +Q (for question) or + wh (because many English question words such as *who, what, where, when* begin by "wh"). The complementizers *that, for* introduce declarative CPs.

  This gives us the following approximate lexical entries for these complementizers.
- *that:* C, free, [+tense], [-Q], select finite +tense TP complement
- *if:* C, free, [+tense], [+Q], select finite +tense TP complement
- *for:* C, free, [-tense], [-Q], selects infinitive −tense TP complement
- *whether:* C, free, [+Q], selects infinitive or finite ±tense TP complement

We have carefully avoided some questions that we should return to later. For example, what is in the position of the tense T in sentences like a and b, below?

(52) a. John saw Mary

b. Harry likes movies

In sentences like these, it looks like tense and the verb are not separated the way they are in the future,

c. John will leave

or in infinitive clauses:

d. [For Mary to leave on time] is important.

To understand this, we will first have to take a closer look at VP structure. A number of other puzzles came up but were not discussed, and there are kinds of CPs that we did not get to yet! We will return to the most important puzzles, but languages are immensely complex and exhaustivity is not our objective. What is most important is developing skills for reasoning about new structures.

4.3 Exercises

(1) Consider the following sentence:
No student will forget that some phrases will be deleted

a. Draw a complete tree for this sentence, using the labels introduced in this chapter

b. For each T' in this sentence, provide at least one example to show that it can be coordinated

c. For each VP in this sentence, provide at least one example to show that it can be coordinated

d. For each VP in this sentence, provide at least one example to show that it can be elided

e. Confirm the constituency of the embedded CP using each of the following:

i. topicalization

ii. a cleft construction

iii. a pseudocleft construction

f. For each element of category T, show whether this element can be coordinated with *to*, and explain what the results mean. (Remember that coordination is one of the tests for which both success and failure are meaningful.)

(2) Consider the following sentence:
For you to succeed will be no surprise

a. Draw a complete tree for this sentence, using the labels introduced in this chapter

b. For each TP in this sentence, provide at least one example to show that it can be coordinated

c. For each T' in this sentence, provide at least one example to show that it can be coordinated

d. For each VP in this sentence, provide at least one example to show that it can be coordinated

(3) Draw a complete tree for the following sentence:
I would hate for the homework to be boring.

5

Many other phrases: first glance

5.1 Verb phrases

In the previous chapters, we arbitrarily used the label VP for the constituent that T selects. Given the structural hypotheses and labelling conventions described in the previous chapter, we now know something about why the label VP is chosen: we expect that the fundamental properties of the constituent we call VP are determined by a V that is its head. In particular,

i. the distribution of the constituent we call VP is determined by its V;
ii. the formation of a VP is determined by what the V selects.

In other words, the verb plays the primary role in determining what is required internal to the VP, and where this VP can occur in a string.

We have already seen evidence that the V is the crucial element in determining the distribution of the constituent selected by T. For example, in the following sentences, we see many different kinds of constituents in the TP following T, but the element they all have in common is a V:

(1) a. The girl [[$_T$will] [sleep]]
b. The girl [[$_T$will] [put a picture on your desk]]
c. I [[$_T$should] [know whether they [[$_T$will] [put a picture on your desk]]]]
d. I prefer for them [[$_T$to] [put a picture on your desk]]
e. I wonder whether [[$_T$to] [put a picture on your desk]]

So far, the main position in which VPs occur is as complements of T. They may also be topicalized (under VP-preposing) but in such cases, there is always another sentence in which the preposed VP is a complement of T as the following pairs illustrate:

(2) a. Sleep ,
the girl will
b. The girl [[$_T$will] [sleep]]
c. put a picture on your desk T
he girl [$_T$will]
d. The girl [[$_T$will] [put a picture on your desk]]

Note that we have two notions of VPs. One is well defined and properly named: a constituent whose head is a V. The other was the informal usages: the constituent subject to what we called VP-preposing or VP-ellipsis. We should make sure that these two notions coincide. As a first approximation, it looks like they do: VP properly named - that is VP the constituent with V as head - is the complement of T. It is also the complement of T that is targeted by VP Ellipsis or VP topicalization. There are cases - some discussed for example in Johnson (2001), which *warning* is a very advanced article - in which what we properly call a VP cannot be subject to VP Ellipsis or VP topicalization. As always, such failures are not obviously indications that such constituent are not VPs.

Although a verb may sometimes come alone as in 1a, often it does not. The other material that is in the VP is also determined primarily by the verb: the verb determines the internal structure of its VP.

The determination of internal structure by the verb is familiar. Even dictionaries usually indicate whether a verb is "transitive" (taking a "direct object") or "intransitive." A quick survey of various verbs immediately reveals that they vary quite a lot:

(3) elapse, *elapse a book, *elapse to Bill, *elapse that Mary slept
*examine, examine a book, *examine a book to Bill
*send, send a book (to Bill), send Bill a book, *send that Mary slept
*put, *put a book, *put on the table, put a book on the table

Let's explore the internal structure of some of these VPs more carefully.

First, recall the surprising conclusion we reached earlier (p.64, for example) that the sentence

(4) this girl will put a picture on your desk before tomorrow

has two VPs in it! Let's review the arguments for this.

5.1.1 V adjuncts

The evidence that (4) has two VPs comes from constituency tests:

two ways of doing VP ellipsis:

a. that girl will put a picture on your desk before tomorrow, but this girl will ~~put a picture on your desk before tomorrow~~ too

b. that girl will put a picture on your desk before tomorrow, but this girl will ~~put a picture on your desk~~ before tomorrow too

c. * that girl will put a picture on your desk before tomorrow, but this girl will ~~put a picture~~ on your desk before tomorrow too

d. * that girl will put a picture on your desk before tomorrow, but this girl will ~~put~~ a picture on your desk before tomorrow too

two corresponding do-so substitutions:

a. that girl will put a picture on your desk before tomorrow, but this girl will do so too

b. that girl will put a picture on your desk before tomorrow, but this girl will do so before tomorrow too

coordination of these two constituents:

a. this girl will put a picture on your desk and leave before tomorrow

b. this girl will put a picture on your desk before tomorrow and leave

There are some other constituency tests that can apply too. Topicalization of a VP also known as *VP-preposing*: gives similar results:

(5) a. Think about linguistics all night, she does ~~think about linguistics all night~~

b. Climb to the top, they do ~~climb to the top~~

This construction sounds rather stilted to some speakers, but for others it is fairly natural. (Yoda, of *Star Wars* fame, uses this construction a lot, saying things like: “Mind what you have learned. Save you, it can.”) With this test, we get further confirmation for our two VP hypothesis, since we can prepose in two ways:

two ways to apply VP-preposing:

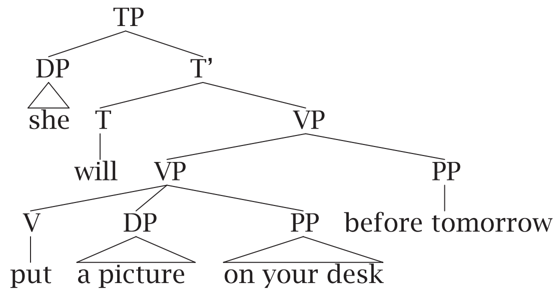
a. put a picture on your desk before tomorrow, she will ~~put a picture on your desk before tomorrow~~

b. put a picture on your desk, she will, ~~put a picture on your desk~~ before tomorrow

c. * put a picture, she will, ~~put a picture~~ on your desk before tomorrow

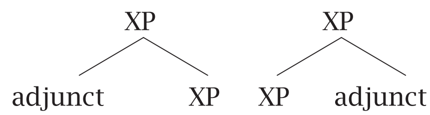
d. * put, she will, ~~put~~ a picture on your desk before tomorrow

These tests provide converging evidence for a structure like this:



In this tree, the DP and the PP [on your desk] are complements of V in the sense defined in chapter 4: they are sisters of V. When a VP has a single DP complement like this, it is called a "direct object" because the relation between this DP and the V is not mediated by any grammatical particle.

The status of the PP [before tomorrow] in the tree above is more surprising: it is not a sister of the V because it is in a different VP. This kind of element is called an *adjunct* of the head V (or of the VP), whether it is on the right or the left:



Constituency arguments like the ones used on the previous example show that the bracketed phrases in the following are adjuncts too:

(6) a. John can go to the market [on his bike]
b. Mary should buy some flowers [on Sunday]
c. My niece could write me letters [before her third birthday]
d. My nephew could write letters to his parents [with a fountain pen]

For all these sentences, The VP has the following structure:

$$[_{VP} \; [_{VP} \; \text{V}\ldots] \; \text{PP}]$$

where the indicated PP is both inside a VP and outside a VP. And the same constituency arguments show that various kinds of constituents can be VP adjuncts, not just PPs:

(7) a. John can go to the market [quickly]
b. Mary should buy some flowers [for her mother to arrange]
c. My niece could write me letters [more faithfully]
d. My nephew could write letters to his parents [every week]

In English, complements always follow their heads, but adjuncts may precede or follow their host (subject to some restrictions that we will postpone exploring):

(8) a. John can [quickly [go to the market]]
b. My niece could [more faithfully [write me letters]]
c. ? My nephew could [every week [write letters to his parents]]

In (8a) the AdvP [quickly] is a VP adjunct that precedes the VP.

There are some general differences between complements and adjuncts that can help determine whether a constituent is one or the other:

As we discuss below in the shaded box, complements are selected in a way that adjuncts are not: the existence of entities that are referred to by complements are implicit in the specific meaning of the verb. This is not the case for adjuncts. This does not mean that there are no selectional relations between a head, say a V, and an adjunct, say to VP. We will discuss some examples later in this chapter.

Adjuncts are always optionally present, while complements are sometimes (most of the time) obligatorily present (we discuss complement omission in a shaded box later in this chapter).

Complements cannot be reiterated while adjuncts can be. This is exemplified below

(9) a. * John can go [to the market] [to India]
b. * Mary should buy [some flowers] [some bread]
c. * My niece could write me you letters
d. * My nephew could write [letters] [the postcards] [to his parents] [to his brother]

(10) a. John can go to the market [on his bike][on a truck]
b. Mary should buy some flowers [on Sunday] [at 5 o'clock]
c. My niece could write me letters [before her third birthday] [before Thanksgiving]
d. My nephew could write letters to his parents [with a fountain pen] [with your help]

Semantic differences between complements and adjuncts. We have seen how constituency tests allow us to identify adjuncts, but, at least in most cases, it seems that the constituents picked out by these tests have a special distinction, which is expressed in the following hypothesis:

(H) Complements denote entities that are required and **specific** to the action or event that the verb refers to, while adjuncts are not **specifically** required in this way.

The notion of being "specific to" the meaning of the verb is sometimes quite clear.

For example, take the verb *visit*. For a visiting to take place, there must be a visitor and something visited: two entities are required. One of these is the subject, and the other is the complement:

(11) <u>Pelé</u> visited <u>his uncle</u>

Visitings may also occur at particular times and places, but every event takes place at some time or in some place, so if you mention the time or place at which an event takes place, it is with an adjunct: *in Brazil*, *every morning*.

Consider the verb *put*: for a putting to take place, there must be someone who does the putting, some object that is moved and a location that the object is moved to. Note that the location in this case is specifically required by the meaning of the verb *put*. So in

(12) <u>Mary</u> put <u>the ice cream</u> <u>in the fridge</u>

the phrases *the ice cream* and *in the fridge* are both complements of *put*.

The reader is invited to check intuitions about the verbs in the following sentences, for example, against the results of constituency tests:

(13) She sold the car to Sam for five dollars

(14) She ran the car on propane from Reno to Vegas

(15) She built the house with her own hands from bricks and mortar

(16) The process changed the substance from solid to liquid to gas to energy

(17) We associated their subsidiaries with our corporate office

(18) I bicycled around France

There is another way in which adjuncts can often reliably be identified. Consider again an example like:

(19) Mary drank [some beer] [in the barn] [from 6 to nine]

Are the three bracketed constituents arguments or adjuncts? The previous tests would show that the first one is a complement of the verb (it is part of the smallest VP containing the verb) but the other two are adjuncts. If someone drank, we can say that a drinking event took place. Now notice what we can and cannot say about this event:

(20) It was in the barn *or* it took place in the barn

(21) It was from six to nine *or* it took place from six to nine

(22) *It was some beer *or*it took place some beer

It is possible to say of this event that it was X if X in an adjunct but not otherwise. This provides a different way to help decide whether a constituent is a complement or an adjunct. Note that we cannot say either:

(23) *It was Mary

So [Mary] is not an adjunct (in fact it not a complement either but rather a subject, of TP).

Of course, eventually, we would like to know why this "event" test works. One observation we can make here is that this test does not work well with stative verbs, for example verbs such as *fear* or *love*, which denotes ongoing psychological states.

5.1.2 V complements

This understanding of the distinction between complements and adjuncts does not change the fact that different kinds of verbs select different complements. We have already seen, for example:

Some verbs select wh-CP among other things

(24) a. They wonder [whether Mary will run]
b. They wonder about this
c. They wonder

Some verbs select that-CP among other things

(25) a. I know [that she runs]
b. I know this
c. I know
d. I said [that she runs]
e. I said that
f. *? I said

Some verbs select for-CP, or DP

(26) a. I prefer [for Mary to run]
b. I prefer [this]
c. * I prefer
d. I said [for Mary to run]
e. I said [this]

(Exercise: Make sure that the embedded CPs in these examples are complements, not adjuncts.)

In the first chapters, we gave a lot of attention to sentences with the verb *put*, which actually has extremely unusual selection requirements:

Some (few!) verbs select a DP and a locative-PP and require it

(27) a. I put the book on the shelf
b. * I put the book
c. * I put

There are other verbs that allow the same two complements, DP locative-PP, but none of these others require them: *arrange, immerse, install, lodge, mount, place, position, situate, stash, stow.* Of course, we would like to know whether it is just an accident that *put* is the verb with the peculiarity of requiring both complements to be present, and why this requirement is so infrequent.

Quite a few verbs do not need to have any complement at all; these are sometimes called "intransitives." But it is easy to see that there are various different kinds of intransitive forms. (Different linguists use different labels for these different kinds.)

Unaccusatives: these verbs can occur intransitively with a subject, but also with the so-called expletive *there* and the subject in complement position:

(28) a. Two ships appeared, arrived, remained, emerged
b. Suddenly, there appeared two ships on the horizon

(29) a. Two inspectors from the INS appeared, arrived, remained, emerged
b. Suddenly, there arrived two inspectors from the INS

Inchoatives: these verbs refer to a change of state, which the subject is undergoing. This subject is not an agent. It is called a "theme", the entity that undergoes something.

(30) a. The ice melts, breaks
b. The door opens, closes
c. The soup cooks, thickens

They often allow another "causative" form in which the theme appears as the object:

(31) a. They melted, broke the ice
b. They opened, closed the door
c. They cooked, thickened the soup

Unergatives: these verbs can occur without a complement with a subject that is an agent, and they do not have corresponding transitive form where the agent is the complement:

(32) a. I go, run, swim, jump, fly, crawl, dance, walk
b. * They went me, ran me, swam me, jumped me, flew me, crawled me, danced me, walked me

These verbs often allow a so-called cognate object, an object that seems somewhat redundant with the verb:

(33) a. I danced a dance

b. He walked the walk

Some verbs don't allow complements at all (few)

(34) a. The time elapsed slowly

b. * The time elapsed the day

Among the transitive verbs, verbs that take an object (possibly together with other things), fall into many different categories too:

Many verbs select DP (and some require it)

(35) a. I see stars

b. I see

(36) a. I liked Mary

b. * I liked

(37) a. They surrounded the fort

b. * They surrounded

Some verbs select DP to-PP or DP DP (but some require them)

(38) a. I gave money to the charity

b. I gave the charity

c. I gave money

d. I gave

e. I handed the ball to Reg

f. * I handed the ball

g. * I handed to Reg

h. * I handed

Why are some selected arguments optional? Why do some verbs select and require a complement? One possibility that this is simply listed in the lexicon, a totally arbitrary, accidental convention that varies from one language to another. It turns out that there is some variation across languages, but that the variation even in a given language is not what one would expect if the choice were totally arbitrary. One instance of this kind of phenomenon is sometimes called the "implicit object alternation." It seems that sometimes when a verb appears without a complement, we already know a lot about what kind of thing the complement would have to be:

(39) John ate (food or something similar)

(40) John knows (a proposition)

(41) John asked (a question)

These seem to contrast with verbs that allow a much wider range of complements, where the object cannot be dropped:

(42) * John needed

(43) * John criticized

And there seem to be intermediate cases which are OK if the discourse context provide some indication of what the object is:

(44) John saw (complement implicit in context)

(45) John told (complement implicit in context)

For cases like (39-41), some linguists have proposed a process in the lexicon which allows for complement-less occurrences of verbs when their complements are predictable, a lexical "saturation of an argument position" (Jackendoff, 1990; Rizzi, 1986). It is rather hard to pin this kind of proposal down enough to make it empirically testable, but there have been attempts using statistical studies of large collections of different kinds of texts (Resnik, 1993).

There are many other patterns of behavior in the verbal system of English – for example, Levin (1993) characterizes hundreds of different classes. But there are some striking limitations too. In English (and other languages too), it seems:

(46) No verb selects more than 2 or 3 complements

(47) No verb requires more than 2 complements (cf. *put, hand*)

What explains these restrictions? Linguists have sometimes proposed structural explanations for this kind of restriction on verbal complements (Pesetsky, 1995, p.153), but other ideas have been proposed too. It could be that there is some general cognitive limitation that makes it awkward to consider basic relations involving many things at once.

One interesting perspective on (46-47) is provided by languages that have productive argument-increasing verbal affixes. The most common of these is the causative. For example, in the language Quechua (an indigenous South American language spoken by some 8 million speakers) there is a very common suffix *-chi* meaning something like 'make', so that *řiku* means 'see' (with 2 arguments: the seer subject and the thing seen as complement); *řiku-chi* means 'make see' or 'show' (3 arguments), and *řiku-chi-chi* means 'make make make see' or 'make show' (4 arguments). The verb *řiku-chi-chi* can be used with 4 arguments to say, for example, that <u>you</u> had <u>someone</u> show <u>something</u> to <u>someone</u>. Four arguments (a subject and three complements) are allowed, but it turns out that none of the arguments is required – even the subject can be left out. But more surprisingly, it is impossible to go one more step. That is, although *řiku-chi-chi-chi* does not sound so bad to native speakers, it seems to be impossible to use this verb in a sentence where five arguments are specified. Is this impossible because of some limits in linguistic structure, or is it some general limitation in human memory, or is it just too pragmatically awkward to say, for example, that you had someone have someone show something to someone? Some recent research has aimed to find ways to bring clear evidence to bear on issues like this (Clifton, Frazier, and Rayner, 1994, for example).

5.1.3 V complement selection and morphology

In chapter **??**, we observed that, to a significant extent, morphology and syntax are sensitive to the same category distinctions. In the class of verbs, we can see that at least some of the subcategories of verbs with distinctive behaviors correspond to subcategories that allow particular kinds of affixes. For example, we observed on the table on page 22 that *-ify* and *-ize* combine with N or A to form V: *class-ify, intens-ify, special-ize, modern-ize, formal-ize, union-ize*, but now we can notice something more: the verbs they form can all be used transitively, that is with a direct object (a DP complement):

(48) a. The agency class-ified the documents
b. *The agency class-ified

(49) a. The activists union-ized the teachers
b. *The activists union-ized (no good if you mean they unionized the teachers)

(50) a. The war intens-ified the poverty
b. *The war intens-ified (no good if you mean it intensified the poverty)

Note that some of them (but not all) can be used intransitively:

(51) a. *The agency class-ified
b. The activists union-ized (meaning they became a union)

c. The war intens-ified (meaning the war became more intense)

In these cases the meaning of the suffixes -ify or -ize seem to involve the idea of becoming.

Another suffix *-able* combines with many transitive verbs but not with unaccusatives:

(52) a. This project is manag-able
b. This document is classifi-able
c. * This train is arriv-able

5.1.4 V adjunct compatibility

We have seen that verbs are sensitive about their objects. For example, some verbs take direct objects while others cannot. We have already encountered this property: we call it selection. Some verbs select certain complements but not others, or perhaps none at all. We will return to a systematic exploration of selection in syntax.

It might seem at first that verbs are not sensitive in a similar way to their adjuncts. For example, we see that the adjunct phrase *on Sunday* is acceptable with a wide variety of verb types:

(53) it mattered on Sunday

(54) I saw John on Sunday

(55) I put the book on the desk on Sunday

But these are misleading. It is easy to find cases where only certain verbs allow certain kinds of adjunctions:

(56) a. I saw John with a telescope
b. ?* It mattered with a telescope

(57) a. I covered the bread with butter
b. ?*I emptied it with butter

In fact, some temporal modifiers like *for an hour*, *within an hour* provide important insights into what is sometimes called the "aspectual structure" of verbs. The following examples provide a first indication of some basic distinctions:

Telic verbs or verb phrases refer to events that have a culmination point, or an end point

(58) a. Mary will complete her exam within an hour
b. *Mary will complete her exam for an hour

(59) a. The alpinist will reach the top of the mountain within an hour

b. *The alpinist will reach the top of the mountain for an hour

The event of completing the exam has a natural end point: when the exam is done; that of reaching the top too: exactly at the instant that the top is reached.

Atelic verbs or verb phrases refer to events without a natural end point

(60) Henri will paint the floor for an hour

(61) I will read linguistics for an hour

We see that some kind of selection is at play here too.

These last examples, and the last few sections of this chapter, provide some first hints of the range of considerations that bear on syntax; it is really very wide. And we have only seen the beginnings here! Human languages provide an enormous range of structures, with many uniquely adjusted to particular aspects of the enormous range of things that we think and talk about.

One conclusion to remember, and to which we will return, is that a head selects its complements, its adjuncts and its subject.

5.2 Determiner phrases

We will not discuss other categories in as much detail, but the basic reasoning is essentially the same as in the previous cases. Consider these examples:

(62) the book

(63) Bill's book

(64) the description of Bill

(65) Mary's description of Bill

(66) the destruction of the city by the barbarians

(67) the barbarian's destruction of the city

(68) Mary's knowledge that the barbarians will destroy the city

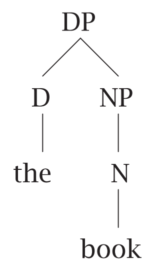
Notice that all of these can appear as the subject of a sentence, where they can be replaced by pronouns, coordinated with known DPs, etc. We have already classified *the* as a determiner and *book* as a noun. But notice that in the position of *book* in (62), we can have phrases like:

(69) a. beautiful book

b. book about dragons

c. book that I told you about yesterday

We will accordingly assume (and it should be easy to corroborate this conclusion by using constituency tests) that these are all phrases, noun phrases (NP), and so we conclude that the determiner *the* selects noun complements, and so the structure of (62) is something like this:



(Actually, this is a simplification that will modify later but it is good enough for the moment.)

Examples (63-68) require more careful consideration. A phrase like *Bill's* in (63) is called a genitive, a DP with genitive case. English DPs that contain genitives, like (63-68), have some interesting properties. First note that the genitives are in complementary distribution with Determiners:

(70) a. the book

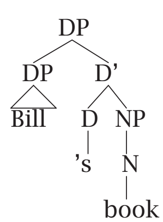
b. Bill's book

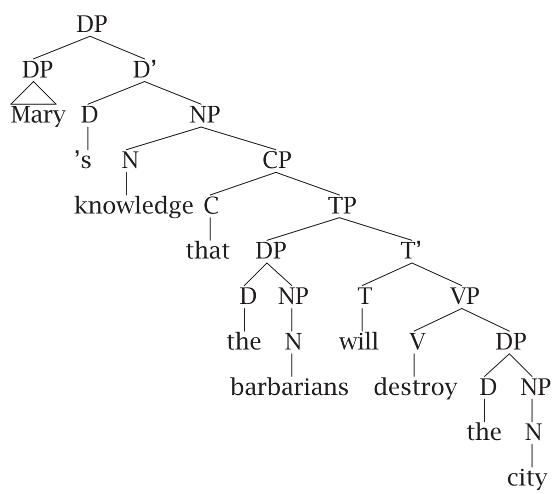
c. * Bill's the book

d. * the Bill's book

The same would be observed with other determiners such as *this, that, some, each,* etc. This would initially suggest that *Bill's* is also a D, but the examples above already show that the genitives can be complex phrases, full DPs.

So how could it be that genitive phrases like *Bill's* are in complementary distribution with simple determiners? A simple way of getting both results is to take *'s* to be a D that allows a DP subject, a DP specifier:





This accounts for the complementary distribution with determiners like *the, a, this, that, these*, because the genitive marker *'s* is a determiner by itself.

There is only one D slot per DP, and so if it's filled by *'s*, it cannot also be filled with *the*.

Note that constituency experiments are harder to run on examples like these because the D *'s* is not a free morpheme: it seems to need to stick onto the preceding DP. In this way, it is very much like the *n't* variant of the negation *not* (*I do not → I don't*).

The situation is further complicated in English by the existence of genitive pronouns: *my, your, his, her, its,....* Recall that we have already seen nominative and accusative pronouns: they distribute like DPs but are pronounced one way or another depending on where they occur, a property we called Case. Our proposal for genitive pronouns will be similar: these elements are instances of the same dependence of shape on context.

[Bill] + 's	→	Bill's
[the girl] + 's	→	the girl's
[who] + 's	→	whose
[him] + 's	→	his
[her] + 's	→	her
[it] + 's	→	its
[we] + 's	→	our
[they] + 's	→	their

The way to understand what happens here is roughly as follows: the D *'s* selects a subject which must be in the Genitive Case. In general, when this subject is a pronoun, this D remains silent. But under certain circumstance (when the NP complement of D is absent or elided, this D appears:

(71) a. I like this book of Bill's, of your's, of her's, of our's , of their's

Notice that the standard spelling convention does not write 's in such cases. Note also that some forms are irregular:

[my] + 's → mine

This elaborates the pronominal paradigm of English as follows:

	1s	2	3s masc	3s fem	3s neut	2p	3p
Nominative (subject of T)	I	you	he	she	it	we	they
Genitive (subject of D)	my	your	his	her	it	our	their
Accusative everything else (in English)	me	you	him	her	it	us	them

We thus see that determiners can have complements (NPs) and they can have subjects too (genitives). We also see that D's select their complement (it must be an NP) and select their subject if they have one (e.g. *'s* select a genitive subject). Are there adjuncts to DP? Yes. It is natural to treat elements like *only* or *even* or *all* as DP adjuncts:

(72) a. [the student] left
b. [only the student] left
c. [even the student] left
d. [all the students] left

(73) a. I saw [the student]
b. I saw [only the student]
c. I saw [even the student]
d. I saw [all the students]

Another kind of DP adjunct is the “appositive relative clause” – a type of CP – as in:

(74) a. [John, who I saw yesterday,] will visit us
b. I wrote to [John, who I saw yesterday]

These deserve further exploration later.

5.3 Noun phrases

Here are some examples of NPs:

(75) a. student
b. brilliant student
c. student with long hair
d. student of physics
e. student of physics with long hair
f. description
g. description of Bill
h. gift of candy to the children
i. claim that John stole her purse

The constituency test, replacement by *one*, can be applied to support the view that in (75b) and (75c) we have two NPs

(76) a. I saw the brilliant student
b. I saw the brilliant one

(77) a. I saw the brilliant student with long hair
b. I saw the brilliant one with long hair
c. I saw the one with long hair

Notice that we get a different result if we try to apply *one* replacement to a proper part of (75d):

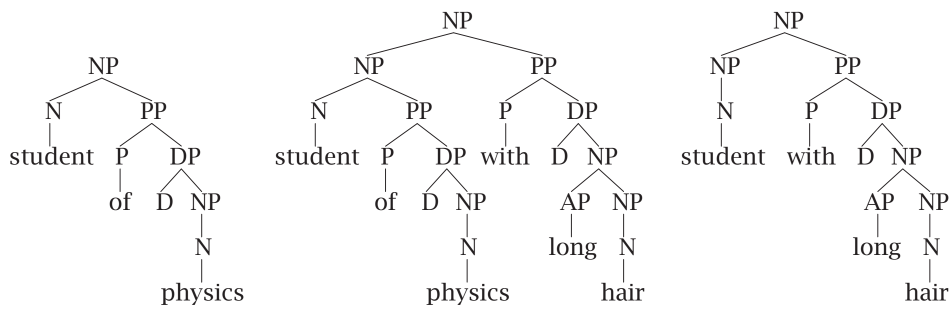
(78) a. I saw the physics student
b. * I saw the physics one

Here *physics* was not an NP; it is an N part of a compound.

(79) a. I saw the student of physics
b. * I saw the one of physics

(80) a. I saw the student of physics with long hair
b. I saw the one with long hair
c. * I saw the one of physics

So we have an adjunct-complement distinction in NPs: [of physics] is a complement, while [with long hair] is an adjunct. There is only two NPs in [student of [physics]], but there are five NPs in [[student] with [long [hair]]]. This is reflected in the number of NP nodes in the trees below:



Apart from the number of NPs here, these trees have some other features that we have not justified yet. First, we have indicated that the complements of the prepositions in these structures are DPs: it is easy to see that they satisfy our constituency tests for DPs (replacement by pronouns, etc.). And since there is no overt D in these DPs, **we have taken the step of putting in an silent D** – a step analogous to assuming silent affixes, and again something we should justify. These issues will be discussed more later, but for the moment, the main point is that there are N complements and N adjuncts, just as there are V complements and V adjuncts.

In fact, the analogy between phrases formed by the noun *student* and the verb *to study* is quite striking. Notice also the analogy between the complements of *gift* in (75h) and the complements of the verb *give*. And the similar analogy between the complements of the noun *claim* in (75i) and the complements of the verb *claim*. When there are verb/noun pairs like these, the verb and the noun have very similar complement (but not identical: Nouns do not take bare DP as complements). Clearly, these are not arbitrary coincidences; there is something regular happening here, but we postpone careful consideration to later.

The way we can determine what is a complement and what is an adjunct in NPs is very much like the way we could do it in VPs. Complements to N correspond to entities specifically required by the meaning of the noun. If the noun is transparently related to a verb, it is a good idea to check what the complements of the verb are.

There is another way in which adjuncts can often reliably be identified, similar to what we saw in the case of verbs.. Consider again an example like:

(81) The [big] student [of physics] [with long hair] [in the library]

Are these four bracketed constituents arguments or adjuncts? Overall, this DP is designating a student, a particular kind of thing. Now notice what we can and cannot say about this thing:

(82) It is big

(83) It is with long hair

(84) *It is of physics

(85) It is in the library

It is possible to say of this thing that it is X if X in an adjunct but not otherwise. This provides a different way to help decide whether a constituent is a complement or an adjunct.

In sum, D requires a complement with an N, so we say N is the head of NP. As for internal structure, we notice that *of physics* is a natural complement for *student*, but not natural for the noun *solid*, and that adjuncts like *with long hair* are possible with *student* but awkward with the noun *description*. So the adjuncts and complements depend on the choice of N; again we conclude that N is the head of NP.

ok: gift of candy to children

* student of candy to children

Complements of N can be PPs, or CPs. Adjuncts in NP can be found to the left (e.g. adjectives) or the right (e.g. PPs). Other adjuncts include complex APs like $[_{NP}[_{NP}$man] $[_{AP}$ fond of cookies]], and restrictive relative clauses which are CPs, as in $[_{NP}[_{NP}$man] $[_{CP}$ who is fond of cookies]].

5.4 Adjective phrases

Here are some examples of APs:

(86) a. sad

b. very sad

c. proud of Bill

d. extremely fond of cookies
e. interesting to whales
f. proud that Mary succeeded

All of these can occur, for example, in the frame

He is ______ .

We will assume that the PPs in (86c-86e) and the CP in (86f)are complements. This is reasonable given the selection effects we observe: *sad* disallows PPs, *proud* and *fond* take PP's with *of* but not with *to*, while *interesting* does the reverse; *Proud* allows a CP while *fond* does not. Similarly, we will take expressions of degree like *very*, *extremely* to be adjuncts (on the left in English).

