Introductory Linguistics

A draft textbook by

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Contents

Preface

This text has been written by me over the years for the course "Linguistics 20: Introduction to Linguistic Analysis", which I teach in my home department at UCLA. The course is meant to be a short introduction to "core" linguistics, by which I mean the analysis of language data using theory. (My department covers broader issues, such as language in society, in a separate course, "Introduction to Language".) To the extent that my text is successful, students will get a clear idea of the goals and character of linguistic analysis and will be well prepared to take on the various subfields of linguistics in later specialized courses.

My text follows mainstream thinking in linguistics in assuming that learning the field is best done through exercises in which students deal with language data, trying to nail down the pattern and express it clearly with rules. The course I teach includes weekly homeworks of this kind; these homeworks include the most ambitious problems. In this text there also 90 Study Exercises; some are interspersed at appropriate moments in the presentation; others are placed in Chapters 8 and 15, meant for pre-midterm and pre-final review. I have arranged the page breaks to make it convenient for students to try to solve the exercises themselves before consulting the printed answer.

The main purpose of the exercises is to help students make the essential transition from passive knowledge (material makes perfect sense when the professor or text explains it) to active knowledge (student can apply the theory in new contexts and make independent assessments). In truth, I also hope that the exercises will be not just a way of achieving control over the material but at least occasionally a source of intellectual pleasure. Most linguists I know enjoy the puzzles presented by language data and I hope that for the reader it will be the same.

My thanks go to the many students who have read through earlier versions of this text, often usefully pointing out errors. I also thank my many teaching assistants for their wisdom and first-hand experience, along with my colleagues Sandra Disner, Craig Melchert, and Jessica Rett for expert advice.

Chapter 1: What is Linguistics?

1. What this book will be like

Linguistics is the science of language; it studies the structure of human languages and aims to develop a general theory of how languages work. The field is surprisingly technical; to describe languages in detail requires a fair amount of formal notation. A good parallel would be the field of symbolic logic, which uses a formal notation to understand the processes of reasoning and argumentation.

There are basically three things I hope you will get out of this book.

First, there is the subject matter itself, which is useful to know for people in many different fields, such as education, psychology, and computation. The course is also an introduction to linguistics for those who are going to major in it.

Second, the course involves some mental exercise, involving analysis of data from English and other languages. I doubt that anyone who doesn't go on in linguistics will remember much of the course material five years after they have graduated, but the analytical skills in which you will get practice will be (I hope) both more permanent and more useful.

Third, the course is intended to give a more realistic view of science and how it proceeds. The reason we can do this in linguistics is that it is a fairly primitive science, without an enormous body of well-established results. Because of this, we are less interested in teaching you a body of established knowledge; rather, our focus is on teaching you to decide what is right on your own, by looking at the data. All sciences are in this state of uncertainty at their frontiers; linguistics can give you a more authentically scientific experience in a beginning course.

2. Implicit and explicit knowledge of language; working with consultants

Linguists are constantly asked the question "How many languages do you speak?" This question is a little irritating, because it is largely irrelevant to what linguists are trying to do. The goals of linguistics are to describe and understand the structure of human languages; to discover the ways in which all languages are alike and the ways in which they may differ. The point is that even if one could speak all 8000 or so of the world's languages, one would not have solved any of the problems of linguistics.

The reason is this: speaking a language and knowing its structure are different things. In speaking a language, one uses thousands of grammatical rules without being aware of them; they are "unconscious knowledge." Linguists attempt to make explicit this unconscious knowledge by looking closely at the data of language. That is, they attempt to make the "implicit knowledge" of native speakers into explicit knowledge.

This goal implies one of the central methods of doing linguistic research, the **consultant session**. Quite often, a linguist will study the structure of language she does not speak; this is done

by finding a native-speaker consultant to provide the data. The linguist normally asks the consultant a great number of questions. Some of them are simple and establish basic knowledge:

(1)   *"What is the word for "duck" in your language?"*

Others look for the various different grammatical forms of the same word:

(2)   *"How would you say "two ducks"?*

(This would be looking, perhaps, for how plurals are formed). Others involve whole sentences and often their meanings as well.

The crucial idea in a consultant session is that the linguist is *thinking about structure*—is making and checking hypotheses. The native speaker is most often trying simply to provide an honest and accurate report of how she speaks the language, and of her intuitions about meaning and other matters.

Obviously, the lines can be blurred a bit: sometimes the consultant (especially if she knows some linguistics), may want to suggest some hypotheses herself. And linguists sometimes "work on themselves," so that the dialogue across the consultant table becomes an internal dialogue in the mind of the linguist.[1]

The following example illustrates the method: for one particular area of English grammar, we get some native speaker intuitions, and work out a series of hypotheses for what the rules of English are. We'll assume without comment that we are working with a native speaker of English, and indeed, I believe that the data below are characteristic of intuitions of English native speakers.

The point of the analysis will be to illustrate a consistent truth about linguistics: *the native speaker consultant doesn't know the answer*. You cannot effectively ask the consultant to provide the linguistic analysis. However, the native speaker does have the tacit, intuitive knowledge that makes it possible to find the answer, or at least to get closer to it.

3. The reference of *each other*

In the sentence (3), a native speaker of English is likely to tell you that *each other* refers to *we*, and that it means something like, "I like you and you like me."

(3) We like each other.
(4) Alice and Sue like each other.

In linguistics this is often called the **reciprocal reading**; i.e. it says we are in a state of reciprocal liking. Sentence (4) has a similar reciprocal reading.

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[1] In practice I and probably other linguists find this hard to do; it's just too much going on in your head at once. More important, it poses methodological problems; the data are likely to be contaminated by wishful thinking.

Sentence (5) is a bizarre sentence, in that *each other* cannot logically refer to *I*.

(5)   *I like each other.

The native speaker responds to it by saying, "That's weird/that's bizarre/you can't say that in English." We will say for present purposes that (5) is **ungrammatical**; that is, ill-formed. Following standard practice, I will place an asterisk before sentences that are ungrammatical

   In (5), the ungrammaticality can be traced to the absence of any plausible interpretation for the sentence; since *each other* describes reciprocal actions, like this:

(6)   X   Y

      X   Y
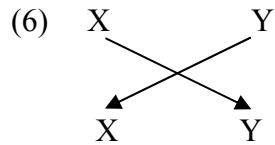
Each other cannot be used unless the agent of the action is plural. But not all cases can be explained in this way. In (7), you can think of a meaning that the sentence could in principle have, but this meaning is not allowed by the rules of English grammar (think through what this meaning would be, then check yourself by reading this footnote[2]):

(7)   *Alice and Sue think I like each other.

   In other words, being grammatical and having a sensible meaning are two different things.

   Sentence (7) shows the same thing: you can think up two logically possible meanings, but only one meaning is allowed by the rules of English.

(8)   We believe they like each other.

Again, reason it through for yourself then read the footnote.[3]

   We've now reached our basic point: there must be some rule of English that accounts for what *each other* can refer to, but it is a tacit rule. No one can look inside their mind to find out what the rule is; one can only look at the data and try to figure the rule out. Linguists have worked on this particular rule for some time, and have gradually made progress in stating the rule accurately. But we cannot claim to have a final answer.

   I will present a partial answer here. We will need two preliminary definitions, both of which will come up later on in the course. Here is the first one:

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   [2] John thinks I like Bill and Bill thinks I like John.

   [3] Possible meaning: if *they* refers, for instance to Bill and John, then *We believe that Bill likes John and John likes Bill.* Impossible meaning: *I believe that John and Bill like you and you believe that John and Bill like me*.

(9) *Defn.:* **clause**

    A **clause** is either a whole sentence or a sentence within a sentence

You can identify clauses because they generally have a subject and a verb, and they express some sort of proposition. We depict clauses by drawing brackets around them; labeled "S" for "sentence".

(10) [We like each other.]$_S$
(11) [John and Bill like each other.]$_S$
(12) *[I like each other.]$_S$
(13) *[John and Bill think [I like each other.]$_S$]$_S$
(14) [We believe [they like each other.]$_S$]$_S$

Note that clauses can have clauses inside them. In (13), there is a clause that expresses the content of John and Bill's thoughts (*I like each other*), and the whole thing is an (ungrammatical) clause that describes a state (John and Bill are having a particular thought.)

    We also need to define **noun phrases**.

(15) *Defn.:* **noun phrase**

    A **noun phrase** is a complete syntactic unit that refers to a thing or a set of things.

    So, in (10), *we* is a noun phrase, and *each other* is a noun phrase. In (7), *John and Bill* is a noun phrase[4] and again so is *each other*.

    With these definitions, we can write a tentative rule for what *each other* refers to:

(16) ***Each other* reference rule**

    Each other can refer only to noun phrases that are inside the smallest clause containing it.

    Like all proposed linguistic rules, this should be applied with great care, checking to see if it works. We can make our work more careful with appropriate graphics, like underlining the noun phrases and putting brackets around the clauses. Let's give it a try.

    Consider first (14), *We believe they like each other*. We want *each other* to refer only to *they*, and not to *we*. We can underline and bracket in the appropriate way, and try drawing arrows indicating candidates for the reference of *each other*, like this:

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    [4] Also, as a matter of fact, *John* is a noun phrase, and *Bill* is a noun phrase; they are noun phrases inside a bigger noun phrase. We will see quite a bit of this later on.

(17)   [We believe [they like each other.]ₛ]ₛ
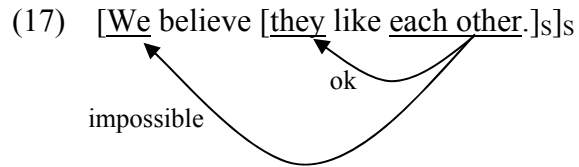
Since the smallest clause containing *each other* is the smaller one, and it contains the noun phrase *they*, the theory predicts that *each other* should be able to refer to *they* and not to *we.* This seems to be correct; i.e. so far the theory is working.

Considering next *John and Bill think I like each other.* I suggest at this point you jot down the structure yourself (brackets, underlines, arrows), and check what you wrote against what you see in (18) on the next page.

(18) *[John and Bill think [I like each other.]$_S$]$_S$

impossible   impossible

Why is this sentence ungrammatical? The reasoning here is more subtle. *Each other* cannot refer to *John and Bill* because of the Each Other Reference Rule, which permits it only to refer to noun phrases inside the smallest clause that contains it. But then why not let *each other* refer to *I*? Here, we run into the semantic restriction we saw earlier: *each other* can only refer to plural noun phrases. So no matter how you attempt to interpret *each other*, the sentence gets blocked, and in the end it is simply ungrammatical.

Cases (10)-(12) are easy: there is only one noun phrase for *each other* to refer to, and the rule permits this.

3.1 Ambiguous sentences with each other

Notice that in a sentence with just one clause, but two noun phrases in addition to *each other*, there will be two possibilities for what *each other* might refer to:

(19)   [We wrapped the ropes around each other.]$_S$

ok

ok
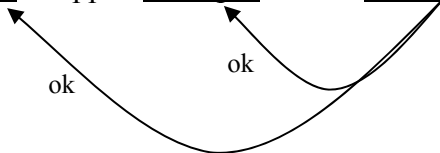
This is just what the Each Other Reference Rule predicts. Because of this, the sentence has two possible meanings. Try making up similar cases (a few are given in the footnote[5]).

4. The role of implicit noun phrases

Here are some further relevant data, which are perhaps syntactically the most interesting:

(20)   [We consulted two detectives in order [to find out about each other]$_S$]$_S$

(21)   [They seem to us [to like each other]$_S$]$_S$

These sentences are mysterious: it looks like there is no noun phrase at all that occurs inside the smallest clause containing *each other* (other than *each other* itself). But consider the meaning of the sentences: *someone* is doing the finding out in (20), namely, "we", and *someone* is doing the liking in (21), namely "they". Thus, the peculiar clauses *to find out about each other* and *to like each other* appear to have **implicit noun phrases**. They have a meaning, but they're not pronounced.

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[5] *We assigned the representatives to each other. We instructed Fred and Sue on behalf of each other.*
Alice and Sue introduced the students to each other's mother. We prepared the cannibals for each other.

For purposes of analyzing explicitly, let us fill them in, inserting overt noun phrases that designate what the implicit noun phrases mean:

(22)   [We consulted two detectives in order [(we) to find out about each other]$_S$]$_S$

(23)   [They seem to us [(they) to like each other]$_S$]$_S$

With the implicit subjects filled in, we can explain what is going on. The *Each Other* Reference Rule needs slight revising:

(24) **Each Other Reference Rule (revised)**

   Each other can refer only to noun phrases (including implicit noun phrases) that are inside the smallest clause containing it.

So now, to apply the Each Other Reference rule properly, we need to evaluate the reference of implicit noun phrases. Here is an analytic diagram for sentence (20):

(25) [We consulted <u>two detectives</u> in order [(<u>we</u>) to find out about <u>each other</u>]$_S$]$_S$

We will do more on this kind of rule later. The major gap in the analysis as given so far is that we haven't said anything about what causes the implicit noun phrase to take on a particular meaning—for instance, why does the implicit noun phrase in (25) have to mean *we*, and not *two detectives*? This would lead us into a different area of English grammar, covering the implicit noun phrase behavior of the phrase *in order to* and many other grammatical constructions.

The example also makes a general point about analytic practice in linguistics: linguists are, in general, willing to go out on a limb and propose structural analyses that include inaudible entities like implicit noun phrases. Such analyses are always more controversial, since they rest on inference rather than directly observable facts. But they can be supported, notably by referring to the meaning of sentences and to the overall coherence of the language system that they make possible.

4.1 Each other: the bottom line

I've gone into the example in a little bit of depth for two reasons. First, it should give you a flavor of linguistic analysis: we assume that utterances have structure, like clauses and noun phrases and implicit noun phrases. We also assume that the language has rules, like the Each Other Reference Rule. Much of the work of linguistics involves analysis, finding out the structures and rules that do justice to the facts of a language.

The other main point so far concerns the question of unconscious knowledge. Any native speaker of English will have the intuitions about grammaticality and other matters that we, as linguists, use to justify our analysis. Thus, knowing English means that you "know" the Each Other Reference Rule, in an intuitive, unconscious sense. But it does not mean that you know it explicitly. There is no English speaker on earth who can just "look inside her head" and say what the rule is. The only way to make progress on language structure is the more indirect way laid out here: we make hypotheses about structure and about rules, then refine and improve them as we encounter more language data. The procedure is actually much the same as in other sciences: we gather data (here, from the native speaker) and formulate hypotheses. The hypotheses make predictions about what we will find in new data, which we can then gather. Sometimes the new data makes our hypotheses look good, increasing our confidence; sometimes the new data is problematic for our hypotheses, forcing us to modify them or even abandon them and try something else. With patience, we can achieve gradual progress; though we cannot directly access the speaker's unconscious knowledge of her language, our repeated inquiries can achieve an ever better approximation of it.

In the long run, we want linguistics (like any well-established science) to have strong *predictive capacity*. With a really good theory, we can make an accurate prediction about the intuitions of a native speaker about a sentence before we ever elicit it. This is a hard goal and unlikely to be achieved very soon.

5. The field of linguistics

With this background, here is a (somewhat narrow) definition of the field of linguistics: it is the study of the (largely implicit) knowledge people have when they speak a language. Some of the subfields of linguistics are the following:

Syntax   study of rules for forming sentences
Semantics   study of rules for meaning
Morphology   study of rules for forming words
Phonology   study of rules of pronunciation

In all cases, the "rules" are of the kind known implicitly by native speakers, not the kind learned in school. Linguistics has two other major subfields that also involve rules but are not as directly focused on them: **phonetics**, which studies how sounds are produced and perceived, and **historical linguistics**, which studies how languages change and evolve.

Linguists attempt to arrive at explicit knowledge of all the world's languages. I should point out that this task will never be completed. First, there are over 8000 different languages, many of which are spoken in remote areas of the world.[6] More important, the amount of explicit knowledge contained in just a single language would fill a whole library. Linguists find it both frustrating and astonishing that a small child can acquire implicitly in just a few years the same knowledge that takes decades of hard work for linguists to figure out explicitly.

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[6] The best directory to the world's languages is the *Ethnologue*, on line at http://www.ethnologue.com/.

Linguists are also interested in developing a general theory of language; a theory of the properties that all languages share. These are called **linguistic universals**. Finding universals is also challenging; many linguists have the experience of having proposed a linguistic universal, only to find out later on about languages that don't fit in.

6. What's this about "native speakers"?

I mentioned native speakers at the start of this chapter and would like to fill in a bit of information for why native speakers are considered important in linguistics.

A native speaker, to give a very strict definition, is someone who has heard their language continuously since birth, learned it in the natural way from exposure (as we say, "at his mother's knee"; "at her father's knee"), and continues to speak it regularly in everyday life, so they stay in practice, as it were. You can be a native speaker of one language (like me), or sometimes of two or more, or of none. The latter usually happens when someone switches languages in mid-childhood.