In our discussion of morphology, we noticed that the verbal suffixes -*ify* and -*ize* may combine with adjectives to form verbs. We can now ask, what kind of adjectives do they combine with? It appears that these suffixes can only combine with certain "intransitive" As, ones that do not take complements (Di Sciullo and Fong, 2000):

(87) a. They are intense
b. *They are intense of Bill
c. They intensified

(88) a. They are special
b. *They are special of Bill
c. They specialized

(89) a. She is proud
b. She is proud of him
c. *He proudized her
d. *He proudified her

(90) a. she is the mother
b. she is the mother of John
c. *She motherized him
d. *She motherified him

And we noticed in Chapter **??** that, for example, that many affixes form adjectives. We can now ask, what kind of adjectives do they form? For example, -*able* combines with verbs to form adjectives, and we can notice that the result is intransitive:

(91) a. They read the paper
b. The paper is readable
c. * It is readable of the paper
d. * They are readable of the paper

The connections between morphological structure and syntactic structure appear to be quite rich.

5.5 Prepositional phrases

We will not discuss PPs in any detail. What we say below will suffice for our purposes. This should not be taken to mean that PPs are simple. As everything in language, they are incredibly intricate (For a small sample of this complexity, see the *advanced* Koopman (2000), pages 204-260).

Examples of PPs:

(92)
a. up
b. up [the rope]
c. in [the south]
d. from [the country]
e. from [under the rug]
f. right [against the grain]
g. exactly [under the tree]
h. before [John came]

Some elements of this category take no complement at all as the *up* of *look up*. Other may take as complement DPs, PPs, or perhaps even TPs as in the last example (actually it is probably a CP with a silent *that* but it is harder to show. We will return to this question later).

We will take adverbs like *right, exactly* to be (left) adjuncts.

5.6 Summary

We saw in chapter **??** that language users must represent some basic facts about the morphemes of their languages, the "atoms" of morphology. For example,

read	free	V	
prefer	free	V	
-able	suffix	A	c-selects for V to form A
-er	suffix	N	c-selects for V to form N
-s	suffix	Number	c-selects for N to form Number
re-	prefix	Adv?	modifies V to form V

Then we saw that the specification of what an affix forms does not need to be listed in the lexicon, because it is determined by the right hand head rule (RHHR). We also noticed that the relation between stems and suffixes is different from the relation between stems and prefixes: in this table we have called one of these "c-selects" and the other "modifies." All of these lexical entries for morphemes get elaborated with their syntactic properties, as we saw in the last couple of chapters.

In chapter **??** we saw that phrases have constituents too, and in chapter we saw that clauses can be regarded as phrases with heads. For example, the CP *that Mary will read* has the head *that*, and the TP *Mary will read* has the head *will*. Different verbs select different kinds of clausal complements. (And we saw that the complements of V are sisters of the V.) We represent the syntactic properties of the "atoms" of syntax in the lexicon too, elaborating the specifications we began in our discussion of morphology.

prefer	free	V	c-selects C[for] to form VP	'prefer for her to go'
wonder	free	V	c-selects C[wh] to form VP	'wonder whether she left'
think	free	V	c-selects C[that] to form VP	'think that she left'
say	free	V	c-selects C[for] to form VP	'say for her to leave'
			c-selects C[wh] to form VP	'say whether she left','say if she left'
			c-selects C[that] to form VP	'say that she left'

that	free	C	c-selects T[+tense] to form CP
if	free	C	c-selects T[+tense] to form CP
for	free	C	c-selects T[-tense] to form CP
whether	free	C	c-selects T[±tense] to form CP

will	free	T[+tense]	c-selects V to form T'
to	free	T[-tense]	c-selects V to form T'

Obviously, verbs also impose requirements on the subject (specifier) of T', which can be either DP or CP. We have not yet considered how to represent those requirements. We observed that the subject of a +tense T needs to be nominative case, while the subject of a -tense T is accusative (and we saw that the subject of D is genitive).

In this chapter, we have extended this perspective through a range of categories. First, we noticed that there is a wide range of verbs. (No need to memorize them all!) The important things we noticed are these. First, that we can elaborate the lexical entries of verbs (like the other categories) with specifications of syntactic properties:

elapse	free	V	c-selects 0 complements to form VP	'time elapses'
read	free	V	c-selects 0 or DP to form VP	'I read', 'I read the book'
put	free	V	c-selects DP, PP to form VP	'I put it over there'

We also observed that verbs combine with adjuncts. The relation between verbs and their adjuncts is different that the relation between verbs and their complements. We can call the relation to adjuncts a "modification" relation, and the relation to complements a "selection" relation. No V selects more than 2 or 3 complements, but there is no limit on the number of adjunct modifiers a verb can have.

Then for other categories:

the	free	D	c-selects N to form DP	'the book'
a	free	D	c-selects N to form DP	'a book'
this	free	D	c-selects N to form DP	'this book'
that	free	D	c-selects N to form DP	'that book'
's	suffix	D	c-selects N to form D'	'Bill's book'

We saw that the genitive *'s* needs a DP subject, a specifier, and we have not yet considered how to represent this requirement. Also we saw that D can have adjuncts: e.g. elements such as *even, only*. Similarly for the nouns:

student	free	N	c-selects 0 or PP to form NP
claim	free	N	c-selects 0 or CP[+tense,-wh] to form NP
question	free	N	c-selects 0 or CP[+tense,+wh] to form NP

Adjective phrases appear to be adjuncts for Ns. The adjectives also vary in the requirements on what can appear internal to their APs:

solid	free	A	c-selects 0 to form AP
proud	free	A	c-selects 0 or [of DP] or CP to form AP

Adjectives also allow adjuncts: *very, extremely*. Prepositions vary too:

up	free	P	c-selects 0 or DP to form PP
of	free	P	c-selects DP to form PP

Prepositions also allow adjuncts: *right, just*. This quick survey reveals a number of general properties of constituents that will be important later:

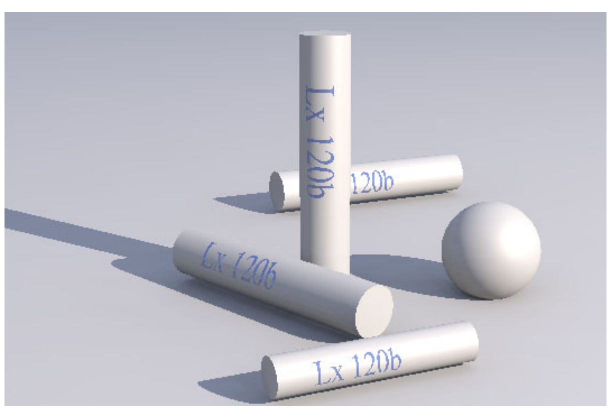
1. In every one of the categories we have looked at, the complements (if any) follow the head, and the subject (if any) precedes the head.
2. For all categories X of heads, there is a regularity about what kind of phrase is formed: a head X always forms an X' or XP after combining with its complements. Clearly this should not need to be included in every lexical entry, but should be stated as some kind of general rule analogous to (but not the same as!) the RHHR of morphology.

6

X-bar theory and a first glimpse of discontinuities

The preceding chapters have informally surveyed some basic properties of constructions in English. The situation may look rather frightening, because there seem to be many different kinds of structures already, even though we have been carefully avoiding many of the difficult issues. (And clearly, this kind of complexity is not peculiar to English.) Beginning with this chapter, though, some theory will be introduced that reveals a surprising simplicity and uniformity behind the range of diverse constructions that English and other languages allow.

Human linguistic abilities resemble visual abilities in certain respects. For one thing, we cannot help using them. If I pronounce this sentence clearly and audibly and you hear it, you cannot help recognizing it as an English structure. In the same way, if you look at an image like the one below, even though it is a two dimensional spatial array of thousands of more or less gray points, you cannot help seeing it as a very simple three-dimensional scene with a small number of objects: 1 sphere and 4 cylinders.



Notice that the objects in the foreground present themselves as spatially continuous parts of the image. We could replace these objects with others and still have an intelligible scene. But notice the cylinder that is "farthest away" presents itself in two discontinuous pieces, since another larger cylinder is standing on end in front of it. If we wanted to replace that cylinder, we had better remove both parts of the image at once. And the base of the larger cylinder standing on end is obscured too, but we naturally assume that it's there.

In the preceding chapters, we have been considering linguistic structures, which in their spoken form also present themselves in two dimensions; acoustically, one dimension is time, and the other is air pressure. Like the structure of visual images, there is nothing about the structure of sentences that imposes any strict bound on how large they can be (the language is "recursive"), but more than that: as in the image, the constituents of sentences stand in significant relationships to each other. We have been trying to identify linguistic constituent structure by seeing which pieces can be replaced to leave a similar and still intelligible structure, which pieces can be moved around and removed. In these first experiments, the assumption of continuity has been a valuable first approximation, but as in the image (or any typical photograph), we ultimately need to allow for constituents that are discontinuous, and relationships which are only partly revealed by the pronounced words. Chomsky (1956) noticed this, and the model presented here is derived from that work. Language and vision are alike in these respects. The most important part of the analogy is this: certain sequences of morphemes, like the array of light intensities in the image, allow a surprisingly simple description. There are lots of different words and structures with different properties, but many of the differences can be revealed as minor variations on familiar structures. Making the common, familiar aspects of structure explicit, even in a preliminary way, will allow us to probe more deeply into language than we have done before.

6.1 Headedness

By experimentally probing the structure of various strings (e.g. by means of constituency tests), we have reached a number of conclusions about syntactic constituent structures. Some of them are fairly obvious, others less so. The basic idea is that phrases, like words, seem to be composed of elements that are associated with a single element, a head, that determines the fundamental properties of the complex. Spelling some of the components of this proposal out more carefully:

(1) a. Each phrasal constituent has a head

b. This head is always a morpheme or a word (a D or N or V or…)

c. The head is unique

d. Every morpheme is the head of some constituent

e. In general, no non-constituent has a unique head

There are some apparent exceptions to (a). For example, we seem to find CPs, complementizer phrases, that apparently lack a complementizer C, and DPs that apparently lack D:

(2) I know [$_{CP}$he can sing]

(3) [$_{DP}$Bears] can bite

There several reasons why it is reasonable to think that that we are dealing with CPs and DPs and not with TPs and NPs. A simple one is that as a general rule, tensed complement clauses are CPs, not TPs. We will see more later. In cases like these, it is natural to assume that there are silent heads, perhaps a deleted or a silent *that*, and a silent determiner *e*:

(4) I know [$_{CP}$ [$_{C}$~~that~~] he can sing]

(5) [$_{DP}$[$_{D}$*e*] Bears] can bite

We will consider these constructions again in section 6.3 below, but for now we observe that analyses like these will let us maintain generalization (a). (And recall that we made a similar move in our brief review morphological structure: there too, we saw that the theory was simplified by the assumption that some heads are silent.) We will discuss (b) just below in section 6.5. We have not seen any reason to doubt (c): no convincing case in which a constituent has two heads jointly determining its fundamental properties. (d) is obviously true, since at the very least, each morpheme is the head of itself. (e) has not been explicitly discussed before, but consider the properties of a string which do not form constituents, such as the underlined parts of the string here:

(6) <u>The driver of the car</u> thinks that Mary should <u>leave Dallas for Boise</u> tomorrow

Here the whole discontinuous string is not a constituent, but it can be split into two continuous parts, each of which is a constituent with its own head (you should be able to name them by now). Or take the following example:

(7) Her <u>**little sister** *will*</u> disagree with her

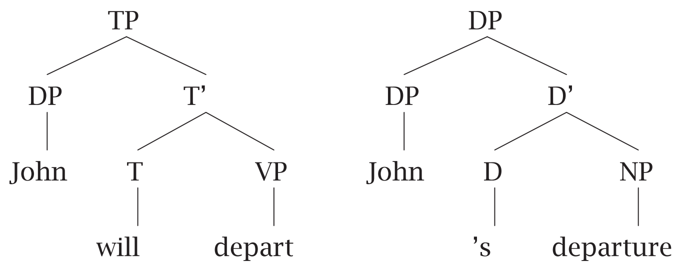
We are dealing with a continuous string which does not form a constituent but which again can be split into two constituents, one in bold and one in italics, each of which has its own head,. Finally in the following case:

(8) The girl he met at the <u>**departmental party** *will* **very surely**</u> call him

We are dealing with a continuous string which does not form a constituent but which can be split into three independently constituents, two in bold and one in italics, each of which has its own head. We will find and discuss fascinating exceptions to this (perhaps you can think of some of them now), which will lead us to some very interesting and fundamental revisions.

6.2 Internal organization of constituents

If we look at the internal organization of the constituents we looked at, we see a lot of similarity. For example, looking at the TP and DP below:



Both phrasal categories TP and DP can be composed of a DP subject or specifier and a constituent T' or D'. T'or D' themselves are each made of the head T or D followed (in English) by the complements of T (namely VP) or D (namely NP). This also true for adjuncts. For example a PP adjunct to a VP together with a VP forms a new VP (as in [[leave the city] early]) while an adjunct AP to an NP form with this NP a larger NP (as in [big [picture of Bill]])

This suggests a certain cross categorial uniformity: the internal organization of phrases is always the same, regardless of the choice of head. This discovery is a generalization over a great number of different chunks of constituent structure and is described as X-bar theory, building on proposals of Chomsky (1970). X-bar theory is the set of principles that tell us how any particular HP can be constructed internally (the way it is actually constructed will depend on the choice of head). Linguistic theory conjectures that these regularities are true of every bit of English (and of human languages in general).

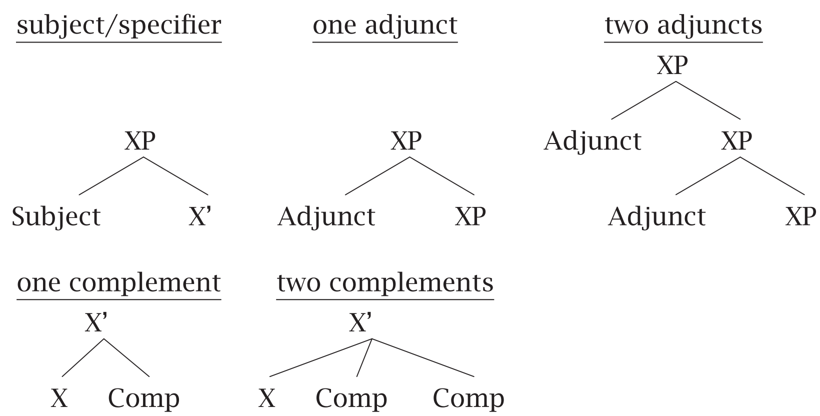
The Principles of X-bar theory elaborate on the basic ideas in (11.3) as follows:

(9) a. Each phrasal constituent has a head
  b. This head is always a morpheme or a word (a D or N or V or…)
  c. The head is unique
  d. Every morpheme is the head of some constituent
  e. In general, no non-constituent has a unique head
  f. The largest constituent with head H is notated HP or H^{max} and is called **the maximal or phrasal projection of H.**
  g. HP or H^{max} is a constituent consisting of a constituent H' and at most one sister called the **specifier (or subject)** of H. H' is also notated and read H-bar (an H with one bar above it).
  h. H' or H-bar consists of the head H and some sisters. These sisters (if any) are called the **complements** of H.

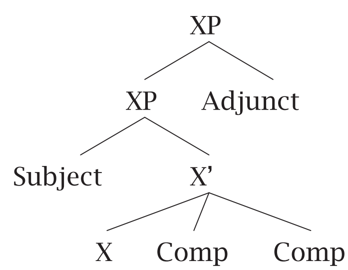
i. HP can also consist of an HP and a sister constituent called an **adjunct** to H (or to HP).

j. Adjuncts, complements and specifiers are themselves phrasal constituents.

While the basic principles a-e have close analogs in morphology, f-j only apply to syntax. The structures allowed by the theory can be depicted with tree fragments as follows, but remember that the left-to-right order of the branches is not specified by X-bar theory. In effect, the structure can be regarded as mobiles: adjuncts can appear on the left or right of the XP they modify; subjects can be the left or right sisters of X', and complements can be left or right sisters of X:

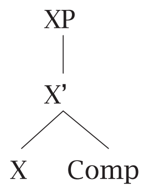


So the overall look of a phrase is this:

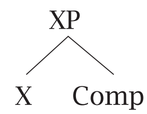


An XP can have 0 or more adjuncts, 0 or 1 subject, 0 or more complements, but always it has a head X. In English, complements follow the head and subjects precede the head, as shown here, but this may vary across languages, and is not part of X-bar theory.

We introduce the following abbreviated notation when an XP has no subject: in these cases, only when the XP has no subject, we can leave the X' out of the tree diagram, since no ambiguity can result in this case: the sisters of the head are always complements:



can be abbreviated as:



6.3 Some consequences

X-bar theory should be true of every single phrase, and these principles are so basic we expect them to hold in other languages too. If we find an apparently headless syntactic (or morphological) constituent, we should find evidence that there is a silent head. And it is natural to expect subjects, complements and adjuncts for every category type. If some categories do not have all these components, we would like to understand why.

6.3.1 Silent heads: D

We have already seen some empty heads. For example, English common count nouns cannot be used without a determiner, unless they are plural (called 'bare' plurals):

the book	the books
a book	books

These plurals occur in DP positions, where they can signify an indefinite reading as in (10), where we make a claim about books in general, or a generic reading, as in (11), where we make a claim about typical or "generic" beavers:

(10) Books would please me

(11) Beavers build dams

In such sentences all the underlined plurals must be DPs. They must therefore all contain a silent D. These silent Ds actually have a meaning, and are heads in this way: they determine what kind of DP we are dealing with (an indefinite, a generic, a definite)

Pronouns and proper names do not cooccur with Ds, but distribute as (definite) DPs .

(12) John will see you

By X-bar theory, proper names and pronouns, which behave like DPs must contain at the very least a D and perhaps a NP. How this should be done is an interesting, but advanced topic. Here, we will not elaborate further. We will generally representing them just as DPs, e.g. with a triangle, or as DPs that dominate D' and D:

6.3.2 Silent heads: T

Tense can also be present as a silent head. In English present tense, this is usually the case, except in 3rd person singular.

Present	Past	Future
I wash myself	I wash**ed** myself	I **will** wash myself
you wash yourself	you wash**ed** yourself	you **will** wash yourself
she wash**es** herself	she wash**ed** herself	she **will** wash herself
he wash**es** himself	he wash**ed** himself	he **will** wash himself
we wash ourselves	we wash**ed** ourselves	we **will** wash ourselves
you wash yourselves	you wash**ed** yourselves	you **will** wash yourselves
they wash themselves	they wash**ed** themselves	they **will** wash themselves

We see that the present tense T is usually a silent head except in the 3rd person singular when it is manifested as the suffix *-s*. Past tense is systematically manifested as the suffix *-ed*, future T is as *will*, and infinitive [-T] as *to*. Note that we still need to explain why present tense or the past tense is manifested on the verb.

6.3.3 Silent heads: C

Consider the following examples:

(13) John thinks that Mary left

(14) John thinks Mary left

(15) John whispered that Mary left

(16) * John whispered Mary left

Some speakers of English allow this last form, while others do not. Note that it is not the same as: *John whispered: "Mary left."*

How do we analyze the apparent optionality of *that*? There are two options we could consider:

(17) a. some Vs (like *think*) select either a CP or a TP

b. verbs select CPs but sometimes allow the C to be silent (i.e. there is a silent C – call it silent *that* and note it ~~that~~.)

There are many reasons, some of them complex, to choose the second option.

One suggestive line of reasoning is this. On either hypothesis, we would like to explain why under certain verbs both allow a silent ~~that~~ and an overt *that*, while others require a non silent *that*. But notice that under (17b), the data above support the idea that a verb with a tensed TP complement *always* also allows a CP complement. Why should this be the case? There is nothing in (17a) to lead us to expect this. But under (17b), this is expected, since the proposal is that the tensed CP without an overt complementizer actually come from a deletion.

Furthermore, if we look at languages other than English, languages in which there is no silent ~~that~~ but there are verbs selecting TPs, then (17a) suggests that other languages should also have verbs selecting TPs. The second idea (17b) predicts that other languages without the equivalent of silent that should <u>not</u> allow TP complements. The latter prediction seems correct.

Dutch: Ik denk dat Jan vertrokken is
I think that John left is

'I think John left'

French: Je crois que Jean est parti
I believe that John is left

'I believe that John left'

We see another consequence in cases like the following, where it might seem that Ps can take TP complements:

(18) a. before [TP John left]

b. after [TP John left]

However, the previous discussion suggests that the correct structure may instead be:

(19) a. before [$_{CP}$ ~~that~~ [$_{TP}$ John left]]

b. after [$_{CP}$ ~~that~~ [$_{TP}$ John left]]

Again, a look at other languages, as well as some evidence internal to English, suggests the second option is correct: Ps take CP complements, not TPs.

Dutch: a. voordat Jan vetrokken is
before-that John left is

b. nadat Jan vertrokken is
after-that John left is

French: a. après que Jean soit parti
after that John is left

b. avant que Jean soit parti
   before that John is left

We may return to this consider some of these questions again when we look at wh-constructions and yes/no questions.

6.4 Cross categorial symmetries

X-bar theory claims that all phrases are organized in the same uniform way. if we interpret this as maximally as possible, we should expect total parallelism between phrasal types.

The following table summarizes our findings so far.

	C	T	D	P	A	V	N
subjects	?	DP CP	DP	?	?	?	?
complements	TP	VP	NP	DP PP CP	PP CP	DP PP CP	PP CP
adjuncts	?	AdvP?	Only Even CP	AdvP	DegP	PP AdvP	PP AP CP

For example Cs seem to take no subject, no adjuncts and only one kind of complement (TP). We see many differences between categories: If the maximal interpretation of X-bar theory is right, either we should find reasons for these differences, or we should find that they are no differences at all. Here is a list of some of the differences. We investigate some of these differences in subsequent chapters.

(20) a. Missing subjects in C, P, A, V, N

b. Different subject options for DP and TP

c. Different categories take different number of complements, kind of complements, and adjuncts:

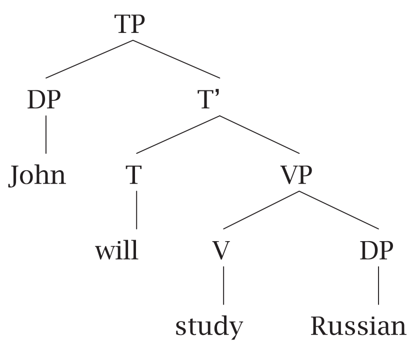
- C, T , D, P and A take only one complement at a time, V and N can take several complements
- C, T and D take only one type of complement each, which no other category takes as complement.
- P, V, N and A take several kinds of complement
- A and N allow PP and CP as complement but V and P allow DP, PP and CP as complement

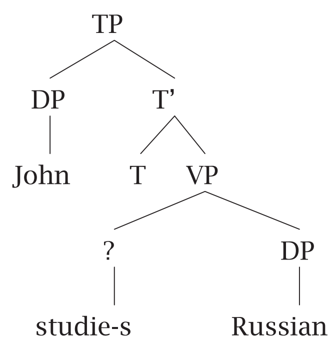
We see that in a sense, C, T and D pattern alike with respect to complementation but not with respect to subjects. They also pattern alike in being "closed categories". No new determiner, tense or complementizer can be freely created the way new adjectives or nouns or verbs can. Ps, Vs, Ns and

As pattern very much alike in not allowing subjects, and allowing several complements. In this latter respect, Vs and Ps pattern exactly like each other (PPs, DPs and CPs as complements) and Ns and As also do (PPs and CPs but no DPs as complements). Notice also that APs seems to be unique in that nothing seems to take an AP as complement. We will see later that there may actually be cases of AP complements. As for C's, it could be that they allow no adjunct because C lacks the kind of meaning that could be modified by an adjunct.

6.5 A more challenging case: English verbal forms

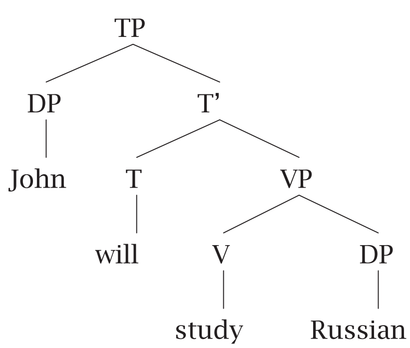
One problematic case for X-bar theory that we have been systematically avoiding so far is found in simple English present and past. Although present and past tense verbs are words, they are morphologically complex, composed of V and T. Compare these two structures:

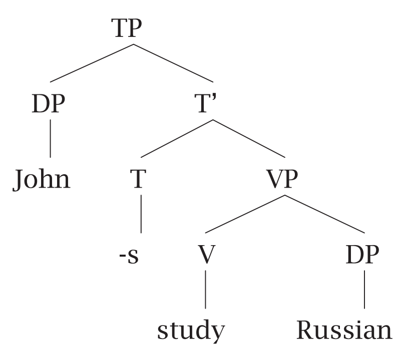




In the simple present, it looks like the tense appears inside the VP, between the verb and its object!

What's going on here? X-bar theory would lead us to expect structures like this instead:





But the tree on the right is not morphologically well-formed, because the tense affix -s cannot attach to names, but only to verbs. What operation could put the verb and the tense into the positions we find in English?

There are two natural ideas:

(21) a. the V *visit* moves up to T, or

b. the T affix *-s* moves down to V

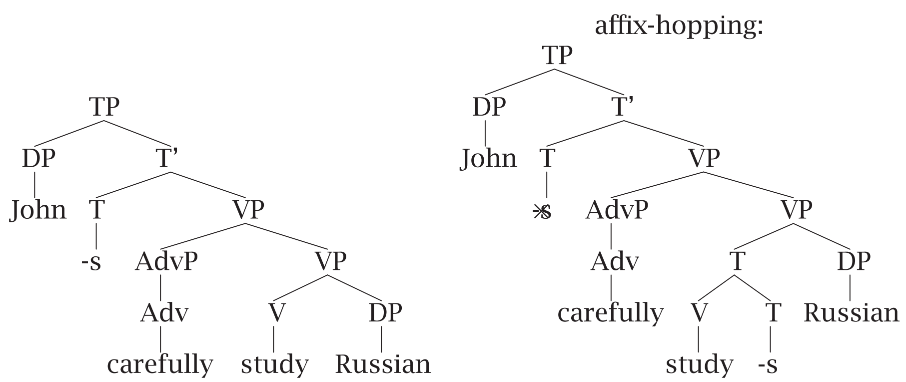
Notice that we could distinguish these proposals if something appeared between T and V, like an adverb. So consider these of structures:

(22) a. John will carefully study Russian

b. John carefully studies Russian

c. * John studies carefully Russian

If the verb were moving out of the VP and up to T, this data would not be predicted, since then the combination V+T would appear on the left side of the adverb. On the other hand, if T is moving to the V, the combination V+T would appear on the right side of the adverb. Clearly, it is this latter option that is correct.



The movement of T onto the verb is called **affix hopping**.

This proposal is confirmed by VP ellipsis tests. Consider the following examples:

(23) a. she [$_{T}$will] [use paints]

b. I wonder if she will [use paints].

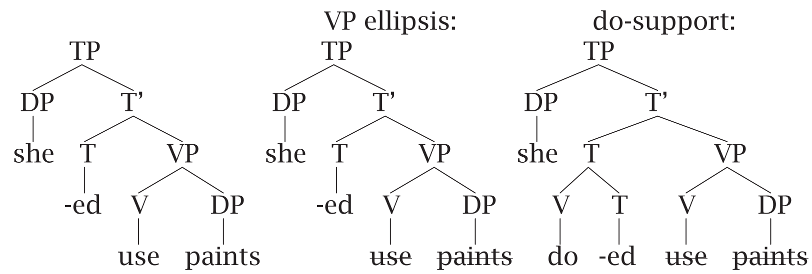
c. Yes, she will / * yes, she / *yes, she will use

(24) a. she [[$_{V}$use] -ed $_{T}$] paints

b. I wonder if she used paints.

c. Yes, she did / * yes, she. / *yes, she used

It is natural to assume that VP ellipsis has applied in the c examples above. In these cases, the constituents that make up the verb phrase and determine the properties of the VP (*use + paints*) are not pronounced, but the tense is. This suggests that the tense is not deleted in VP ellipsis. So in some sense, the tense is not really included in the VP, even though we see it attached to the verb. How can we reconcile these facts? The affix hopping hypothesis allows the following sort of hypothesis about what happens here: VP deletion applies just to the VP before affix hopping, and then since the affix still requires a V, the English verb *do* is provided:



Unfortunately, one more wrinkle is needed to understand how tense attaches to English verbs, since the pattern we saw with the verb *study+-s* in (22) does not always hold. English allows multiple auxiliary verbs to appear in the same clause – a modal, a form of *have*, and a form of *be* can all occur at once, as in

(25) John will have been eating cake

VP ellipsis tests confirm that when we have multiple verbs like this, we have multiple VPs:

(26) * Mary won't have been eating cake, but John

(27) Mary won't have been eating cake, but John will

(28) Mary won't have been eating cake, but John will have

(29) Mary won't have been eating cake, but John will have been

Furthermore, we notice the verb after auxiliary *have* must be in **past participle** form, which in English often ends with -en or -ed:

(30) John has (eaten/taken/hidden/stolen/shown/baked/left/advertised) the cake

While the verb after auxiliary *be* must be in **present participle** form:

(31) John is (eating/taking/hiding/stealing/showing/baking/leaving/advertising) the cake

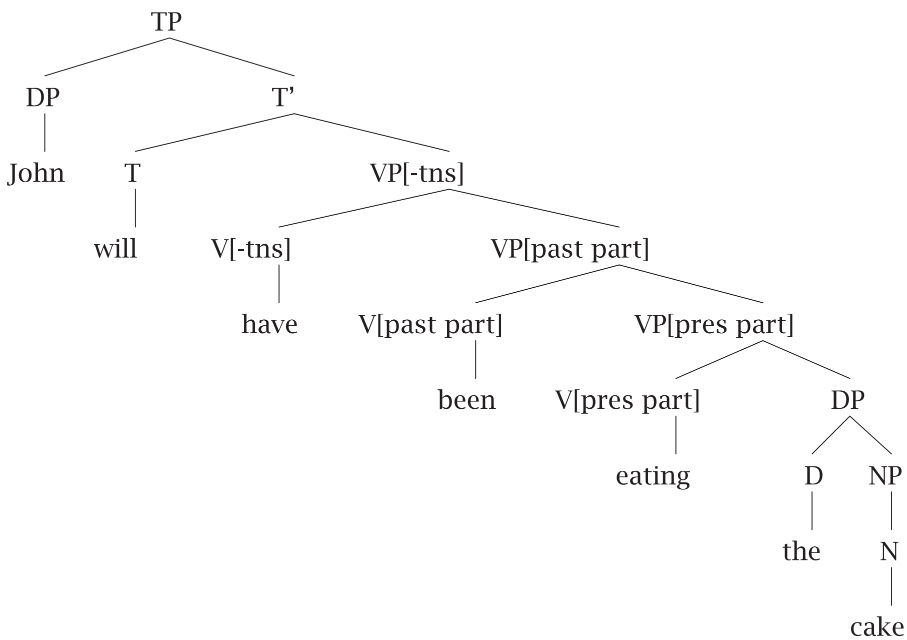
These dependencies between the particular auxiliary and the form of the following verb can be accounted for simply by the assumption that they have lexical entries like this:

will: V?, selects VP[infinitive] = VP[-tns]

have: V, selects VP[past participle]

be: V, selects VP[present participle]

These lexical requirements are met by the sentence (25) with a structure like this:



Notice that there are several different VPs in this structure (of various forms: tensed, infinitive, past participle, present participle). Each VP conforms to X-bar theory, and each could be modified by an adjunct like *enthusiastically*, so we can account for many of the positions in which the adverb could naturally occur.