I wish to emphasize: there are *no value judgments* being made when linguists talk about native speakers! We don't think native speakers are better (or worse) than other people. However, like scientists everywhere, we like our data to be *replicable*: another scientist should be able to conduct the same research and find out if the original results were correct. The native speaker idea is meant to assist replicability. Linguist #1 can say, "the results of this study come from four native speakers of Language X, all of whom speak the dialect characteristic of middle-class inhabitants of city Y." Then, if Linguist #2 wants to carry out further study, or check #1's results, she can go to city Y, find middle-class native speakers, and advance the research program further.

The reason using native speakers as consultants makes this easier is that native speakers tend to be more uniform in their linguistic systems, have more confidence in the forms of their speech, and typically speak their language in its richest and most intricate form. Non-native speakers are more vulnerable to arbitrary, external factors. These include interference from their native language, or the accidents of what sort of data they encountered learning their nonnative language.

Study Exercises for "each other"

The first exercise is a very basic one: finding clauses and implicit subjects. This will matter a lot later on. The others are more directly related to the *each other* phenomenon.

Study Exercise #1

This exercise simply asks you to find the clauses and the Noun Phrases. Put […]ₛ brackets around the clauses and underline the Noun Phrases. Be sure to get all of them. If the subject is implicit, put "( )" where the subject would be and say what it stands for.

Examples:

i.   Alice believes that Fred sang. Answer: [<u>Alice</u> believes that [<u>Fred</u> sang]ₛ]ₛ
ii.   Alice hopes to climb Everest. Answer [<u>Alice</u> hopes [(<u>Alice</u>) to climb <u>Everest</u>]ₛ]ₛ

Exercises:

a.   I believe that turtles can swim.
b.   The fact that Fred left bothers Alice.
c.   Bill said that Jane sang and Fred danced.
d.   I persuaded Fred to buy a telescope.
e.   I promised Fred to buy a telescope.
f.   To appear on television is her fondest dream.
g.   Joe said that he wants to leave.
h.   That Jane can sing tenor makes no difference.
i.   Bill left because he was tired.
j.   the idea that truth is obtainable

Answer to Study Exercise #1

a.   [I believe that [turtles can swim.]_S]_S
b.   [The fact that [Fred left]_S bothers Alice.]_S

   Comment: *the fact that Fred left* is a Noun Phrase with a Noun Phrase inside it; hence double
   underlines. We'll come back to this; but let's not worry about it for a while.

c.   [Bill said that [[Jane sang]_S and [Fred danced.]_S]_S]_S

   Comment: *Jane sang* and *Fred danced* are two simple sentences; *Jane sang and Fred danced*
   is a more complex sentence that expresses what Bill said; and the whole thing is a sentence.

d.   [I persuaded Fred [(*Fred*) to buy a telescope.]_S]_S
e.   [I promised Fred [(*me*) to buy a telescope.]_S]_S
f.   [[(*her*) to appear on television]_S is her fondest dream.]_S
g.   [Joe said that [he wants [(*Joe*) to leave.]_S]_S]_S
h.   [That [Jane can sing tenor]_S makes no difference.]_S
i.   [Bill left because [he was tired.]_S]_S
j.   the idea that [truth is obtainable]_S

   Comment: the whole thing is not a sentence; it's a Noun Phrase; hence the double underlining.
   When people speak, they use a mixture of sentences, noun phrases, interjections, and various
   other linguistic forms.

Study Exercise #2

   This sentence is ambiguous:

   My sister and I gave our parents books about each other.

   Explain each possible meaning and illustrate it with a diagram (brackets and arrows) like the
ones given above.

Answer to Study Exercise #2

My sister and I gave our parents books about each other.

One meaning: "My sister gave our parents books about me and I gave our parents books about my sister."

Other meaning: "My sister and I gave our mother a book about our father and gave our father a book about our mother."

Diagram:

[<u>My sister and I</u> gave <u>our parents</u> books about <u>each other</u>.]_S

ok

ok
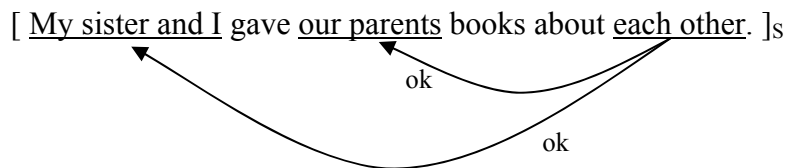
Study Exercise #3

This sentence is ambiguous:

Bill and Fred persuaded Alice and Sue ( ) to buy telescopes in order ( ) to find out more about each other.

For example, in one reading, you could continue: "In fact, as it turned out, Bill succeeded in finding out more about Fred, but Fred did not succeed in finding out more about Bill." In the other reading, you could continue, "In fact, as it turned out, Alice succeeded in finding out more about Sue, but Sue did not succeed in finding out more about Alice."

For each meaning, fill in the implicit subjects shown with ( ). Then draw diagrams for the reference of *each other*. (So you'll end up with two diagrams.)

Answer to Study Exercise #3:

The impossible readings are the ones where *each other* refers to something outside the smallest clause containing it.

[Bill and Fred persuaded Alice and Sue [(*Alice and Sue*) to buy telescopes in order [(*Bill and Fred*) to find out more about each other]s]s]s.

ok

impossible

impossible

[Bill and Fred persuaded Alice and Sue [(*Alice and Sue*) to buy telescopes in order [(*Alice and Sue*) to find out more about each other]s]s]s.

ok

impossible   impossible
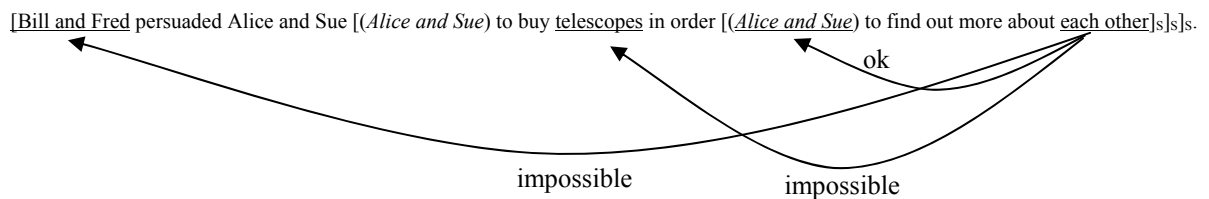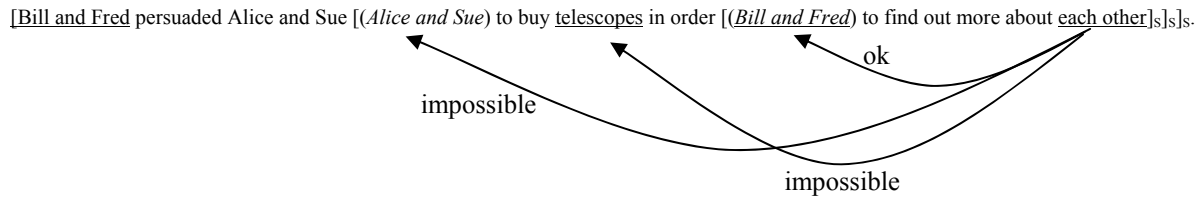
Study Exercise #4

For this sentence:

My parents tell my sister and me every day to write books about each other.

there's only one meaning: "My parents tell my sister every day to write a book about me and tell me every day to write a book about my sister." It can't mean "My mother tells my sister and me every day to write a book about my father and my father tells my sister and me every day to write a book about my mother." Explain why, giving diagrams for both the possible and the impossible meaning.

Answer to Study Exercise #4

The crucial part is to identify the clauses and the implicit subject, which must mean "my sister and me" and not "my parents". Once you've got this, then it follows straightforwardly from the Each Other Reference Rule that *each other* can refer only to *my sister and me*.

[My parents tell my sister and me every day [(my sister and me) to write books about each other]s]s

ok

impossible

Chapter 2: Morphology

1. Orientation

In linguistics, "morphology" means "the study of word structure." We're interested in the structure of individual words, as well as the grammatical rules which which words are formed.

Some of the terminology used here is probably familiar to you. The **stem** of a word is its core, the part that bears its central meaning. Thus in *undeniable*, the stem is *deny*; and in *insincerity* the stem is *sincere*.

Material that is added to the stem, thus modifying its meaning in some way, consists principally of **prefixes** and **suffixes**. The suffix *-able* is suffixed to *deny* to form *deniable*[7]; and the prefix *un-* is added to the result to obtain *undeniable*. Often, multiple prefixes and suffixes can be added to the same stem, producing ever longer and more elaborate words: *undeniability, hyperundeniability*.

Sometimes it is useful to have a term that covers both prefixes and suffixes. The standard word for this is **affix**. More generally still, suppose we want a term that generalizes over stems, prefixes, and suffixes — over all the building blocks from which words are assembled. The standard term here is **morpheme**. It is often defined as follows:

(26) *Defn.*: **morpheme**

A **morpheme** is the smallest linguistic unit that bears a meaning.

In *undeniable*, *un-*, *deny*, and *-able* are the three morphemes. *Deniable* is not a morpheme because it can be split into meaningful *deny* and *-able. De* and *ny* are not morphemes because they are meaningless. More precisely, *de* is a morpheme (it is a prefix, appearing for example in *declassify*, *decompose*, and *delouse*), but is it not a morpheme when it appears in *deny*.

Here is a bit of commonly-used notation. Words are shown broken into their morphemes with hyphens: *un-deni-abil-ity*. And prefixes and suffixes are shown with hyphens to identify them as such: prefixes like *un-*, suffixes like *-ity*. You can think of the hyphen as the bit of imaginary "glue" with which a morpheme attaches to the stem.

2. Two kinds of morphology

Most linguists acknowledge at least a rough distinction between two kinds of morphology: **word formation** vs. **inflectional morphology**. We'll start with inflectional morphology.

Inflectional morphology is grammatical morphology. Here are some examples to start, from English:

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[7] We'll ignore the change of *y* to *i*, a convention of English spelling.

- **tense** on verbs (present tense *jump<u>s</u>*, past tense *jump<u>ed</u>*)
- **number** on nouns (singular *cow*, plural *cow<u>s</u>*)
- a small amount of **person and number agreement** in verbs (*She sing<u>s</u>.* vs. *They sing.*)

English is actually not a very good language for studying inflectional morphology, because it doesn't have all that much of it (Mandarin is a similar case). But other languages, such as Swahili, Russian, or Turkish, have a great deal, and students of these languages can spend years learning the complete inflectional system.

3. Morphological analysis

When they encounter an unfamiliar language, linguists often begin their work by carrying out a morphological analysis. This involves gathering data, determining what morphemes are present in the data, and writing the rules that form the words from the morphemes.

The fundamental method for this is as follows: one must scan a collection of morphologically similar words, together with their meanings, and determine which phoneme sequences remain the same whenever the meaning remains the same.

We will do this now for a fairly simple case, namely a fragment of the nominal morphology (=morphology for nouns) in Turkish. Here are the data:

(27) *Turkish morphology data*

1.	el	'hand'	ev	'house'	zil	'bell'
2.	eli	'hand (object)'	evi	'house (object)'	zili	'bell (object)'
3.	ele	'to (a) hand'	eve	'to (a) house'	zile	'to (a) bell'
4.	elde	'in (a) hand'	evde	'in (a) house'	zilde	'in (a) bell'
5.	elim	'my hand'	evim	'my house'	zilim	'my bell'
6.	elimi	'my hand (object)'	evimi	'my house (object)'	zilimi	'my bell (object)'
7.	elime	'to my hand'	evime	'to my house'	zilime	'to my bell'
8.	elimde	'in my hand'	evimde	'in my house'	zilimde	'in my bell'
9.	elin	'your hand'	evin	'your house'	zilin	'your bell'
10.	elini	'your hand (object)'	evini	'your house (object)'	zilini	'your bell (object)'
11.	eline	'to your hand'	evine	'to your house'	ziline	'to your bell'
12.	elinde	'in your hand'	evinde	'in your house'	zilinde	'in your bell'
13.	elimiz	'our hand'	evimiz	'our house'	zilimiz	'our bell'
14.	elimizi	'our hand (object)'	evimizi	'our house (object)'	zilimizi	'our bell (object)'
15.	elimize	'to our hand'	evimize	'to our house'	zilimize	'to our bell'
16.	elimizde	'in our hand'	evimizde	'in our house'	zilimizde	'in our bell'
17.	eliniz	'your (plur.) hand'	eviniz	'your (plur.) house'	ziliniz	'your (plur.) bell'
18.	elinizi	'your (pl.) hand (obj.)'	evinizi	'your (pl.) house (obj.)'	zilinizi	'your (pl.) bell (obj.)'
19.	elinize	'to your (pl.) hand'	evinize	'to your (pl.) house'	zilinize	'to your (pl.) bell'
20.	elinizde	'in your (pl.) hand'	evinizde	'in your (pl.) house'	zilinizde	'in your (pl.) bell'
21.	eller	'hands'	evler	'houses'	ziller	'bells'
22.	elleri	'hands (object)'	evleri	'houses (object)'	zilleri	'bells (object)'
23.	ellere	'to hands'	evlere	'to houses'	zillere	'to bells'
24.	ellerde	'in hands'	evlerde	'in houses'	zillerde	'in bells'
25.	ellerim	'my hands'	evlerim	'my houses'	zillerim	'my bells'
26.	ellerimi	'my hands (obj.)'	evlerimi	'my houses (obj.)'	zillerimi	'my bells (obj.)'
27.	ellerime	'to my hands'	evlerime	'to my houses'	zillerime	'to my bells'
28.	ellerimde	'in my hands'	evlerimde	'in my houses'	zillerimde	'in my bells'
29.	ellerin	'your hands'	evlerin	'your houses'	zillerin	'your bells'
30.	ellerini	'your hands (obj.)'	evlerini	'your houses (obj.)'	zillerini	'your bells (obj.)'
31.	ellerine	'to your hands'	evlerine	'to your houses'	zillerine	'to your bells'
32.	ellerinde	'in your hands'	evlerinde	'in your houses'	zillerinde	'in your bells'
33.	ellerimiz	'our hands'	evlerimiz	'our houses'	zillerimiz	'our bells'
34.	ellerimizi	'our hands (obj.)'	evlerimizi	'our houses (obj.)'	zillerimizi	'our bells (obj.)'
35.	ellerimize	'to our hands'	evlerimize	'to our houses'	zillerimize	'to our bells'
36.	ellerimizde	'in our hands'	evlerimizde	'in our houses'	zillerimizde	'in our bells'
37.	elleriniz	'your (pl.) hands'	evleriniz	'your (pl.) houses'	zilleriniz	'your (pl.) bells'
38.	ellerinizi	'your (pl.) hands (obj.)'	evlerinizi	'your (pl.) houses (obj.)'	zillerinizi	'your (pl.) bells (obj.)'
39.	ellerinize	'to your (pl.) hands'	evlerinize	'to your (pl.) houses'	zillerinize	'to your (pl.) bells'
40.	ellerinizde	'in your (pl.) hands'	evlerinizde	'in your (pl.) houses'	zillerinizde	'in your (pl.) bells'

We have here three columns, indicating inflected forms of the three nouns meaning "hand", "house", and "bell". Abbreviations and grammatical conventions are as follows:

- "plur." or "pl." abbreviate "plural".
- "your (pl.)" is second person plural. Here, as a possessive, it means "belonging to you, there being more than one of you."

- (object) or (obj.) means that that form would be used as the **object** of a verb. Thus, if one were to say in Turkish something like "I saw my hand", one would use #3, *eli*.[8]

4. Breaking up the words into morphemes

The search, as always, is for invariant form paired with invariant meaning. In the first column of (27), every single form begins with the sounds *el* and has a meaning involving "hands". It seems inconceivable that "hand" could be anything other than *el*, or that *el* could be anything other than "hand"—note in particular the first line, where *el* by itself means "hand" by itself.

4.1 Finding the stems

The columns for "house" and "bell" are completely identical to the column for "hand", except that where column has *el*, columns 2 and 3 have *ev* and *zil* as stems. It is plain that *ev* means "house" and *zil* means "bell".

Moving on, we can compare:

1. el   'hand'
2. eli   'hand (object)'
3. ele   'to (a) hand'

Subtracting out *el* from the second and third forms, it appears that *-i* and *-e* must be suffixes. We can confirm this by casting an eye over the remainder of the data: *-e* "goes together" with the English word "to" given in the translations; and likewise *-i* with "(object)".

4.2 Case

The *-e* and *-i* suffixes apparently denote the grammatical role that the noun plays in a Turkish sentence, a phenomenon called **case**. Let's briefly digress with the basics of case.

- Case is fundamentally an inflectional category of nouns (though often adjectives and articles agree with their noun in case).
- Case tells us, intuitively, *who is doing what to whom* — it identifies the basic semantic roles of the participants in a clause. In many languages, "Man bites dog" is Man-nominative bites dog-accusative", and "Dog bites man" is "Dog-nominative bites man-accusative." Nominative and accusative are probably the two most common cases.
- Case is not the only way to show who is doing what to whom. In languages with no case, or ill-developed case systems (English), the work done by case is taken over by strict word order and by prepositions.[9]

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[8] Thus the reference source on Turkish I'm using gives the sentence

Beş   adam   heykel-**i**   kırdi
five   man   statue-**accusative** broke
'Five men broke the statue'

• Some typical cases in languages (each language is different in its cases and their usage):

  ➢ **Nominative**, usually for subjects of sentences or the citation form of a word
  ➢ **Accusative**, usually for objects of verbs
  ➢ **Dative**, conveying the notion of "to" in English: *I gave the book to the student*.
  ➢ **Locative**, conveying the notion of "at", "in", "on", etc.

There are many other cases; Finnish is analyzed as having fifteen. This isn't really that remarkable, since many of these are simply that way of expressing notions that are expressed in other languages by prepositions.[10]

In Turkish:

  ➢ *-e* is the suffix for the dative case
  ➢ *-i* is the suffix for the accusative case
  ➢ *-de* is the suffix for the locative case.

4.3 Plural

That covers the cases. Then, if we further inspect the data in rows 21-40 of (27), it is plain that every **plural** noun has the suffix *-ler*.

4.4 Possessive suffixes

Lastly, there is a set of **possessive suffixes**, which express essentially the same information as what in English is expressed by possessive pronouns like *my* and *your*.[11] There are four possessive suffixes present in the data (Turkish has more, but these are not included here.)

  ➢ *-im*   'my'
  ➢ *-in*   'your'
  ➢ *-imiz*   'our'
  ➢ *-iniz*   'your-plural'

We can classify the possessive suffixes on the dimensions of **person** and **number**. Number, in this context, is simply the distinction between singular vs. plural. Person takes (as a first approximation) three values:

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[9] Still other ways exist—in Tagalog, much of this information is given using prefixes or suffixes on the verb.

[10] Or their counterpart, postpositions, which follow their object noun phrase.

[11] Their usage is not quite the same, because if there is a noun possessor, you use the suffix *as well*. Thus, in English, we say (for example) *Ayşe's bell*; but in Turkish *Ayşe-nin zil-si*, which is literally *Ayşe's bell-her*; similarly *biz-im zil-imiz*, literally "us's bell-our".

- "**First person**" refers to pronouns and grammatical endings that involve the speaker, either alone or with others. Thus in English *I* is a first-person singular pronoun, *we* is first person plural.

- "**Second person**" refers to pronouns and grammatical endings that involve the hearer, either alone or with others. In Spanish *tú* is a second-person singular pronoun, used to address one person, and *vosotros* is a second-person plural pronoun, used to address more than one person.[12]

- "**Third person**" refers to pronouns and grammatical endings that involve neither the speaker nor the hearer. Thus *he/she/it* are third-person singular pronouns, *they* third person plural.

4.5 Hyphens and glosses

Once we've found all the parts, we can restate the original data, putting in **hyphens** to separate out the morphemes. I'll do this just for the "hand" forms. I've also add a morpheme-by-morpheme translation, also separated out by hyphens; this is called a **gloss**. Glosses are a sort of micro-translation; they are meant to clarify structure, rather than give an idiomatic reading.

	Word	*Gloss*	*Idiomatic translation*
1.	el	'hand	'hand'
2.	el-i	'hand-acc.	'hand (object)'
3.	el-e	'hand-dative	'to (a) hand'
4.	el-de	'hand-locative'	'in (a) hand'
5.	el-im	'hand-1 sg.	'my hand'
6.	el-im-i	'hand-1 sg.-acc.'	'my hand (object)'
7.	el-im-e	'hand-1 sg.-dat.'	'to my hand'
8.	el-im-de	'hand-1 sg.-loc.'	'in my hand'
9.	el-in	'hand-2 sg.'	'your hand'
10.	el-in-i	'hand-2 sg.-acc.'	'your hand (object)'
11.	el-in-e	'hand-2 sg.-dat.'	'to your hand'
12.	el-in-de	'hand-2 sg.-loc.'	'in your hand'
13.	el-imiz	'hand-1 plur.'	'our hand'
14.	el-imiz-i	'hand-1 plur.-acc.'	'our hand (object)'
15.	el-imiz-e	'hand-1 plur.-dat.'	'to our hand
16.	el-imiz-de	'hand-1 plur.-loc.'	'in our hand'
17.	el-iniz	'hand-2 plur.'	'your (plur.) hand'
18.	el-iniz-i	'hand-2 plur.-acc.'	'your (pl.) hand (obj.)'
19.	el-iniz-e	'hand-2 plur.-dat.'	'to your (pl.) hand'
20.	el-iniz-de	'hand-2 plur. -loc.'	'in your (pl.) hand'
21.	el-ler	'hand-plural'	'hands'
22.	el-ler-i	'hand-plural-acc.'	'hands (object)'

---

[12] Standard English doesn't make the distinction between singular and plural in the second person; though many regional dialects have a special plural pronoun, "yall", used whenever the addressee is plural.

23. el-ler-e   'hand-plural-dat.'   'to hands'
24. el-ler-de   'hand-plural-loc.'   'in hands'
25. el-ler-im-i   'hand-plural-1 sg.-acc.' 'my hands (obj.)'
26. el-ler-im-e   'hand-plural-1 sg.-dat.' 'to my hands'
27. el-ler-im   'hand-plural-1 sg.'   'my hands'
28. el-ler-im-de   'hand-plural-1 sg.-loc.' 'in my hands'
29. el-ler-in   'hand-plural-2 sg.'   'your hands'
30. el-ler-in-i   'hand-plural-2 sg.-acc.' 'your hands (obj.)'
31. el-ler-in-e   'hand-plural-2 sg.-dat.' 'to your hands'
32. el-ler-in-de   'hand-plural-2 sg.-loc.' 'in your hands'
33. el-ler-imiz   'hand-plural-1 plur.'   'our hands'
34. el-ler-imiz-i   'hand-plural-1 plur.-acc.' 'our hands (obj.)'
35. el-ler-imiz-e   'hand-plural-1 plur.-dat.' 'to our hands'
36. el-ler-imiz-de   'hand-plural-1 plur.-loc.' 'in our hands'
37. el-ler-iniz   'hand-plural-2 plur.'   'your (pl.) hands'
38. el-ler-iniz-i   'hand-plural-2 plur.-acc.' 'your (pl.) hands (obj.)'
39. el-ler-iniz-e   'hand-plural-2 plur.-dat.' 'to your (pl.) hands'
40. el-ler-iniz-de   'hand-plural-2 plur.-loc.' 'in your (pl.) hands'

5. Classifying the suffixes and discovering order

It is useful at this point to sort all the suffixes discovered according to their function:

Case endings

-i   accusative
-e   dative
-de   locative

Possessive suffixes

-im   'my'
-in   'your'
-imiz   'our'
-iniz   'your-plural'

Plural

-ler

In particular, if you scan the data (now greatly clarified with hyphens and glosses), you can find two important generalizations:

- No word contains more than one possessive suffix, or more than one case.
- Suffix order is invariant, and goes like this:

    Plural *precedes* **Possessive Suffix** *precedes* **Case**.

With a word processor, it's not hard to prove these relationships by lining up the relevant morphemes into columns with tabs. Here the data once more, displayed in this way.

(28)   **Turkish data laid out in columns**

Stem	Plural	Poss.	Case		
1. el				'hand	'hand'
2. el			i	'hand-acc.	'hand (object)'
3. el			e	'hand-dative	'to (a) hand'
4. el			de	'hand-locative'	'in (a) hand'
5. el		im		'hand-1 sg.	'my hand'
6. el		im	i	'hand-1 sg.-acc.'	'my hand (object)'
7. el		im	e	'hand-1 sg.-dat.'	'to my hand'
8. el		im	de	'hand-1 sg.-loc.'	'in my hand'
9. el		in		'hand-2 sg.'	'your hand'
10. el		in	i	'hand-2 sg.-acc.'	'your hand (object)'
11. el		in	e	'hand-2 sg.-dat.'	'to your hand'
12. el		in	de	'hand-2 sg.-loc.'	'in your hand'
13. el		imiz		'hand-1 plur.'	'our hand'
14. el		imiz	i	'hand-1 plur.-acc.'	'our hand (object)'
15. el		imiz	e	'hand-1 plur.-dat.'	'to our hand'
16. el		imiz	de	'hand-1 plur.-loc.'	'in our hand'
17. el		iniz		'hand-2 plur.'	'your (plur.) hand'
18. el		iniz	i	'hand-2 plur.-acc.'	'your (pl.) hand (obj.)'
19. el		iniz	e	'hand-2 plur.-dat.'	'to your (pl.) hand'
20. el		iniz	de	'hand-2 plur. -loc.'	'in your (pl.) hand'
21. el	ler			'hand-plural'	'hands'
22. el	ler		i	'hand-plural-acc.'	'hands (object)'
23. el	ler		e	'hand-plural-dat.'	'to hands'
24. el	ler		de	'hand-plural-loc.'	'in hands'
25. el	ler	im		'hand-plural-1 sg.'	'my hands'
26. el	ler	im	i	'hand-plural-1 sg.-acc.'	'my hands (obj.)'
27. el	ler	im	e	'hand-plural-1 sg.-dat.'	'to my hands'
28. el	ler	im	de	'hand-plural-1 sg.-loc.'	'in my hands'
29. el	ler	in		'hand-plural-2 sg.'	'your hands'
30. el	ler	in	i	'hand-plural-2 sg.-acc.'	'your hands (obj.)'
31. el	ler	in	e	'hand-plural-2 sg.-dat.'	'to your hands'
32. el	ler	in	de	'hand-plural-2 sg.-loc.'	'in your hands'
33. el	ler	imiz		'hand-plural-1 plur.'	'our hands'
34. el	ler	imiz	i	'hand-plural-1 plur.-acc.'	'our hands (obj.)'
35. el	ler	imiz	e	'hand-plural-1 plur.-dat.'	'to our hands'
36. el	ler	imiz	de	'hand-plural-1 plur.-loc.'	'in our hands'
37. el	ler	iniz		'hand-plural-2 plur.'	'your (pl.) hands'
38. el	ler	iniz	i	'hand-plural-2 plur.-acc.'	'your (pl.) hands (obj.)'
39. el	ler	iniz	e	'hand-plural-2 plur.-dat.'	'to your (pl.) hands'
40. el	ler	iniz	de	'hand-plural-2 plur.-loc.'	'in your (pl.) hands'

Study Exercise #5

Reexamine these suffixes and propose a different — finer-grained — analysis.

-im	'my'
-in	'your'
-imiz	'our'
-iniz	'your-plural'

Answer to Study Exercise #5

   -imiz is really *-im + -iz,* and *-iniz* is really *-in + -iz.*

   We can make this work if we give the suffixes slightly more abstract meanings: *-im* doesn't mean "my", but more generally, "first person". *-in* doesn't mean "your", but more generally, "second person". Then, *-iz* means "plural possessor". Singular possessor is indicated by including no suffix.

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6.   Position classes in inflectional morphology

   When we looked at the Turkish data, the primary finding was that the morphemes could be arranged in a linear order, which could be expressed as five slots.

(29)   *Five slots in Turkish morphology*

Stem		*Plural*	*Possessor Person*	*Possessor Number*	*Case*	
el	'hand'	-ler	-im 1st	-iz plural	$\varnothing$	nominative
ev	'house'		-in 2nd		-i	accusative
zil	'bell'				-e	dative
					-de	locative

   In a long word like *ellerimizde* 'in our hands', all five slots get filled:

(30)   *All five slots occupied*

Stem	*Plural*	*Possessor Person*	*Possessor Number*	*Case*
el	*-ler*	*-im*	*-iz*	*de*
hand	plural	1st	plur. poss.	locative

In analysis, words like *ellerimizde* are very useful, since they demonstrate the need for all five slots at once.

   The slots in a system like this are often called **position classes**. Each position is an abstract location in the word, which can be filled by a particular morpheme or set of morphemes. In the analysis given earlier, we derived position classes using blocks of rules, one block per class.

   An important check on a position class analysis is that there should be no contradictions of ordering in the data, if the analysis is correct. We can look through the data and see that (for

example) *-in*, *-iz*, and *-de* never precede *-ler*; that *-iz* and *-de* never precede in; that *-de* never precedes *-iz*; and similarly with the other morphemes.

Position classes can be defined simply by looking at the morphemes and checking their mutual ordering. But the usual picture is that the classes are related to **morphological function**. For example, it's hardly an accident that the two suffixes in the third Turkish slot are both possessor person suffixes. The general principle is: position reflects function.

This said, it should be noted that there are exceptions; the occasional language will take the same function and put some of the morphemes into different positions; or fill a position with morphemes of variegated function. For instance, the Swahili morpheme *cho*, which means roughly "which", gets put in a different position for positive and negative verbs:

(31)   ki-tabu   a-ki-taka-**cho**   Hamisi
         book   SUBJ-OBJ-want-**which**   Hamisi 'the book which Hamisi wants'

         ki-tabu   a-si-**cho**-ki-taka   Hamisi
         book   SUBJ-NEG-**which**-OBJ-want Hamisi   'the book which Hamisi
                                                                  doesn't want'

7. Formalizing with a grammar

Linguists seek to make their analyses as explicit as possible, by expressing the pattern of the language with **rules**. The rules taken together form a **grammar**. We'll start with a very simple grammar for Turkish nominal inflection.

The "architecture" of this grammar is conceptually about as simple as it could be: we'll start with a representation of (roughly) meaning, and set up rules that input this meaning and output sound.

In particular, let's assume that the stem (*el*, *ev*, *zil*, or whatever) comes with **morphological features** specifying its grammatical content. The bundle of features is called the **morphosyntactic representation**.[13] The job of our grammar will be to manifest this content with actual material. For example, we can start out with something like this for #40 from (28) above (on p. 25):

el:[Number:plural, PossessorPerson:2, PossessorNumber:plural, Case:Locative]

The *el* part is the stem meaning 'hand'. The part in [ ] is the morphosyntactic representation. It contains four morphological features:

(32)   Number
         PossessorPerson
         PossessorNumber
         Case

---

[13] Why? We'll see later on: the morphosyntactic representation transfers information over from the syntax to the morphology.

Each feature has a **value**, which is shown by placing it after a colon. So you can read the formula *el*:[Number:plural, PossessorNumber:plural, PossessorPerson:2, Case:Locative] as: "the stem *el*, with a morphosyntactic representation indicating plural Number, plural PossessorNumber, second PossessorPerson, and Locative Case". We'll return later on to the question of where these features come from.

The grammar itself consists of four rules. The order in which the rules are stated is significant and is part of the grammar. Only the first rule is stated in full.

(33) *A Grammar for Inflectional Morphology in Turkish Nouns*

a. Number Rule

Suffix /-ler/ if the morphosyntactic representation bears the feature [Number:plural]

b. Possessor Person Rule

Add a possessor suffix, as follows:

-im   if [PossessorPerson:1person]
-in   if [PossessorPerson:2person]

c. Possessor Number Rule

Add a possessor suffix, as follows:

-iz   if [PossessorNumber:plural]

d. Case Rule

Add a case suffix, as follows:

-i   if [Case:Accusative]
-e   if [Case:Dative]
-de   if [Case:Locative]

The reason that the rules must apply in the order given is that by doing this, we construct the word from "inside out", adding a bit more to the material we've already accumulated. This "inside out" character will be shown immediately below.

You can show how the rules apply to a particular form by giving a **derivation**. In linguistics, a derivation shows each rule applying in succession, and justifies the rules by showing that they correctly derive the observed forms. You've probably seen something like a derivation before, as similar devices are used for proofs in math or illustrate an inference in logic — each line is "justified" by the rule that is applied.

For the Turkish form *ellerinizde* 'in your (plur.) hands' (#40 in the data of (27) above), the derivation would look like this:

(34) **Morphological derivation for *ellerinizde***

el:[Number:plural, PossPers:2, PossNum:plural, Case:Locative]   'hand' with its
                                                       morphosyntactic representation

*el**ler***:[**Number:plural**, PossPers:2, PossNum:plural, Case:Locative]   Number Rule

*eller**in***:[Number:plural, **PossPers:2**, PossNum:plural, Case:Locative]   Possessor Person Rule

*ellerin**iz***:[Number:plural, PossPers:2, **PossNum:plural**, Case:Locative]   Possessor Number Rule

*elleriniz**de***:[Number:plural, PossPers:2, PossNum:plural, **Case:Locative**]   Case Rule

At each stage, the relevant rule "sees" the right feature, and adds the appropriate suffix.