(32) a. John will enthusiastically [$_{VP}$have been eating cake]

b. John will have enthusiastically [$_{VP}$been eating cake]

c. John will have been enthusiastically [$_{VP}$eating cake]

d. * John will have been eating enthusiastically cake

e. John will have been [$_{VP}$eating cake] enthusiastically

Why introduce this discussion of auxiliary verbs here? Auxiliaries come up here because they seem to act differently with respect to adverb placement than main verbs do, and this affects what we want to say about how verbs combine with tense. In particular, in (22) we saw that an adverb cannot intervene between *study+-s* and its complement. But in the case of auxiliary verbs, an adverb can intervene between a tensed auxiliary like *have+s* and its complement:

(33) a. * John studies carefully Russian

b. * John studied carefully Russian

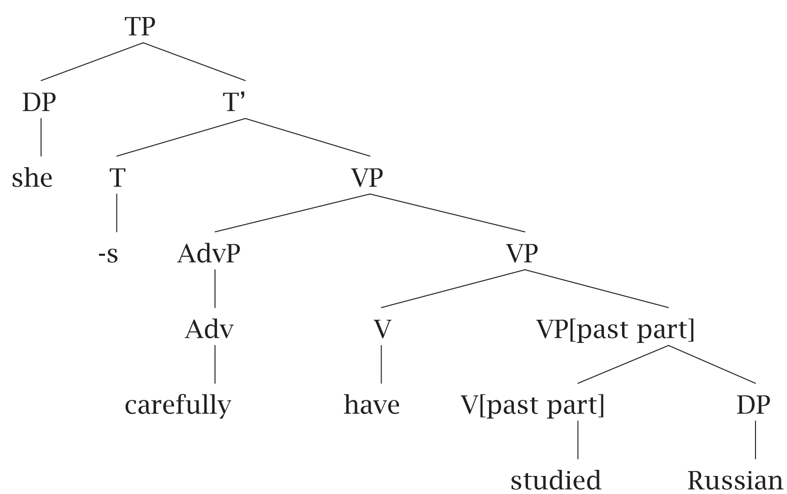
c. John has carefully studied Russian

d. John had carefully studied Russian

e. John is carefully studying Russian

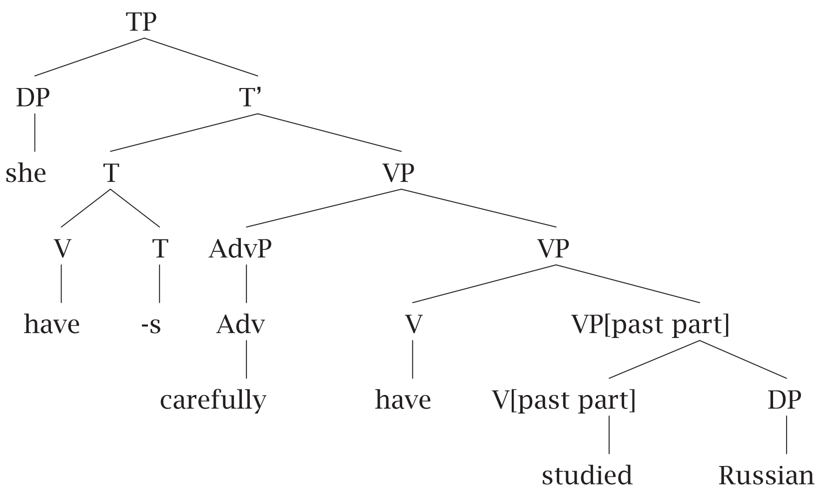
f. John was carefully studying Russian

In (33c-33d) the tensed auxiliary verbs (*has,had,is,was*) appear to left of the adverb, something which is impossible for the main verb in (33a-33b). How can we explain this difference? If *carefully* or any other adverb can modify the verb phrase *have carefully studied Russian*, then there is a puzzle:



(Notice that the adverb might also modify the VP[past part] *studied Russian*.)

One option for resolving this puzzle, and explaining the contrast between (33a) and (33c-33d) was already proposed in (21) above, where we noticed that there are (at least) two ways to adjust things to get the V+T together. For the main verb *study*, we moved the T down into the VP, and we found some preliminary evidence for this from adverb placement. For auxiliary verbs, though, we could propose that these verbs move up to T, crossing the adverb and leaving the VP. This kind of movement is sometimes called **V-to-T movement**:



There are other possible explanations, of course, but we will see further evidence later to suggest that this idea is on the right track: there are various kinds of evidence to support the idea that the English main V occupies a different position in the clause than the English auxiliary V.

6.6 One more verbal position: T-to-C movement

The regular Modal-Have-Be pattern of auxiliaries, where each auxiliary verb determines the form of the following one, is apparently disrupted in yes/no questions:

(34) a. John will [$_{\mathrm{V}[-\mathrm{tns}]}$ go] to school
 b. Will John [$_{\mathrm{V}[-\mathrm{tns}]}$ go] to school?

(35) a. John has [$_{\mathrm{V}[\mathrm{past\ part}]}$ gone] to school
 b. Has John [$_{\mathrm{V}[\mathrm{past\ part}]}$ gone] to school?

(36) a. John is [$_{\mathrm{V}[\mathrm{pres\ part}]}$ going] to school
 b. Is John [$_{\mathrm{V}[\mathrm{pres\ part}]}$ going] to school?

Usually, the first verb after the subject is present or past tense, but not when an auxiliary verb+tense begins the sentence. When that happens, the verb following the subject is the one selected by the auxiliary that begins the sentence. Furthermore, we notice that only auxiliaries, not main verbs, can be fronted in this way. When there is a main verb, the yes/no question requires *do*:

(37) a. John goes to school
 b. *Goes John to school?
 c. Does John go to school?

Consequently, it is no surprise that the question forming process here is often called **subject auxiliary inversion.** These structures also apparently violate X-bar theory, since the tense head appears before the subject instead of where it is expected, between the subject and the VP.

What position is the fronted auxiliary+T in? A plausible answer is that it is in C. There are several reasons for this conclusion. First, we have seen that various overt complementizers appear in this position, and they seem to play the role of indicating whether the CP is a question or a declarative. And we have seen that verbs are sensitive to which type of CP they have in their complement position:

(38) a. Mary thinks [$_{\text{CP}[-\text{q},+\text{tns}]}$ that [Bill will come]]
b. Mary thinks [$_{\text{CP}[-\text{q},+\text{tns}]}$ ~~that~~ [Bill will come]]
c. *Mary thinks [$_{\text{CP}[+\text{q},+\text{tns}]}$ whether [Bill will come]]
d. *Mary thinks [$_{\text{CP}[-\text{q},-\text{tns}]}$ for [Bill to come]]

(39) a. *Mary wonders [$_{\text{CP}[-\text{q},+\text{tns}]}$ that [Bill will come]]
b. *Mary wonders [$_{\text{CP}[-\text{q},+\text{tns}]}$ ~~that~~ [Bill will come]]
c. Mary wonders [$_{\text{CP}[+\text{q},+\text{tns}]}$ whether [Bill will come]]
d. *Mary wonders [$_{\text{CP}[-\text{q},-\text{tns}]}$ for [Bill to come]]

(40) a. *?Mary prefers [$_{\text{CP}[-\text{q},+\text{tns}]}$ that [Bill will come]]
b. *Mary prefers [$_{\text{CP}[-\text{q},+\text{tns}]}$ ~~that~~ [Bill will come]]
c. *Mary prefers [$_{\text{CP}[+\text{q},+\text{tns}]}$ whether [Bill will come]]
d. Mary prefers [$_{\text{CP}[-\text{q},-\text{tns}]}$ for [Bill to come]]

It is natural to suppose that the fronted auxiliary+Tense plays the same role: indicating that the sentence is a question. Does it actually sit in the same syntactic position as the overt complementizers? This idea is supported by same kind of complementary distribution arguments that were used in section 4.1 to support the view that *whether, that, for* and *~~that~~* are in the same position. In certain dialects of English, an embedded yes/no question can be introduced by an auxiliary verb too:

(41) a. I wonder has Mary worked for Microsoft
b. I wonder whether Mary has worked for Microsoft

But even in these dialects, when there is an overt lexical complementizer, we do not also find subject-auxiliary inversion:

(42) a. I wonder whether Mary has worked for Microsoft
b. *I wonder whether has Mary worked for Microsoft
c. *I wonder has whether Mary worked for Microsoft

How can we make sense of this? If T raises to C, we can account for this by saying that T and whether compete for the same position only one of them can be present to fill the C slot. It turns out that T raising is found in all sorts of other languages and constructions. This complementarity between T raising and the presence of overt C is observable in many such cases.

Finally, note that subject-auxiliary inversion always seems to move a single word, rather than a more complex phrasal unit, suggesting that it is a head moving to a head position. This can be seen by examining cases with negation. These questions can be put in the negative either with a regular negation *not* or a contracted negation *n't*:

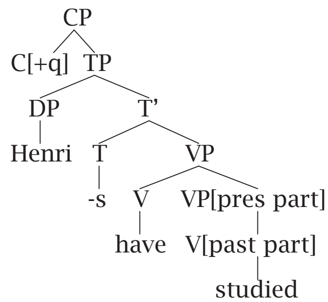
(43) a. Will John not go to school
b. Should Mary not taste the soup
c. Has Henri not studied for his exam
d. Is Bill not sick
e. Did Sue not pass her exam

(44) a. Won't John go to school
b. Shouldn't Mary taste the soup
c. Hasn't Henri studied for his exam
d. Isn't Bill sick
e. Didn't Sue pass her exam

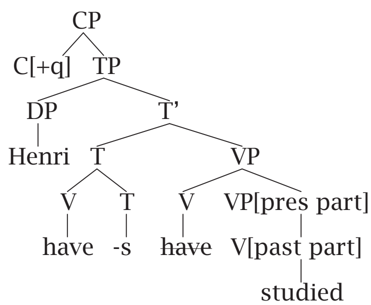
If *not* has contracted onto T to form a single word (we can think of this process as involving head raising of *not* to T), then this negated T can raise past Tense. If however, not has not contracted onto T, it cannot raise along with T:

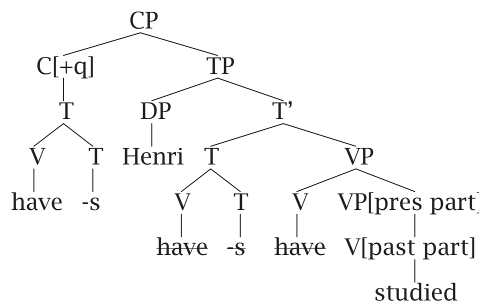
(45) a. * Will not John go to school
b. * Should not Mary taste the soup
c. * Has not Henri studied for his exam
d. * Is not Bill sick
e. * Did not Sue pass her exam

All this then, leads to the conclusion that T raises to a head position since what can raise is head like (one word long), that this position is in complementary distribution with overt [+wh] complementizers, that his raising is somehow linked to the fact that we get a yes/no questions. We interpret this by saying that T raises to a [+wh] C in Yes/No questions, and so the rule of subject-auxiliary inversion is is really a T-to-C movement. We start with this tree, which satisfies X-bar theory, but which is unpronounceable because it has an unattached bound affix and a C[+q] with no lexical content:



The problems with this tree can be fixed in two steps: first, we apply V-to-T in order to give the tense affix something to attach to, and then we move the head T up to C in order to give provide the needed lexical content for C[+q]:





6.7 Crosslinguistic variation

X-bar theory says something about how Subject, Complements and Heads and adjuncts are hierarchically organized in a given category, but does not entirely predict linear order. For example, there is no reason why a complement could not precede its head.

If we let Subjects, Heads and Complements in a given category order freely, we should a priori find six possible orders:

SHC HCS HSC SCH CHS CSH

But if X-bar theory is correct, certain of these orders should be excluded, even though X-bar theory says nothing about the order of sisters. Because X-bar theory says that a head combines with its complement first, we predict that the subject cannot intervene between them. This excludes the two orders:

HSC CSH

When the Head is the V in a simple clause, and we consider the order of V, Subject and Object, we see that one of the excluded orders, HSC corresponds to the common language type VSO – languages in which typical neutral clauses have the verb first, then the subject, then the object. Mechanisms other than simple X-bar structure will be needed to explain this, and as we are already seeing, mechanisms that distort simple X-bar orderings are independently motivated anyway. It might be the case that in VOS languages, the S is really not in a usual subject position, but is in fact in a derived position.

In English, all categories seem to follow the same order: SHC. This may suggest that the order is fixed once and for all in a given language and all categories in this language conform to it. If true, we would expect when we turn to another language that all categories in it should conform to a unique order.

The linguist Joseph Greenberg compiled word order information about normal or basic word ordering in about thirty languages. He stated many findings as language universals (Greenberg, 1978). Some of these putative universals remained true after his study was extended by others to a much larger set of languages. Among them are the following two:

Universal 2. In languages with prepositions, the genitive almost always follows the governing noun while in languages with postpositions it almost always precedes.

Universal 4. With overwhelmingly greater than chance odds, languages with normal SOV order are postpositional.

What universal 4 says is that there is a correlation between the order of the verb with respect to its complement and the order of the preposition with respect to its complement. This is what is expected if X-bar theory is correct and ordering is fixed once and for all for each language.

It is easy to see that Universal 2 establishes similar correlations when we realize that by genitive, Greenberg means *of*-complements to nouns, as in *student of physics*.

A language which standardly places the head before the complements is called Head Initial. Head initial languages include English, Zulu, Arabic, and many others. A language with the complement before the head is called Head Final, and languages of this type include Japanese, Turkish, Korean, Quechua,....

That there is cross categorial uniformity is predicted by X-bar theory. Note however that Greenberg's universals do not say always. They say almost always or with overwhelmingly greater than chance odds. This means that there appear to be mixed languages, for example languages with a certain order in some category but a different order in another (German is Verb final but complementizer initial) or even both orders for the same category (Dutch PPs can be prepositional or postpositional). This suggests that there are additional factors at play and further analysis is required.

One universal that is particularly interesting states that language with VSO word order is prepositional. This is mysterious but we will see later some reason why this may be true.

6.8 A review

We have made extensive use of the constituency tests introduced earlier. It is essential to be familiar with them in order to understand what is at stake in X-bar theory. In turn, it is important to be clear about the explicit claims of X-bar theory in order to understand the motivation for the special new movement rules introduced here. These are the first rules we have seen which introduce discontinuities in phrases:

Auxiliary verbs: select VP complements (with specific requirements on the form of the selected V)

Affix-hopping: A tense affix T that needs to attach to a V, if its complement is not an auxiliary VP, can hop onto the head of its complement VP

V-to-T movement: A tense affix T that needs to attach to a V, if its complement is an auxiliary VP, can attract the head of the complement VP to it.

The X-bar notions of **head, complement, subject (or "specifier"),** and **adjunct** were introduced, and defined in terms of the hierarchical tree-like geometry of syntactic structures. In these trees, it is important to understand these basic terms:

Branches: The lines connecting points in a tree are called branches or arcs.

Nodes: The points (e.g., TP, NP, VP, D', and the points labeled with words) are called nodes.

Root: The topmost node in a tree is the root. More formally, the root is the node in a tree which is not dominated by any other node.

Dominate: One node, A, dominates another node, B, if A is connected to B by a downward path along the branches. If you can trace from A to B by following branches and never going up the tree, then A dominates B. Dominate is synonymous with contain.

Immediately Dominates: A immediately dominates B just in case A dominates B and there is no other node, call it C which dominates B and does not dominate A.

Mother: A node A is the mother of a node B just in case A immediately dominates B.

Sister: Nodes are sisters just in case they have the same mother.

Precede: A node A precedes another node B just in case A does not dominate B and A occurs to the left of B in the tree structure.

7

The model of syntax

7.1 Review: The model of morphology

It is useful to compare the model of syntax that is being developed with the model of morphology discussed in chapter **??**. The model of morphology had the following ingredients:

1. the **atoms** of morphology are morphemes. Morphemes were defined as the simplest meaningful units, as "semantic atoms," but it turned out that these same units are, at least to a first approximation, the atoms of morphology. Each morpheme has intrinsic properties, which are specified by its lexical entry, including

   a. its category

   b. the kind of elements it selects

   c. its contribution to meaning etc..

   d. its phonological shape (i.e. how it is pronounced)

   e. its bound or free nature (also a phonological property)

   The notion of "word" that is common among non-linguists does not usually include bound morphemes, but it includes free morphemes and also free complexes whose properties are constrained by the second component of the model.

2. The atoms can be assembled into complexes, complexes which have an internal structure that can be represented by labeled trees with lines that do not cross. These larger units and these atomic units can be further compounded to form still larger units representable by labeled trees, with the following properties:

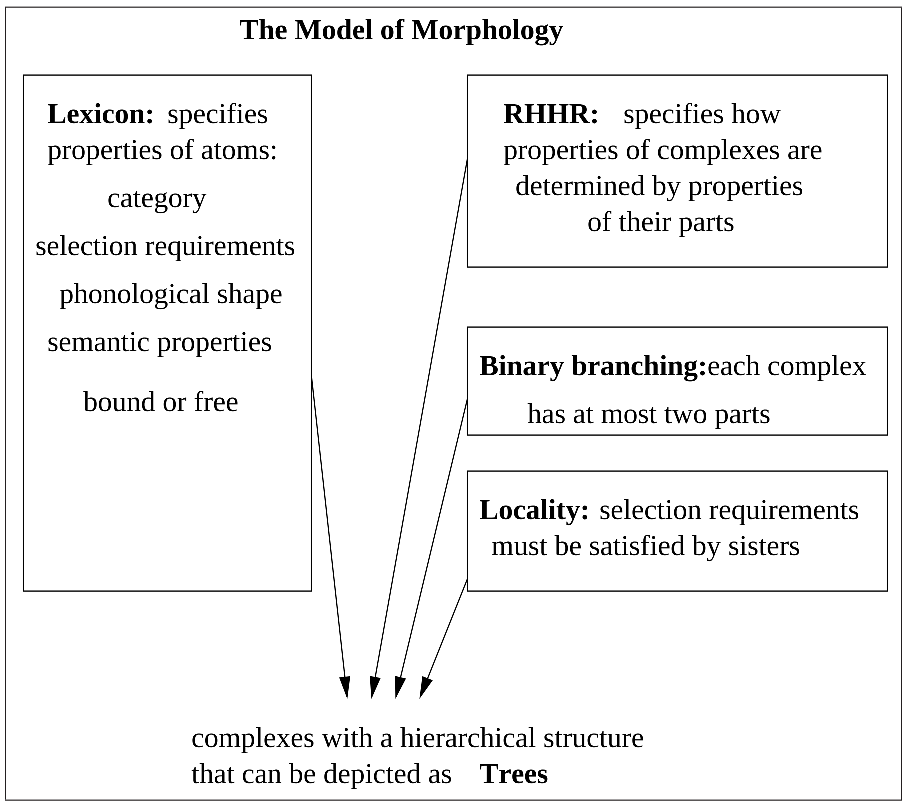
   a. **Locality:** If a head selects an element, this element must be a sister to this head: Selection is local in the sense that it is restricted to operate under sisterhood.

b. **Binary branching**: in any morphological tree structure, a mother node only has two daughters at most.

c. **Right hand head rule (RHHR):** the head of a morphological constituent is (normally) the right daughter of this constituent.

The notion of "word" that is common among non-linguists does not usually include compounds and certain other sorts of complexes, which linguistic investigation reveals to be of the same sort as their simpler variants. For example, the complex noun compound *bull dog train-er* has essentially the same morphological and syntactic properties as the morpheme *dog* does – it is a noun. We call these categories N, V, A, P, D, C, Adv,…"word level" categories.

All these components interact to determine morphological structures, as indicated by this diagram:



Note that the sizes of the components of this figure are not "to scale": the lexicon is vast, with all the morphemes that the speaker has any acquaintance with at all – many tens of thousands for a normal adult speaker; while the rules about complexes indicated on the right are extremely simple and few in number.

7.2 Review: The model of syntax

So far, our simple theoretical model of syntactic organization is very similar. This is what we have so far.

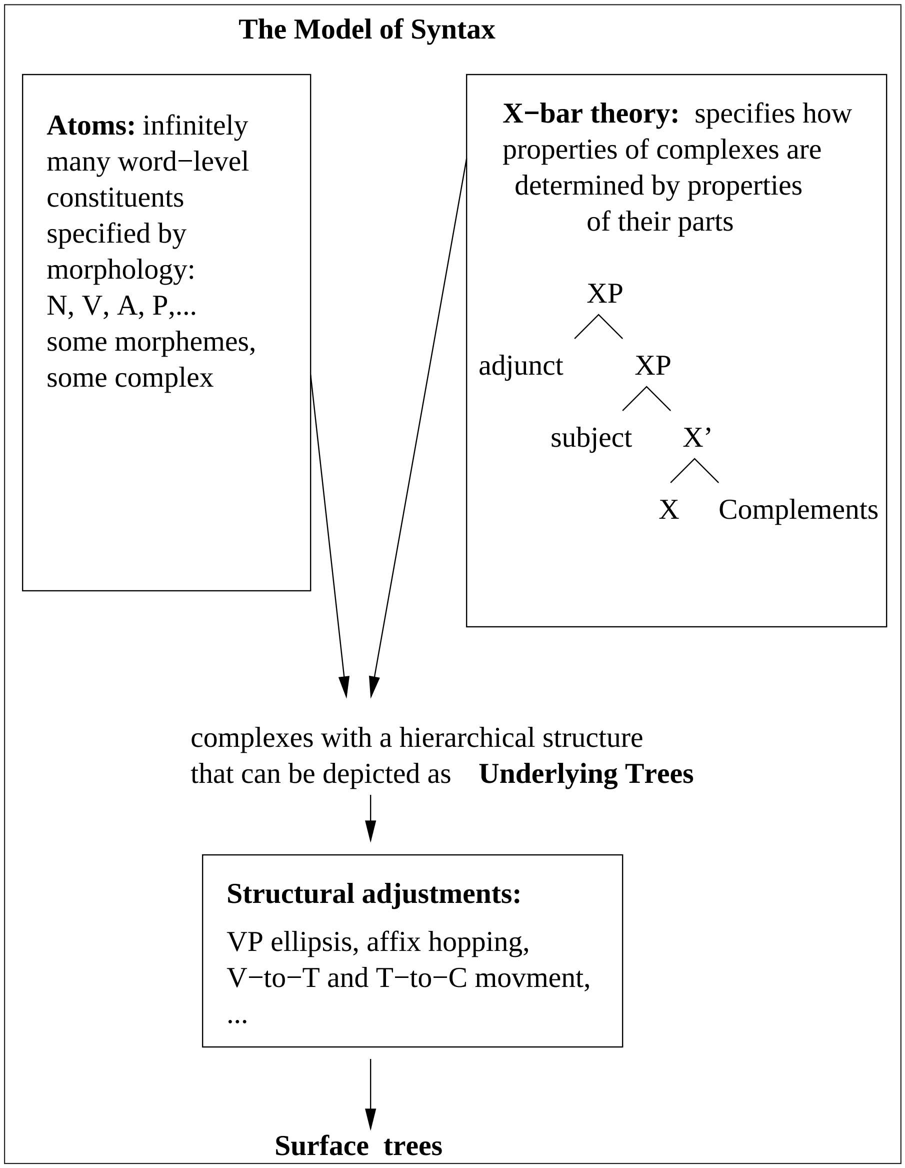
1. the **atoms** of morphology are "word-level" categories (not meaning that they are words but rather that the categories they belong to are the same that words belong to, Xzeros in the X-bar system. When the atoms are morphemes, as we saw above, their syntactic properties will be listed in the lexicon; and when these elements are complex (e.g. compounds), then their properties are determined by the RHHR.
2. The atoms can be assembled into complexes, complexes which have an internal structure that can be represented by labeled trees with lines that do not cross. These larger units and these atomic units can be further compounded to form still larger units representable by labeled trees, with the following properties:

   a. **X-bar theory:** The syntactic structure of a head X with 0 or more complements, 0 or 1 subjects, and 0 or more adjuncts is regular across categories.

   We do not have a binary branching requirement (so far) since we have allowed a head to have any number of complements as its sisters. And our treatment of X-bar theory and selection actually does imply a certain kind of locality, but it is not simple. We will turn to this in a moment.

In morphology, the atoms have the same "word level categories" as the complexes do, so we do not distinguish complements, subjects and adjuncts the way we do in syntax. In syntax, we could distinguish them because a complement is a sister to the head but an adjunct is a sister to a phrasal constituent.

Recall that one fundamental way on which complements and adjuncts differ is that complements are "part of the meaning of the head". They are specifically selected by the head because they specify the meaning of an entity whose existence is implied by the very meaning of the head. For example, if we consider the verb *surround*, part of its very meaning implies that some object is being surrounded. For a "surrounding" to take place, there must be some entity being surrounded. In the expression *surround the fort*, the DP *the fort* simply specifies what entity this is, namely the fort. If we just said *Surround!*, it would at best feel incomplete, elliptical. In *surround the fort quietly*, it is not part of the very meaning of the verb surround that a surrounding must be accomplished in some manner or other. It may be true that actions are accomplished in some manner or other but this is true of all actions. And the expression *surround the fort* does not feel incomplete because we have not specified the manner in which the surrounding took place. This is why the AdvP *slowly* is an adjunct. This does not mean that adjuncts are not selected. They are, but not in the same way as complements. For example a sentence such as *Mary slowly seems sick* is strange. The VP headed by *sick* is not the kind of VP that can be modified by *slowly*.



The syntactic requirements of the heads of the X-bar trees must be satisfied, requirements that we get ultimately from the lexicon. This is a pretty obvious but fundamental requirement, so we give it a name:

Projection Principle: lexical requirements must be satisfied.

Among the lexical requirements are syntactic selectional properties, which must be satisfied "locally" in a tree in a sense of "local" that we will now briefly explore.

7.2.1 The projection principle and locality

We have already observed numerous cases where a syntactic head imposes selection requirements on other constituents of phrases: each item selects a distinctive kind of complement, subject, and adjunct. Consider the following examples:

(1) a. *Sue put
  b. *Bill elapsed
  c. *Henri arrived Bill
  d. *Sophie will theater

These examples are deviant because some lexical requirement of some item in them is not satisfied:

put requires two complements: a DP (normally denoting a displaced object) and a PP (normally denoting a location)

elapse requires a subject that talks about time

arrive does not tolerate a direct object DP

will takes a VP complement, not an NP.

We would like to formulate the "projection principle" to define how the lexical requirement of heads must be met when they appear in a tree. But how exactly should this be stated? It looks like some kind of locality requirement also holds. To see this, consider the following examples:

(2) a. *Time said that Bill elapsed
  b. *Mary wonders that John said if Bill left
  c. *Henri told Sue in the drawer that Bill put socks

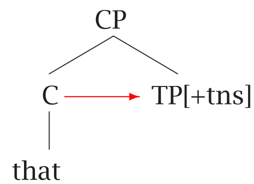
They are all seriously deviant. Let us examine them in turn:

(3) a. the verb *say* requires an animate subject, and there is such a subject in the structure namely *Bill.* And the verb *elapse* requires a subject that talks about time, and there is such a subject in this sentence namely *time.* What goes wrong here is that the subject that say requires must be <u>its</u> subject in the structure. The subject that elapse requires must be its subject, not the subject of some other verb.
  b. *wonder* requires an *if*-clause as complement, and there is one, namely *if Bill left.* And *say* requires a *that*-clause as complement, and there is one, namely *that John said if Bill left.* Again we have the same problem: if a verb requires something of a complement, this complement must be realized in the structure as <u>its own</u> complement.

c. *tell* wants a DP complement and a CP complement, while put wants a DP and a PP. This PP cannot occur as complement of *tell* instead.

The general idea then is this: if a head requires a complement, this complement must be realized as its own complement, i.e. as its sister. We have illustrated this with verbs, but this is a very general property.

Local satisfaction of lexical requirements can also be illustrated with a C like *that* which requires its own complement to be a tensed CP.

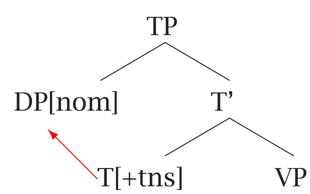


Another illustration can be given for T. We have seen that a [+tense] T requires a nominative subject. This what differentiates the following two sentences:

(4) a. she will win the race

b. *her will the race

The subject of a tensed clause in English must be in the Nominative Case. The nominative form of the 3rd person singular feminine pronoun in English is *she* not *her*. We can state this requirement by saying that a [+tense] T requires a nominative subject as its subject.



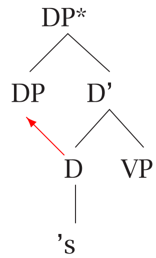
And another example involving D:

(5) a. John 's book

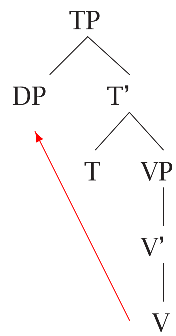
b. * 's book

c. * John D book (if D is different from *'s*)

A *'s* D head of a DP (call it DP*) requires a DP subject (and no other D does, this is why the third example is ill formed). This is why the second example is ill formed. This subject must appear as the daughter of DP*:



We have also seen that if a verb in a clause requires a subject, this subject must be the subject of the very clause whose VP is headed by this verb. For example in the case of the verb *elapse* above, its subject appears as the subject of the TP containing the VP).



So there is a locality condition, a restriction on where selection requirements must be satisfied, but it is not a simple one.

(6) **Locality of Selection for Syntax (preliminary):**

a. If a head α selects β as complement, β is a complement of α.

b. If a head α selects β as subject, β is the subject of α or the subject of <u>the clause containing α</u>

c. If a head α selects β as an adjunct, β is the adjunct of α.

Clearly, the second of these conditions – the case of the verb's selection for its subject – looks more complex than any of the others.

7.3 Structural adjustments: ellipsis, movement,...

We have encountered the following problem: In a sentence like *John finished the cake*, there seems to be two different kinds of constituency available. One – the standard one we had seen so far takes the string *finished the cake* to be a constituent, as evidenced by, say, coordination:

(7) John finished the cake and drank the lemonade

The other, as evidenced by VP ellipsis for example shows that the bold portion of the string ***finish****ed* ***the cake*** forms a constituent. This is evidenced by VP ellipsis, which only deletes this bold portion:

(8) Elmer finished the cake and John did too, finish the cake

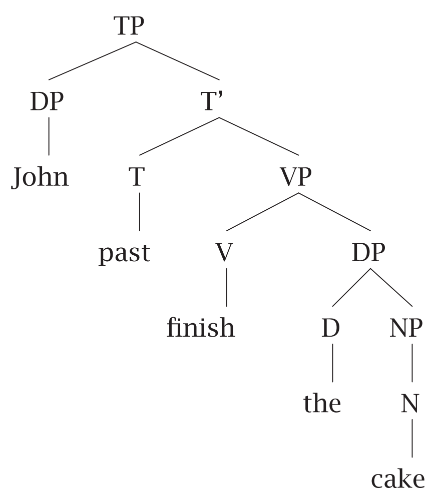
We therefore need to describe what these two constituencies are, i.e.

a. we need to provide two trees and

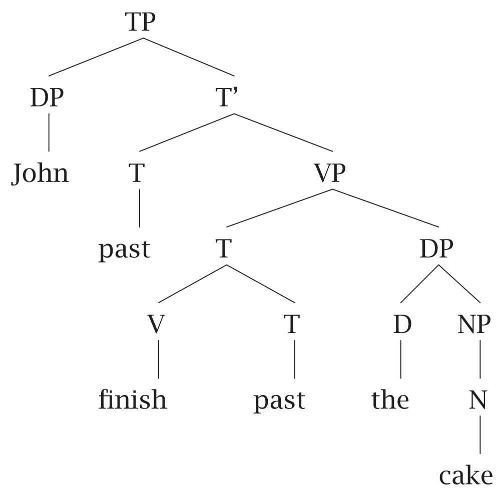
b. we also need to explain the relation between these trees.

The way we have done this is as follows: We have taken one tree to directly reflect the lexical properties of the items that appear in it, as required by the Projection Principle and by the Principle of Locality of Selection.

We have called this tree the Underlying Tree, or Deep Structure Tree. In such a tree, a tense appears in T as required by its lexical specification, etc. Thus the underlying tree for *John finished the cake* is:



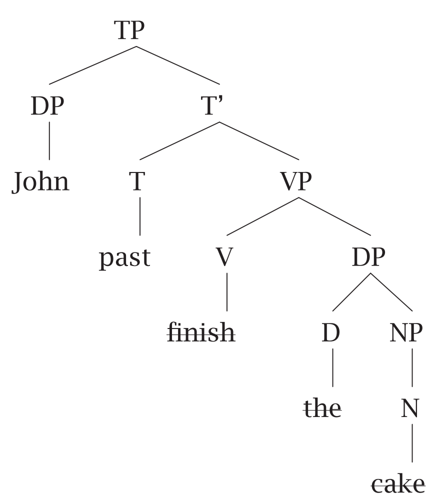
In addition, we need to provide a second tree and explain how it is related to the first. This second tree is called the Surface tree. In case VP ellipsis does not occur, this surface needs to reflect the constituency given in (7) above. This tree looks like:



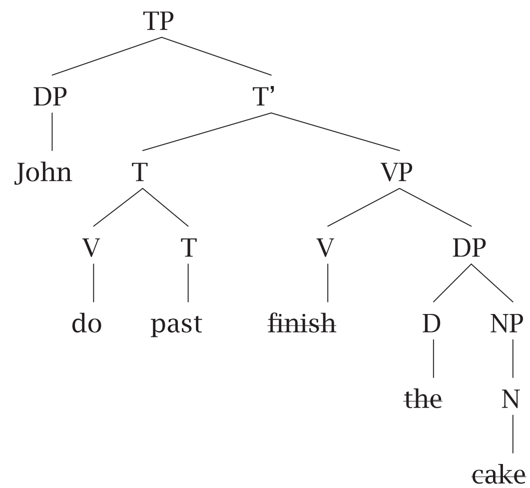
To explain the relationship between the underlying tree and the Surface tree, we have invoked the rule of Affix Hopping, which applies only in the case of tensed main verbs.

Thus we can think of the underlying tree as providing an input to the rule of affix hopping, which yields the surface tree as output. The reason why this rule is needed is that the past T is a bound morpheme in English, and thus needs to be attached to a host. This is what the rule of Affix Hopping does creating a "word" headed by T (in accordance with the Right Hand Head Rule).

In a sentence in which a VP is missing, there is a puzzle about how the selection requirements of T are satisfied, since T always selects a VP complement. This puzzle is resolved if we provide the VP complement in the underlying tree, which is deleted by VP ellipsis:



In such a case, Affix hopping cannot do its job of providing a host for the T suffix "past". What English allows in this case is insertion of a dummy verb *do* (not to be confused with the main verb *do*) to provide such a host. This rule is called **do-support.** Applied to the previous tree, we obtain the structure we see in the second part of (8):



VP ellipsis is not the only case in which Affix Hopping is blocked. Negation also blocks Affix Hopping. This is why we have the following paradigm:

(9) a. John liked Mary

b. * John not liked Mary

c. * John liked not Mary

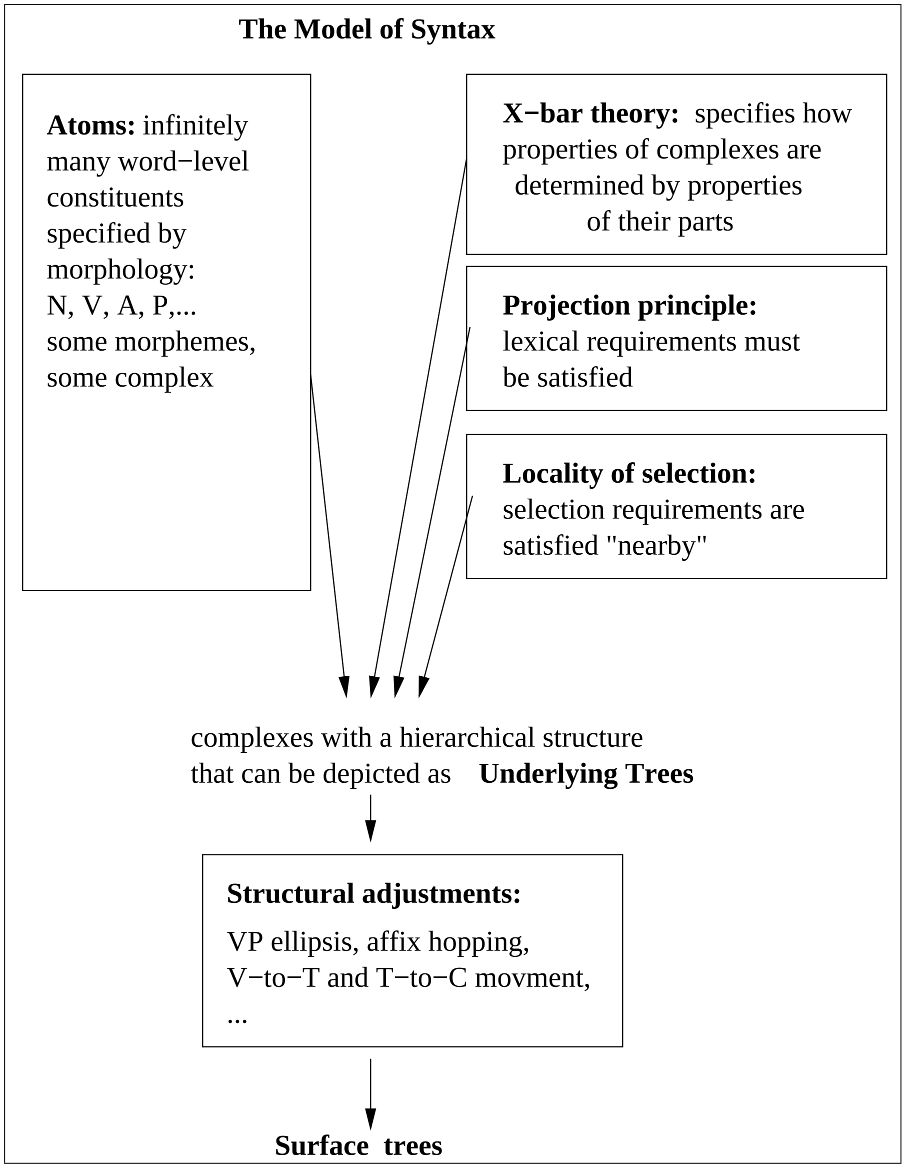
d. John did not like Mary

If you go on studying syntax, you will get to see that there is a lot more to be said about Negation.

The conclusion we draw is that certain operations (head movement, affix hopping, etc) can manipulate trees that have been constructed according to the principles of X-bar theory, the Projection Principle, and Locality of Selection, to yield a different constituent structures that satisfy other requirements.

The first trees are called **underlying trees** or deep structure or D-structure trees. Trees we obtain after structural changes we call S-structure trees or **surface trees.** We also talk of underlying structures and surface structures.

Taking all this into account, we have this slightly revised, still preliminary, model syntactic theory:



7.4 Digression: a brief note on rule interactions

When we look carefully at the assumptions outlined above, it is easy to see that some of them are rather tricky. Recall that that VP ellipsis can apply to various VPs in a sentence, as we see here:

Mary won't have been eating cake, but Joe will have been eating cake
but Joe will have been ~~eating cake~~
but Joe will have ~~been eating cake~~
but Joe will ~~have been eating cake~~
* but Joe ~~will have been eating cake~~

A natural assumption is that VP ellipsis can apply to any VP. We also saw that do-support can act to "rescue" a stranded affix, as in

Mary didn't finish the cake, but John finished the cake
but John did ~~finish the cake~~
* but John

The proposal is:

Joe -ed finish the cake
↓affix hopping
Joe finish-ed the cake

And in the other case:

Joe -ed finish the cake
↓VP ellipsis
Joe -ed ~~finish the cake~~
↓do support
Joe do-ed ~~finish the cake~~

Notice what must be disallowed though:

Joe -ed finish the cake
↓affix hopping
Joe finish-ed the cake
↓VP ellipsis
Joe ~~finish-ed the cake~~

Maybe we could say:

1. VP ellipsis must apply before affix hopping
2. VP ellipsis can only delete the VP, not anything that has moved into it

Examples like the following confirm that tense is not part of what goes on in VP ellipsis:

John ran, and Mary will ~~run~~ too

Notice that we all understand what is elided, even though it does not explicitly appear in the first sentence.

There is another puzzling case. Consider these examples:

Othello wasn't listening to Iago	but she was listening to Iago
	but she was ~~listening to Iago~~
	* but she did ~~be listening to Iago~~

For some reason, we cannot delete the verb *be* and repair with *do*-support. Remember: Failures are not usually informative, because they could be due to many things. But let's look at the prohibited sequence of events and consider what the problem might be:

* she -ed be listening to Iago
↓VP ellipsis
she -ed ~~be listening to Iago~~
↓do support
she do-ed ~~be listening to Iago~~

What explains why this is bad? First: notice that the puzzle does not go away when we accept affix hopping applies to main verbs while V-to-T applies to auxiliaries. The reason this sequence is bad may be related to the pattern we see emphatic uses of *do*:

She listens to Iago	She does listen to Iago
She likes eating biscuits	She do like eating biscuits
She has listened to Iago	*She does have listened to Iago
She is listening to Iago	*She does be listening to Iago

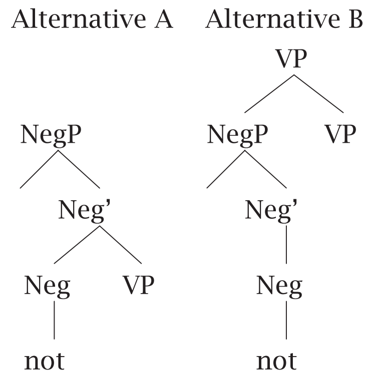
There are other puzzles too. One well known one relates to a difference between auxiliary VPs and main VPs with respect to the possibility of deletion:

John was here, and	Mary will be here too
	*Mary will ~~be here~~ too
John left	but Mary shouldn't ~~leave~~
	*but Mary shouldn't ~~have left~~

A full exploration of these matters is beyond the scope of this class, but are standard fare in more advanced syntax classes.

7.5 Digression: a brief note on negation

At this point, there are two available options for the treatment of Negation. Either Neg is a head combining with a XP complement, (roughly alternative A) or Neg is a head of an adverbial phrase NegP (Alternative B)



not It turns out that this is a quite difficult question to settle. Both proposals have been pursued, as well as mixed proposals (some negative items enter into the configuration in A, others in B): all proposals have some merits and problems. We will very roughly outline the reasons why we adopt Alternative A, using the tools that we have so far developed. Consider VP ellipsis first:

(10) a. John will endorse the treaty,
but Georges will not ~~endorse the treaty~~

b. Will George indeed not endorse the treaty?
He will indeed not ~~endorse the treaty~~

c. *He will indeed ~~not endorse the treaty~~

d. He will indeed ~~endorse the treaty~~

Thus, by looking at VP ellipsis, we see that the polarity of the clause (whether it is negative or not) must always be overtly expressed in the remnant, and can never be recovered in the way VP adjuncts can be recovered under VP ellipsis.

VP preposing shows the same:

(11) He will not endorse the treaty; and indeed
[endorse the treaty] he won't
*not endorse the treaty he will

Again, we see that the constituent we have identified as VP fails to show some distributional properties of VP. As before, failure of constituent tests does not show conclusively that the constituent is not a VP. Both these tests show that*not* is located outside VP: thus minimally the node in B is not VP.

There are also some arguments in favor of B. In morphology we were led to assume that Neg was a modifier/adjunct: since Neg (un/in) did not change the category of the word. This suggests that we should treat *not* in the same way, as a modifier of VP: negation turns the VP into a negative VP. There is also an argument from locality of selection: we have treated T as c-selecting VP, and this should translate into sisterhood. Under alternative A, Negation seems to intervene between T and VP, and sisterhood would need to be loosened. Under alterative B, no problem arises.

7.6 Example structures and lexical entries

We have seen that different heads select different kinds of complements or subjects. These are selectional differences. Selectional properties are stated in the lexical entries for these heads. We are going to see examples of lexical entries for various items containing information on how these items should appear in syntactic structures and discuss how they should be organized.

7.6.1 Complementizers: *that, ~~that~~, for, if, whether*

that: C[+tense,-wh], selects TP[+tense]

That is a tensed complementizer, which cannot appear in (embedded) questions and takes a tensed TP as complement.

~~that~~: C[+tense,-wh], selects TP[+tense]

Although *~~that~~* is not pronounced, it has the same properties as overt *that*.

for: C, [-tense,-wh], selects TP[-tense]

For is a tenseless complementizer, which cannot appear in (embedded) questions and takes a tenseless TP as complement.

Note that we say that *that* is +tense and *for* is -tense so that these two elements will have distinct categories. Some verbs take *that* complements but not *for* complements, so we need to distinguish their C-selection requirements.

(12) a. John thinks that Bill left
b. *John thinks for Bill to leave

if: C[+tense,+wh], selects TP[+tense]

If is a tensed complementizer, which can appear in (embedded) questions and takes a tensed TP as complement.

whether: C[+wh], selects TP

Whether is a tensed or tenseless complementizer, which can appear in (embedded) questions and takes a tensed or a tenseless TP as complement.

(13) a. John asked whether Bill left
b. John was wondering whether to leave (or not)

7.6.2 Tense: present, past, infinitive *to*

Past: T[+tense], suffix (normally realized as -ed), c-selects VP[bare form], (means past..)

Past tense means that the event described by the VP occurred before the moment of speech.

to: T[-tense], selects VP[bare form]

7.6.3 Determiners and other D-related elements

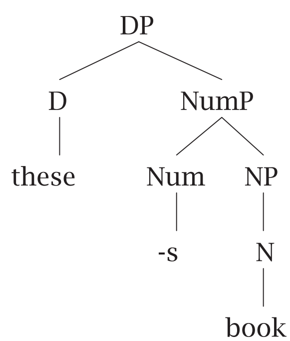
We have seen various determiners: *the, this, every, each, these, some,...* First, note that the choice of a D does not really seem to influence specifically the kind of N it takes. However, it often requires that the N have a certain number (singular, plural or singular or plural) or no number at all (mass nouns). Recall also that we concluded in the morphology chapter that just like a tensed verb is of category T (by the right hand head rule), a plural noun is of category Plural.

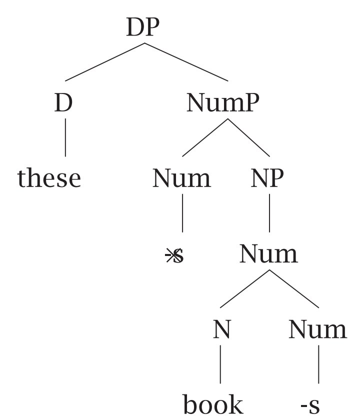
[story book] [book author]
*[stories book] *[books author]

This suggests that *books* does not really have the category noun, but another category, one that we called <u>Number</u>. One idea is that number affixes in DP are sort of like the tense affix in TP, so plural DPs start with Number separated from N, as in:

the -s interesting book.

It is natural to assume that D quite generally selects a category Number which we will abbreviate Num, and that Num can be [+/- count]. If it is [-count], it is a silent head and it is only compatible with a mass noun (like water, sand, etc.). If it is [+count], it can be plural or singular. If it is plural, this Num is pronounced -s in English. If it is singular, (we will assume here that) it is silent. This give us the following representation for the DP *these books*:



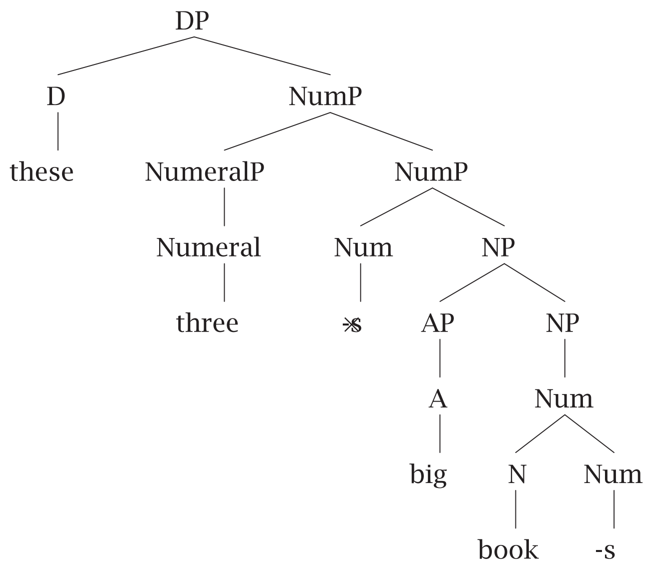


Since we introduce this new category Number, we may ask whether it allows subjects and adjuncts. It turns out we have already encountered elements that seem to be reasonable NumP adjuncts! These should be elements not specifically required by a Number head, but compatible with only certain number heads. Numerals such as *two, three, four*, and quantity expressions such as *many, few, several*, etc... look like reasonable candidates. Note that they can only occur with a [+plural] Number. Note also that, as expected, they precede adjectives, which are NP adjuncts.

(14) a. these three big books

b. * these big three books

The former example, *these three big books* has something like this structure:



There are also NumP adjuncts for the [-count] Num head which selects mass nouns as complements (it is actually unclear whether nouns are intrinsically count and mass or whether they are used in a count or mass fashion. If the latter, nouns do not have a feature [+/- count]. They are interpreted as mass when they are complements of a mass Num, and as count otherwise.) Examples of mass quantity expressions are *much*, or *little* which are the mass counterparts of the [+count] *many* and *few*.

Lexical entries for Ds will then look like the following:

These: D(demonstrative) selects NumP[plural]

Each: D(distributive), selects NumP[singular]

It is left as an exercise for the reader to formulate lexical entries for *every, some, no, this*.

Naturally, various Number heads will also have lexical entries, using the symbol e to indicate a silent head:

-s: Num[plural], selects NP[count]

e Num[singular], selects NP[±count]

And quantity expressions will have the following type of lexical entries:

many: Qu[+count,+plural] (roughly meaning a large amount)

little: Qu[-count,+singular] (roughly meaning a small amount)

7.6.4 Verbs

Modals: *will, would, can, could, shall, should,...*

We are now in a postion to treat modal verbs as just verbs raising to T, the way we have treated auxiliary verbs have and be.

will: V(future modal), selects VP[+bare]

Will (other modal verbs work the same) is a modal verb roughly meaning future which takes a bare VP complement (i.e. a VP headed by a bare V).

Note that English Modal verbs are defective. They lack bare forms and thus must always raised no a finite T node. They cannot occur in infinitives (some other languages – like Spanish or French – have modals which do not lack the form necessary to occur in infinitive clauses and so they can).

Auxiliary verbs: *have, be*

We have seen that the verb *have* requires a complement VP where the verb is in the perfect form (also called participial form). The verb be requires a complement VP where the verb is in the progressive form (the -ing form of the verb).

have: V, selects VP[past participle], perfect auxiliary (roughly indicates being in the resulted state of the action)

be: V, selects VP[present participle], progressive auxiliary (indicates ongoing action)

Main verbs

We have considered paradigms like this:

(15)
a. *Mary send, Mary send a book (to Bill), Mary send Bill a book,...
b. Time elapse, *Bill elapse, *elapse a book, *elapse to Bill
c. *examine, Bill examine a book, *examine a book to Bill, *Sincerity examine a book
d. We *put/*put a book/put a book on the table
e. We think that/*for/*if TP
f. We wonder whether/if/*that TP

The verb *send* is a three place predicate. It relates an Agent (the sender, realized as a subject), a Theme (what gets sent, realized as a DP complement), and a Goal (the recipient, realized either as a PP headed by to or as a DP).

send: V, DP, DP, ((to) DP)

One DP must be a subject (there can only be one subject) to indicate this, we underline it. Note how we put parentheses around the Preposition to indicate that it is optionally present.

(If it is present, by X-bar theory there will of course be a PP). Secondly, note how we put parentheses around to DP to indicate that this argument is optionally present (it is ok to say: *John sent a book* – where the goal remains implicit).

(16) a. Mary sent a book to Bill
b. Mary sent Bill a book

Part of the lexical entry of the verb send should indicate that even when the goal is not realized, a goal is implicit (thus *send* is different from *examine* for example, as *examine* does not have an implicit goal).

(17) a. Mary examined a book
b. *Mary examined a book to Bill,

To this effect, we need to complicate our lexical entries a bit:

send: V, Agent-DP, Theme-DP, Goal –((to) DP)

This lexical entry encodes the following information: The word *send* is a verb. it takes three arguments respectively interpreted as Agent (or Cause), Theme and Goal. The Agent (or Cause) argument is realized as a subject DP, the Theme as a complement DP and the Goal may or may not be realized syntactically. If it is, it may be either as a complement DP or as a to-PP.

Naturally, only certain kinds of DPs can felicitously represent Agents or Causes. The DPs *the man, Sue*, or *they* can, but the DP *the rock* cannot naturally (unless it is used metaphorically). This means that the verb *send*, because it treats this DP as realizing an Agent or a Cause, requires certain semantic properties of this DP subject: this is a case of s-selection. Similarly, the fact it requires of one of its complement to be of category DP is a case of c-selection.

The verb *elapse* is a one place predicate, s-selecting a theme subject

elapse: V, theme- DP .

The verb *examine* is a two place predicate. Its two arguments are interpreted respectively as Agent (who does the examining) and Theme (what is examined). The agent argument must be a DP subject (and because it is an Agent it must be animate), and the Theme must be a DP.

examine: V, Agent-DP, Theme-DP

here are lexical entries for the verbs *think* and *wonder*:

think: V, Experiencer-DP, Theme-CP

wonder: V, Experiencer-DP, Theme-CP[+wh]

A note on thematic relations

We informally use terms like **Agent, Theme, Cause, Possessor, Location, Goal, Experiencer, Beneficiary**,...to identify the kind of meaning relation that holds between a verb or a predicate and one its arguments. These terms do not really have a theoretical status, they are just convenient shorthand. The way we use them is pretty transparent except for Theme.

Cause: is a cause (*The rock broke the window*)

Agent: is a person or entity (intentionally) causing something (*John (intentionally) broke the window*)

Experiencer: is a sentient being in or acquiring a psychological state (*John fears storms, storms frightened John*)

Location: is a location (*John sleeps in his bed*)

Goal: is a location that is an endpoint (*John sent Bill books*)

Beneficiary: is a beneficiary (*John baked a cake for Mary, John baked Mary a cake*)

Possessor: is a possessor (*John owns books*)

Possessee: is a possessee (*John own books*)

Theme: is something that undergoes a change (e.g. of location) (*John sent Bill books*) or that is progressively affected as the event denoted by the verb progresses (*John read a book*), (*Three minutes elapsed*), etc..

7.7 The general format of lexical entries

If we take the examples we have looked at as representative, the lexical entry for an item, say W, contains at least the following king of information:

1. The category of W
2. The number of arguments (if any) W takes
3. The semantic relationship if any, between W and each of these arguments (that is the s-selectional properties of W)
4. The category that syntactically realizes each of these arguments (that is c-selectional properties of W) It looks like this kind of information is not generally predictable, given minimal pairs such as *wait* and *await*. They appear to be synonyms. Yet, *wait* takes a PP complement as Theme (*wait for Bill*), while *await* takes a DP complement (*await Bill*)
5. The syntactic configuration in which these arguments are syntactically realized. This also does not look generally predictable given pairs such as *own* and *belong*. They also appear to express the same relation. Yet the possessee is a subject in one (*This book belongs to John*) and an object in the other (*John owns this book*).

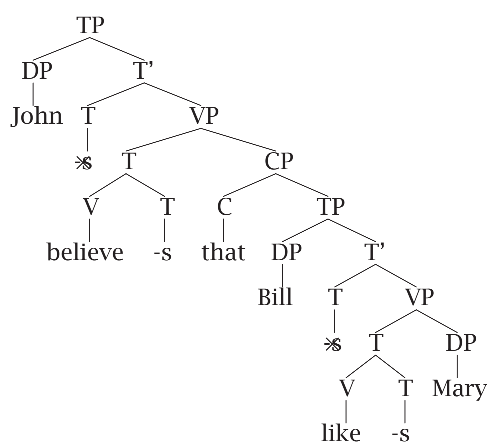
6. Additional morphological properties, e.g. is a free or bound element
7. Additional semantic information about this item (what its meaning is). this is of course an important aspect but we will not worry vey much about it here. For example, this is what would distinguish a verb like *reach* (which allows an adjunct like *in an hour* but not one like *for an hour* from a verb like *paint* (which may allow either e.g *paint the door in/for an hour*).

8

Binding and the hierarchical nature of phrase structure

We have described a model of syntax in which (i) underlying structures are "projected" to locally satisfy lexical requirements in a way that conforms to the requirements of X-bar theory, and (ii) these structures are transformed into surface structures by rules that can move (Affix Hopping, Verb Raising), insert (Do-support) and delete (Ellipsis) constituents of various sizes. According to this model, the constituents of a sentence stand in hierarchical relationships of containment that can be represented with a tree (**Important note: we sometimes omit the X'level to shorten the tree when it makes no difference to what we are discussing, but it should always be present in a complete tree):**

(1)



These hierarchical structures are constructed by satisfying the lexical properties of lexical items entering into them in according with the principle of locality of selection. They are independently justified by constituency tests. In this chapter we will get surprising confirmation for these structures, as well as new tools to investigate constituent structures coming from some slightly more subtle facts about how sentences are interpreted.

First, note that when we want to refer to a particular person, the person named "John," we sometimes use the DP *John* but not always. We may also use a description that uniquely identifies him to our "audience," for example we might use a DP like *the young boy who lives next door*. We could refer to someone named John by using any of the several underlined expressions below:

(2) a. John came in.
   b. Then, John left
   c. He took his umbrella
   d. He hurt himself with it when he tried to open it.
   e. The idiot can't even open an umbrella!

We can refer to John by using the name *John*, a pronoun *he*, a reflexive *himself* or even an epithet such as *the idiot*. We can also use the pronoun *it* to refer to John's umbrella. Thus we can paraphrase the last three sentences in the following very awkward way (although in the last one, we lose some information – namely that the speaker thinks John is an idiot):

(3) a. ? John took John's umbrella
   b. ?* John hurt John with John's umbrella when John tried to open John's umbrella
   c. John can't even open an umbrella!

Because of this, reflexives (reciprocals) and pronouns are called pronominal expressions (they stand for nominal expressions).

Since we could use a name or a description to refer to a particular individual or an object, we may wonder why a language like English (or any other human language) bothers to have pronouns at all. One motive is probably the conversational principle that you should be no more specific about things than necessary (especially with regard to matters that are already obvious!), but we will also see later that certain ideas cannot be expressed just with names or descriptions. Pronominal expressions play a fundamental role.

In general, we can use a pronoun or an epithet to refer to some person if there is some reasonable way to find out who this pronoun is referring to. For example, we have seen that if we have previously mentioned John, we can use a sentence with the pronoun he to refer to John. We can also use a pronoun in a sentence to refer to John if the DP *John* is used elsewhere in the same sentence, even if John has never been mentioned before, as in:

(4) a. John said he was sick
   b. The TA who graded him says that John did really well

We can indicate that we mean John, and that *he* or *him* to refer to the same person by putting a "subscript" or "index" *i* on each of the phrases which is interpreted as referring to an individual *i*. This is just a convenient notation: if two phrases have the same index, they are meant to be **coreferential**, to refer to the same entity (real or fictional, in some sense that we will not try to be too specific about). If they have different indices, they are meant to refer to different objects, to be **non-coreferential** or **disjoint in reference**.

We will assume for the moment that referring is exclusively a property of DPs (not of Nouns, Adjectives, NPs, or CPs). In this text, an index is thus always going to be an index on a DP.

Accordingly, we would rewrite the two sentences above as:

(5) a. John$_j$ said he$_j$ was sick

b. [The TA]$_k$ who graded him$_j$ says that John$_j$ did really well

Certain combinations, however, seem impossible. For example, even if John has been mentioned previously in the discourse or made prominent in some other way, the following sentences a and b are impossible, even though c and d are fine:

(6) a. * Himself should decide soon

b. * Mary wrote a letter to himself last year

c. He should decide soon

d. Mary wrote a letter to him last year

Similarly, in the case in which John has not been mentioned in previous discourse but is mentioned in the sentence, the following sentences are impossible:

(7) a. *John$_j$ hurt him$_j$

b. *John$_j$ says Mary$_k$ likes himself$_j$

c. *Herself$_j$ likes Mary$_j$'s mother$_k$

d. *He$_j$ heard that [the idiot]$_j$ should win.

e. *He$_j$ saw John$_j$

In this chapter, we will investigate a small part of the problems raised by such sentences. It turns out that the description of these patterns depends on the structures of the sentences. That is a nice surprise, since we did not consider these patterns at all in our earlier development of syntactic theory. The fact that the theory nevertheless is providing the structures we need to describe these new facts constitutes independent evidence that we are on the right track.

8.1 Anaphors

Languages contain a class of items that are called anaphors. These are elements that have no independent reference, but depend on an antecedent for their interpretation. The core case of anaphoric elements in English are reflexive pronouns (*myself, yourself, herself, himself, itself, ourselves, yourselves, themselves*) and reciprocals like *each other*.

8.1.1 Reflexive pronouns

We begin with reflexives. They seem to minimally differ from pronouns in that they cannot be used in a sentence unless there is another coreferential DP in the same sentence:

(8) a. [Mary]$_i$ likes [herself]$_i$
 b. [Our rabbit and the neighbor's cat]$_i$ like [each other]$_i$
 c. [The boys]$_i$ fought with [each other]$_i$

The reflexive in the first sentence refers to exactly the same thing as the subject *Mary*, and the reciprocal indicates mutual reference in a group of some kind. That is, the sentences roughly mean:

(9) a. ?* Mary likes Mary
 b. Each of our rabbit and the neighbor's cat likes the other
 c. Each of the boys fought with (some of) the other boys.

Let's begin with some simple sentences with reflexive first. A first, obvious point is illustrated by these examples:

(10) a. I saw John$_j$. * Bill$_i$ likes himself$_j$.
 b. I saw John$_j$. * Himself$_j$ laughs.

The point is this one:

(11) A reflexive must be coreferential with another DP in the same sentence, its antecedent.

Another basic point is illustrated by these examples:

(12) a. the boy$_i$ likes himself$_i$
 b. * the boy$_i$ likes herself$_i$
 c. * the boy$_i$ likes themselves$_i$

(13) a. the girls$_i$ likes themselves$_i$
 b. * the girls$_i$ likes herself$_i$
 c. * the girls$_i$ likes yourselves$_i$

The point here is:

(14) A reflexive must agree with its antecedent in person, number and gender (not: case)

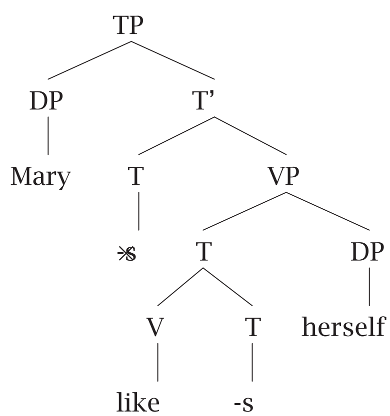
English reflexive anaphors are bimorphemic: they apparently consist of a pronoun + *self*. The pronominal part of the reflexive anaphor must agree in person, number and gender with its antecedent, the self part only agrees in number.

Now we get to the tougher issues. Why aren't the following simple examples any good? They satisfy our requirements (11) and (14).