Study Exercise #6

    Derive #34, *ellerimizi* 'our hands-accusative,' starting with an appropriate morphosyntactic representation and using the rules above. Answer on next page.

Answer to Study Exercise #6

el:[Number:plural, PossPers:1, PossNum:plural, Case:Accusative]   'hand' with its
                                                                                                             morphosyntactic representation

*el**ler**:[**Number:plural**, PossPers:1, PossNum:plural, Case:Accusative]*   *Number Rule*

*eller**im**:*[Number:plural, **PossPers:1**, PossNum:plural, Case:Accusative]   Possessor Person
Rule

*ellerim**iz**:*[Number:plural, PossPers:1, **PossNum:plural**, Case:Accusative]   Possessor Number
Rule

*ellerimiz**i**:*[Number:plural, PossPers:1, PossNum:plural, **Case:Accusative**]   Case Rule

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8.   A note on grammars and "turning your brain into a computer"

       The rules of (33) above are the very first *grammar* we have discussed; there will be quite a few more grammars as we proceed.

       Grammars, written with formalized rules, are the lifeblood of linguistics; they are the method that linguists use to make explicit hypotheses that can be tested and improved. The formalization of grammars has a purpose: we want the grammars to be utterly unambiguous, so we can always agree on how the rules apply.

       The role of formalized rules in linguistics is not that different from the role of explicit theory in any other science. The theory is supposed to be *applicable,* capable of making predictions about new data. When the predictions are right, we rejoice; if the predictions are wrong, we go back to the drawing board, either modifying or replacing the theory.

       Students new to formal grammars may need to master a skill that I will facetiously call "turning your brain into a computer": you do nothing but look at the rule and the forms it applies to, and derive the result, as if you were a machine. For a moment, don't think about what the grammar *ought* to be deriving; just follow the rules and see what it *does* derive.[14]

       The payoff for such behavior is that the grammars become tools in our hands; tools for understanding in explicit terms how a language is working. We treat our tools with respect when we take them for what they are, namely, utterly mechanical principles.

       I hasten to add: the need to turn your brain into a computer is temporary. All you want to do, at this moment, is check the outcome and see if it matches the true data of the language. But the other tasks of a linguist are actually quite creative: they include (a) thinking of better rules when the old rules fail; (b) looking at language data to detect the patterns that the rules should be

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[14] This is actually not such a bad skill to cultivate; there aren't all that many people in the world who are capable of following complex instructions to the letter; you can be one of them!

capturing; (c) thinking of new ways (data to elicit in fieldwork, designing experiments) to get the data that will reveal interesting truths about a language. Linguistics is indeed a field that welcomes creativity; the "turning your brain into a computer" bit I've described here occurs only at the stage of checking how the rules apply.

9.   The bigger picture

Grammars like the one we are working on can derive quite a bit of data. It's worth pondering, for instance, how many forms a Turkish noun can have. There are several choices to be made:

- Number: singular or plural, thus **two** possibilities
- Possessor Person: any of **three**: 1, 2, 3 ("his or her")
- Possessor Number: any of **two** (singular, plural)
- Case: nominative (no ending), accusative, dative, locative, plus ablative ("from"), genitive "'s", instrument ("with"), thus **seven** possibilities

Multiplying these out, every Turkish noun can appear in (at least) 2 x 3 x 3 x 7 = 84 forms, of which we covered only 40. It seems likely that Turkish speakers often must produce a new form for a noun, when they haven't heard a particular combination before.

The Turkish nominal system is a fairly simple one; Turkish verbs, for instance, are quite a bit more complex. The most elaborate system I know of is the verbal system of Shona (Bantu, Zimbabwe), where (according to the linguist David Odden), the typical verb has about 10 trillion possible forms. Odden has developed a system that generates these forms using a rather complicated set of rules; most of the complications arise in getting the tones right.

It seems also likely that Turkish children or Shona children must also come up with a grammar; they could not possibly memorize every form of every word. We cannot know — yet — to what extent their grammars resemble our grammars, but the idea that through analysis and research we can get close to what they learn is a central idea of contemporary theoretical linguistics.

10.   The source of morphosyntactic representations

The discussion in the last chapter showed how we can write a set of rules that create morphologically well-formed words through the successive addition of prefixes and suffixes by rule. But what do these rules *apply to*? There are various answers given by various linguists; here, we will examine just one fairly representative one.

The idea is that the syntax of a language builds up a feature structure for every stem that appears in a sentence. Here are the data we address:

I jump.   We jump.
You jump.
He/she/it/Fred jump**s**.   They jump.

The suffix -*s* is seen, and only seen, when the subject is one of the pronouns he/she/it, or a singular noun phrase. This indicates the fact that in English the verb "agrees with" its subject. A simple way to do this syntactically is to set up a rule that copies the morphosyntactic features of the subject onto the verb. Specifically, in a sentence like *Fred jumps* this rule must cause the features [Person:3, Number:Singular] to appear on the stem *jump*. Looking ahead to syntax, we can draw a syntactic structure[15] and the process of agreement:

(35)
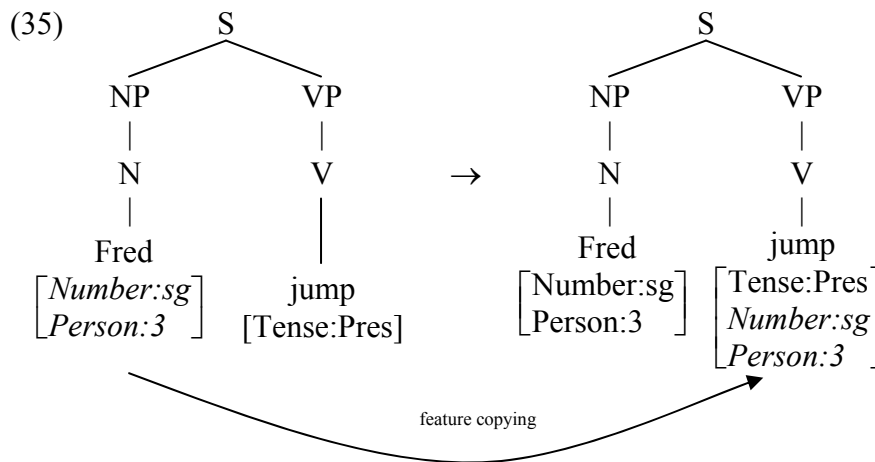
We can assume that *Fred* is inherently [Number:sg, Person:3], since it is a proper name. The [Tense:Pres] must be assumed at the start as well, since it is part of the meaning of the sentence.

The operation above is part of syntax. Once the rules of the morphology get to apply, the presence of these feature will cause a suffixation rule to apply, which attaches the suffix that we spell -*s*. Here is a sample rule:

(36) **3rd Sing. Present Rule**

Suffix -*s* when the morphosyntactic representation contains
[Tense:Pres,Person:Sing.,Number:3].

In sum, we have quite a bit of descriptive work to do in a complete grammar: the **syntactic component** arranges words in correct order and builds up the morphosyntactic representations, while the **morphological component** refers to the morphosyntactic representation in order to add the appropriate affixes.[16]

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[15] This is looking ahead, so don't be alarmed if the diagrams aren't clear. To clue you in a bit: S = Sentence, NP = Noun Phrase, VP = Verb Phrase, N = Noun, V = Verb, vertical line means "is part of".

[16] The definition of the term "affix" was given on p. 18.

11. German inflection: more than one feature per morpheme

Consider the person-number endings of German, in the present and past:[17]

(37) *A German verb paradigm*

Present   **Past**

1 sg.	ich warte	'I wait'	ich wartete	'I waited'
2 sg.	du wartest	'you-sg. wait'	du wartetest	'You waited'
3 sg.	sie/er wartet	'she/he waits'	sie/er wartete	'she/he waited'
1 pl.	wir warten	'we wait'	wir warteten	'we waited'
2 pl.	ihr wartet	'you-plur. wait'	ihr wartetet	'you-plur. waited'
3 pl.	sie warten	'they wait'	sie warteten	'they waited'

First, a bit of terminology I'll be using more later on: a **paradigm** is a table like (37) in which the rows and columns reflect inflectional features and the cells of the table contain the same stem inflected for the relevant features. Paradigms are a great way to display morphological data and are commonly used in linguistics.

Looking at the paradigm of (37), we find a tricky issue: is the stem *warte*, with endings like -(zero), *-st, -t, -n, -t, -n*; or is it *wart*, with endings like *-e, -est, -et, -en, -et, -en*? Further evidence[18] indicates that the second is correct. Here are the forms broken up into position classes (shown with vertical alignment):

(38) *The same paradigm arranged as position classes*

Present   **Past**

1 sg.	ich	wart	e	ich	wart	et	e
2 sg.	du	wart	est	du	wart	et	est
3 sg.	sie/er	wart	et	sie/er	wart	et	e
1 pl.	wir	wart	en	wir	wart	et	en
2 pl.	ihr	wart	et	ihr	wart	et	et
3 pl.	sie	wart	en	sie	wart	et	en

The first thing to notice here is that unlike in Turkish, we are not going to be able to put forth an analysis in which the inflectional rules mention just one feature each—that is, with endings for person, endings for number, and endings for tense. Rather, German "bundles" the features, in the sense that one single suffix manifests more than one feature at a time. Thus, for instance, the suffix *-est* is simultaneously the realization of second person and singular number. As a result, in the

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[17] I'm glossing over some inessential complications arising from the fact that the stem *wart* ends in a [t].

[18] Notably, the imperative is just the plain stem: *Wart!* (wait).

analysis below, I have mostly written rules that mention more than one feature at a time. For the six person/number *combinations*, one needs (at least six rules). Here is a grammar:

(39) *Rules for verbal inflection in German*

I. Tense Marking

Suffix *-et* when the morphophosyntactic representations contains [Tense:Past]

II. Person/Number Marking

Suffix:

-e if [Person:1, Number:Singular]
-st if [Person:2, Number:Singular]
-e if [Tense:Past, Person:3, Number:Singular]
-et if [Tense:Present, Person:3, Number:Singular]

-en if [Person:1, Number:Plural]
-et if [Person:2, Number:Plural]
-en if [Person:3, Number:Plural]

In fact, things are even more complicated than this. In precisely one place in the system—the 3rd person singular—the person-number ending is different in the past than in the present. The analysis takes account of this with the rules in boldface, which mention three features at once. Systems of inflectional morphology are well known for including asymmetries of this kind.

English has a very similar case: the *-s* of *jumps*, seen above, simultaneously manifests [Number:Singular, Person:3, Tense:Present]. In fact, such "tangling" is found in languages all over the world.

Subparadigms often involve **partial overlap**: thus, the German present and past verb paradigms overlap in all but the third singular. From the viewpoint of rules, this is because it is only in the third singular that the rules are sensitive to tense.

12. What are the characteristic inflectional categories?

Every language has a set of inflectional categories, though the sheer amount of inflection can vary quite a bit. Mandarin Chinese has very little; Turkish and Finnish are quite richly inflected; English is closer to the Mandarin end of the scale.

Each inflectional category is expressed (in the theory we are using) as a feature within the morphosyntactic representations.

Here is a quick survey of some inflectional categories.

12.1 Nominal Inflection

Nouns and pronouns are often inflected for **number** (singular, plural, and occasionally dual, meaning exactly two; or even trial, exactly three). Pronouns are in addition inflected for **person** (first = includes speaker; second = includes hearer; third = neither).

12.1.1 Gender

In a number of languages nouns are inflected for **gender**; for instance, in German nouns can be masculine, feminine or neuter (as we can tell by the definite articles they take). In some cases, gender is semantically quite sensible:

(40) *der Mann*   'the-masculine man'
       die Frau   'the-feminine woman'

Extraordinarily, this system carries over—often quite arbitrarily — to the whole vocabulary of nouns, irrespective of meaning. Thus each of the three common items of silverware is a different gender in German:

(41) *der Löffel*   'the-masculine spoon
       die Gabel   'the-feminine fork'
       das Messer   'the-neuter knife'

Thus gender is for the most part a purely formal device, not an expression of meaning.

Gender involves many other semantic correlations that have nothing to do with biological sex. From a web page intended to help learners of German[19] I quote the following rules:

(42) 60. Fabrics are predominantly masculine (*der Gingham*, *der Kaschmir*).
        61. Heavenly bodies are predominantly masculine (*der Mond* [moon], *der Stern* [star]).
        62. Forms of precipitation are predominantly masculine (der *Regen* [rain], *der Schnee* [snow]).
        63. Bodies of water (restricted to inland streams, currents, and stagnant bodies) are predominantly masculine (*der See* [sea], *der Teich* [pond]).
        64. Words denoting sound or loud noise or phonetic speech sounds are masculine (*der Donner* [thunder], *der Dental* [dental sound], *der Diphthong*).
        65. Dance steps and popular music forms are masculine (*der Jazz*, *der Tango*).

Such generalizations are pervasive in gender languages. However, since there are usually exceptions of various sorts, it seems that people who know gender languages have probably memorized the gender of every word.

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[19] https://sites.google.com/site/meyersde/Home/determinants-of-gender-in-german.

Gender is not just a property of familiar European languages; for example, it is also found in Semitic languages, and a kind of system rather like gender (but with at least a dozen types) is found in Bantu languages.

12.1.2 Case

Nouns, and the syntactic phrases they occur in, are marked for **case**, which marks their role in the sentence. See p. 21 above for discussion of case.

12.2 Verbal Inflection

Very common is **tense**, which gives the time of action relative to the present: past (*I jumped*), present (*I jump*), future (*I will jump*), and other (for example, "remote past") tenses.

Aspect sets the boundaries of the action of the verb time, for instance, completed vs. non-completed action.

Verbs often agree with their subjects (and sometimes their objects as well) in features for nouns (as shown above in section 10 of this chapter). These features include person (*I am*, *you are*, *she is*), number (*I am, we are*), gender.

Verbs, particularly second person forms (see below) can also be inflected for the **degree of familiarity** of the addressee; thus English used to make a distinction between (say) *thou believest*, addressed to intimates, children, and animals; and *you believe*, for less familiar addressees. Most European languages, Javanese, Persian, Japanese, and Korean have such systems today.

In various languages verbs are inflected for **degree of belief**. German, for instance, has an indicative (for full endorsement), a weak subjunctive (for weak endorsement), and a strong subjective (full skepticism):

(43) *Indicative and two subjunctives in German*

Er   sagte,   dass   er   krank   **ist**.
He   said   that   he   sick   is-indicative
"He said he is sick" (acknowledging a belief held by all)

Er   sagte,   dass   er   krank   **sei**.
He   said   that   he   sick   is-weak subjunctive
"He said he is sick" (and it's not necessarily true)

Er   sagte,   dass   er   krank   **wäre**.
He   said   that   he   sick   is-strong subjunctive
"He said he is sick" (and the speaker doubts it)

Related to this is the category of verbal inflection in many languages which marks information known only by hearsay rather than by direct witness; this is found in Turkish and is common in American Indian languages.

12.3 Adjectival Inflection

Adjectives typically don't have their own inflectional categories, but acquire inflection by agreeing with the nouns they modify; thus German:

(44) *ein gut<u>er</u> Löffel*   'a-masculine good-masculine spoon'
     eine gut<u>e</u> Gabel   'a-feminine good-feminine fork'
     ein gut<u>es</u> Messer   'a-neuter good-neuter knife'

13. The principle of obligatory expression

An important aspect of inflectional morphology is that it often involves *obligatory choices*. When in English one says "I bought the book", it specifically means "one book", not "any old number of books". Likewise, "books" necessarily implies the plural. To avoid the obligatory choice, one must resort to awkward circumlocutions like "book or books". There are other languages (for example, Mandarin) that work quite differently. Thus, the following sentence:

(45) $wɔ^3$ mai^3 $ṣu^1$
    I   buy   book

is quite noncommittal about how many books are bought. (It is also noncommittal about when the buying takes place.) Thus an important aspect of the grammar of languages is the set of choices they force speakers to make when speaking; this is determined by their systems of inflectional morphology.

Fundamentally, there is a bifurcation between the two ways that thought is embodied in language. The following diagram tries to make this clearer.