(15) * Himself$_i$ likes John$_i$

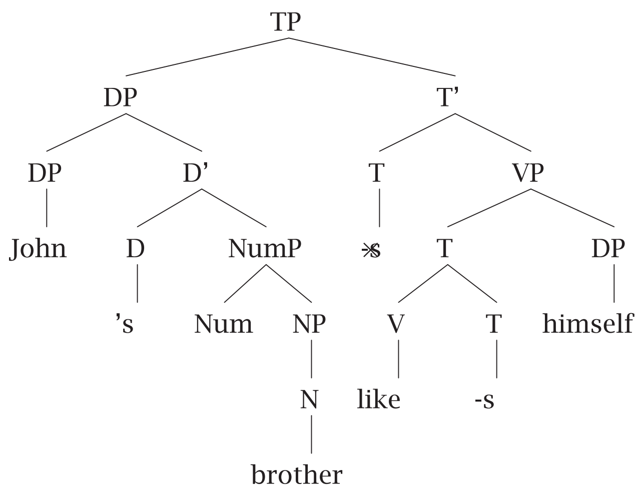
(16) * John$_i$'s mother likes himself$_i$

We might explain (15) by assuming that the reflexive is not nominative case, or that the antecedent must precede the reflexive, but neither of these ideas would account for (16). (Check: is this claim true?) It turns out that a different, unified account for these two cases is possible, one that we can find by comparing these structures in which the reflexive cannot find an antecedent with structures that are OK, like (8a), with structure (17):



(17)

Now compare the tree (18) for sentence (16), noticing that the reflexive can have the DP *John's brother* as its antecedent, but not the DP *John*:



(18)

There is a simple proposal about the relevant difference between these structures: roughly, the reflexive must be included in the constituent that is a sister of the antecedent, not buried inside of it. In searching for its antecedent, a reflexive cannot dig inside the children of its ancestors. This idea is usually expressed in the following way, because it involves a basic structural relation that we will use again later:

(19) Node X **c-commands** node Y if a sister of X dominates Y.

We can state the following principle:

(20) The DP antecedent of a reflexive must c-command the reflexive.

So the DP *John* in (16) with tree (18), is not a possible antecedent because it does not c-command the reflexive. Notice that the requirement (20) also explains why (15) is deviant: in (15), there is no DP at all that c-commands the reflexive. (Check: is this true?)

So now we have 3 special requirements associated with reflexives: (11), (14) and (20). These explain the following data:

(21) John_i believes that Bill_j saw himself_j

(22) * John_i believes that Bill_j saw himself_k

(21) is OK because the reflexive has the c-commanding antecedent DP *Bill*, with which it agrees in person, number and gender. (22) is deviant because the indices indicate that we are trying to interpret the reflexive as having no antecedent in the sentence at all – and that is ruled out by (14). There is however a third possible way of interpreting this sentence, which we can make more transparent by including indices:

(23) * John_i believes that Bill_j saw himself_i

This sentence is deviant. If we replace the reflexive by a name, the result is very awkward, but you can make sense of the result:

(24) John$_i$ believes that Bill$_j$ saw himself$_j$

(25) * John$_i$ believes that Bill$_j$ saw himself$_k$

(26) * John$_i$ believes that Bill$_j$ saw himself$_i$

Neither of our three conditions are violated in this last sentence. What then explains the deviance of example (26)? Looking at the tree in (1), we can see that the DP *John* is a possible antecedent in the same clause, c-commands the reflexive, and they agree is person, number and gender.

A natural idea about (26) is that the antecedent John is "too far away" from the reflexive – there is a closer one available, namely the DP *Bill*. So maybe the antecedent and the reflexive have to be "clausemates" in the following sense:

(27) The reflexive and its antecedent must be in all the same TPs.

In (26), we see that there are 2 TPs. One of them is the whole sentence, while the other is just *Bill saw himself*. Since *John* is not in the smaller TP but the reflexive is, they are not close enough together. (27) properly rules this example out. (Check: is this compatible with our earlier examples too?)

The antecedents we have considered so far have all been DP subjects of TP. Since DPs can occur in other positions too, it is important to consider whether our requirements properly handle everything. A DP can be the complement of a verb, the complement of a preposition, or the subject of a DP. Can any of these positions c-command reflexives? The object of a verb does not c-command the subject of the verb, but it can c-command DPs in other complements. One construction that like this is one in which a complement DP is the antecedent of the object of a complement PP. It looks like we make the right prediction about these cases:

(28) Mary revealed John$_i$ to himself$_i$

(29) * Mary revealed himself$_i$ to John$_i$

And when we consider DP subjects, we get the following cases right:

(30) Mary$_i$'s pictures of herself$_i$ surprised Bill.

(31) I noticed John$_i$'s excessive appreciation of himselfi.

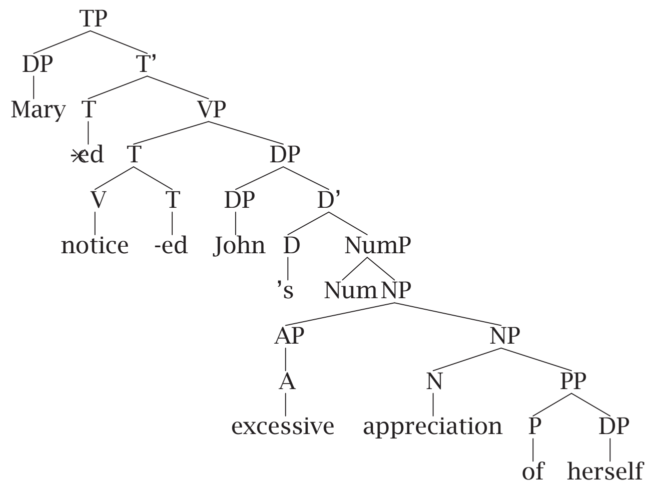
In (30), the DP *Mary* does not c-command *Bill*, but it does c-command herself. (Draw the structure to convince yourself.) Our special requirements on reflexives seem to be getting a wide range phenomena right.

But there is another similar construction that we do not yet make the right predictions about. Compare (30) with this example:

(32) a. Mary$_i$ noticed John$_j$'s excessive appreciation of himself$_j$

b. * Mary$_j$ noticed John$_j$'s excessive appreciation of herself$_i$

Why is (32a) so much worse than (30)? When we hit a surprise like this, it is a good idea to consider the structure carefully:



Notice that in this tree, both DPs *Mary* and *John* c-command the reflexive, and they are in all the same TPs (since there is only one TP, namely, the whole sentence). But now it is tempting to treat this case in exactly the way that we handle the following

(33) * Mary$_i$ noticed that John excessively appreciates herself$_i$

This sentence is already ruled out because the reflexive and the subject are not in all the same TPs. But now we see that the TP [*John excessively appreciates herself*] is similar to the DP [*John's excessive appreciation of herself*]! We can capture this similarity with the following modification:

(34) The reflexive and its antecedent must be in all the same TPs and all the same DPs.

The idea here is that a DP defines the same kind of local domain as a TP with a subject does: reflexives must find their antecedents in these local domains. We may wonder why are TPs and DPs singled out in this fashion. One answer immediately suggests itself: those are the two types of constituents which we have seen have subjects. It is plausible that it the very fact they have a subject that make them local domains. We could modify (34) to:

(35) The reflexive and its antecedent must be in all the same XPs with subjects.

The statements (34) and (35) make different predictions. Suppose we have a DP without a subject which contains a reflexive. According to the first statement, the antecedent of this reflexive should nevertheless be found within this DP. Not so according to the second. The following sentences show that the second statement is better:

(36) a. John$_k$ loved [the new pictures of himself$_k$]

b. I showed Mary$_k$ [several portraits of herself$_k$]

Both of these sentences are fine with coindexing indicated even though the reflexive is inside a bracketed DP without a subject. This shows that the presence of a subject is crucial, not the DP boundary itself.

To review, we have suggested that reflexives have the following four special requirements.

(37) a. A reflexive must be coreferential with another DP in the same sentence, its antecedent.

b. A reflexive must agree with its antecedent in person, number and gender.

c. The DP antecedent of a reflexive must c-command the reflexive.

d. The reflexive and its antecedent must be in all the same XPs which have a subject

The first of these requirements is semantic: it refers to how the reflexive is interpreted. The second is a general requirement imposed on coreferential DPs. It also applies to the relationship between a name or a description and a pronoun when they corefer. The third and fourth requirements clearly involve the syntactic configurations of the reflexives: these configurations restrict where reflexives can occur, and provide independent confirmation of our syntactic theory. the first, third and fourth requirements are usually grouped together and given the name of Principle A.

Principle A. An anaphor needs an antecedent which is in all the same XPs with a subject as the anaphor.

These four restrictions on reflexives provide an account of our first examples, examples (24-25) and it will turn out that we have set the stage for explaining similar examples with pronouns. We have also set the stage for explaining much more complex examples which we will see in subsequent chapters. We will develop the story about pronouns in the next sections.

Question 1: The reason behind Principle A was that the reflexive seemed "too far away" in examples like (26) and (33), so why can't we just say:

Principle A': The antecendent of an anaphor must be the nearest c-commanding DP in the sentence (in terms of number of words)

Question 2: The previous question makes you wonder if we can't replace <u>both</u> (37c) and Principle A with this even simpler idea:

Principle A'': The antecendent of an anaphor must be the nearest DP in the sentence (in terms of number of words)

In our examples (26) and (33), it does look like Principle A'' accounts for the data! The antecedent of the reflexive does have to be the nearest DP:

(38) a. (=26) * John$_i$ believes that Bill$_j$ saw himself$_i$

b. John$_i$ believes that Bill$_j$ saw himself$_j$

(39) a. (=33) * Mary$_i$ noticed that John excessively appreciates herself$_i$

b. Mary$_i$ noticed that John$_j$ excessively appreciates himself$_j$

However, we can easily find examples in which Principles A' and A'' make the wrong predictions. Consider this one:

(40) a. Mary$_i$ appreciates only [[John] and herself$_i$]

b. ?? Mary$_i$ appreciates [John$_j$ and himself$_j$]

(41) a. Mary$_i$ really appreciates and constantly praises herself$_i$ and Sue knows it.

b. * Mary$_i$ really appreciates and constantly praises herself$_j$ and Sue$_j$ knows it.

Here, A' and A'' both incorrectly predict that (40a) should be bad. And consider these cases:

(42) a. * The man who reads Shakespeare$_i$ appreciates himself$_i$

b. [The man who reads Shakespeare]$_i$ appreciates himself$_i$

(43) a. * The biographer of [Elizabeth Bishop]$_i$ appreciates herself$_i$

b. [The biographer of [Elizabeth Bishop]$_i$]$_j$ appreciates himself$_i$

Here A' and A'' have a different problem: the DP *the biographer of Elizabeth Bishop* and the DP *Elizabeth Bishop* both end at the same position, so they are <u>the same</u> distance from the reflexive (in terms of number of words). In these cases, only one of the DPs is a possible antecedent – namely, the c-commanding one, as our principle A requires.

8.1.2 Reciprocals

Our proposals about reflexives also apply to reciprocals – there are some differences but we set them aside for the moment. Reciprocals are also anaphors in English, and thus subject to Principle A above, and to the agreement requirement. The earlier example of a reciprocal is repeated below, with its intended meaning spelled out underneath:

(44) a. [Our rabbit and the neighbor's cat]$_i$ like [each other]$_I$

b. [Our rabbit x and the neighbor's cat y] are such that [x likes y and y likes x]

Because it is plural, a reciprocal requires an antecedent that is plural. And this antecedent must c-command the reciprocal and must be close enough: within all the same XPs with a subject, exactly like reflexives:

(45) a. John$_i$ heard their$_j$ criticism of each other$_j$.

b. John_i heard their_j criticism of themselves_j.

(46) a. * They_i heard John_j's criticism of each other_i.

b. * They_i heard John_j's criticism of themselves_i.

(47) a. * John_j heard that they_i criticized each other_i

b. * John_j heard that they_i criticized themselves_i

c. * They_i heard that John_j criticized each other_i.

We have not explored the internal structure of reflexives, and it is tricky, so let's treat them like pronouns and names – that is, they are DPs where we simply will leave aside the question of what the internal structure is.

Exercise: go through all the examples of this chapter and replace each instance of a reflexive by a reciprocal and each instance of an antecedent by a plural DP. The status of each resulting sentence should be the same as before the change.

8.1.3 Summary and reformulation

The previous section considers how anaphors, that is, reciprocals and reflexives, get "bound" to "antecedents"' in English sentences, as in the simple example:

(48) a. John_i likes himself_i

b. The students_k boys are proud of themselves_k

Antecedents of reflexives can be names (*John, Mary,...*), or descriptions (*the student, a book,...*). They can also be quantified DPs like the following, allowing us to express things that really cannot be expressed in any other way!

(49) a. Everyone_i likes himself_i

b. No spy_k betrayed himself_k

These sentences cannot be paraphrased the way we did for names or description, as in a and b below. This would give a completely different meaning. Instead, we must convey the meaning of such sentences by using a different, more complex type of paraphrase, as in c and d:

(50) a. Everyone likes everyone # wrong meaning!!

b. No spy betrayed no spy # wrong meaning!!

c. For every person x, x likes x

d. For no spy x, x betrayed x

The expressive capability which we see here in reflexives (we will also find it with pronouns) is very important, and is found in some form in all human languages. (We briefly discuss some other languages below.) This is one reason why languages have reflexives and pronouns.

For such cases like (47a,b), it is a bit strange to talk about "coreference", i.e. of "referring-to-the-same-objects-as" between the reflexive and its antecedent. This is particularly clear in the case of the sentence *no spy betrayed himself*. What does the DP *no spy* refer to?

It is a very interesting question how exactly the meaning of such expressions is computed. We would need to be precise about this to understand how exactly such DPs function as antecedents for a reflexive or a reciprocal (or in fact a pronoun). But this is not a question we will address here. We will simply assume that the antecedent does its job of determining how the reflexive is interpreted without spelling it out in detail.

This is why we modify our terminology. We will say that an anaphor needs to be bound by an antecedent, by which we mean c-commanded by its antecedent DP.

We can now reformulate our findings. The most important conclusion to remember is that the way anaphors are associated with an antecedent depends on the syntax. It is useful to introduce the following notions:

(51) A DP is **bound** just in case it is interpreted as coreferential with a c-commanding DP.

(52) The **domain** of a DP is the part of the structure that is contained in all the same XPs with a subject: the smallest XP with a subject that contains the DP.

Using these notions, we have the following requirements.

Agreement: An anaphor must agree with its antecedent in person, number and gender (not case).

Principle A: An anaphor must be bound in its domain.

Principle A combines 3 requirements that were stated separately in the previous sections:

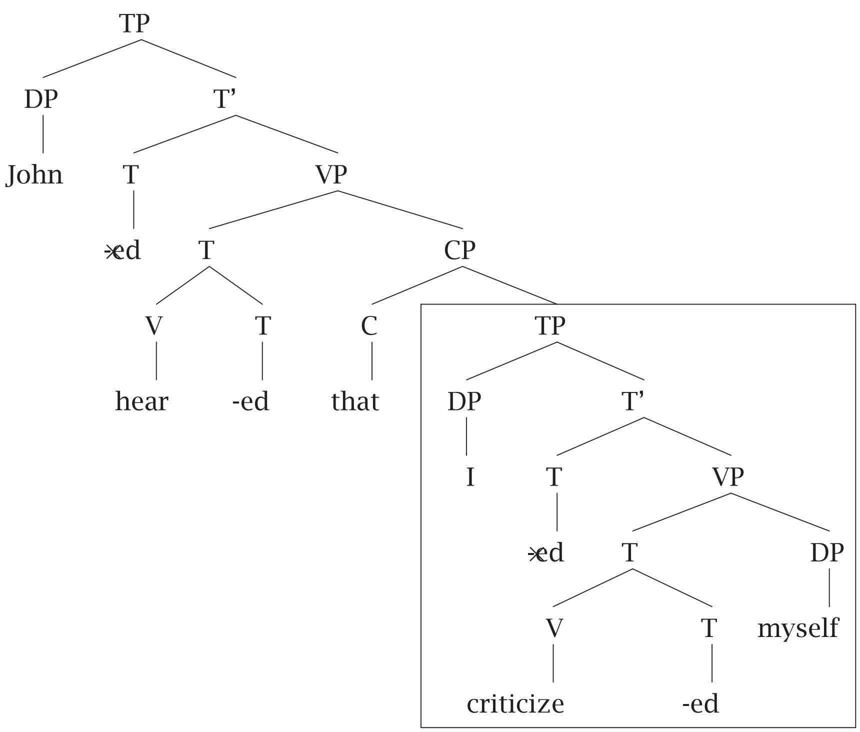
a. an anaphor must have an antecedent, and
b. the antecedent must be c-commanding, and
c. the antecedent must be in the domain of the anaphor, in the sense that it is in all the same XPs with a subject as the anaphor.

The "domain" in which an anaphor must find its antecedent can be indicated in a tree. Consider again a few examples like the following:

(53) a. I_i heard John_j's criticism of himself_j
b. * I_i heard John_j's criticism of myself_i
c. John_j heard that I_i criticized myself_i

d. * I_i heard that $John_j$ criticized $myself_i$

We can indicate the domain of a reflexive by putting a box around the nodes that are in the same XPs with a subject as the reflexives are. This is called the **domain of the reflexive.** It will always be the smallest XP with a subject that contains the reflexive.



This perspective on binding and domains is still simplified, but it is pretty good and will suffice for the moment.

8.2 Pronouns

8.2.1 Basic Principle B

If we collect some of the examples considered in the previous section and change the reflexive pronouns to simple accusative pronouns, in most cases, the good sentences become bad and the bad ones become good:

(54) a. $Mary_i$ likes $herself_i$

b. *$Mary_i$ likes her_i

(55) a. [Our rabbit and the neighbor's cat]$_i$ like [each other]$_i$

b. * [Our rabbit and the neighbor's cat]$_i$ like $them_i$

(56) a. [The boys]$_i$ fought with [each other]$_i$
b. * [The boys]$_i$ fought with them$_i$

(57) a. I saw John$_j$. * Bill$_i$ likes himself$_j$.
b. I saw John$_j$. Bill$_i$ likes him$_j$.

(58) a. I saw John$_j$. * Himself$_j$ laughs.
b. I saw John$_j$. * He$_j$ laughs.

(59) a. the boy$_i$ likes himself$_i$
b. * the boy$_i$ likes him$_i$

(60) a. the girls$_i$ likes themselves$_i$
b. the girls$_i$ likes them$_i$

(61) a. * John$_i$'s mother likes himself$_i$
b. John$_i$'s mother likes him$_i$

(62) a. * John$_i$ believes that Bill$_j$ saw him$_j$
b. John$_i$ believes that Bill$_j$ saw himself$_j$

(63) a. John$_i$ believes that Bill$_j$ saw him$_i$
b. * John$_i$ believes that Bill$_j$ saw himself$_i$

There is clearly a regularity here. Pronouns seem to be in nearly complementary distribution with reflexives. (We will see that this is not quite true below, but it covers all the cases we have seen so far.) We can summarize this symmetric behavior by stating that:

> If a relation between an anaphor and an antecedent is fine, replacing the reflexive by a pronoun with the same antecedent yields a deviant result. And vice versa, if a relation between an anaphor and an antecedent is deviant, replacing the reflexive by a pronoun with the same antecedent yields a fine result.

Adopting this tentative approximation, we can account for the distribution of pronouns by requiring them to satisfy a condition opposite of that which anaphors need to satisfy.

Principle B a pronoun cannot be bound in its domain
(i.e. it cannot have a c-commanding antecedent in its domain).

Note that Principle B says nothing about whether a pronouns needs an antecedent or not. In particular it is fine for a pronoun to lack an antecedent altogether in a given sentence. It only states that if a pronoun has a c-commanding antecedent, this antecedent must be outside of the domain of the pronoun, i.e. outside of the smallest XP with a subject that contains the pronoun.

Exercise: Go through all the examples of this section, draw their tree and make sure that Principle B applies as it should.

8.2.2 A complication

Principle A and Principle B taken together predict that pronouns and anaphors should be in complementary distribution. In truth, complementarity between pronouns and anaphors fail. One pair of examples illustrating this is the following:

(64) a. They$_j$ like **their$_j$ books**

b. They like **[each other]$_j$'s books**

Both examples are fine. The domain of the DP pronoun *their* or the DP reciprocal *each other* is the same: it is the first XP with subject containing them, i.e. the direct object DP (in bold). Principle B correctly fails to rule out the first sentence. But principle A predicts that the second sentence is ill formed (since the antecedent of the reciprocal is the subject of the sentence and thus not in the domain of the anaphor). To correct this problem, we would have to make the domain of an anaphor slightly larger than what we have assumed. Here we leave this as unresolved.

8.2.3 Quantified antecedents

Like anaphors, pronouns can be interpreted as "bound"', in the sense that they take their referential value from some other DP in the sentence below. We can express the resulting meaning in the two ways given below it.

(65) a. Mary$_i$ thinks that she$_i$ is smart

b. ? Mary thinks that Mary is smart

c. Mary is someone x, such that x thinks x is smart

When the antecedent is a quantified expression, the first gives the wrong result but the second is fine. Using # to indicate a meaning that the sentence does not have, consider this data:

(66) Everyone$_i$ thinks he$_i$ is smart

a. # Everyone thinks everyone is smart

b. For every person x, x thinks x is smart

(67) Who$_i$ in this class thinks he$_i$ is smart

a. # Who in this class thinks who in this class is smart

b. for which person x in this class is it the case that, x thinks that x is smart

These special translations are needed when the antecedent of the pronoun is a quantified expression (that is a DP with a D such as *no*, or *every*, or *each*). These cases have something else that is special. Compare the following pairs:

(68) a. Bill$_j$'s mother saw him$_j$

b. *?Noone$_j$'s mother saw him$_j$

(69) a. The mayor of John$_j$'s hometown wrote to him$_j$

b. * The mayor of everyone$_j$'s hometown wrote to him$_j$

(70) a. I showed your description of John$_j$ to him$_j$

b. * I showed your description of [every boy]$_j$ to him$_j$

The difference arises because of the following principle we will not investigate here:

(71) If a pronoun has a quantified expression as antecedent, the pronoun must be must c-commanded by this antecedent.

One particularly striking case of this requirement is given in the following two discourse fragments:

(72) John$_j$ came in. He$_j$ was wearing a hat

(73) Nobody$_j$ came in. *He$_j$ was wearing a hat

The second sentence of the second fragment has a quantified antecedent nobody which cannot c-command the pronoun: this is disallowed.

8.3 Non-pronominal expressions

We started at the beginning of this chapter by noting the ill formedness of all the following sentences.

(74) a. *John$_j$ hurt him$_j$

b. *John$_j$ says Mary$_k$ likes himself$_j$

c. *Herself$_j$ likes Mary$_j$'s mother$_k$

d. *He$_j$ heard that [the idiot]$_j$ should win.

e. *He$_j$ saw John$_j$

We have now an account of the deviance for the first three but not for the last two.

Exercise: verify that neither Principle A nor Principle B accounts for these sentences.

If we start with the last one, one aspect of this type of example suggesting that there is no notion of "domain" involved is that even we separate the pronoun and the name further, the result is still deviant:

(75) a. * He$_i$ likes John$_i$

b. * He$_i$ likes [the student]$_i$

(76) a. * He_i knows that Mary_j likes John_i

b. * He_i knows that Mary_j likes [the student]$_i$

Expressions such as proper names (like *Mary*), descriptions (like *the man on the corner, my brother*) or epithets (like *the idiot*) are not pronominals. They are sometimes called **R-expressions**, where the "R" is for "(independently) referential". The examples above illustrate that non-pronominal expressions cannot be bound the way that anaphors and pronouns can. However, they may be coindexed with preceding pronouns for example:

(77) a. * He_i said that Peter_i too_k the car

b. After you spoke to him_i, Peter_i too_k the car

c. The builder of his_i house visited Peter_i

We can describe these observations in a preliminary fashion by stating that non-pronominals cannot be c-commanded by a coindexed pronoun. This requirement is not limited to any domain, but goes all the way up to the root node:

(78) a. * He_i said that John_i would leave

b. * He_i said that Mary thought that you talked to the person who saw Peter_i

And as noted before, when the antecendent is a c-commanding name or description, the sentences are deviant too:

(79) a. *? John_i said that John_i would leave

b. * The student_i said that Mary thought that you talked to the person who saw Peter_i

So we have the following requirement on R-expressions:

Principle C: An R-expression cannot be bound

8.4 Binding theory summarized

We have considered the constructions in which reflexives and pronouns are bound, where by "bound" we mean that they are interpreted as getting its reference from a c-commanding antecedent. The basic facts we have discovered can be summarized as the following simple binding theory:

A. An anaphor must be bound in its domain

B. A pronoun must be free (= not bound) in its domain

C. An R-expression cannot be bound.

Binding theory was proposed in this form by Chomsky (1981), though we have set aside a number of tricky issues. We have assumed that the domain of a anaphor or pronoun is the set of nodes that is included in the smallest XP with a subject that contains the anaphor or the pronoun. (Characterizing the domain precisely in fact proves to be difficult, but this simple characterization works for many cases.) We also noticed the agreement requirements:

Agreement. Pronouns and anaphors agree with their antecedent in person, number and gender

8.5 Some of the tricky issues

We have only begun to develop our syntactic model, but even just considering the kinds of constructions we have talked about so far, we can spot some tricky issues for our binding theory. We will briefly mention some of them, but we leave a more careful development of the theory to later.

8.5.1 Coreference without binding

We proposed that R-expressions cannot be bound, but one student asks about the sentence:

(80) a. That$_i$ is [a bird]$_i$

b. That$_i$'s [the truth]$_I$

c. He$_j$ is John$_j$

When we think about it, there are lot's of cases like this!

(81) [Bob Dylan]$_i$ is [Robert Zimmerman]$_i$

(82) [Ice-T]$_i$ and [Tracy Marrow]$_i$ are [the same person]$_i$

What should we say about these?? They look like principle C violations. There are a number of complex issues here, but one main idea the DPs here are coreferential not because of binding, but because of the meaning of the verb: Two expressions can be co-referential when they are related to a verb (*be*) that requires it, even if there is no binding.

Here is another case that is similar in some ways. Imagine a party in which most people come in casual clothes but one guy comes in a white tuxedo, and everyone notices the guy in the white tuxedo. Now suppose we know that John was at the party. Then we can say

(83) John saw him. John saw the guy in the white tuxedo, since everyone did!

But what if John was the guy in the white tuxedo (and maybe we didn't know it). Then what we said really has forbidden coreference relations:

(84) John$_i$ saw him$_i$. John$_i$ saw [the guy in the white tuxedo]$_i$

These look like principle B and C violations! Again, what we want to say here is that there is no binding, but just a kind of "accidental" coreference: Two expressions can be co-referential just because of the circumstances, even when it is not intended by the speaker. In this case, clearly, it is not part of binding theory or of the meanings of the verbs or anything else that the expressions are coreferential.

8.5.2 VP ellipsis

Lots of tricky things go on when constructions with VP-ellipsis get interpreted, and binding relations get involved! Consider these facts, for example:

(85) I$_i$ like Mary$_j$ and she$_j$ likes me$_i$

(86) * I$_i$ like Mary$_j$ and she$_j$ does too.

Why is (86) bad?? We want to say that it violates principle C. Our treatment of VP-Ellipsis works fine here:

(87) * I$_i$ like Mary$_j$ and she$_j$ does [like Mary$_j$] too

Even though the VP is elided, i.e. is marked as unpronounced, it seems to be present in the structure and in the meaning of our sentence. The second conjunct is thus subject to Principle C as expected.

8.6 Crosslinguistic variation

The binding relations described here are for modern English. Other languages have different properties. It would be nice to have a binding theory that specified exactly the range of variation that could be expected in any language, the range of variation that is really due to the facts about how people determine coreference relations, but linguistic theory has not reached this yet. Here we provide a very quick and incomplete survey just of some of the things we find, to provide an impression of the kinds of significant extensions and revisions needed for other languages.

8.6.1 Reflexives

There is a lot of variation in the form of reflexive. Many languages have more than one form to express the reflexive. In many languages, reflexivity is expressed by a bound morpheme: Russian *-sja*, Swedish *-s*, Icelandic *-sk*, Fulani middle voice, Maasai *-a*, Quechua *-ku*.

Quechua: Riku-chi-ku-ni
see-cause-self-1s

'I caused myself to be seen', or 'I gave myself away'

In other languages, there are special weak, unstressed pronouns, "clitics," that express reflexivity:

French:

(88) Jean lave l'enfant
John washes the-child

'John washes the child'

(89) Jean se lave
John self washes

'John washes himself'

(90) Jean s' est lavé
John self is washed

'John has washed himself'

The same clitic again can give rise to other interpretations as well in different contexts:

French impersonal construction: il se construit beaucoup de maisons
it self build many of houses

'many houses are being built', 'there are being built many houses'

French passive: beaucoup de maisons se construisent
many of houses self build

'Many houses are being built'

French middle: ce livre se lit bien
this book self reads easily

Many languages have simple (monomorphemic) reflexives: Dutch *zich*, Icelandic *seg*, Japanese *zibun*, Chinese *ziji*:

French: Quand on parle de soi
When one speaks of (one)self

Dutch: Jan waste zich
John washed self

Chinese: Lisi hai-le ziji
Lisi hurt-ASP self

And some of these languages have complex reflexives consisting of more than one morpheme too:

Dutch: Jan zag zichzelf
John saw himself

Chinese: Lisi hai-le taziji
Lisi hurt himself

The distribution of the anaphor seems to depend, at least in part, on the morphological form that the anaphor has. For example, the simple monomorphemic anaphors like *ziji* or *zibun* in Japanese differ from English *himself* in that they can take an antecedent outside the TP that contains it ("long-distance anaphors"). Complex anaphors do not allow this, even in the same languages:

Chinese: Zhangsan$_i$ renwei [Lisi$_j$ hai-le ziji$_{i,j}$]
Zhangsan think Lisi hurt self

'Zhangsan thought that Lisi hurt himself/him'

Zhangsan$_i$ renwei [Lisi$_j$ hai-le taziji$_{*i,j}$]
Zhangsan think Lisi hurt self

'Zhangsan thought that Lisi hurt himself'

Japanese: Tarooi ga Hanako ni [[zibun$_i$ Amerika e itta] koto o]
Taroo NOM Hanako DAT self America to go-PAST that
hanasanakatta
tell-NEG-PAST

'Taro did not tell Hanako that he had been to the States'

Many questions arise concerning the distribution of anaphors. How exactly should long distance anaphora be treated? Why does the form of the anaphor matter for the distribution? What precisely is the local relation to antecedent, what semantic role can the antecedent have? what syntactic function must it have?

Pronouns

Just as the behavior of anaphora is complex crosslinguistically, and certainly not as straightforward as our binding theory leads us to expect, the distribution of pronouns is too. Again, some very brief remarks.

Pronouns can be like DPs in their distribution, roughly occupying the same positions as lexical DPs (as is the case in English), or they can be bound morphemes (subject or object "agreement" morphemes), or sometimes, as "portmanteau" morphemes that express subject and object agreement at once, where no individual parts can be distinguished):

Inuktitut, West Greenlandic taki-va-ssinga
see-Ind-you(pl)me

'I saw/see you(pl)'

Maasai, east Africa ɛaá-d`ɔl-´ɨtà toret
see-IND-PROGR Toret

'he is looking at Toret'

k´ɨ-d`ɔl-´ɨtà (k´ɨ- = he-you or you-me)
he-you-see-PROGR, or you-me-see-PROGR

'he is looking at you', or 'you are watching me'

´ɨ-d`ɔl-´ɨtà toret
you-see-PROGR Toret

'you are watching Toret'

In many other languages, pronouns are expressed as clitics :

French: Je te l'ai donné
I you it-have given

Czech: Karel mi je dal
Karl to-me them gave

Some languages allow a pronominal subject to be absent (these languages are called Pro-drop languages):

Spanish: Lo hemos cantado
it have-1st-pl-pres sung

'We have sung it'

Some languages allow sentences without any overt agreement or pronoun present:

Japanese: yonda
read-past

'He/she/I/you/they read'

Some languages have interesting pronominal systems that show distinctions that do not exist overtly in English. Dogrib, an Athapaskan language of Northern Canada, has a pronominal form that is referred to as the fourth person. This pronoun needs a c-commanding antecedent, and thus may not occur in the environment below; (this is what it has in common with an anaphor):

Dogrib: * ye-zha shèeti
ye-son 3.ate

But when it has an antecedent, it must be disjoint from it (this is what it has in common with a pronoun):

John$_i$ ye$_{*i,j}$-mo eʔi
John ye-mother 3.saw

'John$_j$ saw his$_j$ mother'

Many native American languages have fourth person pronouns or agreement markers; in general, their distribution has not been studied very extensively.