(46)

```
                    ┌─────────────────────────────┐
                    │          Thought            │
                    │                             │
                    │ concepts, classifications,  │
                    │        ideas…               │
                    └─────────────────────────────┘
                       ╱                        ╲
                      ╱                          ╲
```

Grammar	Content

[Number: singular, plural]
[Tense: present, past]
[Honorific: formal, informal]
[Mood: indicative, subjunctive]
   etc.
	one vs. more than one: "two", "three"
	overt statements about time: "now", "then"
	overt labels of respect: "Mr."
	overt statements of degree of belief: "I doubt
	   …"
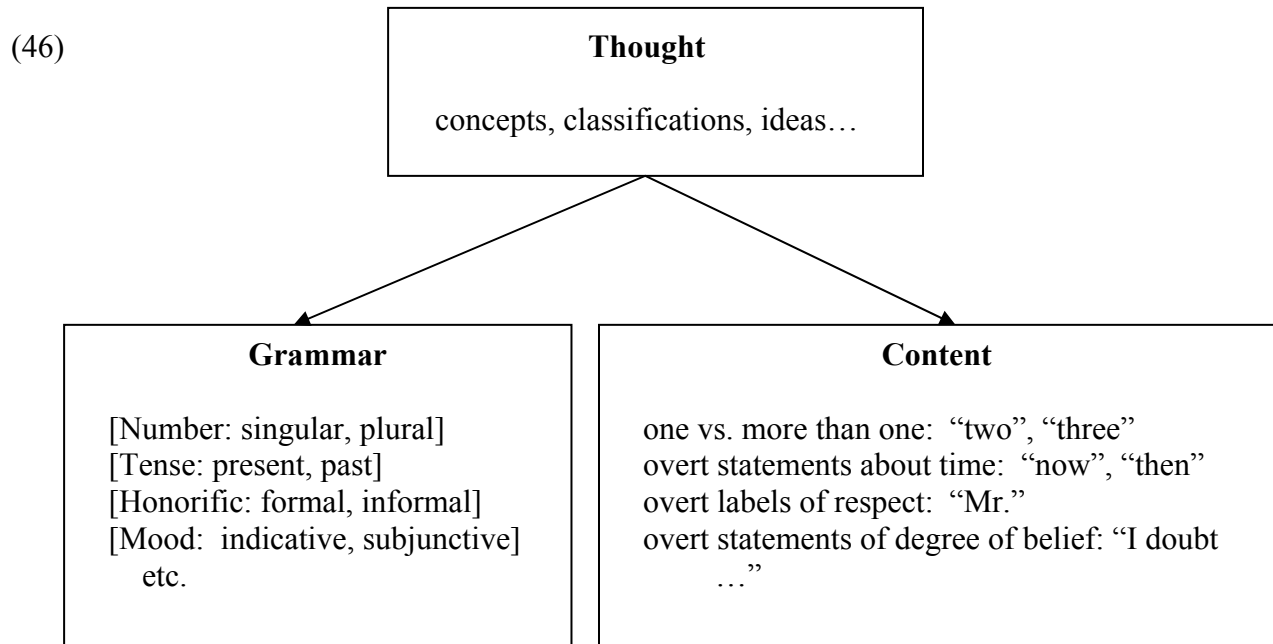
Languages differ: each one takes a subset of the fundamental ideas, and *grammatically codifies* them. By this I mean that in some particular language, a particular concepts get expressed as grammatical features, and that these features are included in the morphosyntactic representations and thus integrated into the grammar. Whenever this happens, the expression of the concept in question becomes obligatory — since you have to obey the grammar of your language when you speak. Alternatively, a concept can remain uncodified grammatically, and the speaker is free to express it or not as she chooses, through choice of words and other means.

On the whole, the forms of thought that can get integrated into grammar are, as we might expect, the ones that are omnipresent in our lives: time, number, belief vs. doubt, and the fundamental aspects of conversations (speaker/hearer/other and their social relations.)

14. The typology of inflection

It's quite possible for there to be inflectional rules that apply (attaching their affix) only if *two* features are present in the morphosyntactic representation. Take a look, for instance, at the following Latin data:

(47)   *A Latin noun paradigm*

somnus, somni. nm., sleep.

Case	Singular	Plural	Meaning of case
Nominative	*somn-us*	*somn-i*	for subjects
Genitive	*somn-i*	*somn-orum*	for possessors
Dative	*somn-o*	*somn-is*	"to"
Accusative	*somn-um*	*somn-os*	for objects
Ablative	*somn-o*	*somn-is*	"from"
Locative	*somn-i*	*somn-is*	"at, on, in"
Vocative	*somn-e*	*somn-i*	for calling to someone

Taking just the suffix *-us*, we can see that it packs a considerable bundle of information: it tells us that *somnus* is nominative, that it is singular, and (with a few exceptions we will ignore) that it is masculine. We could write the rule like this:

(48)   *A rule for the Latin inflectional suffix* -us

Add *-us* if [Case:Nominative, Number:singular, Gender:masculine]

In this respect, Latin is rather different from the Turkish we saw before. In Turkish, the rules that attach the suffixes generally refer to just one feature at a time.

This distinction is part of a traditional three-way system for classifying types of inflectional morphology, given below.

(49)   *Isolating / agglutinative / inflecting*

- A language is **isolating** to the extent that it has little or no inflectional morphology. Examples: English, Chinese.

- A language is **agglutinating** if it has a rich inflectional morphology, and each morpheme expresses a single morphosyntactic feature. Thus, words tend to be long but have a very clear structure. Examples: Turkish, Swahili.

- A language is **inflecting** (bad term, since it's ambiguous) if it has a rich morphology, and morphemes typically express *multiple* features. Example: Latin.

Of course, these terms are just matters of degree; Turkish is famous for being really quite agglutinating, and Latin is famous for being highly inflecting (in the relevant sense). There are plenty of less-clear cases.

All else being equal, inflecting languages will tend to have *shorter* words than agglutinating languages. However, there is usually a "cost" to this terseness: typically, in an inflecting the same ending often serves multiple purposes, so words tend to be inflectionally ambiguous.

MORPHOLOGY, PART II: WORD FORMATION

15. Rules of word formation

The discussion in this chapter so far is of inflection; the morphology that is related to grammar. The other "side" of morphology is the system of rules used to to expand the stock of words, by forming new words from old. Often linguists refer to this process as **derivational morphology**; I will try to stick to the term **word formation** since it is more precise.

For example, given that *identify* is an existing word of English, a rule of English word formation can create a new word, *identifiable*. From this another rule can provide *identifiability*, and from this yet another rule can create *unidentifiability*.

15.1 Rules of word formation

Consider some words formed with the English suffix *-able*:

(50) *-able*:   *washable, lovable, thinkable, growable, doable*

We wish to write the **word formation rule** that attaches *-able* to an existing word to form a new one. There are three kinds of information that must be included in the rule.

First, there is a change of **form**; the existing word is augmented by the suffix. This could be expressed with the formalism:

(51) $X \rightarrow X +$ *-able*

Second, there is a change of **meaning**: *Xable* means "able to be Xed". We will not formalize this, since the task of representing meaning is far too big to take on in this context. Finally, there is often a change in **part of speech**. *-able* attaches to Verbs (e.g. *wash*, *love*, *think*, etc.) and forms Adjectives. We can do this by adding in appropriate brackets to the primitive version of the rule seen in (51). Let's put this all together:

(52) *-able* **Rule**

[X]$_{Verb}$ $\rightarrow$ [[X]$_{Verb}$ -able]$_{Adjective}$ Meaning: "able to be V'ed"

You can read this, approximately, as follows: "-able may be attached to verbs to form adjectives with the meaning, "able to be Verb'ed".

Rules of word formation can be shown applying in a formal derivation. As before, we label each line of the derivation according to the rule that applies. Thus, for instance, here is a derivation for *washable*:

(53) [wash]$_{Verb}$ Stem
     [[wash] $_{Verb}$ able]$_{Adjective}$ *-able* Rule

If you want to figure out how to express a word formation rule of English, the first step is just to find the right data: a set of representative words that have the relevant prefixes and suffixes (or more precisely, that have the same word formation process; we'll see sometime that suffixes can be ambiguous.

Here are some further word formation rules of English. To express the derivation of words in -*ity*, (for example, *divinity*, *obscurity*, *obesity*, *insanity*, *sensitivity*), we could write the rule

(54)   -*ity* Rule

[X]$_{Adjective}$ → [[X]$_{Adjective}$ ity]$_{Noun}$ Meaning: "quality of being Adjective"

This creates structures like [[obes]$_{Adjective}$ ity]$_{Noun}$.[20]

To handle words formed with the prefix *un-*, (*unfair*, *unkind*, *unjust*, *unspoken*, *unattested*, *unidentifiable*) we could write the following rule:

(55)   *un-* Rule

[X]$_{Adjective}$ → [un [X]$_{Adjective}$]$_{Adjective}$ Meaning: "not Adjective"

The rule creates structures like [un [kind]$_A$]$_A$.

To solve problems involving writing of rules of word formation in English, it's clear that the first task is to think of a bunch of words that have the relevant prefix or suffix, then generalize over what you find. You can get help with prefixes just by consulting a dictionary, where words with the same prefix alphabetize together. To find words with the same suffix, there are dictionaries that alphabetize from the end of the word rather than the beginning.[21]

16. Stacked derivation

At least in English, the idea of the position class, covered above for inflection, is not relevant for derivation. Rather, the rules of derivation can apply freely, provided their requirements are met. For example, we can derive the long word *unmindfulness* by applying the following rules in succession:

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[20] English spelling generally drops the letter *e* before suffixes that begin with a vowel; let us ignore this fact for purposes of the rule.

[21] The two I know are entitled *Walker's Rhyming Dictionary* and *The English Word Speculum*. There is also a great deal of software that can do this; e.g. http://www.linguistics.ucla.edu/people/hayes/EnglishPhonologySearch.

(56) Derivation of *unmindfulness*

[mind]$_{Noun}$ stem

[[mind]$_{Noun}$ ful]$_A$ **-ful Rule:** $[\ X\ ]_N \rightarrow [[\ X\ ]_N\ ful\ ]_{Adj}$

[un[[mind]$_{Noun}$ ful]$_{Adj}$]   **un- Rule** ((55))

[[un[[mind]$_{Noun}$ ful]$_{Adj}$]ness]$_{Noun}$ **-ness Rule:** $[\ X\ ]_{Adj} \rightarrow [[\ X\ ]_{Adj}\ ness\ ]_{Noun}$

With a bit of strain, it's possible even to have the same inflectional rule *apply twice in the same form*. Here is an outline derivation for the (novel) word *industrializational*.

industry
industrial
industrialize
industrialization
industrializational

Although the last word is a bit of stretch, you can see that the result has "double application" of the rule that attaches *-al*.

Study Exercise #7: give the rules and derivation for *industrializational*. Answer on next page.

Answer to Study Exercise #7

[industry]$_{Noun}$ stem

[[industri]$_{Noun}$ al]$_A$[22]   **-al Rule:**
                                                                          [X]$_N$ → [[X]$_N$ al]$_{Adj}$
                                                                          "[[X]$_N$ al]$_{Adj}$" means "pertaining to X"

[[[industri]$_{Noun}$ al]$_A$ ize]$_V$ **-ize Rule:**
                                                                          [X]$_{Adj}$ → [[X]$_{Adj}$ ize]$_{Verb}$
                                                                          "[[X]$_{Adj}$ ize]$_{Verb}$" means "to render X"

[[[[industri]$_{Noun}$ al]$_A$ iz]$_V$ ation]$_N$ **-ation Rule:**
                                                                          [X]$_{Verb}$ → [[X]$_{Verb}$ ation]$_{Noun}$
                                                                          "[[X]$_{Verb}$ ation]$_{Noun}$" means "the process of

Xing"

[[[[[industri]$_{Noun}$ al]$_A$ iz]$_V$ ation]$_N$ al]$_A$ **-al Rule (again)**

Here are some words that justify these rules:

-al: cynical, coastal, epochal, triumphal
-ize: humanize, criminalize, socialize, legalize
-ation: visitation, accreditation, limitation, condensation

The repetition of the same suffix in the word is fairly good evidence that English word formation does *not* involve position classes. The multiple appearances result from the inherent property of word formation, that the rules apply where they can. In contrast, in the position-class systems seen in inflection, the rules apply in a strict arrangement defined by blocks.

16.1 *Ambiguity from stacked derivation*

A theme we will repeatedly return to in this book here is **ambiguity** and the ways it emerges from the rules of a language. This will become almost an obsession when we turn to syntax and semantics, but for now it is worth doing an example from word formation — the more elaborate examples to come will work in similar ways.

To start, let's set up a bit of the English morphological system. We have already dealt with the following rules:

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[22] We may ignore the spelling change, assuming our focus is on spoken English.

(57)   *Negative un-* Rule (repeated from (55), but renamed)

      [X]$_{Adjective}$ → [un [X]$_{Adjective}$]$_{Adjective}$ Meaning: "not Adjective"

(58)   *-able* **Rule** (repeated from (52))

      [X]$_{Verb}$ → [[X]$_{Verb}$ -able]$_{Adjective}$ Meaning: "able to be V'ed"

We will also need a new rule. If you consider pairs like the following

seat	*unseat*
attach	*unattach*
do	*undo*
twist	*untwist*

it should be clear that there is some kind of rule attaching *un-*. However, this rule cannot be the same rule as (57), since it attaches *un-* to verbs. Moreover, its meaning is not really negative (*unseat* doesn't mean "to not seat") but rather something more specific, which we might call **reversive**; each of the *un-* verbs in the list more or less reverses the action of the simple verb. Write the rule yourself, then check your work on the next page.

(59)   *Reversive un-* Rule

$[X]_{Verb} \rightarrow [un [X]_{Verb}]_{Verb}$ Meaning: "reverse the action of X"

We now have the apparatus we need to characterize an ambiguity, namely *untieable* (as in, "My shoes are untieable."). Just to be clear about it, we could provide contexts that make both meanings clear (the usual term for this is "disambiguating context").

(60) *Two meanings of "untieable"*

   a. My shoelaces were untieable, so I went ahead and untied them.
   b. I tried and tried to tie my shoelaces, but it turned out that they were simply untieable.

It's more ungainly, but we could say, following the bits of meaning we put into our word formation rules, that the meaning in (60)a is something like "not able to be tied", and the meaning in (60) is "able to be untied" or (more explicitly) "able to be undone with respect to tieing". This is meant to lead up to the actual morphological derivations that generate the two meanings.

(61)   *Two meanings of "untieable": derivations*

   a. $[tie]_{Verb}$ stem
      $[[tie]_{Verb} able]_{Adj}$ 'able to be tied'   *-Able* Rule
      $[un [[tie]_{Verb} able]_{Adj}]_{Adj}$ 'not able to be tied'   Negative *un-* Rule

   b. $[tie]_{Verb}$ stem
      $[un [tie]_{Verb}]_{Verb}$ 'undo the action of tieing'   Reversive *un-* Rule
      $[[un [tie]_{Verb}]_{Verb} able]_{Adj}$ 'able to be undone with respect to tieing' *-Able* Rule

17. What meanings are expressed by word formation rules?

The short answer here is "almost anything," as we'll see shortly. But there are some core meanings.

17.1 Changing syntactic category

Perhaps the most common purpose of word formation rules is to **change syntactic category**; we may want to say pretty much the same idea, but using the stem as a noun instead of a verb:

   He had trouble *concentrating*.   (verb)
   He had trouble with his *concentration*.   (noun)

In English, there are word formation processes that can change between any pair of the three major syntactic categories of verb, noun, and adjective:

(62) **Part-of-speech-changing word formation in English**

   Verb to noun: *-ation*, as above (as in *visitation*)

usual meaning: "the process of Verbing"
Noun to verb: *-ify*, *-ize*   (as in *classify*, *demonize*)
   usual meaning: "to do something involving Noun"

Adjective to noun: *-ness*, *-ity* (as in *goodness*, *perversity*)
   usual meaning: "the quality of being Adjective"
Noun to adjective: *-esque* (as in *picturesque*)
   usual meaning: "resembling Noun"

Verb to adjective: *-ent*   (as in *effevescent*)
   usual meaning: "tending to Verb"
Adjective to verb: *-ify*   (as in *clarify*, *humidify*)
   usual meaning: "render Adjective"

The following terminology is sometimes used to describe such cases:

Visitation is a **deverbal noun**. (noun derived from verb)
Classify is a **denominal verb**   (verb derived from noun)
Perversity is a **deadjectival noun**.
Picturesque is a **denominal adjective.**
Humidify is a **deadjectival verb**.
Effervescent is a **deverbal adjective**.

17.2 Changing the number of participants in a verb

Verbs often have rules of word formation that change the number of participants. Consider the Persian verbs below:

(63) **Word formation processes the change the number of participants in a verb**

   res-idan   'reach-infinitive'
   res-aːn-idan   'send-infinitive'

   xaːb-idan   'to sleep'
   xaːb-aːn-idan   'to put to sleep'[23]

Here, we can take a verb that has just one participant (the one who is reaching, or sleeping), and make from it a verb that has an additional participant (the one who causes to reach, or causes to sleep). This is called a **causative verb**. English has no such word formation process, and uses syntactic constructions to express causation ("He made them sleep").

For Persian, the rule could be expressed as:

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[23] In the International Phonetic Alphabet, the symbol [ː] designates a long vowel.