Some languages have two series of third person pronouns. This is the case of Abe, a Kwa language spoken in the Ivory Coast (Niger-Congo). One series basically behaves as English pronouns, but the other series does not at all! For example in Abe:

Abe (o-series behaves like English pronouns) yapi$_i$ wu o$_{i,j}$ wo n
Yapi/he saw his dog D

(n-series behaves differently) n$_i$ wu n$_i$ wo n
he saw he dog D

'He saw his dog'

Yapi$_i$ wu n$_j$ wo n
Yapi saw n dog D

'Yapi$_i$ saw his$_j$ dog'

Nothing in our binding theory leads us to expect this! So figuring out systems like this is important for insights into the kinds of binding relations that the human mind creates and recognizes.

R-expressions

You might think that while pronouns and anaphors might vary from one language to another, names and descriptions and other R-expressions are probably basically the same in all languages, at least with respect to their binding properties. That is, you might think: as in English, R-expressions in language generally cannot be bound. But even this seems not to be true. Lasnik and Uriagereka (1988) report that in **Thai**, sentences like this are perfectly good:

(91) cɔɔn$_i$ chɔaâɔp cɔɔn$_i$
John likes John

John likes himself

(92) cɔɔn$_i$ khít wâa cɔɔn$_i$ chàlàat
John thinks that John is smart

John thinks that he is smart

Looking further into this, it turns out that the restrictions on binding R-expressions are not simply missing. Rather, they seem to be different. That is, there are cases of R-expression binding that are bad:

(93)	* khǎw$_i$	chɔaâɔp	cɔɔn$_i$			
	he	likes	John			
(94)	* khǎw$_i$	khít	wâa	cɔɔn$_i$	chàlàat	
	he	thinks	that	John	is smart	

It appears that in Thai, an R-expression can be bound, but not by a pronoun. Looking back at English, it seems that maybe we have the same contrast, but it partly is hidden by the availability of reflexives:

(95) John$_i$ likes himself$_i$

(96) * John$_i$ likes John$_i$

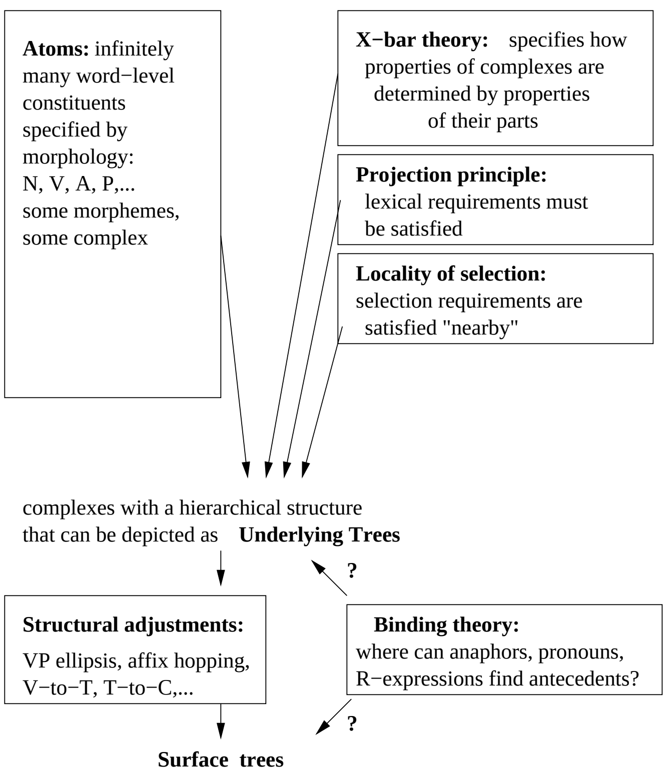
(97) ** He$_i$ likes John$_i$

9

Apparent violations of Locality of Selection

9.1 Summary

The syntax developed so far has a structure we can depict like this:



Notice that we cannot complete this diagram without considering the question of whether Binding Theory applies to underlying trees, to surface trees, or both. We were able to ignore this question in the previous chapter because we considered a rather narrow range of constructions, obtaining this formulation:

(Agreement) An anaphor must agree with its antecedent in person, number and gender (but not case).

(1) A DP is **bound** just in case it is interpreted as coreferential with a c-commanding DP. (Recall that we indicate coreference by coindexing).

(2) The **domain** of a DP is the part of the structure that is contained in all the same XPs with a subject: the smallest XP with a subject that contains the DP.

(A) An anaphor must be bound in its domain

(B) A pronoun must be free (= not bound) in its domain

(C) An R-expression cannot be bound.

We will see later that there are many constructions where it makes a difference whether the binding theory applies to underlying trees or surface trees.

A tentative definition of locality of selection was given on page 157, repeated here:

(3) **Locality of Selection (LoS), preliminary version:**

a. If a head α selects β as complement, β is a complement of α.

b. If a head α selects β as subject, β is the subject of α or the subject of <u>the clause containing α</u>

c. If a head α selects β as an adjunct, β is the adjunct of α.

In this chapter, we will simplify this statement greatly.

X-bar theory encodes the idea that all syntactic categories are organized in similar fashion. It was given on page 198, repeated here:

(4) a. Each phrasal constituent has a head

b. This head is always a morpheme or a word (a D or N or V or…)

c. The head is unique

d. Every morpheme is the head of some constituent

e. In general, no non-constituent has a unique head

f. The largest constituent with head H is notated HP or H^{max} and is called **the maximal or phrasal projection of H.**

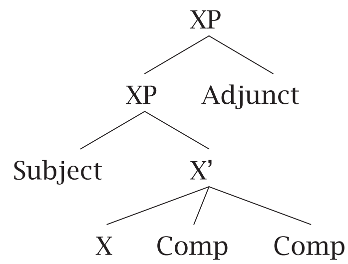
g. HP or H^{max} is a constituent consisting of a constituent H' and at most one sister called the **specifier (or subject)** of H. H' is also notated and read H-bar (an H with one bar above it).

h. H' or H-bar consists of the head H and some sisters. These sisters (if any) are called the **complements** of H.

i. HP can also consist of an HP and a sister constituent called an **adjunct** to H (or to HP).

j. Adjuncts, complements and specifiers are themselves phrasal constituents.

Consequently the overall look of every phrase is this:



We conducted a brief survey of English constructions, and collected the results in this table:

	C	T	D	P	A	V	N
subjects	?	DP CP	DP	?	?	?	?
complements	TP	VP	NP	DP PP CP	PP PP	DP PP CP	PP CP
adjuncts	?	AdvP?	Only Even CP	AdvP	DegP	PP AdvP	PP AP CP

This table reveals that there are some cross categorial similarities but also lots of categorial dissimilarity. The most striking dissimilarity is that lots of categories seem to lack subjects, or specifiers. We will look into this matter more carefully, and discover that there are more kinds of subjects than this table suggests. This leads us to constructions that seem to violate the Locality of selection.

9.2 Small clauses

Consider sentences such as the following:

(5) a. Mary prefers her icecream in a cone

b. She considers John proud of his work

c. Henry found Bill sad

d. They saw Bill leave

What kind of constituent structure should we give them? Let us concentrate on the first example. It is very parallel to the following example:

(6) a. Mary prefers that her icecream is in a cone
b. ? She considers that John is proud of his work
c. Henry found that Bill is sad
d. Henry saw that Bill left

In both the former and the latter examples, the main verb (*prefer,consider,find,see*) is naturally regarded as naming an event that involves 2 essential things, the subject (an "experiencer"), and the state of affairs toward which the experiencer has some kind of mental "attitude" (the "theme"): preference, consideration, discovery, sight. Given that these two entities (the experiencer and the state of affairs) seem required by the meaning of these verbs, where state of affairs is named by the CP in (6) and in some other way in (5), what is the structure of the sentences in (5)?

We can probe the question with constituency tests. Surprisingly, they indicate that the material following the verbs in (5) forms a constituent, as shown by the positive results below (remember, the negative results raise puzzles but, by themselves, do not generally allow us to draw any certain conclusion):

coordination:

a. Mary prefers her icecream in a cone
Mary prefers her pancakes cooked
Mary prefers her icecream in a cone and her pancakes cooked

b. She considers John proud of his work
She considers Sam expendable
She considers John proud of his work and Sam expendable

c. Henry found Bill sad
Henry found Sue happy
Henry found Bill sad and Sue happy

d. They saw Bill leave
They saw Sue leave
They saw Bill leave and Sue leave.

pseudoclefts:

a. What Mary prefers is her icecream in a cone
b. * What she considers is John proud of his work
c. * What Henry found is Bill sad
d. * What they saw is Bill leave

Wh-movement:

a. What does Mary prefer? (Answer: her icecream in a cone)

b. What does she consider? (*Answer: John proud of his work)

c. What did Henry find? (?Answer: Bill sad)

d. What did they see? (?Answer: Bill leave)

The coordination test provides the strongest evidence that the following parts of the sentences in (5) are constituents:

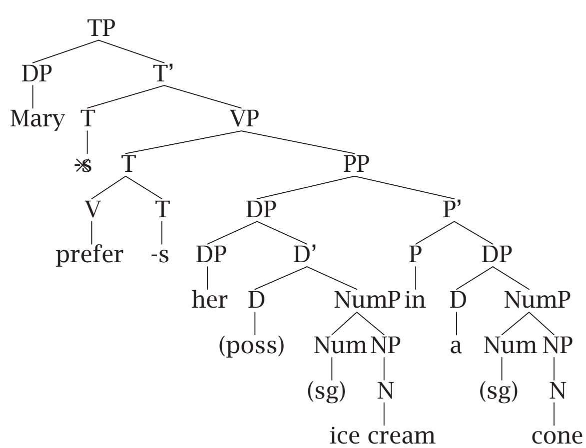
(7) a. her icecream in a cone

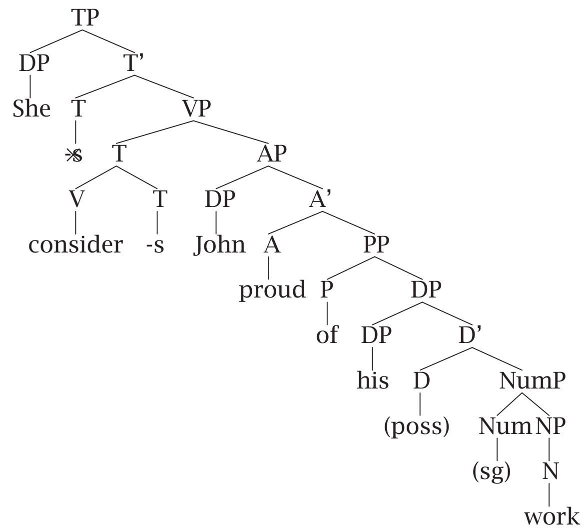
b. John proud of his work

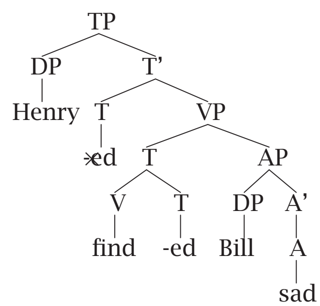
c. Bill sad

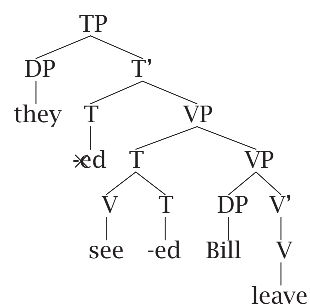
d. Bill leave

So what is the category of these constituents? In each case, it looks like we have a DP, which looks like a "subject" of some kind, followed by a "predicate" of some kind: a PP in a, APs in b and c, a tenseless VP in d. But there is no evidence of any tense on these elements, nor is there any verb for any tense elements to attach to in a-c, so in these cases it is natural to suppose that we have PPs, APs, and VPs with subjects. That is, the structures of (5) could be something like the following. (We show the complete trees for practice, but notice that the only new thing in these trees is the subject in PP, AP, VP):









The lexical entries for the main verbs in these trees are accordingly something like this (where we underline the selected subject):

(8) a. prefer, V, selecting DP-Experiencer, PP-Theme
b. consider, V, selecting DP-Experiencer, AP-Theme
c. find, V, selecting DP-Experiencer, AP-Theme
d. see, V, selecting DP-Experiencer, VP-Theme

What is more surprising is that in these structures, we find prepositions and adjectives also selecting subjects:

(9) a. in, V, selecting <u>DP-Theme</u>, DP-Location
b. proud, V, <u>DP-Experiencer</u>, DP-Theme
c. sad, V, <u>DP-Experiencer</u>
d. leave, V, <u>DP-Agent</u>

The tenseless constituents formed by these last items are called **small clauses.** We sometimes call them PP small clauses, AP small clauses, and VP small clauses, respectively.

9.3 Consequences for X-bar and Binding Theory

If we revise the table summarizing what we found as X-bar complements, adjuncts and subjects for various categories, we have found more similarity across categories taking subjects than we had seen before. Now, we have selection for subjects by D, P, A, V. (There is evidence for NP small clauses too, but there are some tricky issues there so we leave them aside for now.) This conclusion can be further confirmed by examining the binding theory. Remember that the domain of a DP is the set of nodes included in the smallest XP with a subject. So now that we have more subjects than we thought, we should be able to check the new kinds of constructions. We get exactly the behavior that binding theory predicts:

(10) a. * John$_j$ heard [VP Mary describe himself$_j$]
b. John$_j$ heard [VP Mary describe him$_j$]

(11) a. John$_j$ heard [VP Mary describe herself$_j$]
b. * John$_j$ heard [VP Mary describe her$_j$]

(12) a. * Mary$_j$ considers John proud of herself$_j$
b. Mary$_j$ considers John proud of her$_j$

(13) a. Mary$_j$ considers John proud of himself$_j$
b. * Mary$_j$ considers John proud of him$_j$

Intuitively, to find the domain of an anaphor or a pronoun, we go up the tree from the anaphor or a pronoun until we found an XP with a subject – that is the domain. A reflexive must have a c-commanding antecedent in this domain, but a pronoun cannot have an c-commanding antecedent in that domain.

Exercise: go through each of the examples above and make sure that you see how the binding theory correctly predicts the pattern of data.

Some remaining puzzles: The following example is puzzling:

(14) John$_i$ considers himself$_i$ proud of Mary.

The analysis above would suggest that [*himself$_i$ proud of Mary*] is an AP with a subject, so that the domain of *himself$_i$* should exactly this AP, but the reflexive is bound from a higher position. Unless there is some other analysis for this example, we have a problem. In deciding what to do, it is useful to notice that a similar puzzle arises for

(15) John$_i$ believes himself$_i$ to be proud of Mary.

The standard approaches to this problem propose that the domains of the DPs for the purpose of satisfying Condition A of the Binding Theory should be a little larger than we have proposed. One idea is roughly this: the **domain'** of DP1 (for condition A) should be the smallest XP with a subject that contains both DP1 and also a DP that could in principle serve as antecedent (if any). In the puzzling examples (14) and (15), this would allow the reflexive to go as high as the DP *John* to look for an antecedent. So then the domain of the reflexives for condition A is the whole sentence in both cases. In contrast, the examples (10-13) the inclusion of the case assigning V does not change the calculation of the domain. This also provides a solution to the case of possessive DPs, where the subject of the possessive DP we had noted in the previous chapter:

(16) They like each other's books

Now the domain of the reciprocal *each other* is the entire clause. This is not the final formulation of Condition A by any means. Such an extension of the binding domain for condition A creates apparent problems elsewhere, that can be solved, but not in any simple way.

9.4 Apparent violations of Locality of Selection

Updating the table on page 199, we would now say that the categories that allow subjects are D, T, P, A, and V. We need to postpone the consideration of N subjects, but let's turn to remaining category: C. To understand what happens in this case, we will have to do a long detour.

We begin with a set of cases which all seem to violate the principle of Locality of Selection.

Violations of Locality:

Topicalization: The pictures of Bill, she put on your desk

wh-question: Which pictures of Bill did she put on your desk

Raising verbs: Time seems to elapse slowly in the tropics

Control structures: Susan wanted to sleep

Simple clauses: Time will elapse more slowly in the tropics

In all these cases, there is a selectional relation between the underlined verb and the underlined phrase. To show that there is a selection relation between two items, we show that they must co-vary, that is, changing only one of them can make the sentence deviant unless we change the other one as well. In this chapter, we will get practice with many ways of doing this.

Even if we do not yet know how to draw the trees for all these sentences, what we do know is enough to show that in all these cases (except the last one), locality is violated.

Below, we indicate the minimum amount of structure we know must be there, and this is enough to show the existence of these violations:

(17) a. The pictures of Bill [$_{TP}$ she [$_{VP}$ put on your desk]]
b. Which pictures of Bill did [$_{TP}$ she [$_{VP}$ put on your desk]]
c. [$_{TP}$ Time [$_{VP}$ seems [$_{TP}$ to [$_{VP}$ elapse slowly in the tropics]]]]
d. [$_{TP}$ Susan [$_{VP}$ wanted [$_{TP}$ to [$_{VP}$ sleep]]]]

Here is what you should do: for each of these sentences draw its tree as well as you can, leaving unattached what do not know how to attach. Then verify that in each of them, the LoS condition (3) is not satisfied.

9.5 Topicalization and Wh-constructions

We start by investigating these two constructions: Topicalization and Wh-questions. No doubt, the structure of the good sentences (17a) and (17b) violate LoS. What can we do? We could give up LoS but this would be too radical. We would lose all the results we postulated it to derive in the first place.

But the facts remain. So we need to allow some violation of locality of selection, but in a restricted fashion. The problem is how exactly.

9.5.1 Topicalization

To guide us to the right answer, here is the most important observation: in all these violations of locality, there is a related structure that does not exhibit the same locality violation: In the case of topicalization, the following pair is representative:

(18) a. She put the pictures of Bill on your desk
b. The pictures of Bill, she put on your desk

The first sentence is possible only if the second one is possible. In a different case, we may find both elements of a pair impossible:

(19) a. *The picture of Bill she slept

b. *She slept the picture of Bill

We would like to capture the systematic relations among the sentences in (18), and this could help us understand LoS, since in the second sentence there is no locality problem. The simple idea is this: to solve the locality problem we postulate that the first sentence is the same as the second except that the object has been moved to the front of the clause, and we impose LoS only on the underlying phrase, before the object has moved.

So technically, we associate two structures with sentence (17a): the **underlying structure** S1 before movement, and the **surface structure** S2 after movement. Only the first is required to satisfy LoS:

S1: she put [the picture of Bill] on your desk

⇓

S2: [The picture of Bill] she put ~~[the picture of Bill]~~ on your desk

We can add this movement to our inventory of processes relating underlying trees to surface trees. It is a type of XP movement (i.e. moving DPs, PPs, VPs, etc..) that we called **topicalization** in section **??** where it was informally introduced.

Naturally, one question that arises is: what is the surface that we get when we apply Topicalization. We will not investigate this question in detail. It suffices to assume that the Topicalized Phrase becomes an adjunct to TP. This is consistent with the position of topicalized constituents in embedded clauses as in:

(20) Mary thinks [$_{CP}$ that [the picture of Bill] [$_{TP}$ she put on your desk]]

in which the topicalized phrase (underlined) is sandwiched between the C that and the TP boundary. And it is also consistent with the fact that the Topic forms a constituent with the TP following it, as in constructions like this (which is acceptable but marginal, and pronounced with an unusual prosody which is roughly indicated with the commas):

(21) Mary thinks that [the picture of Bill, she put on your desk] and [the sandwich, she ate]

The process of topicalization is added to the already existing such processes: Affix Hopping, Head raising, VP ellipsis, etc.

We already observed that underlying structures satisfy X-bar theory, with the tense and verbal heads of simple sentences in their usual places, but after affix hopping and verb raising, we have structures that do not quite satisfy X-bar theory. For example, in the trees displayed just above, we see that the left daughter of VP or V', after affix hopping, is a T and not a V. X-bar theory applies to the underlying structure. Now we can add to that observation that the selection requirements of the heads are satisfied in the underlying structure too. For example, if the verb *have* is found in T due to verb raising instead of heading its own VP, not only does this violate X-bar theory, but it also is superficially no longer in a position where it takes a participial VP as complement, as is required by its lexical entry.

have: V, selects VP in past participle form.

So we see that the rules of movement allow violations of Locality of Selection to be "merely apparent," since it changes an underlying tree into a surface tree. Another way to say the same thing is that movement allows a single constituent to enter into local processes at various different points in the structure: a constituent can satisfy some requirements before movement, and some processes after movement.

9.5.2 Wh-questions

We take the same approach in wh-questions. The two sentences we relate now are:

(22) a. You put [which picture of Bill] on his desk?

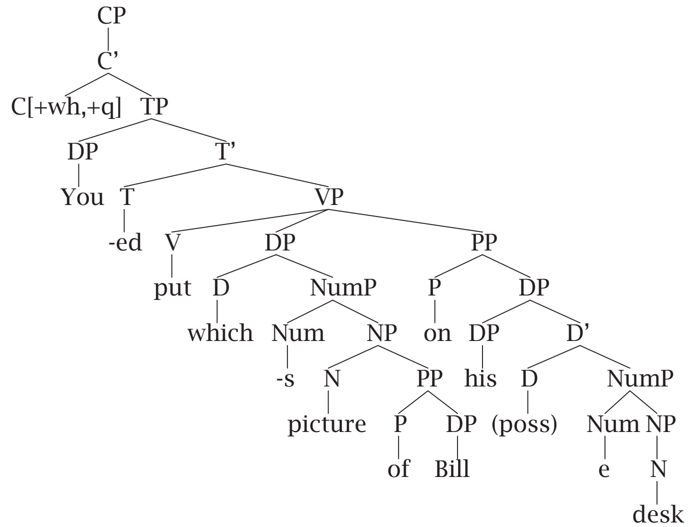
b. [Which picture of Bill] did you put on his desk?

(The first of these examples is pronounced with a special question intonation, with emphasis on *which*, and it is only appropriate in certain contexts.) The verb *put* selects a complement DP, a theme, and also a locative. In the latter case, a movement has applied after selection to separate the DP complement from the verb:

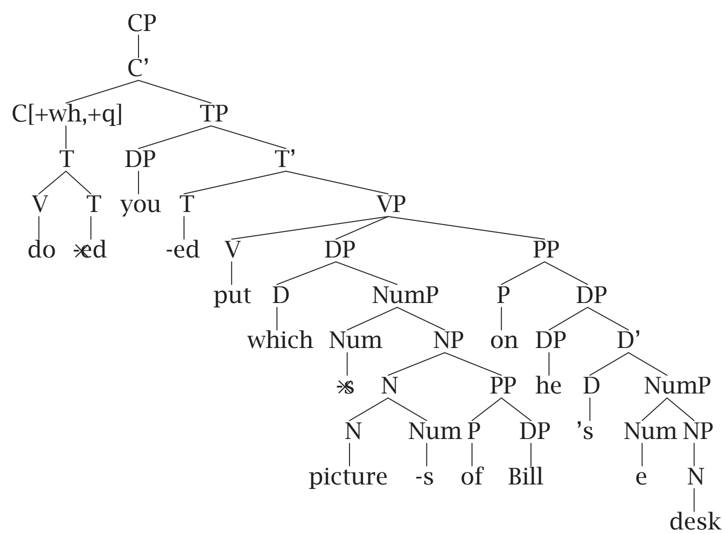
S1: You put [which picture of Bill] on his desk?
$\Downarrow$
S3: [Which picture of Bill] did you put on his desk?

Wh-movement only moves wh-phrases, that is, phrases containing a wh-word like *which, what, who, how, why.* The result is interpreted as a request for information, not as a statement. The preposed object of the V is separated from the subject by an auxiliary or modal verb, or some form of *do*, which is placed into the position C by T-to-C movement, as we discussed in section 6.6.

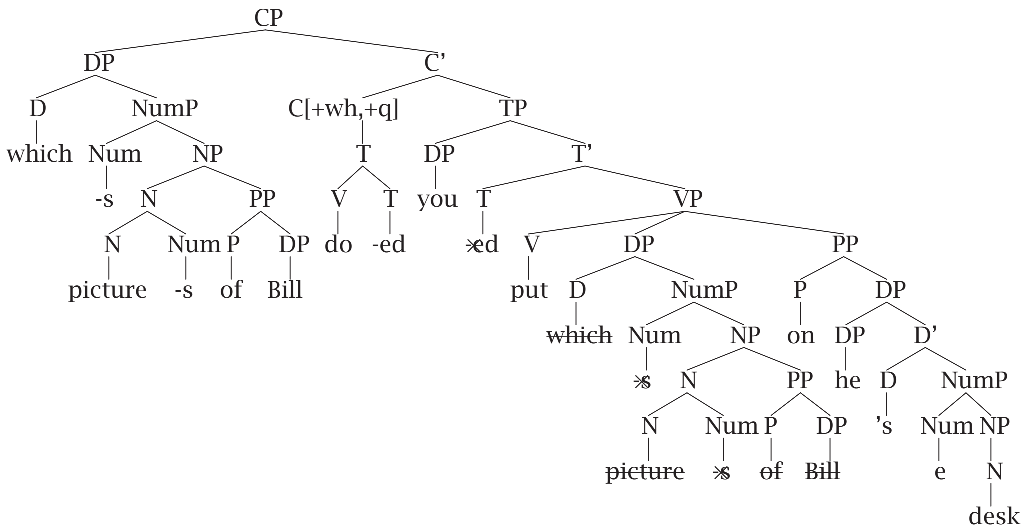
Where do wh-phrases move to in wh-questions? We now know they raise past C: the natural conclusion is that they raise to the subject position of CP. On analogy with the agreement between the subjects and T in person and number, we could also propose a hypothesis about why wh-movement is moves only wh-phrases. Since it involves movement to the subject position of a CP whose C is marked [+wh], we can attribute this restriction to the fact that a head and its subject often must agree. The subject of a clause and T must agree in person and number, and similarly, we could suppose there is a kind of agreement in the feature wh between a C and its subject.



This tree respects X-bar theory, and all the selection requirements of the lexical items are satisfied locally. Now we can apply T-to-C raising, do-support, and affix hopping in NumP to get the structure which would be pronounced *did you put which pictures of Bill on his desk?*:



This satisfies the +q requirements of C, making the structure into a question. Finally, wh-movement can apply to satisfy the +wh requirements of C, to yield the surface tree for the sentence (22b):



9.6 Some help in Determining Selection

One way to determine what selectional relations hold in a tree is to systematically investigate what co varies with what. For example, one typical way we have done it is by:

i. selecting a verb
ii. asking what entities the verb relates
iii. finding what strings of morphemes correspond to these entities

Typically the verb requires that these strings have certain properties: that they refer to be animate objects, or are concrete, etc. We conclude that we have a selectional relation when the content of the string is dependent on which verb we picked. An example is:

(23) Time seems to elapse slowly in the tropics

We select the verb *elapse*. It is a one place predicate. It attributes a property (that of elapsing) to an entity denoting a duration. It is the DP *time* that refers to this duration. We have a selectional relation between the V elapse and the DP time, as we can see by trying to vary the subject without varying the verb:

(24) * Mary seems to elapse slowly in the tropics

Sometimes, there are more specific ways to determine that we have a selectional relation between two positions in a tree. We review a few here that will come handy later.

9.6.1 Very tight selection: idiom chunks

Those are cases in which typically a verb selects so tightly its object that this object needs to be a specific word, rather than a range of possible words.

Pull strings = use one's connections

Take care of = care for

Lend assistance = help

In the following sentences, we see a portion of an idiomatic expression, an idiom chunk, separated from other parts of the idiomatic expression:

(25) a. How many strings did you say she had to pull in order to do that?
b. How much care do you think he would be taking of his patients under those circumstances?

These stranded idiom chunks clearly illustrate that we are dealing that a case of non-local selection in these sentences: we concluded they must involve movement (here: wh-movement).

Certain idiom chunks do not even occur outside of the idiomatic expressions. One example is the word headway which only occurs as part of the idiom:

make headway = improve

This idiom can occur in sentences like this:

(26) How much headway is he likely to make

The fact that in all these cases, the tightly selected N does not appear in its "selected position" immediately implies that movement has taken place.

9.6.2 Case

Case is a property that DPs have which depends on the position in which they occur. In English, it is only visible for various pronouns, but many other languages show case on almost all DPs: German, Latin, Japanese, Finnish.

Nominative:	* they saw Bill	*them saw Bill	*their saw Bill
Accusative:	* Bill saw they	Bill saw them	* Bill saw their
Genitive:	* they cat saw Bill	* them cat saw Bill	their cat saw Bill

The particular Case a DP gets is tied to the position it occurs in:

Nominative: specifier of Tensed T, so it is property selected by tensed T

Accusative: complement of V, so it is a property selected by (certain) Vs

Genitive: specifier of DP, so it is a property selected by the 'possessive' D

Again, the following examples lead to postulating movement, since we observe non-local selection:

(27) a. Who left Bill
b. * Whom left Bill

(28) a. Who did Bill leave
b. Whom did Bill leave

In English, the form *whom* is accusative, not nominative, while the form *who* can be anything. The contrast between the b forms receives an explanation under the movement analysis of *whom* from its selected position as object of leave.

9.6.3 Existential constructions

Certain other words are restricted to occur in very restricted environments too. The word *there* has a use in which it does not designate a location:

(29) a. There were 3 firemen available
b. There is no largest prime number
c. Is there anything to do today?
d. There are two main characters in the novel

This non-locative *there* is called *existential*, because it attributes or (with negation) denies existence (whether real or fictional) but not any particular location. Existential *there* is very restricted in its distribution. It does not get stressed, and it can occur as the subject of certain verbs but not others:

(30) a. There are 3 firemen available
b. ? Suddenly, there arrived two strange men
c. * There stabbed an animal
d. * There ran many people

It does not seem to occur as complement:

(31) a. * Mary judged there (object of V)
b. * You should sit before there (object of P)
c. * I had a realization of there (object of N)
d. # I ate there (object of V, OK only with locative *there*)

An exact description of this phenomenon would require somewhat more background than we have at the moment. However, a simple description of the restriction can be given as follows:

(32) Existential *there* can only occur as subject of certain verbs

Here are a couple of reasons why we are justified in calling there a subject. First, it is involved in subject-auxiliary inversion:

(33) a. There were seven people
Were there seven people?