(64) -aːn Rule

　　　[X]_{Verb} → [[X]_{Verb} aːn]_{Verb}　　　Meaning: "to cause to Verb"

17.3 The grand miscellaneous

　　　Although the two purposes of word formation rules just given are probably the most common across languages, individual languages can include word formation rules of marvelous specificity. Among my favorites is one in Ilokano (Philippines), with a process that derives from a verb a new verb meaning "to pretend to be verbing"

daʔit	'to sew'
ʔagindadaʔit	'to pretend to be sewing'
saʔit	'to cry'
ʔaginsasaʔit	'to pretend to cry'
d͡ʒanitor	'to work as a janitor'
ʔagind͡ʒad͡ʒanitor	'to pretend to be a janitor'

English has some very specific word formation processes:

(65) *Highly concrete word formation processes of English*

bowl-arama, carpet-arama	'grand emporium for X or X-ing'
Stalin-ism, *Mao-ism*	'doctrine propounded by X'
pay-ola, shin-ola, plug-ola	'bribery involving X'

18. The ordering of word formation and inflection

　　　It is at least a strong cross-linguistic tendency — perhaps a universal of language — that rules of word formation apply before inflectional rules. Thus, for instance, in English it is possible to have words like *nullifies*, which are derived as follows (I'll use IPA transcription to duck issues involving spelling):

[nʌl]_{Adj.}	root: 'null'
[[nʌl]_{Adj.}ɪfaɪ]_{Verb}	Word formation rule: Adjective + /-ɪfaɪ/ → Verb
[[nʌl]_{Adj.}ɪfaɪ+z]_{Verb}	Inflectional rule:
	X → Xz　　　when [Verb, +3rd person, +singular, +present]

The opposite rule ordering would have derived *[nʌlzɪfaɪ], so that the inflectional suffix would appear "inside" the derivational suffix. Cases of this sort are rare at best.

　　　This has implications for when you analyze a new language: typically it is possible to work out the inflection — appearing on the "outside" of the word, and then work with the leftover material and find the word formation rules.

19. Compounding

A widespread view of compound words is that they are a form of word formation. They differ in that rather than attaching an affix to a stem, they concatenate (chain together) two stems.

Here is a same rule of compounding for English nouns:

(66) **English Noun Compounding Rule**

[X_1]$_{\text{Noun}}$ + [X_2]$_{\text{Noun}}$ → [[X]$_{\text{Noun}}$ [X]$_{\text{Noun}}$]$_{\text{Noun}}$
Meaning: "an X_2 that has something to do with X_1."

Thus: *boat house* (structure: [[boat]$_{\text{Noun}}$ [house]$_{\text{Noun}}$]$_{\text{Noun}}$) is a house that has something to do with boats (for example, you keep boats inside it). A *houseboat* is a boat that functions as a house.

The word *tigerbird* is probably not familiar to you, but you can guess part of its meaning simply by knowing how to speak English: you know it is a kind of bird (and not a kind of tiger!), and that it has something to do with tigers (perhaps it is striped like a tiger, or it likes to roost on top of sleeping tigers, or that it fights like a tiger, and so on).

Compounds like *houseboat, boathouse*, and *tigerbird*, derived by the rule given above, are said to be **headed**: the "head" of *houseboat* is *boat*, because a houseboat is a boat. Likewise *house* is the head of *boathouse*, because a boathouse is a house, and *bird* is the head of *tigerbird.*

In English, most compounds have at most one head, but other languages allow "double-headed" compounds, for instance when "mother-father" is used to mean "parents." One possible English example is *Austria-Hungary*, which designated the country of the 19th century that included both Austria and Hungary. Double-headed compounds can be derived with a rule that is exactly like the compound rule given above, except that the meaning has to be stated differently.

It is possible to form a compound from two words one of which is itself a compound. For example, we can combine the compound *law degree* with the word *requirement* to get the complex compound *law degree requirement*. This compound can in turn be combined with *changes* to get *law degree requirement changes*; and so on. The following example suggests that the process is essentially unlimited:

(67)   *Unlimited compounding in English*

eggplant	'plant shaped like an egg'
eggplant plant	'factory for manufacturing eggplants'
eggplant plant plant	'factory for manufacturing factories for manufacturing eggplants'

Thus compounding is like other forms of word formation in that it applied freely, rather than in the strict "assembly line" fashion of inflectional rules.

19.1 The spelling of compounds

The spelling system of English is inconsistent with regard to compounds; some are spelled without a space between the component words and some are spelled with a space. It is important to realize that an expression spelled with a space can still be a compound.

One can argue for this in two ways. First, consider German: it is customary in German to spell all compounds without a space between the component words. That is, the English practice is more or less an accident; given that other languages go the other way.

More important, there are linguistic arguments that compounds spelled with spaces are just like compounds spelled without them. Note first that, in the case of a genuine NP of the form Adjective + Noun, it is possible to insert an extra adjective between the adjective and the noun. For example, we can take the NP *large cake* and add an additional adjective to get *large round cake*. But if we start with a compound, it is impossible to get an additional adjective in the middle. For example, starting from *pancake*, we cannot get **pan round cake*. The basic point is the while the noun of a NP can be modified by an additional immediately preceding adjective, a noun that is the second word of a compound cannot.

This fact provides us with a test to determine whether an expression really is a compound, even if it is spelled with a space. For instance, we can show that *carrot cake* is a compound by trying to place an adjective in the middle: **carrot large cake*. Other examples also show that expressions spelled with a space can be compounds:

> coal scuttle   *coal dirty scuttle
> lap dog   *lap slobbery dog
> can opener   *can handy opener

20. Summing up so far

The picture of morphology thus far drawn is like this.

First, languages have means of expanding their inventory of words (more precisely: of stems). The rules of word formation add affixes to stems to derive new stems, which have new meanings. These meanings can be common, characteristic ones (like "the quality of being Adjective", "to cause to Verb"), or exotic ones (like "emporium for selling Noun"). Compounding likewise expands the stock of stems, creating either single-headed compounds (like *boathouse*) or, in some languages, two-headed ones (like *Austria-Hungary*).[24] There is in principle no limit to "when" a derivational rule can apply; it simply looks for the right kind of base form and applies optionally.

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[24] For thoroughness: there are also compounds with **implied** heads, like *airhead*. These typically have an unstated head, usually meaning "person" or "thing". Thus *airhead* means, essentially, "air-headed person", "person with head filled with air". Similarly: *pick-pocket* "person who picks pockets"; *stopgap* "thing that stops gaps".

The stems that result, whether they are basic or derived, are used in sentences. In a sentence context, the rules of the syntax (as yet undiscussed) provide each stem with a morphosyntactic representation, that is to say, a bundle of inflectional features. These features are specific to a particular language, although a number of features like [Case:Accusative] or [Number:Plural] occur repeatedly in languages. The features are referred to by the rules of inflectional morphology, which add affixes in order to express their content overtly. It is generally possible to arrange the affixes of an inflectional system into "slots", where each word has at most one affix per slot. In terms of rules, the slots are expressed by having one rule per slot; each rule attaches the affix that corresponds to the features given in the morphosyntactic representation of the stem.

As a consequence of this scheme, inflectional morphology, being attached by rules that apply "later", occurs on the "outside" of a word; that is to say, further from the stem than inflectional morphology.

21. Phonological realization in morphology

When I say "phonological realization", I mean the arrangement of the phonological material (speech sounds) that realizes the morphological categories, whether they be derivation or inflectional. I would guess that a large majority of all morphology (in the narrow sense that excludes compounding) is prefixation, suffixation, or compounding. All three are **concatenative**, in the sense that they string together sequences of speech sounds. They are the meat and potatoes of morphology, and are found in most languages.

But concatenation is not the only way you could carry out an inflectional or derivational process: segments can be interpolated, or copied, or altered in their phonetic content. Below, I will give some cases, and present ways that explicit rules can be written for them.

Note that all of these "fancy" forms of morphology can be used for both inflection and derivation — on the whole, the *functions* of morphology (grammatical or derivational) can be studied independently of the changes in phonological material that carry out these functions.

21.1 Infixation

The following data from Bontoc (Philippines) illustrate **infixation**, which can be defined as insertion of segments into some location inside the base:

(68) *Bontoc infixation*

fikas	'strong'	fumikas	'he is becoming strong'
kilad	'red'	kumilad	'he is becoming red'
bato	'strong'	bumato	'he is becoming stone'
fusul	'enemy'	fumusul	'he is becoming an enemy'

It's reasonably clear that this is a derivational process, and that the brackets we'll need are something like this:

(69) *Rules for Bontoc infixation (first draft)*

[X]$_{Adj}$ →   [[X]$_{Adj}$]$_{Verb}$
Meaning: "become Adjective"

[X]$_{Noun}$ →   [[X]$_{Noun}$]$_{Verb}$
Meaning: "become Noun"

But how to express the infixation? The important part here is to be precise about just where the infixed material should be inserted. We will use here a method that makes uses of **variables** and **subscripts**.

The variables we have seen already with simple rules in prefixation and suffixation, as in [X]$_{Adj}$ → [[X]$_{Adj}$ ness]$_{Noun}$ there are various methods proposed; we will follow a rather simple one. Instead of simply expressing the speech sounds of the base with a simple variable X (meaning: any sequence), we will give this part of the rule more structure, sufficient structure to specify where the infix goes. Doing just the adjective case, we have:

[C V X]$_{Adj}$ →   [[C um V   X   ]$_{Adj}$]$_{Verb}$
  1 2 3   1   2   3

Meaning: "become Adjective"

You can read the rule above as follows:

(70)   "An adjective base consisting (precisely) of a consonant, followed by a vowel, followed by anything, is converted to an verb by inserting the sequence *-um-* after the consonant."

Some details: the numbers under the terms of the rule are included to make sure we are clear on what matches up with what (important if, for example, a rule contains more than one C). "C" and "V" are very commonly used in linguistics as abbreviations for "consonant" and "vowel". (The vowels in the examples above are [i, a, o, u].)

Applying the rule to the form, we have the following matchup:

[f   i kas]$_{Adj}$ [[f um i   kas]$_{Adj}$]$_{Verb}$

[C V X   ]$_{Adj}$ →   [[C um V   X   ]$_{Adj}$]$_{Verb}$
   1 2 3   1   2   3

Infixation is not common in English. You are probably familiar with the colloquial expression *fan*[ˈfʌkən]*tastic*,[25] in which a taboo word is placed in the middle of the stem, as a kind of infix.

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[25] IPA symbols: [ʌ] is the vowel of *cut*, [ə] is the second vowel of *taken*.

Cockney dialect recognizes similar constructions like *abso-bloomin'-lutely*. From time to time linguists have proposed analyses that predict, for any given word, where the expletive can be infixed; this turns out to be a surprisingly difficult area for analysis.[26]

Infixes are normally written with both preceding and following hyphens, since they have two "joining points": *-um-*.

A caution concerning infixes: not all morphemes in the middle of a word are infixes. Many of them are prefixes/suffixes that happen to have had additional material added to their left/right: in *ex-vice-president*, *vice-* is a prefix, not an infix. You can identify the infixes by their ability to occur in the middle of a morpheme.

Infixes are normally considered to be affixes (like prefixes and suffixes); the English cases above, a curious sort of "compounding infixation", are a curious exception.

21.2 Reduplication

Reduplication is a morphological process in which all or part of a word is copied. For example, in Samoan (S. Pacific), the plural form of a verb is formed by reduplicating the second-to-last syllable of a verb:

(71) *Samoan plural reduplication*

nofo	'he sits'	nonofo	'they sit'
pese	'he sings'	pepese	'they sing'
savali	'he walks'	savavali	'they walk'
atamaʔi	'he is wise'	atamamaʔi	'they are wise'

One might think of reduplication as a morpheme whose content varies, dependent on the segments that it is copied from.

We can use our numerical subscript notation to express the Samoan process above unambiguously:

(72) *Samoan Plural Subject Reduplication as a rule*

$$\begin{array}{cccccccc} X & C & V & C & V & & \\ 1 & 2 & 3 & 4 & 5 & & \end{array} \quad \rightarrow \quad \begin{array}{ccccccc} X & C & V & C & V & C & V \\ 1 & 2 & 3 & 2 & 3 & 4 & 5 \end{array}$$

when the morphosyntactic representation contains [Number:Plural]

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[26] A pretty good analysis appears in John McCarthy (1981) "Prosodic structure and expletive infixation," *Language* 58, 574–590, available at http://scholarworks.umass.edu/cgi/viewcontent.cgi?article=1062&context=linguist_faculty_pubs.

The rule tell us to count off the final CVCV of a word, and copy its first CV sequence (what is numbered "23" in the rule). Here is a derivation for *savavali*

savali[Number: Plural]

```
sa   v   a   l   i                sa   v   a   v   a   l   i
 \/  |   |   |   |                 \/  \   |   |   |   |   |
 X   C   V   C   V       →         X   C   V   C   V   C   V
 1   2   3   4   5                 1   2   3   2   3   4   5
```
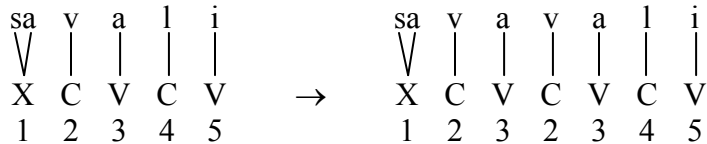
In Yidiɲ,[27] an aboriginal language of Australia, the intensive form of verbs is created by adding to the beginning of a word a copy of the first two syllables of the word:

(73) *Yidiɲ reduplication*

madʲindan	'walk up'
madʲinmadʲindan	'keep walking up'
dʲadʲaman	'jump'
dʲadʲadʲadʲaman	'jump a lot'[28]

We can't formalize the Yidiɲ rule (yet) because we haven't yet covered the theory of syllables.

The meanings expressed by reduplication are often "symbolic," designating plurals, intensiveness, repeated action — things present in quantity.

Study Exercise #8

Write the rule for forming causatives in Ateso (Nilotic family, Uganda). [29]

duk	'to build'	tuduk	'to cause to build'
lel	'to be glad'	telel	'to gladden'
ɲam	'eat'	taɲam	'feed'
wadik	'write'	tawadik	'cause to write'
cak	'throw'	tacak	'cause to throw'

---

[27] ɲ is a symbol of the IPA. Imagine make a sound like the first sound in English *jump,* except that it's a nasal (similar to *m* or *n*).

[28] dʲ is the IPA for a voiced lamino-palatal stop, similar to the English "j" sound.

[29] IPA phonetic symbols: vowels more or less as in Spanish, [ɲ] is rather English "ny", [c] is rather like English "ch" only made further back in the mouth.

Answer to Study Exercise #8

In words, you begin the word with /t/, then copy the first vowel, the conclude with the rest. Using the notation taught here, this is:

[C V X]_{Verb} → [[t V C V X]_{Verb}]_{Verb}
  1 2 3   2 1 2 3

Meaning: "cause to verb"

So, in wadik/tawadik, 1 is w, 2 is a, 3 is dik.

21.3 Segment Mutation

Morphology sometimes is carried out by finding a particular segment (perhaps in a particular context) and changing it into something else. For instance, a fair number of English verbs form their past tense by changing the stem vowel [ɪ] into [ʌ] (the value of the IPA symbols should be clear from context).

(74) Present   Past

cling   clung
sling   slung
fling   flung
string   strung
wring   wrung

While these are irregular verbs (and thus are probably memorized), the process is nevertheless a little bit productive: forms have arisen in dialects like *sing - sung*, *ring - rung*, *bring - brung;* the latter is explored for a period even by many children whose parents say *brought*. In experiments, people asked to provide a past tense for the made-up verb *spling* often volunteer *splung*.

We can state this rule as follows, noting that a crucial element in (most of) these verbs is the presence of a following [ŋ], the "ng" sound:

(75) *A segment-mutation rule for English past tenses*

[X ɪ ŋ]   →   [X ʌ ŋ]
  1 2 3   1 2 3

when the morphosyntactic representation contains [Tense:Past]

21.4 Morphological conversion

Consider the following data.

(76)   *Examples of verb-to-noun conversion*

Fred likes to jump.   His last jump was 20 feet.
Chomsky likes to talk.   His last talk was attended by 500 people.
We need to think.   We had a good long think.

These cases have simplest possible string operation of all; that is, nothing changes. Such rules can be expressed as follows:

(77)   **Verb-Noun Conversion Rule**

[X]$_{Verb}$ → [[X]$_{Verb}$]$_{Noun}$
meaning: "an instance of Verbing"

There is also a rule that goes in the opposite direction, for data like these:

(78) *Examples of noun-to-verb conversion*

Noun	*Verb*
a mop	I mopped the floor.
a fax	I faxed the message.
a hammer	I hammered the nail in.

The rule needed is something like this:

(79) **Noun-Verb Conversion Rule**

[X]$_{Noun}$ → [[X]$_{Noun}$]$_{Verb}$
meaning: "do something crucially involving Noun"

These are simply word formation rules that carry out no affixation (or any other change). There is no reason to exclude them from the theory, and indeed they seem to be pretty common among languages. The usual term for rules of derivational morphology that do nothing but change category is **conversion**.

One might ask why we want rules going in both directions. The best answer, perhaps, is that the morphological base form in each case is somehow semantically primary: a *jump* is what happens when you engage in jumping (rather than: "jumping is what happens when you execute a jump"); *mopping* is the activity you do with a mop (rather than: a mop is the device you mop with).

Occasionally in older linguistic works one will find the claim "Language X lacks a distinction between nouns and verbs." This is currently viewed as rather implausible; instead, one could say that in Language X, morphological conversion between nouns and verbs is highly productive, so most nouns stems can be used as verb stems and vice versa. In any language, there are good *syntactic* reasons to want to have a distinction between nouns and verbs.

The conversion rules of English will turn out to matter quite bit starting in the next chapter, as we start to parse (assign syntactic structure to sentences). You have to treat a word like *hammer* in a context-dependent way, so that for example it is a verb in *Please hammer the nail in* and a noun in *This is an excellent hammer.*

Study Exercise #9

Does English have adjective-to-noun conversion? Try to find examples. Specify the meaning that this process imparts. Write a formalized rule for it. Answer on next page.

Answer to Study Exercise #9

You can get adjective-to-noun conversion in English most easily in a particular context, namely with a preceding definite article *the*.

Adjective	*Noun derived by conversion*
lame	(the) lame
able	(the) able
meek	(the) meek
lonely	(the) lonely
tall	(the) tall

It's clear that there is a rather particular meaning here: "the tall" means "people who are tall". Formalizing:

(80) *Adjective-Noun Conversion Rule*

[X]_{Adjective} → [[X]_{Adjective}]_{Noun}

Meaning: "those people who are Adjective"

This analysis is incomplete in that it doesn't indicate the special context of occurring after *the*.

Chapter 3: Normative views of language

1. Introduction

Suppose we are eliciting some data on English morphology from one particular speaker of English, and obtain the following:

(81)   *Present*   *Past participle*

   I jump.   I have jumped.
   I place it.   I have placed it.
   I allow it.   I have allowed it.
   I grow it.   I have grown it.
   I cling to the branch.   I have clung to the branch.
   I string the racket.   I have strung the racket.
   I bring it with me.   I have brung it with me.

The last form would, if I were collecting it from a UCLA undergraduate, startle me, but in fact there are many dialects of English in which the past participle of *bring* is *brung*.

This is an example of a *normative* belief — on my part, and perhaps for you as well. Somewhere, deep inside me, I feel that people **ought** to say *brought* as the past participle of *bring*, and that *brung* is "wrong." A normative belief involves "ought to be", as opposed to "is".

Normative beliefs can be about some particular word or construction, or about whole languages or dialects. Here are examples of both kinds.

(82) *Examples of normative beliefs*

- "French has a more beautiful sound than German."
- "It is better to say 'it is I' than 'it is me'."
- "[Such and such an ethnic group] speaks a substandard dialect of the language"
- "Southern accents sound friendly."
- "Southern accents sound ignorant and uneducated."

Here, of course, our interest in language is entirely scientific; we aren't going to wallow in our normative beliefs, but try to come to terms with them as an object of study. The questions at hand are:

- What might we do as linguistic scientists to make sure that our work remains objective in the face of normative beliefs?
- How do we find out about normative beliefs and assess them?
- Where do normative beliefs come from? Why do they arise?
- Are normative beliefs ever "justified" in a factual sense?

2. The professional practice of linguists concerning normative beliefs

Normative beliefs arise for linguists as a methodological issue. We want to do good science, and it's quite likely that our normative beliefs might impede our scientific objectivity. My own favorite metaphor for this is the clean white lab coat — the emblem that a laboratory scientist wants to keep the samples clean and uncontaminated. As linguists, we keep our lab coats clean (in part) by ignoring what we *feel* about language, and concentrating on the data.

Scientific objectivity is of course a goal that cannot always be attained. Everyone, including experienced linguists, has normative beliefs, and we can't make them go away. To speak personally on this point: I find that whenever I encounter a phrase like "very unique," or the pronunciation [ˈnukjulər] ("nucular") for *nuclear*, I experience real, unavoidable normative feelings. Both cases are instances where the normative belief is one that favors the older meaning or pronunciation (see more on this below). But as a scholar I know there is nothing *inherently* wrong with them — the world would not come to an end if everyone started saying [ˈnukjulər]! And when I am doing linguistics, I can try to factor out my feelings from my thoughts and analysis.

The fact that even linguists are vulnerable to normative feelings has consequences for how linguistics is conducted. First, a careful fieldworker will carefully conceal from their native speaker consultant any normative feelings that they may have about what the consultant is saying. Any expression of such feelings is likely to distort the material given by the consultant later on, as (s)he seeks to avoid the embarrassment of being laughed at or otherwise negatively evaluated. (Suppressing normative opinions about the consultant's speech is, of course, also a good way to retain a good working relationship with the consultant.)

Linguists also display their commitment to objectivity by employing professional vocabulary that shows that (at least when at work) that they do not buy into the normative beliefs that may be are held by the speakers of the language being investigated. For instance, a linguist would be likely to use the term "nonstandard" rather than "substandard"; "prestigious forms" for "correct speech".

Indeed, the whole academic culture of linguistics seems generally aware that there is a need to be vigilant about normative beliefs. I believe that if a linguist let slip a blatant normative belief in a lecture at the annual Linguistic Society of America, there would later be quite a bit of smirking and mockery in the hotel bar …

Lastly, normative beliefs are not just "factored out" where appropriate, but made into an **object of study**. This is the topic of the next section.

3. Investigating normative beliefs

To learn about normative beliefs, a good starting point is simply to attend to what people say about language. For instance, the "Cockney" dialect of English is that historically spoken by working-class people in poorer neighborhoods of London. It is fairly familiar to Americans because we hear it in mouths of fictional characters of this background in film and drama. Here is a reported opinion of Cockney from about a century ago:

'inspectors and teachers of English in London elementary schools who met in conference in 1906 declared that "The Cockney [London lower-class] mode of speech, with its unpleasant twang, is a modern corruption without legitimate credentials, and is unworthy of being the speech of any person in the capital city of the Empire.'[30]

The description may surprise Americans, since the Cockney they hear is sentimentalized; usually placed in the mouths of fictional characters who are uneducated but have a heart of gold.

All over the world, there are dialects that are considered (by many people) to be prestigious and dialects that are considered (by many people) to be non-prestigious — often the way that this is put is that the speakers do not speak "correct" English (or Spanish, or Korean, etc., etc.). Cockney is a clear example of a low-prestige dialect of a language.

What sort of dialect is likely to have low prestige? There seem to be at least three criteria:

- **Social class**, as in Cockney.

- **Minority ethnicity**, as in the German-influenced varieties of English spoken in North Dakota and neighboring states, or African-American English Vernacular (Black English).

- **Geography**: the varieties of Korean spoken outside Seoul, and the varieties of Japanese spoken outside Tokyo, tend to be stigmatized.

To some degree, you can get an idea of the prestige of varieties of language just by asking people, but social psychologists have tried to be more systematic about it. A favored research method is the so-called **matched-guise** experiment:[31] you find a perfect bilingual or bidialectal, and have them say (more or less) the same thing in both of the language varieties in question. You also mix in many other voices, so that, if all goes well, the experimental subjects who listen to the recording aren't aware that one person is speaking twice. The subject are asked to rate the speakers on various scales, for instance:

- intelligence
- suitability for employment
- trustability
- likelihood to be a friend

The measurement of interest concerns how these ratings differ for the recordings of the same speaker saying (essentially) the same thing in two languages or dialects.

By now, dozens of matched-guise experiments have been carried out around the world. Generally, they show what you might expect: that people who are speaking a prestigious dialect are judged as more intelligent and suited to positions of responsibility. For the more intimate criteria of trustability and friendliness, the less prestigious variety sometimes wins, but quite often the more prestigious variety does. Often enough, prestigious varieties are preferred even by the

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[30] Source: *Does Accent Matter?* (1989) by John Honey.

[31] A good review is in Ralph Fasold (1984) *The Sociolinguistics of Society*, Basil Blackwell, Oxford, Chapter 6.

native speakers of the non-prestigious variety — at least when they are giving reponses in an experimental setting, which is itself an academic, prestige-oriented environment.

This is what matched-guise experiments teach us. However, they are limited in their scope, due to the artificiality, just noted, of the experimental setting. A more nuanced view would be that there are different *kinds* of prestige. Nonstandard varieties are valued, at least by their speakers, as badges of community membership, and members of a community with a non-standard dialect who speak the standard dialect to their peers are "sending a message" of some sort.

Educators, particularly of young children, often have an extremely delicate task: they judge that teaching a standard variety to non-standard speakers will help their students with their lives and careers, but the tacit message "your dialect is inferior" that may come with this training is not a very nice — or, as we will see, valid — message to give to kids. Enlightened educators try to steer a course between the need to teach a standard, and the need not to alienate their students when teaching the standard.

4. The origin of normative beliefs

Why do people have normative beliefs about language? This question is in need of further study, but it seems reasonable to point out two possible sources.

4.1 Societal division

Many normative beliefs seem to stem from the divisions found in a society. I don't think it is controversial to say that every society is in a state of conflict, ranging from mild to extreme. The divisions can be ethnic, economic, or geographic. In general, the varieties of language that are affiliated with power will be the more prestigious ones. This includes varieties spoken by wealthier and better-educated people; the varieties spoken in the capital city of a country; and the varieties spoken by the politically dominant ethnicity.

An interesting comparison of this sort can be made when the very same language has different status in different locations. French has an exalted status in France, where it is the dominant language, but until recent decades it had low status in Quebec, where the ethnic minority that spoke it was economically dominated by English speakers. German once had very high status in Latvia, where it was the language of an economically dominant foreign-based minority. German was less prestigious in 19th century America, where it was widely spoken but gradually abandoned by its speakers in favor of English.

Here, I am guessing, but I suspect that people's normative attitudes about language are far less subject to self-censorship and self-reproach than attitudes about other people. In the 21st century many people would feel ashamed to admit to prejudice against members of another ethnic group — but perhaps less ashamed to state that they consider the dialect spoken by that group to be ugly or ungrammatical.

4.2 Linguistic conservatism

A rather different, and less political, source of normative beliefs results from the ever-present process of language change. Typically, speakers will feel that the older forms of a language are

inherently "correct" and that the innovating forms are wrong. For example, "it is I" is the older form; "it is me" is an innovation. Putting the accent on the first syllable of *compensate* and *confiscate* was considered pretty vulgar in the 18th century, since at that time many people still used the old pronunciation with the accent on the second syllable.

The example I gave above of my own normative beliefs ("very unique", [ˈnukjulər]) are of this kind: the older meaning of "unique" is "exactly one" (so it makes no sense to modify it with "very"); nowadays, "unique" is coming to mean "unusual" (so it's perfectly sensible to say "very unique"). The older pronunciation of *nuclear* is [ˈnukliər].

5.   The labels "language" and "dialect" as used by linguists and in ordinary life

Once we have a clear picture of normative beliefs and their basis, we can define the terms *language* and *dialect.* It is helpful to provide two definitions for each word: one as they are commonly used in linguistics and one for the way they are commonly used in ordinary language.

In linguistics:

- We start with the concept of **idiolect**. An idiolect is the version of a language spoken by one single person. For example, my own idiolect of English represents the large set of rules of this language in the version that is currently stored in my mind/brain, ready for the creation of novel utterances. My idiolect would also include my *lexicon*; the store of English words and idioms I have memorized in the course of my lifetime.

- A **dialect** is a relatively uniform set of idiolects; people who speak the same dialect can communicate fluently with minimal possibility of misunderstanding. Naturally, the identity of idiolects is never perfect, so the concept of dialect is not a precise one.

- A **language** is a collection of mutually-intelligible dialects. Here again, the concept is imprecise since there are dialects so different that mutual intelligibility is possible but marginal.

Crucially, any dialect regarded by the public as a "standard" dialect is, from the viewpoint of the linguist, just another dialect.

In ordinary speech of non-linguists, the difference between a "language"and a "dialect" is totally bound up with normative beliefs. In particular, a dialect is:

- a language variety that is (according to prevailing normative beliefs) **non-important**.
- a language variety that is (according to prevailing normative beliefs) **non-standard**.

An example of "non-important" occurs when the *World Almanac* lists the languages of some faraway country as "French, English, African dialects."[32] An example of "non-standard" is in a sentence like *I asked the farmer for directions and was amused when he replied in dialect*.

An old saying shared among linguists[33] is, *A language is a dialect with an army and a navy*. This is meant to be silly but is often surprisingly accurate when applied to the real world. Cantonese, which by the linguist's mutual-intelligibility criterion is a language, has no army or navy of its own and indeed is commonly called a "dialect" of Chinese. Norwegian, Swedish, and Danish, which by the linguist's criterion would constitute divergent dialects of Scandinavian, all have their own armies and navies and all get counted by the public (including their own speakers) as languages.

6.   Are normative beliefs ever justified?

Returning to the main thread, let us now take on the most loaded question of all: is it really true that one language or dialect could legitimately be called inferior to another?

It seems unlikely to me that any language could be significantly simpler than any other. The reason I believe this is that field workers who go to work on a language never believe that they're done. A responsible and accurate reference grammar of a language[34] will go on for hundreds of pages, and still be giving just a rough outline of many areas. The languages for which the only grammars are thin ones are the languages that haven't been studied much. What we know about English would probably fill a large bookshelf. There's little reason to doubt that the same would hold of any other language that was submitted to the same degree of study.

Often, grammatical issues in a particular language are subtle or complex, and thus difficult for the linguist to establish confidently. This holds true just as much for languages spoken by peoples with simple material culture as for languages spoke in large industrialized countries.

A related point is that all languages seem to be about equally expressive: roughly speaking, whatever can be thought, can be said in any language; though the degree of effort needed might vary in certain cases.

This claim is probably true for dialects as well. A famous article by the linguist William Labov, "The logic of nonstandard English,"[35] made a case for the grammatical integrity of African American Vernacular English as a system (a well known fact about the dialect is that it has

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[32] Here is another one: all the languages of China that are genetically related to Mandarin are called "dialects" in ordinary speech. So, in ordinary speech Cantonese is a "dialect" but for a linguist it is a language, being mutually unintelligible with other varieties of Chinese.

[33] There's a not-so-bad article on the Wikipedia about the origin of this saying; https://en.wikipedia.org/wiki/A_language_is_a_dialect_with_an_army_and_navy.

[34] A *reference grammar* is a grammar book written for linguists: its goal is to give the structure of a language clearly. Other grammars are organized to help teach the language, or are addressed to the lay public. For more on reference grammars see p. 400 below.

[35] In his book *Language and the Inner City* (University of Pennsylvania Press, Philadelphia 1974).

distinctions of verbal tense not available in the standard dialect), and also for the distinction between being a speaker of a prestigious dialect and being an articulate speaker (there are both articulate and inarticulate speakers of both prestigious and nonprestigious dialects).

Naturally, languages differ greatly in vocabulary. A language will normally include a vocabulary suitable for the culture within which it is spoken; and indeed, experience suggests that it is not at all easy just to take a random language "off the shelf" and adapt it instantly to the needs of an industrialized society. But this seems to be a rather superficial difference, as with time languages can acquire new vocabulary (through borrowing and the use of word formation rules) to accommodate any culturally-novel concept.

Languages also differ a great deal in their morphological complexity. But it would be a mistake to equate morphology with overall complexity. In English, for instance, the inflectional morphology is very simple, but the choice of articles (*the* vs. *a*) is monstrously complex and difficult; it just happens to be a problem in syntax and semantics, not morphology.

Earlier in this text (p. 38) I very tentatively suggested that there may be some virtue in inflectionally-impoverished languages like Mandarin Chinese, which don't force their speakers to make commitments they don't want or need to make. Yet as a native speaker of a mildly inflectional language, I feel it is implausible that the inflectional choices of English are somehow hampering my ability to communicate, and I'm sure that native speakers of heavily inflected languages like Turkish or Finnish would feel the same.

6.1 Putative cases of "illogicality" in language

It is sometimes said that stigmatized languages or dialects are "illogical." For example, in many dialects of English (including African American Vernacular English), the sentence corresponding to standard English "You don't know anything" is "You don't know nothing". Some people believe that this makes the non-standard dialects "illogical", in that they are "really saying" something they don't mean, namely "it is not the case that you know nothing."

The absurdity of this is revealed by looking at other, non-stigmatized languages, which do the same thing without being looked down upon. For example, in French "You don't know anything" would be translated as "Tu ne sais rien", literally "You not know nothing."