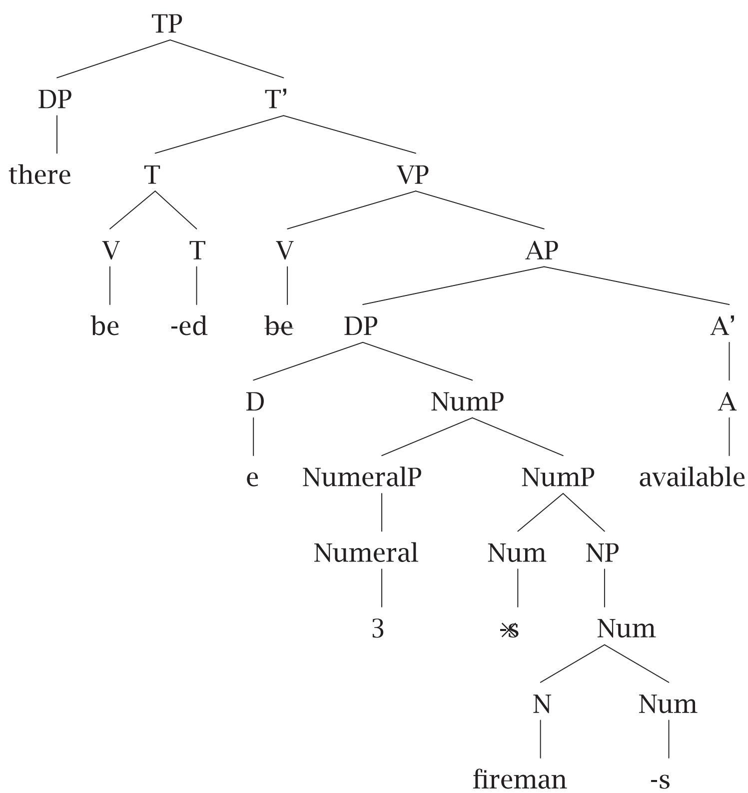
b. There were several doctors available
Were there several doctors available?

The second is that it behaves like a subject in the so-called "tag-question" construction that we see here:

(34) a. Rodney was eating some squid, wasn't he?

b. There is a man ready to jump from the roof, isn't there?

It is natural to propose that the structure of an existential *there* sentence such as (29a) involves a small clause complement of the verb *be* and *there* as subject:



10

Raising and Control

10.1 Raising verbs

We now return to another of the sentences mentioned on page 204:

(1) Time seems to elapse slowly in the tropics

We want to determine what selects the DP *time*. There are several reasons to conclude that this DP is selected by the verb *elapse*, not by the verb *seem*. First, notice that if we change *elapse* to a verb that requires a different kind of subject, like the verb *swim*, we must change this DP to get an acceptable sentence:

(2) *Time seems to swim in the tropics

(3) Sharks seem to swim slowly in the tropics

Secondly, it is possible to even have the "tightly selected" subjects of idioms as the subject of *seem* (cf. §9.6.1):

(4) the cat seems to be out of the bag

(5) the shit seems to have hit the fan

Here, the idiomatic readings are available even though the subject appears in the matrix clause with the verb *seems*. We conclude that the subject of the main clause is selected by material in the embedded clause. Again, we either need a more complicated notion of locality of selection, or else we need to have movement apply after selection has occurred. We adopt the latter strategy.

This conclusion that movement is involved in these constructions with *seem* is corroborated by other cases of tight selection, such as the distribution of existential *there*. Recall that existential *there* can occur only as subject of certain verbs:

(6) a. There is a nurse available

b. * There run many people

c. * There stabbed an animal

d. ? There arrived many people

Now observe the following sentences:

(7) a. There seems to be a nurse available

b. * There seems to stab an animal

c. * There seems to run many people to the station

d. ? There seemed to arrive many people

We reach the same conclusion as before: the DP there is selected by material in the infinitival clause. It may appear as subject of *seem* (in these sentences) only if it is selected by material in the infinitival clause.

In all the sentences we have just looked at, the only property of the DP subject of the main clause that mattered was whether or not it was selected by a predicate (a verb) in the infinitival clause. There was never any additional condition to impose on this DP that could have come from the a specific requirement imposed by the verb *seem*. The idea that *seem* is not selecting these subjects is confirmed by related constructions like this:

(8) a. it seems that John left

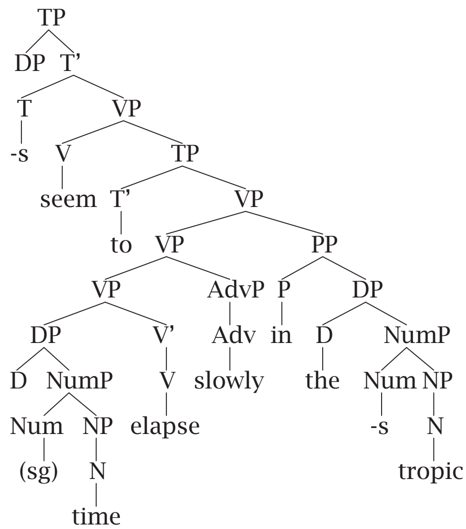
b. it seems that time elapses slowly in the tropics

Here we see that the subject of the main clause can also be a pronoun that does not refer to any particular thing: what is called a *pleonastic* or *expletive pronoun*.

The conclusion that we reach then is the following. In a sentence like:

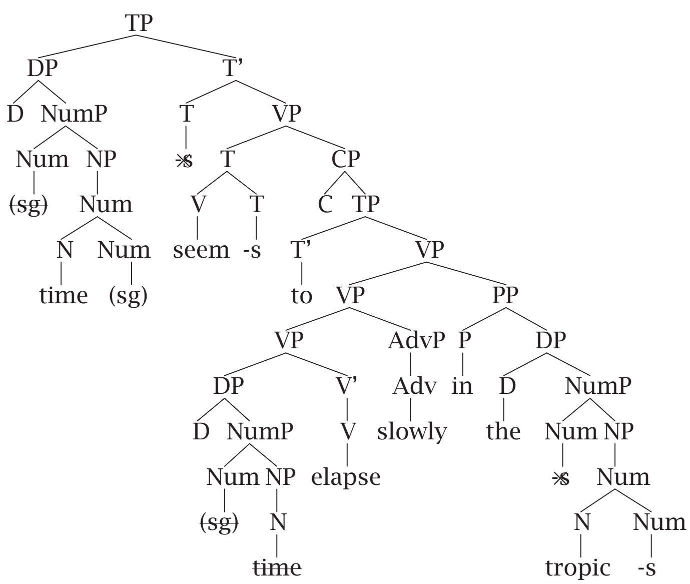
(9) Time seems to elapse slowly in the tropics

the main clause subject is selected by the infinitival verb, and the main clause subject is not selected by the main verb. To resolve the conflict between these conclusions and our ideas about locality of selection, we conclude that the DP *time* originates in the embedded clause. The simplest idea is that it originates as subject of the VP. Then the structure of this sentence **before movement** looks like this:



Notice that locality of selection is satisfied before movement applies. The argument of *seem* is its complement clause, which could be a CP with a silent C as shown here, or it could be just a TP. The argument of *elapse* is its subject *time*.

The structure before movement is not an acceptable sentence of English yet. Not only do the affixes need to combine properly with the verbs, but also, English seems to require a subject in tensed clauses. We can satisfy this requirement by moving *time* to the subject position of the tensed clause.



This movement of *time* is called **raising to subject.** The requirement that tensed clauses have a subject is sometimes called the “Extended Projection

Principle" (EPP):

EPP: a tensed TP must have a subject

After the raising to subject movement, this principle is satisfied.

Remember that we said that whenever movement is involved, a pair of sentences is involved. This is the case here too. The sentence:

(10) Time seems to elapse slowly in the tropics

is well formed if and only the following is well formed too.

(11) Time elapses slowly in the tropics

The verb *seem* also allows small clause complements from which raising takes place:

(12) Several people seem sick

(13) Several people seem [$_{AP}$ ~~several people~~ sick]

The lexical entry for *seem* will now look like this (assuming that seem takes a CP complement - this makes the lexical entry simpler. Otherwise, we would have to complicate it a bit: it is more commonly assumed that the complement is a TP, for theory internal reasons).

seem: V, (experiencer:to-PP), theme:{CP,AP}

This indicates that *seem* requires no subject, that it may optionally take a to-PP that names the "experiencer," and that it takes as complement either a CP or an AP.

(14) Mary seems (to Bill) [$_{CP}$ ~~Mary~~ to be sick]

(15) Mary seemed [AP ~~Mary~~ sick] (to Bill)

(16) it seems (to Bill) [$_{CP}$ that Mary is sick]

A verb like *seem* whose superficial subject comes from elsewhere is called a **raising verb** (because it induces raising to subject).

What is happening in that last example? The main subject *it* does not refer to anything in particular: it is the **expletive** *it*. Let's introduce a rule that supplies this *it* when nothing occupies the subject position of a tensed TP at S-structure, so that the EPP can be satisfied. We call this rule **expletive insertion.** In tensed clause with the verb *seem*, if raising has not taken place, this rule applies inserting *it* in the subject position of the tensed TP. This will only happen when the verb *seem* takes a tensed clause as complement.

underlying structure: present seem that John past left the room

no raising⇒expletive insertion applies: it seems that John left the room.

To summarize again, what we are doing again when we are invoking movement is this: we are saying that locality of selection can be violated. We invoke movement to take allow this rather than allowing selection to be non-local generally, because the specific ways in which these violations are allowed have a constellation of very specific properties. These comprise the special category of phenomena that we call movement.

10.2 Simple clauses revisited

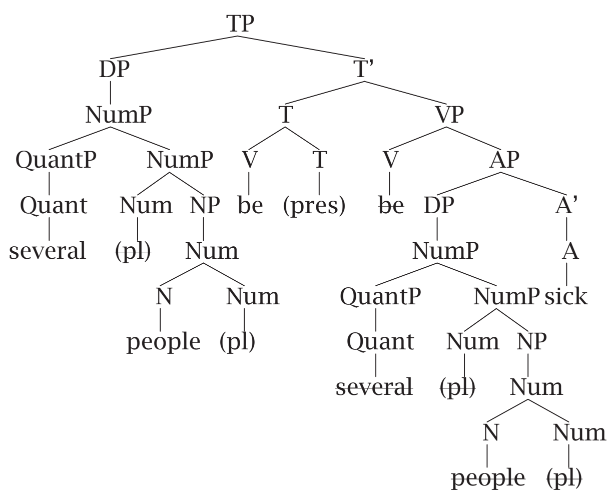
Let us compare all the following sentences:

(17) a. John considers [$_{AP}$ several people sick]
b. There are [$_{AP}$ several people sick]
c. Several people seem [$_{AP}$ ~~several people~~ sick]
d. Several people are sick

We have already seen that in the first sentence, several people sick is a constituent (because it can conjoined for example as in *John considers [several people sick] and [several people healthy]*). We also concluded that this constituent is an AP headed by the adjective *sick*, which takes the DP *several people* as subject. We have the same analysis for the second sentence. In the third sentence the string *several people sick* is also an AP. Movement takes place displacing the subject *several people* from the subject position of the AP, raising it to the subject position of the main TP.

Based on these three cases, we could conclude that the adjective *sick* requires a DP subject that is realized as subject of the AP headed by *sick*.

When we turn to the fourth example, we have so far provided a different analysis. We have assumed that the subject required by the adjective *sick* could be realized syntactically as the subject of the TP containing this adjective. However, the other related structures suggest another analysis, namely one in which the subject DP required by the adjective *sick* is subject of the AP underlyingly, and is raised to subject of TP by movement.



This analysis is in fact required by our assumptions: the verb *be* does not select for a subject at all. If the DP *several men* appeared in underlying structure as the subject of the TP, it would not be selected by anything.

This analysis can be generalized to all cases of subjects. Consider for example an idiom like this:

(18) The shit will [$_{VP}$ hit the fan]

The subject of the idiom is selected by *hit*, not by *will*, and now we have a way to make sense of this. Nothing prevents us from supposing that the subject DP appear as subject of VP in the underlying tree and moves to subject of TP by raising to subject.

If this is generalized to all VPs, a number of advantages ensue. First, it will now be routinely true that APs or VPs have subjects. Secondly, it considerably simplify how we should state the Principle of Locality of Selection. We formulated that principle this way:

(19) **Locality of Selection (LoS), preliminary version:**

a. If a head α selects β as complement, β is a complement of α.

b. If a head α selects β as subject, β is the subject of α or the subject of <u>the clause containing α</u>

c. If a head α selects β as an adjunct, β is the adjunct of α.

Now we can switch to a simpler idea:

(20) **Locality of Selection (LoS), final version:** If a head α selects β, β appears as the complement, subject, or adjunct of α.

This highly desirable consequence was noticed and defended by Koopman and Sportiche (1991). It makes the statement of locality of selection extremely simple.

Adopting this new LoS principle, the subject of a head is <u>always</u> the specifier of that head. If it appears elsewhere, it has been moved.

(21) Bill$_k$ is [t_k sick]

(22) [The shit]$_k$ will [t_k hit the fan]

(23) [The girl in the red coat]$_k$ will [$_{VP}$ t_k [put a picture of Bill on your desk]] in two seconds

(The notation t_i is just another way of notating a unpronounced copy – a "trace" – which is coreferential with other i-indexed constituents).

Do we sometimes see the subject of VP not raised to subject of TP? It would be tempting to say that this what happens in Subject auxiliary Inversion. For example in:

(24) Will John leave

(25) Will [$_{TP}$ John [$_{T'}$ will [$_{VP}$ John leave]]]

(26) [$_{TP}$ Will [$_{VP}$ John leave]]

Instead of saying that will has raised from T to C (as in (25)), we could say that John has failed to raise from inside VP to TP as in (26). This would be wrong however: recall that whether T to C can apply crucially depends on what kind of material occurs in front of TP. The overt presence of a C for example blocks T to C. It would remain mysterious why the presence of an overt C would block DP-movement to subject of TP.

However in some cases, we can see a portion of the subject remaining in VP. Consider first a DP like *all the children. The children* is a DP, and *all the children* is also a DP. This suggests *all* can be an adjunct to DP.

(27) [$_{DP}$ all [$_{DP}$ the children]]

If a DP like *all the children* starts as subject of a VP, it is possible to raise this entire DP to subject of TP, but it is also possible to raise the lower DP leaving the adjunct all behind (as we have done with VP preposing: we could prepose a VP but leave a VP adjunct behind).

These options are illustrated below:

(28) **underlying structure:**

will [$_{VP}$ [$_{DP}$ all [$_{DP}$ the children]] leave]

whole DP moved:

[$_{DP}$ all [$_{DP}$ the children]] will [$_{VP}$ [$_{DP}$ all [$_{DP}$ the children]] leave]

only the smaller DP moved:

[$_{DP}$ the children] will [$_{VP}$ [$_{DP}$ all [$_{DP}$ the children]] leave]

This phenomenon is called **Quantifier Floating** (because *all* is a quantifier and it appears to have "floated" away from the DP it modifies).

As final remark, note that the rule of Expletive insertion also applies in existential *there* construction; with a number of verbs such as be which takes a small clause complement (and also other verbs called **unaccusative verbs**), the subject of the small clause may raise to subject of TP but does not have to. When it does not, expletive insertion can insert there in subject position.

(29) Several men are sick

underlying structure: pres be [$_{AP}$ several men sick]

raising to subject, affix hopping⇒surface structure:

several men be+pres be [$_{AP}$ several mean sick]

(30) There are several men sick

underlying structure: pres be [$_{AP}$ several men sick]

there **insertion, affix hopping⇒surface structure:**

There be+pres be [$_{AP}$ several mean sick]

In conclusion then, we have found that there are "raising categories:" these are categories that trigger raising to subject. (Do not confuse this with "verb raising" which is another name for V-to-T movement). Verbs like *seem*, auxiliary verbs like *be, have*, and generally the category T since even in simple clauses, the subject of TP always comes from elsewhere.

10.3 Control

This is what we see in this section and the next:

- There are infinitival complements that superficially lack a subject but behave differently from infinitival complements of raising verbs. We call these cases *(subject) control* constructions. In raising to subject constructions, the subject of the main clause is not selected by the main verb, but rather by the infinitival verb. In (subject) control constructions, the observed selectional properties are different: the subject of the main clause is selected both by the main verb and by the embedded verb.
- This will lead us to postulate the existence of a silent category called PRO (which sometimes behaves as a silent reflexive anaphor, and sometimes as a silent indefinite pronoun).
- The presence of this PRO solves some problems for the binding theory.

The last case of locality violation to consider is:

(31) Susan hopes to sleep

We are going to see that the subject in bold is selected by both verbs. First, note that we can provide a sentence synonymous to (31) with a tensed clause complement instead of an infinitive:

(32) Susan$_j$ hopes that she$_j$ will sleep

Note the coindexation to indicate that the DPs *Susan* and *she* should be interpreted as coreferential. Clearly, the meaning of this sentence is (almost) identical to the meaning of (31) . In this sentence, *she* (meaning Susan) is selected by the verb *sleep* and *Susan* is selected by the verb *hope*.

Secondly, changing the bottom verb can lead to unacceptability:

(33) * Susan hopes to elapse

This is clearly an incompatibility between *Susan* and *elapse*, not between *hope* and *elapse*. We can see in the following sentence that the verb *elapse* can perfectly well be the main verb of a clause complement of the verb *hope*:

(34) Susan hopes that time will elapse

Conversely we can see that a DP subject selected by the infinitival verb must still be compatible with – i.e. selected by – the main verb:

(35) * Time hopes to elapse

Here *time* satisfies the selectional requirements of *elapse*, but not of *hope*. The subject of *hope* must be an Experiencer, an entity with a mind.

How can both the verb *sleep* and the verb *hope* select the subject of the main clause? By the Principle of Locality of Selection, this subject must be both the subject of the VP headed by *hope* and the subject of the VP headed by *sleep* in underlying structure. How is this possible? A single DP cannot be in two locations at once in underlying structure.

This means that, although we hear only one DP, we must have two DPs, each of which is selected by its own verb the same way the DP *Susan* is. The solution is simple, if we say that in underlying structure, we have two DPs both interpreted as Susan: one is subject of *hope* and the other is the subject of *sleep*, and the second must be silent:

(36) Susan hopes [~~Susan~~ to sleep]

This structure is very similar to what we got in the tensed counterpart given earlier that we now repeat:

(37) Susan$_j$ hopes [that she$_j$ will sleep]

But there are some differences between these two structures. To indicate that the second subject was interpreted as Susan, we assumed it was a silent version of Susan. In the tensed case, we had a pronoun that was coreferential with the main subject. Which option is better? Suppose we replace the subject of the main clause by a DP like *everyone*. According to the two options we are considering, we would get either one of the two structures:

(38) a. Everyone hopes [~~everyone~~ to sleep]

b. Everyone hopes [~~him~~ to sleep]

If the missing DP was identical to the subject of the main clause, we would predict the wrong meaning. We can bring this out clearly if we paraphrase these structures by replacing the infinitive clauses by a tensed clause counterpart:

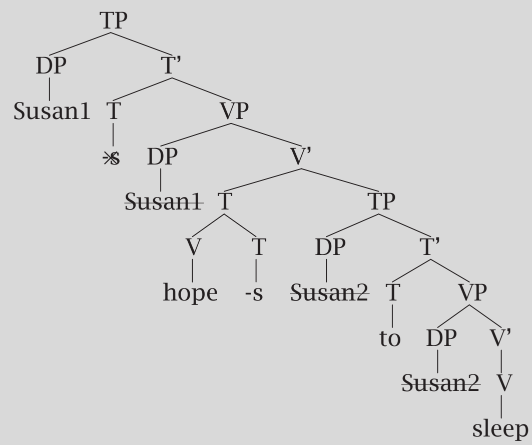
(39) Everyone hopes to sleep

(40) a. Everyone hopes [that everyone will sleep]

b. Everyone hopes [that he will sleep]

Clearly the first sentence does not have the meaning of (39) while the second does.

Brief digression on Principle C: Skip this section for now: we have not covered enough of principle C in class. First, note that if this second subject really is a silent version of the DP *Susan*, this DP would not be free (it would be coreferential with a c-commanding DP namely the other DP *Susan*.) This would violate Principle C of The Binding Theory. To distinguish the two occurrences of *Susan*, let's label the first one *Susan1* and the second *Susan2*, but we are assuming them to be coreferential:



We see that the DP *Susan1* has the main T' as sister which contains everything else in the clause. So it c-commands everything including *Susan2*. Since *Susan1* and *Susan2* are coreferential, this is a principle C violation. (Note that *Susan1* also c-commands its trace, ~~Susan1~~. Doesn't this also cause a Principle C violation? The crucial property to note is that only one of these two *Susan1* is "interpreted." This is why Principle C does not apply.

A proper name thus looks like it is not an option. Instead, on analogy with (37), we may try to put a pronoun there:

(41) Susan$_j$ hopes [her$_j$ to sleep]

However, there is still a difference between this sentence and the earlier tensed counterpart. In the tensed sentence (37), the pronoun *she* may be, but does not have to be, coreferential with the main subject *Susan*. Thus (37) (without the coindexing) can mean that Susan hopes that some other female than her will sleep. This option does not exist for (31).

What then is the identity of this silent DP we are looking for? To get a sense of its properties, consider the following examples about the British Prime Minister's famous speech on the radio during WWII:

(42) a. Only Churchill remembered [?? giving the Blood, Sweat and Tears speech]

b. Only Churchill remembered [Churchill giving the Blood, Sweat and Tears speech]

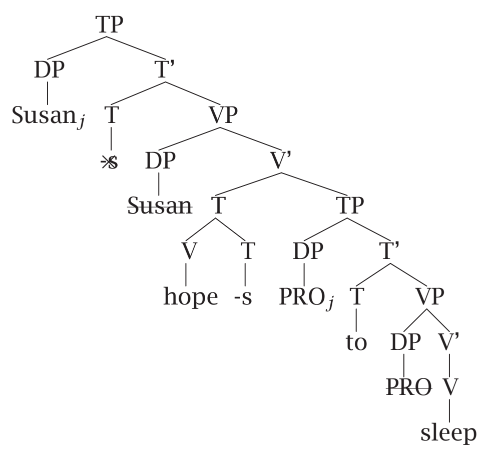
c. Only Churchill remembered [his giving the Blood, Sweat and Tears speech]

d. Only Churchill remembered [himself giving the Blood, Sweat and Tears speech]

We are looking for the nature of the silent subject of the verb *give* which is marked in the first sentence by ??. The interesting point here is that only the d sentence means the same as the a sentence. Neither the b sentence nor the c sentence mean the same: the a sentence and the d sentence are true. But the b sentence and the c sentences are (probably) false. To see this, suppose I utter b or c. Suppose further that Young Macmillan heard this speech and remembered vividly hearing it on the radio. Then he also remembers Churchill giving the speech. Or he remembers his (=Churchill's) giving the speech. So Churchill would not be alone in remembering this. (Note incidentally that the b sentence is awkward because it is a Principle C violation.) However, if I utter the sentences a or d, I am making a true statement, because no one other than Churchill can remember giving the famous speech. Only the speech giver can do that. This shows again that neither a silent name nor a silent pronoun is satisfactory. They predict a range of interpretations that is not fully available. Instead what seems to be needed is a kind of silent reflexive anaphor:

(43) Susan hopes [~~herself~~ to sleep]

This would guarantee that the subject of *sleep* is interpreted exactly like the subject of *hope*. As we will see, there are cases in which it is not entirely obvious that this silent DP should be thought of as a silent reflexive anaphor (also in truth, sentences (42a) and (42d) do not quite mean the same thing!!!). This is why we give it a different name: the traditional name given to this silent category is PRO (always written in capital letters). Taking into account all this, we get the following surface tree for (31):



We have shown *hope* taking a TP complement here, but really, like in the raising verb constructions, we set aside the question of whether this should be a TP or a CP with a silent C. In sentences like this one, the value of PRO is determined by the subject of the main clause, as we have indicated by co-indexing. We say that PRO is controlled by the subject of *hope*. This is a **subject control construction**. What determines whether we have a control construction or not is the verb taking the infinitive complement. This is why *hope* is called a subject control verb.

The class of subject control verb is large: it contains verbs such as *hope, wish, try, attempt*, etc. (In contrast, there are only very few raising verbs like *seem*!)

The control relation is similar to (but not quite the same as) the relation between an antecedent and a reflexive anaphor. It is no surprise that they agree in person, number, and gender.

10.4 Using the theory: Control and Binding

10.4.1 Subject infinitives

Principle A. Consider the following two sentences:

(44) a. [for [John to hurt his friends]] is stupid

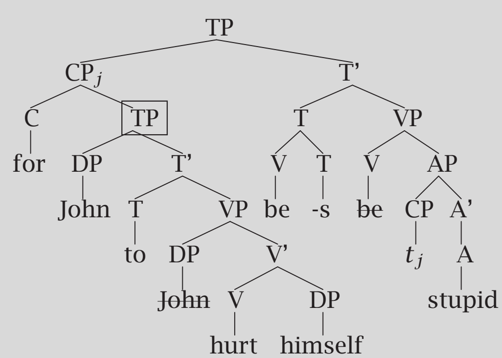
b. [[to hurt his friends]] is stupid

In both cases, the infinitive clause is the subject of the main clause. We can replace the DP *his friends* by the anaphor *himself* in the first sentence and by the anaphor *oneself* in the second and the results are fine:

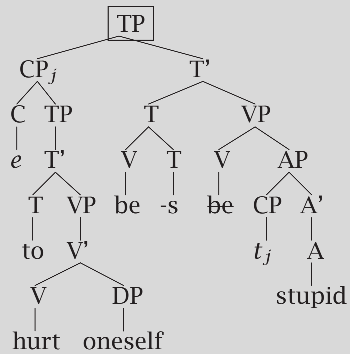
(45) a. [for [John to hurt himself]] is stupid

b. [[to hurt oneself]] is stupid

In (45a), the anaphor satisfies principle A of the Binding Theory: it has a c-commanding antecedent in its local domain, namely the DP *John*. As can be seen below, the local domain is the embedded TP, the first TP with a subject, indicated with a box. The only antecedent available is *John*.



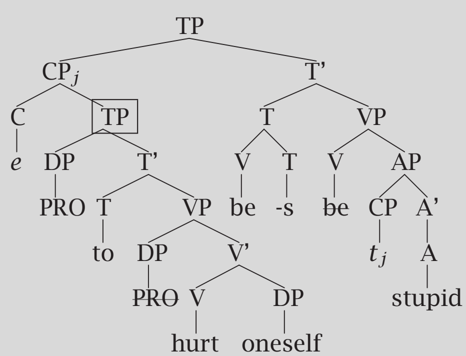
Here instead of showing a whole copy of CP_j as the subject of the AP where it originated, we use the abbreviated "trace" notation t_j. Contrast this structure with the second sentence, where Principle A seems to be violated for the anaphor *oneself* since there does not seem to be any antecedent around. For the second sentence, we might try a tree like this:



The domain for the anaphor is now the boxed TP, the first with a subject. Within this local domain, there isn't any possible antecedent for the reflexive, and so this sentence is wrongly predicted ill-formed. However, the verb *hurt* selects a subject. If the tree above was right, it would mean that this subject is optionally syntactically realized. If the subject <u>is</u> syntactically realized, it is obviously silent in the second case and has not moved anywhere. (There is no place to move to). The subject must then be PRO. Let us put it in.

(46) a. [for [John to hurt oneself]] is stupid

b. [[PRO to hurt oneself]] is stupid



Once PRO is added, we see that this sentence does not violate Principle A of the Binding theory after all!! The anaphor has a local domain (the boxed TP) and a licit antecedent, the subject of the boxed TP. This antecedent is just silent. Note that by the same token, PRO itself cannot be an anaphor – at least not always – as we had mentioned earlier, since clearly it does not have an antecedent in this last sentence.

So we see that the existence of PRO, postulated purely to satisfy the lexical requirement of verbs under the Principle of Locality of Selection also plays a role in how the Binding Theory works.

Principle B. If we examine the following sentences:

(47) a. [for [John to hurt him]] is stupid

b. [[to hurt him]] is stupid

We see that we have a Principle B effect in the first case: *him* must be disjoint in reference from *John*. This follows straightforwardly from Principle B. [You should check this yourself: draw the tree and check that Principle B would be violated under coreference].

In the b sentence, we also have a Principle B effect: *him* cannot refer to whoever is doing the hurting. Again, this straightforwardly follows if the subject of *hurt* is syntactically realized as PRO, but not otherwise. [Again, You should check this yourself: draw the trees with and without PRO and check that Principle B would not be violated if PRO is absent, but would under coreference between him and PRO if PRO is present.].

10.4.2 object infinitives

We can illustrate the same positive effects of the presence of PRO in other cases. Consider for example the following sentence:

(48) John promised Bill to leave

Again we can paraphrase it by replacing the infinitive clause by a tensed clause. (Incidentally, it's always a very good idea to try to do this to find out what kind of infinitive we are dealing with.)

(49) John promised Bill that he(John) would leave

This paraphrase immediately indicates that:

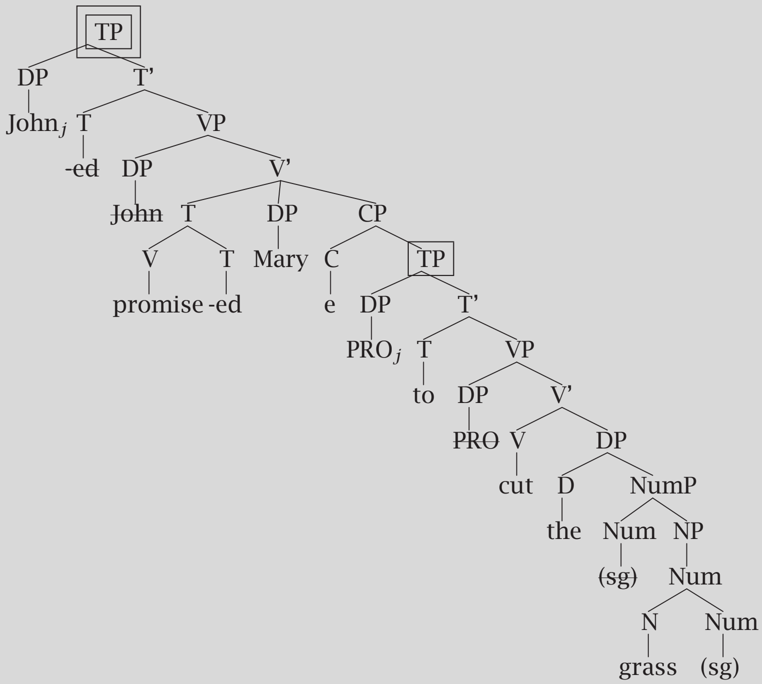
i. *Bill* is a complement of the verb *promise*

ii. the infinitival clause is also a complement of the verb *promise*

iii. this infinitive has a missing subject – a PRO – interpreted as coreferential with the subject *John*, so we are dealing with a subject control verb.

The structure of this sentence is now roughly given as:

(50) John$_j$ promised Mary [$_{TP}$ PRO$_j$ to cut the grass]



Now consider the following sentences:

(51) a. John promise Mary to control himself

b. * John promised Mary to control herself

Why is the first sentence fine, but the second sentence deviant? If we appeal to the presence of PRO, the respective structures of these sentences becomes:

(52) a. John$_j$ promise Mary [$_{TP}$ PRO$_j$ to control himself]

b. * John$_j$ promised Mary [$_{TP}$ PRO$_j$ to shave herself]

In both cases, the anaphor is c-commanded by either *John* or *Mary*. [This is what our tree would predict but do you know how to check this independently? One way would be to modify the sentence and use Principle C to show that either the subject or the object of promise c-command the object of control. Go ahead and do this.] In both cases, the domain of the anaphor is the smallest TP with a subject, that is the embedded infinitive clause (the singly boxed TP in the tree above). So the only antecedent allowed is PRO. Since PRO is controlled by *John*, the reflexive can only corefer with *John*. If we do not appeal to the presence of PRO, the respective structures of these sentences is:

(53) a. John promise Mary [$_{TP}$ to shave himself]

b. * John promised Mary [$_{TP}$ to control herself]

In both cases, the anaphor is c-commanded by either *John* or *Mary*. In both cases, the domain of the anaphor is the smallest TP with a subject, that is the main clause TP (the doubly boxed TP in the tree above). So both sentences would be wrongly predicted to be fine.

10.5 Summary for object infinitives so far

How to analyze an infinitive complement depends on the choice of the verb or the main clause expression. We have seen how to identify raising to Subject expressions: *seem, tend, be likely, be a cinch, be supposed,...* These are relatively uncommon.

(54) John seems to sleep all day

(raising is obligatory for these verbs)
*John seems Bill to sleep all day

(raising verbs don't take for-infinitives)
*John seems for Bill to sleep all day

(raising verbs don't select a subject)
*John seems that Bill sleeps all day

(raising verbs allow expletive subjects)
it seems that Bill sleeps all day

In the case of a raising verb like *seem*, if nothing can raise to the subject position of the clause, expletive it is inserted because TPs need subjects.

Subject Control verbs come in at least two kinds: W-verbs of the *hope* type (*wish, want, long, yearn, desire, need, itch, pine, thirst, etc.…),* which may be, but do not have to be, subject control verbs. The verb *hope* selects CP with silent head:

(55) John hopes to sleep

(control not obligatory, for some speakers)
John hopes for Bill to sleep

(*hope* selects *for*-CP)
John hopes for Bill to sleep

(*hope* selects *that*-CP)
*John hopes that you will sleep

(no good with expletive *it*)
*it hopes that you will sleep

There are also subject-control-only verbs of the *try* type (*attempt, endeavor, aim, venture, strive, dare,...*) The verb *try* selects CP with silent head:

(56) John tried to sleep

(control obligatory)
.*John tried Bill to sleep

(*try* doesn't select *for*-CP)
*John tried for Bill to sleep

(*try* doesn't select *that*-CP)
*John tried that Bill sleeps

(no good with expletive *it*)
*it tried that Bill sleeps

The configurations in which each of these verbs can occur are all different: each represents a different class.

10.6 Object Control and ECM

There are at least two more patterns for infinitive complements. The first is the pattern of "exceptional case marking" (ECM) verbs, also sometimes called "raising to object" verbs. The class includes *believe, expect, prove, know, assume,...*

(57) a. *John believes to have slept
b. John believes Bill to have slept
c. *John believes for Bill to have slept
d. John believes that Bill has slept
(no good with expletive *it*)
*it believes that Bill has slept
e. *John believes Bill that Mary has slept

Yet another class is the object-control (OC) verbs, including *convince, persuade, order,...*:

(58) a. *John convinced to sleep
b. John convinced Bill to sleep
c. *John convinced Bill for Mary to sleep
d. *John convinced that Bill has slept
e. *it convinced Bill that Mary should sleep
f. John convinced Bill that Mary should sleep

Where they can be compared, the * patterns are different from the above three, and they are different from each other (an ECM verbs seems to allow either a direct object, or a clause complement, but not both while Object Control verbs allows both). This suggests we are dealing with two new patterns. What are they? The crucial question we ask is: Is the "object" (here *Bill*) selected by the main verb?

We compare the two sentences:

(59) John believes Bill to have slept

(60) John convinced Bill to sleep

The object can be expletive *it* or existential *there* with ECM verbs, but not with object control verbs:

(61) a. John believes it to be obvious that Bill left
 b. John believes it to be raining
 c. John believes there to be several firemen available

(62) a. *John convinced it to be obvious that Bill left
 b. *John convinced it to be raining
 c. *John convinced there to be several firemen available

This suggests that the DP following *believe* is the subject of the following infinitival clause but the DP following *convince* is not.

Active/Passive pairs share truth value: they are either both true or both false (except in special cases):

(63) a. Bill cooked the rice
 b. the rice was cooked by Bill

(64) a. Bill visited Mary
 b. Mary was visited by Bill

But note what happens under ECM verbs and OC verbs:

(65) a. John believes Bill to have cooked the rice
 b. John believes the rice to have been cooked by Bill

(66) a. John believes Bill to have visited Mary
 b. John believes Mary to have been visited by Bill

With *believe*, the sentences do not change truth value if we apply passive in the infinitive.

(67) a. John convinced Bill to cook the rice
 b. *John convinced the rice to be cooked by Bill

(68) a. John convinced Bill to visit Mary

b. # John convinced Mary to be visited by Bill (#=ok but wrong meaning)

With *convince*, the sentences do change truth value and sometimes in acceptability when we apply passive in the infinitive.

We can make sense of all these differences if the "object" of an object control verb is selected by this verb, while that of an ECM verb is not, so it is not really the object of the ECM verb. This is consistent with our judgment on the meaning of believe and convince:

Believe is the name of relation between two objects: a thinker, and a proposition (a state of affairs) that the thinker takes to hold true. The thinker is realized as a DP subject, while the proposition is realized as a clausal object, a CP.

Convince is the name of a relation between three objects: two thinkers and a proposition expressing a state of affairs or an action) where the first thinker makes the second believe that the state of affairs is true, or intend to carry out the action. The two thinkers are realized as DPs, while the proposition is realized as a clausal object, a CP.

This leads to the following structures:

(69) a. John believes [CP [Bill to have slept]] (inf-CP complement)

b. John convinced Bill$_k$ [CP [PRO$_k$ to sleep]] (inf-CP complement)

c. John believes [CP that [Bill slept]] (+tns CP complement)

d. John convinced Bill [CP that [Mary should sleep]] (+tns CP complement)

We can summarize some of our conclusions this way: Expletive *it* is allowed with ECM verbs – (61) – as long as it is allowed in the clause embedded under the ECM verbs. It is disallowed with OC verbs – (62) – because the object needs to be a "thinker." This also why Passive under ECM poses no problem – (**??**) – and does not change truth value: the passive is really only in the embedded clause. For OC verbs however, passive changes what the second thinker is. With *rice* – (67) – passive fails because *rice* is not a thinker. With the other case – (68) – the second thinker changes: it is *Bill* in one case and *Mary* in the other, so the meaning changes. We can check these claims with some representative verbs, considering first the ECM class:

(70) (PRO subject disallowed)
*John believes to have slept

(selects CP with silent head)
John believes Bill to have slept

(disallows *for*-CP)
*John believes for Bill to have slept

(selects *that*-CP)
John believes that Bill has slept

(no good with expletive *it*)
*it believes that Bill has slept

(selects only one object)
*John believes Bill that Mary has slept

And for the OC verbs:

(71) (DP object of *convince* is required) *John convinced to sleep

(selects DP and CP with PRO)
John convinced Bill to sleep

(disallows *for*-CP)
*John convinced Bill for Mary to sleep

(DP object of *convince* is required)
*John convinced that Bill has slept

(no good with expletive *it*)
*it convinced Bill that Mary should sleep

(selects DP and *that*-CP)
John convinced Bill that Mary should sleep

11

Summary and review

In the past few chapters, we have made some small adjustments in our fundamental assumptions about linguistic structure. In general, what is happening is that we are discovering ways in which structures that looked quite different are actually very similar. With this kind of theory development, the subject should get simpler and simpler as we study it. But of course what really happens is: after we discover simple regularities at the beginning, we can notice subtler phenomena that require further adjustments in the theory.

Some of the theoretical simplifications of the last chapters have far-reaching consequences for the structures of the phrases we have been studying. As a result, none of the sentence structures that we propose now are the same as the ones we were proposing at the beginning. For this reason, it is valuable to quickly review everything, but this time, we will look at things as they appear from our theoretically more sophisticated perspective.

11.1 Morphology

We adopted the tentative hypothesis that the "atoms" of morphology, **morphemes** are the "semantic atoms," the smallest meaningful units. **Morphology** is the theory of these atoms and the complexes they form.

Bound morphemes (affixes) can only appear when attached with some other word; the others are called **free**. Bound morphemes are especially "fussy" about what they can combine with: for example, the affix *-er* **selects** other morphemes of category V to form a complex of category N. Here we see how morphemes fall into **categories** N, V, A, P, D,…according to their "distribution," i.e. according to where they can appear in linguistic structures. We can get evidence whether two elements have the same category with **substitution tests**: can one element be substituted for the other in most contexts?

We also noticed that certain kinds of morphemes (categories or subcategories) are easy extended with new elements all the time. New names are added to the language all the time; also new nouns, new verbs, new adjectives. These kinds of elements are called **open class**. There are other kinds of elements that are not easily extended, parts of the language that do not change rapidly. Examples of **closed class** elements are the auxiliaries, modals, coordinators, prepositions, determiners, numerals.

Compared to other languages, English does not have a very rich morphology, but it has a range of affixes and productive **compounding**, especially with **nouns**:

…[$_N$book] [$_N$book maker] [$_N$book maker convention] …

What we pre-theoretically call "words" are very roughly the free morphemes and the complexes built by affixation and compounding, but here we see that *[$_N$ book maker convention]* is a single noun with at least 5 morphemes, even though it would pre-theoretically be counted as 3 "words." The pre-theoretic notion of "word" is not useful in linguistic theory. We replace the pre-theoretical notions with clearer technical terms. Instead of following the usual notion "word," we will call free morphemes and free morphological complexes "words." So in this sense, *[$_N$ book maker convention]* is a single word that has 3 other words in it.

The compounds also show that English morphology is **recursive**: an element of category N can properly contain other elements of the same category. This means that the set of compounds is infinite. The number of English words is infinite, because there is no principle in English that sets any limit to the size of a compound.

When we considered the structure of compounds in English, we discovered that English morphological complexes usually respect this principle:

English right hand head rule (RHHR): the rightmost element of a word is the head of the word.

This applies even to affixes, and explains why English suffixes are often category-changing, while prefixes are usually category preserving. The properties of morphemes are specified in a **lexicon**. This lexicon has information like this:

cat	free,	N	
eat	free,	V	
er,	bound,	N,	c-selects for V
able,	bound,	A,	c-selects for V
s,	bound,	Number,	c-selects for N
s,	bound,	Tense,	c-selects for V
en,	bound,	V[Past Participle],	c-selects for V
ing,	bound,	V[Present Participle],	c-selects for V

(The lexicon also includes information about what each element means, which is not indicated here.) Complexes of morphemes must respect the lexical requirements of the morphemes, and furthermore we have:

Locality of Morphological Selection: Morphological selection is *local* in the sense that a word can only select properties of its sister(s).

The reasons for starting with morphology are these: first, morphology provides simple examples of selection and locality; and second, morphology provides the atoms of syntax.

11.2 Syntactic constituents

We hypothesized that morphological elements of the categories N, V, A, P, D, C,…are the atoms of syntax. We often called these things "words," but we now realize that the atoms are sometimes single morphemes, and sometimes complexes of morphemes (as in the case of noun compounds). According to this hypothesis, there are infinitely many syntactic atoms, because morphology is recursive.

We also formulated some first hypotheses about how relations among linguistic structures, certain ways of transforming one structure into another, provide evidence about what **constituents** of phrases are:

Substitution: if a string S can be replaced by a single word, this is some evidence that S is a constituent. In particular:

Pronominalization: if a string S can be replaced by a pronoun, this is some evidence that S is a DP

One **substitution:** if a string S can be replaced by *one*, this is some evidence that S is a NP

Do so **substitution:** if a string S can be replaced by *do so*, this is some evidence that S is a VP

Ellipsis: if a string S can be deleted, this is some evidence that S is a constituent

Coordination: if a string S can be coordinated with a word (or phrase), this is some evidence that S is a constituent, a constituent of the same category as the word (or phrase) it is coordinated with

Movements: if a string S can be moved to another position (typically, all the way to the right or to the left), this is some evidence that S is a constituent. In particular:

Topicalization: DPs, PPs, APs, VPs (VP preposing)

<u>John</u>, I like
<u>on the shelf</u>, you should put the book
<u>Afraid of the dark side</u>, he is
<u>Follows the force</u>, he does

Clefting: DPs, (and for some speakers:) PPs

It's <u>your mind</u> that he wants
It's <u>on the desk</u> that he put the manuscript

Pseudo Clefting: VPs, APs, DPs,...

What we do is work hard
What they are is dangerous What Mary wants is the money

Wh-movement: DPs, PPs,...

Which picture does he like?
In which boat did they find the contraband?

Right node raising: DPs, VPs,...(warning: tricky!)

They tolerate but I love postmodern art that pushes the limits
She may have and should have practiced drawing trees

Heavy shift: DPs

I sent to you all the work I have done this semester

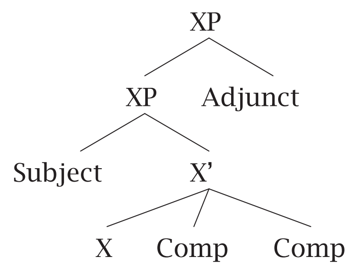
Important caveat: When an experiment does not successfully apply to S, the reasons for failure could be extremely varied. In particular it does not show that S is not a constituent.

11.3 X-bar theory, Projection Principle, Locality

X-bar theory includes the following claims:

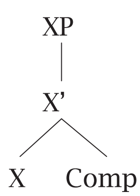
i. Each phrasal constituent has a head
ii. This head is always a morpheme or a word (a D or N or V or...)
iii. The head is unique
iv. Every morpheme is the head of some constituent
v. In general, no non-constituent has a unique head
vi. The largest constituent with head H is notated HP or H^{max} and is called **the maximal or phrasal projection of H.**
vii. HP or H^{max} is a constituent consisting of a constituent H' and at most one sister called the **specifier (or subject)** of H. H' is also notated and read H-bar (an H with one bar above it).
viii. H' or H-bar consists of the head H and some sisters. These sisters (if any) are called the **complements** of H.
ix. HP can also consist of an HP and a sister constituent called an **adjunct** to H (or to HP).
x. Adjuncts, complements and specifiers are themselves phrasal constituents.

So the overall look of a phrase is this (but remember: the order of elements is not part of X-bar theory; only what dominates what):

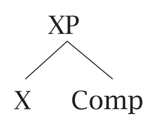


An XP can have 0 or more adjuncts, 0 or 1 subject, 0 or more complements, but always it has a head X. In English, complements follow the head and subjects precede the head, as shown here, but this may vary across languages, and is not part of X-bar theory.

We introduce the following abbreviated notation when an XP has no subject: in these cases, only when the XP has no subject, we can leave the X' out of the tree diagram, since no ambiguity can result in this case: the sisters of the head are always complements:



can be abbreviated as:



You don't have to use this abbreviation. That is, it is always safe to assume that whenever there is an X, there is an X' and an XP.

We also have these fundamental ideas:

Projection principle: lexical specified syntactic requirements must be respected

Locality of Selection (LoS), final version:

Extended projection principle (EPP): a tensed TP must have a subjectIf a head α selects β, β appears as the complement, subject, or adjunct of α.

The first two principles apply to underlying structures. The last one applies to surface structures (so if a tensed TP does not have a subject in underlying structure, something must raise there or an expletive must be inserted so that there is a subject at surface structure.

11.4 VP complements and adjuncts

Let's review again what counts as a complement in VP. Direct and indirect objects are complements, as in:

(1) I sent money

(2) I sent Mary money

(3) I sent money [to Mary]

Notice that the indirect object can appear in a PP. We cannot have multiple indirect objects:

(4) * I sent [Bill] money [to Mary] [to Sam]

However, the number of PPs that can be included in a VP seems essentially unlimited:

(5) I worked on Sunday in the city on that project without a break.

Are all of these PPs complements? Or are some of them adjunct modifiers? Our constituency tests and X-bar theory can help us decide. (It is useful to think about how each one of these tests relates to the principles of the syntactic theory we have formulated.)

Tests for adjuncts and complements of V

(6) **Semantic considerations**: These should probably be mentioned first, since they are often easy to apply and usually lead to conclusions that are supported by the structural tests below. The semantic proposal is simply this: the subject and complements name the essential, distinctive parts of the action or event named by the verb. So a "putting" involves essentially an agent (the subject), a theme (the thing being put) and a location. Each putting occurs at a time and place too, but this is true of any action and so these are not distinctive to puttings. So we have, for example,

he	put	the book	on the desk	on Sunday	in Paris
subject	verb	theme	location	adjunct	adjunct

(7) **Iteration**: The number of complements is strictly limited by the selection properties of lexical items, but there can be any number of adjuncts. That is, adjuncts can be "iterated" or "repeated."

I sang [with gusto] [on Saturday] [with Mary] [about love] [at the hall]

(8) **Optionality**: Complements are sometimes required, sometimes optional. Adjuncts are always optional.

a. I praised [Mary] (obligatory complement)

b. ?* I praised

c. The moon glows [in the darkness] (optional adjunct)

d. The moon glows

(9) **adjuncts can modify "do so" VPs**:

a. I sang a song with Mary while you did so [with Bill]. (adjunct)

b. * I saw Bill while you did so [Mary]. (complement)

(10) **unlike complements, adjuncts are OK in "do what" pseudoclefts**:

a. What Mary did [with Bill] was sing a song. (adjunct PP)

b. * What Mary did [Bill] was give a book. (complement NP)

(11) **adjuncts can modify coordinated VPs**: (not so useful as a test because of right node raising complements)

Robin [$_{VP}$ wrote a book] and [$_{VP}$ sang three songs] [with Sandy.]

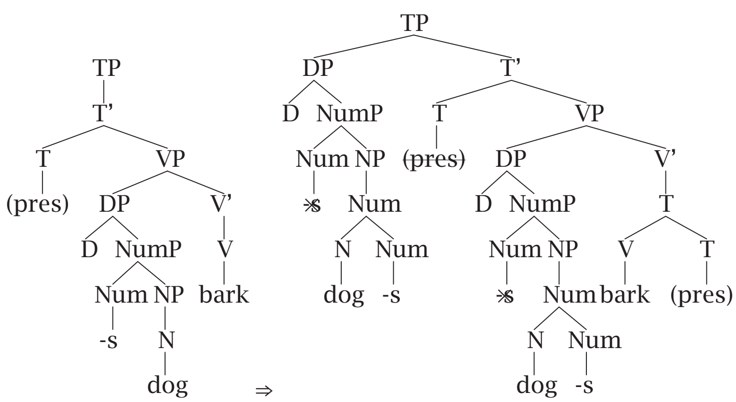
(12) **adjuncts can be left behind in VP-preposing**:

Robin said she would sing a song, and [sing a song] she did, [with Sandy]
* Robin said she would give Mary a book, and [give Mary] she did, [a book]

Usually, these tests provide convergent evidence about the status of any given phrase. When these tests yield different results, it is less clear what to say about the structure.

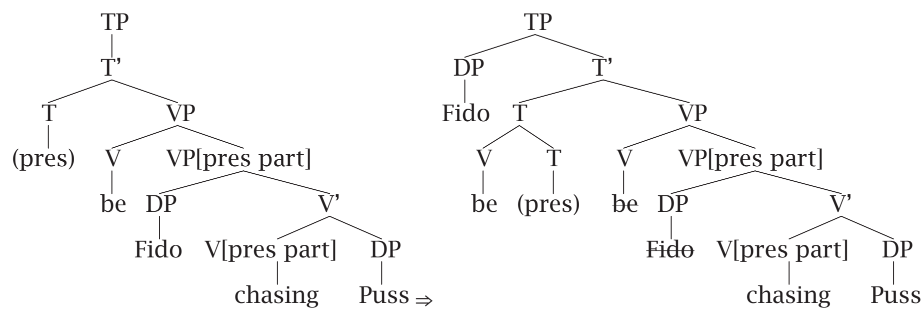
11.5 Movements, etc

We observed that surface structures of sentences do not always respect the principles reviewed in the last section, and so these structure-changed were proposed. We see two instances of **affix hopping** and one instance of **raising to subject** even in simple sentences like *dogs bark*:

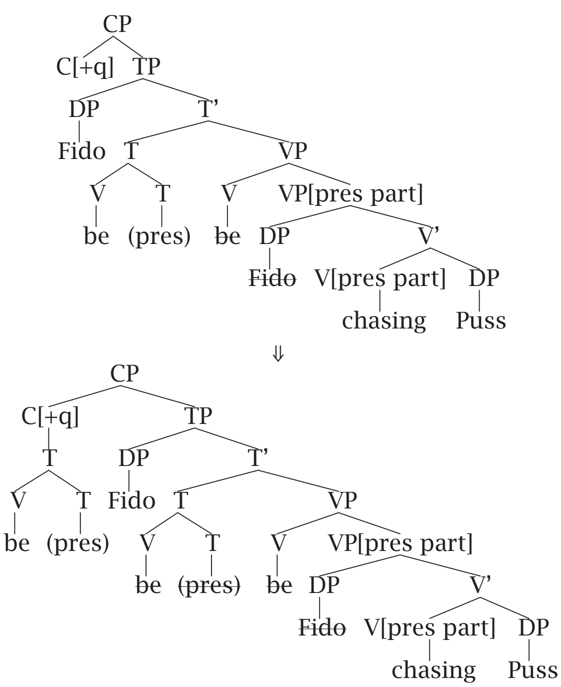


Notice that the projection principle and locality of selection are satisfied by the underlying structure on the left. In particular, the silent present tense affix T is properly selecting V (so it has a VP complement), the plural number affix Num is properly selecting N (so it has an NP complement), and the V *barks* selects a subject DP. Affix hopping moves the tense and number affixes, and subject raising moves the subject to specifier of TP to satisfy EPP.

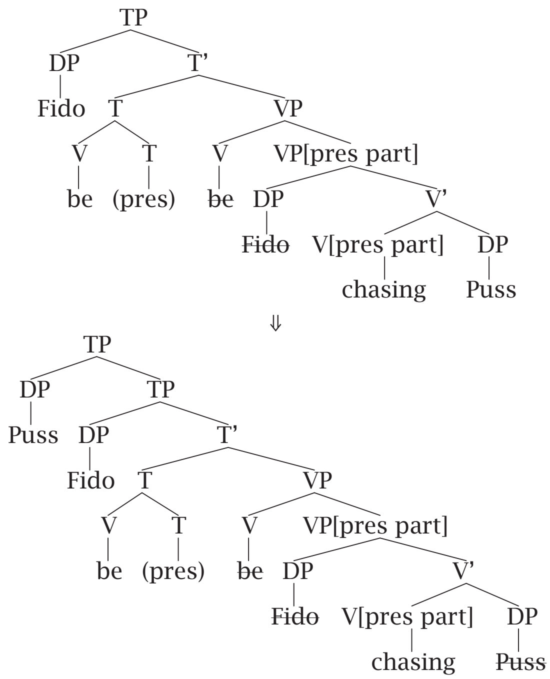
Auxiliary verbs seem to be "lighter" than other English verbs: they can move up to a tense affix (instead of requiring the tense affix to "hop" down to them). We see this in examples like this, where *be+(pres)=is*:



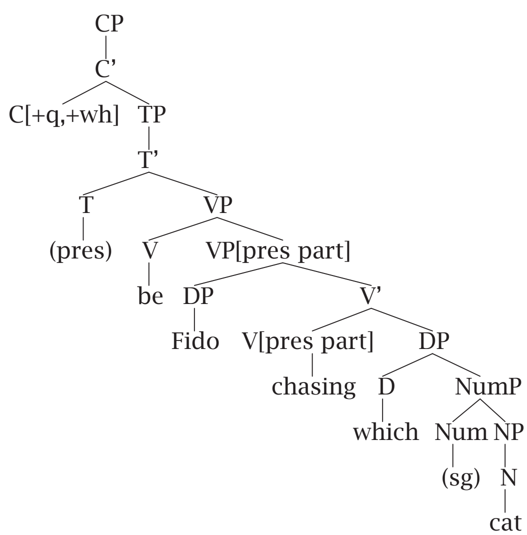
The structure on the right above can appear in a question context, and then T-to-C (subject-auxiliary inversion) can apply:



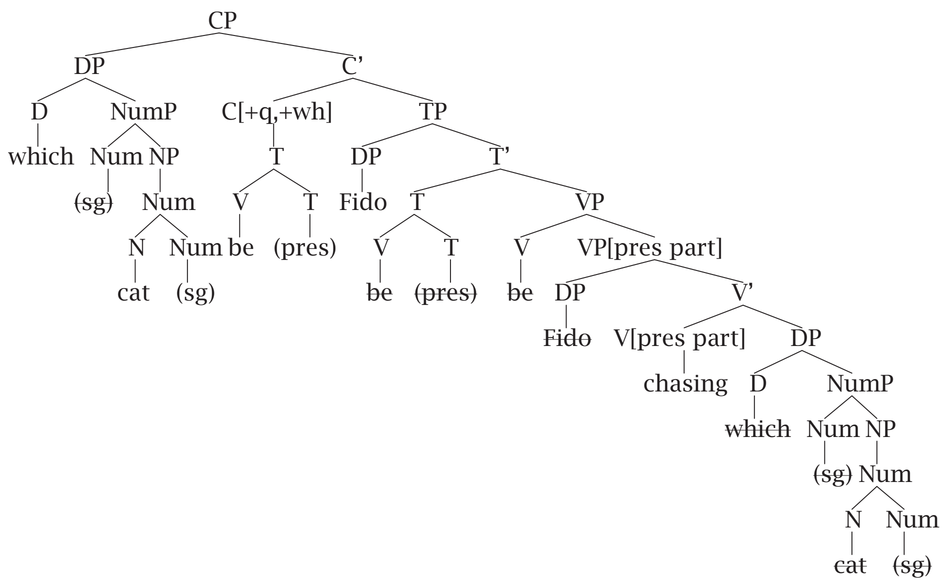
Another thing that can happen to our structure for *Fido is chasing Puss* is that the object can be **topicalized** to get *Puss, Fido is chasing*:



We also briefly considered wh-questions. We have argued that the wh-question properties must be associated with C, since some verbs like *wonder* select only wh-complementizers. So for example, suppose we start with the following underlying structure:



After V-to-T, T-to-C, affix-hopping, raising-to-subject, and wh-movement, we can derive:



We have also discussed deletion rules (**VP-ellipsis**) and insertion rules (**do-support, expletive insertion**).

11.6 Binding theory

Binding theory restricts how DPs can be interpreted. We indicate "coreferential" DPs by co-indexing them:

(13) * She$_i$ likes Mary$_i$

(14) * They$_i$ like them$_i$

(15) They$_i$ like each other$_i$

(16) They$_i$ like themselves$_i$

Expressions like *Mary* or *the student* are called **R-expressions**, because they are independently Referential. Expressions like *each other* are called **reciprocals**, and expressions like *herself, themselves* are called **reflexives.** Reflexives and reciprocals are both **anaphors.** Expressions like *she* and *her* are **pronouns.** R-expressions, pronouns, and anaphors have different interpretive restrictions. We formulated them this way:

(17) Node X **c-commands** node Y if a sister of X dominates Y.

(18) A DP is **bound** just in case it is interpreted as coreferential with a c-commanding DP.

(19) The **domain** of a DP is the part of the structure that is contained in all the same XPs with a subject: the smallest XP with a subject that contains the DP.

A. An anaphor must be bound in its domain

B. A pronoun must be free (= not bound) in its domain

C. An R-expression cannot be bound.

We never really settled the question of whether binding theory applies to underlying structures or to surface structures, but we looked at several examples which suggested that it should apply to underlying structure.

11.7 Solved exercises

We have discussed a fairly wide range of structures now, and we have proposed principles that apply to them. Since the language is recursive, there is an infinite range of structure that we can ask about. That's why all the exams can be "open book"! It's completely easy to think of structures that our principles apply to but that we have not discussed. The best test of your understanding involves considering structures that are rather different than any we have discussed in the notes or in class. Let's consider just a few more exercises here.

(20) Draw the morphological structure of the word *postmodernism*, and provide lexical entries for each of its morphemes (you don't need to include semantic info in the lexical entries).

(21) Draw the underlying syntactic structure for the sentence

Mary told every student$_i$ *that he*$_i$ *could leave*

and explain whether the indicated interpretation of *he* is allowed by binding theory.

(22) In the structure of (21), is *that he could leave* an adjunct or a complement?

(23) Draw the underlying syntactic structure for the sentence

Mary graded every student$_i$ *before she met him*$_i$

and explain whether the indicated interpretation of *he* is allowed by binding theory.

(24) In (23), is *before she met him* an adjunct or a complement?

(25) Consider the following contrast:

a. John$_j$ came in. He$_j$ was wearing a hat

b. Every student$_j$ came in. *He$_j$ was wearing a hat

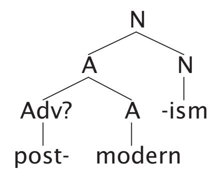
To account for facts like this, hypothesis Q was very briefly mentioned on page 188:

Q. **If a pronoun has a quantified expression as antecedent, the pronoun must be must c-commanded by this antecedent.**

Accepting that the structures in (21) and (23) are both good, do these support hypothesis Q?

Solutions:

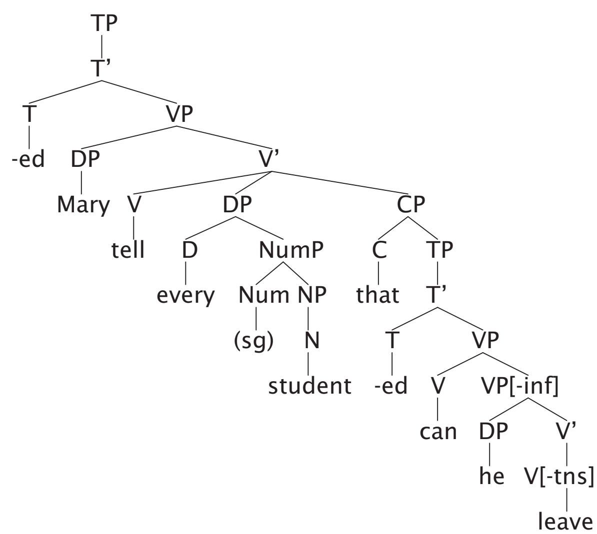
(20) Draw the morphological structure of the word *postmodernism*, and provide lexical entries for each of its morphemes. (You don't need to include semantic info in the lexical entries. We had this exercise earlier but did not solve it).



post-	Adv?	bound	combines with A to form A
modern	A	free	
-ism	N	bound	c-selects A to form N

Notes: For prefixes like *post-*, the RHHR does not help in determining their category. I am guessing that it should be some kind of Adv since various kinds of adverbs sometimes modify adjectives.

(21) Draw the underlying syntactic structure for the sentence *Mary told every student$_i$ that he$_i$ could leave* and explain whether the indicated interpretation of *he* is allowed by binding theory.

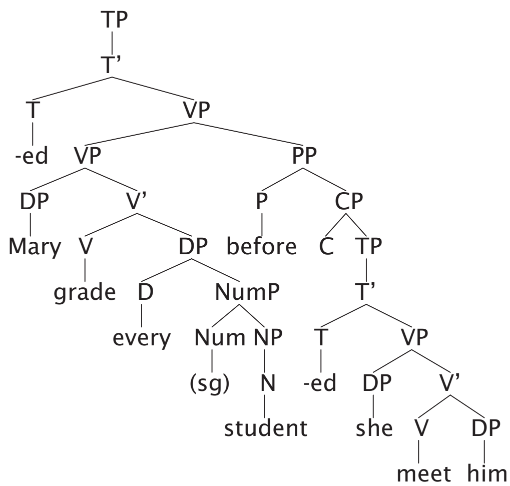


The indicated coreference is allowed by principle B, since the domain of *he* is the VP[-inf] *he leave*, and *he* is free in that domain.

(22) In the structure of (21), is *that he could leave* an adjunct or a complement? a complement

(23) Draw the underlying syntactic structure for the sentence *Mary graded every student$_i$ before she met him$_i$* and explain whether the indicated interpretation of *he* is allowed by binding theory.

I assume *meet+ed=met*. And I assume *before she met him* modifies the VP (but maybe it modifies TP):



The indicated coreference is allowed by binding theory, since the domain of *him* is the VP *she meet him*, and the pronoun *him* is free in that domain as principle B requires.

(24) In the structure of (23), is *before she met him* an adjunct or a complement? an adjunct

(25) The following facts were mentioned on page 188:

a. John$_j$ came in. He$_j$ was wearing a hat

b. Every student$_j$ came in. *He$_j$ was wearing a hat

To account for facts like this, hypothesis Q was very briefly mentioned on page 188:

Q. **If a pronoun has a quantified expression as antecedent, the pronoun must be must c-commanded by this antecedent.**

Accepting that the structures in (21) and (23) are both good, do these support hypothesis Q?

Q is respected by (21), but it is contradicted by (23), because in (23), the pronoun *him* has a quantified expression *every student* as antecedent but it is not c-commanded by that antecedent.

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