In fact, in non-standard English dialects, "You don't know nothing" is completely clear and unambiguous. The way one would say "It is not the case that you know nothing" would be "You don't know *nothing*", with a heavy accent placed on *nothing*. There is no possibility for confusion. So, for instance, the following sentence is a possible one in African American Vernacular English:

(83)   I didn't say **nothing** — I just said it very softly.[36]

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[36] Example taken from this article: Stefan Martin and Walt Wolfram (1998) "The sentence in AAVE," in Guy Bailey, John Baugh, Salikoko S. Mufwene, John R. Rickford (eds.) *African-American English: Structure, History and Use*, pp. 11-36. New York: Routledge.

The "illogicality" accusation is based on a fundamental analytic error, that of analyzing other languages or dialects from the viewpoint of one's own language or dialect. Every language and dialect has a grammar, which to be understood has to be studied in its own terms.

I conclude that at present there seems to be very little justification for any claims that one language or dialect is superior to another. Naturally, since I have my "white lab coat" on (see

above), I would not want to exclude the possibility that such justification could be discovered in the future, but this is at present a hypothetical possibility.

7. Normative beliefs: who is in charge?

The normative beliefs that arise from societal divisions raise tough political questions. Notably, the speakers of stigmatized languages or dialects face the dilemma that their mother tongue — the vehicle of their innermost thoughts and of conversation with their nearest and dearest — brings them into some degree of disrepute when they speak it among members of the majority community. This can be hard to take.

Rebellions have been known to occur. They can take place on a national scale, where speakers of non-standard varieties insist on the right of having their language treated as a standard (examples: French in Quebec, Catalan and Basque in Spain, Irish in Ireland). Often the linguistic uprising goes hand in hand with a political one. There are also minor, individual rebellions, consisting of speakers of non-standard dialects choosing (consciously or unconsciously) not to alter their speech when talking with standard dialect speakers.

8. Summary: normative beliefs

Summing up: normative beliefs about languages and dialects are found everywhere. They can be measured in matched-guise experiments, and typically are a reflection of the hierarchy and conflicts (economic, ethnic, geographic) within a society. With regard to particular grammatical constructions, words, and pronunciations within a single dialect, normative beliefs usually involve adherence to slightly archaic variants, that is to say, resistance to change.

Linguists, aspiring to be scientists, seek to be aware of their own normative beliefs, in order to be able to guard against bias. A number of scholars are actively interested in the nature and causes of normative beliefs and examine them as a research topic.

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Study Exercise #10

Go through the text of this chapter and make a list identifying all of the normative beliefs mentioned. You can say "X is bad" if you like, but where possible be more specific. Answer below.

Study Exercise #11

This is open ended, so can't have a single correct answer. On p. 62 above, the text says "Nonstandard varieties are valued, at least by their speakers, as badges of community membership." This is not the whole story, however. Sometimes nonstandard varieties are valued by speakers *outside* the community. Try to think of examples. Use a search engine to try to find some justification for your claim. (Note: Google Books and Google Scholar are more likely to get you answers from people who have actually done some research on the question.)

Answer to Study Exercise #10

I believe the following list is fairly complete.

1. *Brung* as past tense of *bring* is bad.
2. All items listed in (80)
3. "very unique" is bad
4. [ˈnukjulər] ("nucular") for *nuclear* is bad
5. The Cockney dialect of English is unworthy.
6. Dialects of English with German influences are bad.
7. Non-Seoul dialects of Korean are bad
8. Non-Tokyo dialects of Japanese are bad.
9. French is good (for France)
10. French is bad (for Quebec)
11. German is good (for Latvia)
12. German is bad (for America)
13. *Compensate* and *confiscate* ought to be pronounced with stress on the second syllable.
14. "It is me" is bad.
15. Double negatives are bad.
16. Double negatives are illogical (speaker isn't saying what he really means).

Sample answer to Study Exercise #11

Here are a couple possible examples.

1. There are European-American youths who attempt to speak African American Vernacular English. Naturally enough, this comes with an affinity for African American vernacular culture, particularly as it appears in works of popular culture like music and film. Looking this up on Google Books, I spotted: Chapter 6 of Mary Buchholtz's book *White Kids: Language, Race, and Styles of Youth Identity* (2010) Cambridge: Cambridge University Press, of which you can read little bits on line at http://books.google.com/books?id=mtqrQIzIM4wC&dq=white+speaker+of+AAVE&source=gbs_navlinks_s.

2. It's apparently quite common for British popular musicians to sing, at least in part, in American accents (from my youth I remember the Beatles singing [ˈdæns] for *dance*, rather than British [ˈdɑns]). Of course, American English *is* the standard variety in America, but it isn't in Britain. Malchow (p. 108) puts this "singing in American" phenomenon in a broader context. (Howard Malchow. 2011. *Special Relations: The Americanization of Britain*? Stanford: Stanford University Press. Little bits on line at http://books.google.com/books?id=l8xT0epJ5OoC&dq=american+accents+british+bands&source=gbs_navlinks_s.

Chapter 4:   Syntax I — Phrase Structure

1. Knowledge of syntax

A theme of Chapter 1 was *implicit knowledge*: people show they possess such knowledge in that it is reflected in the patterning of their language, but they cannot directly intuit the form of that knowledge. Here, we will focus on the kinds of implicit knowledge encountered in studying **syntax**, which is the study of sentence structure. What do speakers know when they know the syntax of a language?

(1) They have intuitions about **grammaticality**. A sentence is grammatical if it is syntactically well-formed; if it counts as "part of the language." Grammaticality is distinct from merely making sense. Consider, for example, the following series of sentences:

   She wonders if Alice is going to like Bill.
   Who does she wonder if Alice is going to like?   (answer: *Bill*)
   *Who does she wonder if is going to like Bill?   (answer: *Alice*)

As far as meaning goes, the third sentence is as sensible as the second. It is only ungrammatical. Similarly, sentences like *John and *Bill think I like each other* (p. 6) have a perfectly sensible interpretation, but are ungrammatical. Sentences like *Colorless green ideas sleep furiously*, however, are quite grammatical but are nonsense.

(2) Our implicit knowledge of syntax cannot possibly take the form of a list of sentences. No such list could be stored in a finite mind, as there are an infinite number of grammatical sentences in English (or any other human language). It is easy to show this. A list of sentences like the following:

(84) *A potential infinity of sentences*

Alice likes Fred
John said that Alice likes Fred
Bill believes that John said that Alice likes Fred

can be extended onward to infinity. The basis of this particular potential infinity, as we'll see shortly, is that clauses can occur inside clauses.

Since syntactic knowledge cannot take the form of a list, we are led to the hypothesis that we implicitly know a set of syntactic **rules**; the rules enable us to create novel sentences (a potentially infinite supply of them) on the spot.[37] Just what sort of rules could do this will become clear later on.

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[37] This book already argued for the necessity of rules on the basis of huge paradigms in some inflectional systems, like the 10 trillion verb forms of Shona (p. 32).

(3) Speakers have the ability to recognize and manipulate systematic relations among sentences. For example, the following set of four sentences:

Bill shaved Fred	(active statement)
Did Bill shave Fred?	(active question)
Fred was shaved by Bill	(passive statement)
Was Bill shaved by Fred?	(passive question)

forms a clear pattern that can be duplicated by a speaker of English for an indefinite number of other sentences.

(4) Sentences are not simply strings of words; they also involve grouping of words into larger units. The easiest way to show this is with sentences that have two meanings, traceable to two different groupings of the words:

(85) *Four ambiguous sentences, with ambiguity traceable to different word groupings*

There were (old)(men and women)
There were (old men)(and women)

They (danced) and (sang the first number)
They (danced and sang)(the first number)

Sue saw (the man)(with the telescope)	(she used the telescope to help see him)
Sue saw (the man with the telescope)	(the particular man she saw had a telescope)
Bill (gave)(the Chinese vases)	(...to someone who likes Chinese vases)
Bill (gave)(the Chinese)(vases)	(...even though they already had a lot of vases)

This is essentially the same point we made for word structure in Chapter 2; see for instance the discussion in (61)-(60) of the ambiguous word *untieable*. Structurally ambiguous sentence are far more common, though, than structurally-ambiguous words.

2. Constituent structure

The first step in developing a syntactic theory is to devise a formal notation for the structure of sentences. We wish to express the fact that the words of a sentence form groups of various kinds; that the groups are themselves grouped into larger units, so that a sentence forms a single complex structure. Linguists normally use a *tree* notation to do this.

Trees are actually applicable to morphology as well as syntax, so I'll illustrate the idea with a morphological example done earlier. On p. 43 above we gave a derivation for the word *unmindfulness*, as follows.

(86)   *Derivation of* unmindfulness *(repeated)*

$[mind]_{Noun}$ stem

$[[mind]_{Noun} ful]_{Adj}$ **-ful Rule:**

                                    $[X]_N \rightarrow [[X]_N\ ful\ ]_{Adj}$

$[un[[mind]_{Noun} ful]_{Adj}\ _{Adj}]$ **Negative un- Rule**

                                    $[X]_{Adjective} \rightarrow [un [X]_{Adj}]_{Adj}$

$[un[[mind]_{Noun} ful]_{Adj}\ _{Adj}]ness]_{Noun}$ **-ness Rule:**

                                    $[X]_{Adj} \rightarrow [[X]_{Adj}\ ness\ ]_{Noun}$

      The output, $[un[[mind]_{Noun} ful]_{Adj}\ _{Adj}]ness]_{Noun}$, can be shown more clearly with the alternative, but equivalent, tree notation, which is as shown below:

(87)   Unmindfulness *as a tree*
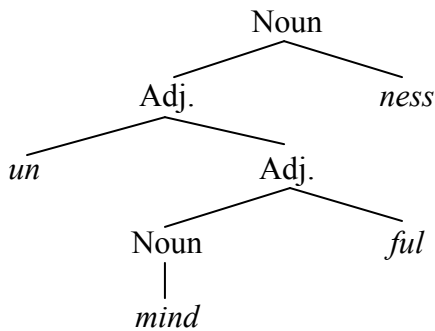
As you can see, the tree metaphor is a bit odd, since linguistic trees are drawn upside down, relative to biological ones.

      Definition: any unit in a tree is called a **node**. The nodes in the tree above are as follows: Noun, Adj., *-ness*, Adj. (again), Noun, *-ful*, and *mind* .

      When you combine a node with *all the material you can reach by going "downhill" from that node*, the result is called a **constituent**. The constituents of the tree just given are:

(88)   *All the constituents of* unmindfulness

(a)
```
                    Noun
                 /       \
              Adj.        ness
            /     \
          un      Adj.
                /     \
             Noun      ful
              |
             mind
```

(b)
```
          Adj.
        /     \
      un      Adj.
            /     \
         Noun      ful
          |
         mind
```

(c)
```
             Adj.
           /     \
        Noun      ful
         |
        mind
```

(d)
```
        Noun
         |
        mind
```
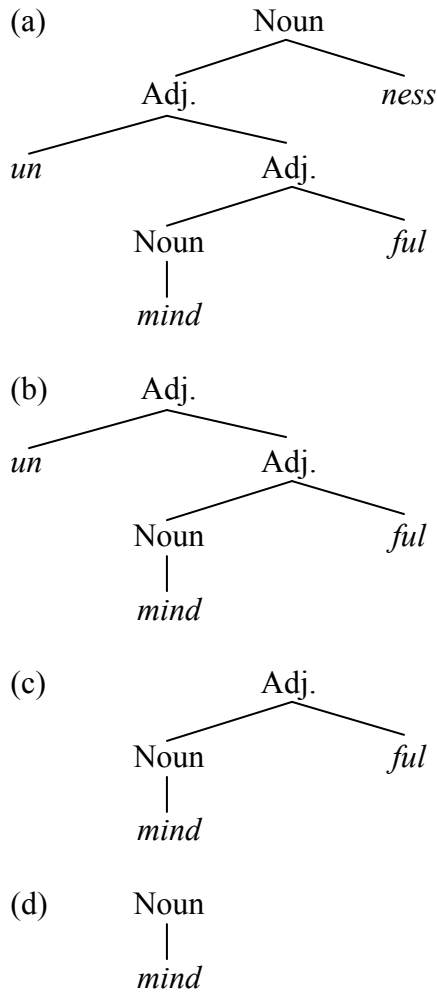
    In addition, the elements *un*, *mind*, *ful*, and *ness*, each of which is at the "bottom" of the tree, are called **terminal nodes**. The terminal nodes are constituents, too, though in informal practice they are often left out of a list of constituents.

    If you compare the tree with the bracketed version of *unmindfulness* given above, you'll see that every constituent that isn't a terminal node corresponds to a bracketed unit.

(89) *All the constituents of* unmindfulness: *shown with brackets*

(88)a	=	[[un[[mind]$_{Noun}$ ful]$_{Adj}$]ness]$_{Noun}$
(88)b	=	[un[[mind]$_{Noun}$ ful]$_{Adj}$]
(88)c	=	[[mind]$_{Noun}$ ful]$_{Adj}$]
(88)d	=	[mind]$_{Noun}$

So the two notations are equivalent. For syntax, we'll mostly use trees, because syntactic structures tend to be quite a bit more complex than morphological structures, and the tree notation is much more readily apprehended by the eye. Bracketed notation is convenient for simple cases because it is compact.

You can *name* a constituent by pronouncing its terminal nodes in order. So, for example, you can say things like: "in the word *unmindfulness*, *unmindful* is a constituent, and *mindfulness* is not a constituent."

3. Trees in syntax

Drawing the syntactic trees for sentences depends in part on our knowledge of the meaning of the sentence, and in part on our knowledge of the grammar (the syntactic part of the grammar) of the language. The idea is to think through the meaning, and locate the syntactic units.

Consider the sentence *Sue saw the man with the telescope*. This sentence actually has two meanings (either Sue used a telescope for her observations, or the man was carrying one). Often, different meanings correspond to different trees, so let us for present purposes assume the meaning in which the man was carrying the telescope. I will build the tree from the bottom up.

I believe it is pretty intuitive that *the telescope* is a linguistic unit. We show this with a tree diagram.

```
            NP
           /  \
        Art    N
         |     |
        the  telescope
```
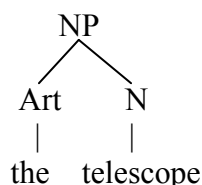
What does this diagram mean? The basic idea is that *the* is classified as an Article, and *telescope* as a Noun, and the entire unit is a **Noun Phrase**, abbreviated NP.[38] This NP can stand alone, for instance as the answer to the question "What did the man have with him?"

Let's move on to the next larger unit. If we want the answer to "which man", we could say (rather tersely):

---

[38] I'll assume you learned in school how to identify articles, nouns, verbs, helping verbs, adjectives, and prepositions. If you'd like to review this material, please consult this help page: http://www.linguistics.ucla.edu/people/hayes/20/resources/CheckingPartsOfSpeech.pdf.

```
            PP
          /  \
        /    NP
      /    /    \
     P   Art    N
     |    |     |
    with the telescope
```
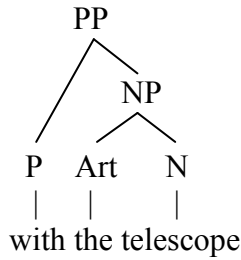
This is a **prepositional phrase** (PP), with the preposition *with* (P). The constituent *the telescope* is contained within the constituent *with the telescope*. One can also say it like this: *the telescope* is **embedded in** *with the telescope*.

    We can continue, building up the structure as follows:

```
          NP
         /  \
        /    PP
       /    /  \
      /    /    NP
     /    /    /  \
   Art  N   P  Art  N
    |   |   |   |    |
   the man with the telescope
```
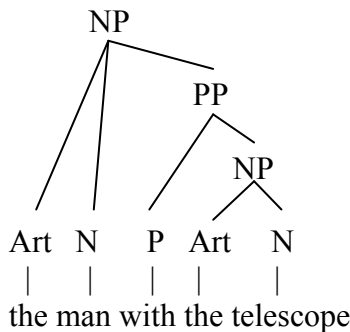
This is a bigger Noun Phrase, involving a *man*, further identified with the article *the* and the Prepositional Phrase *with the telescope*. It could answer the question, "Which man are we speaking of?

```
           VP
          /  \
        /    NP
       /    /  \
      /    /    PP
     /    /    /  \
    /    /    /    NP
   /    /    /    /  \
  V   Art  N  P  Art  N
  |    |   |  |   |    |
 saw the man with the telescope
```
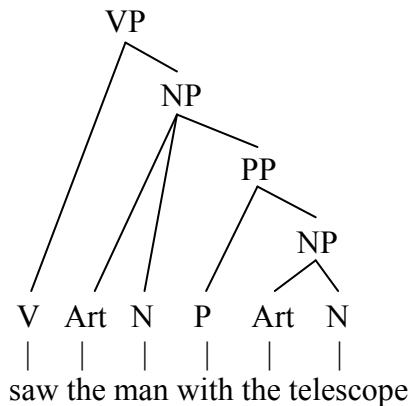
This is a **Verb Phrase**, whose verb is *saw*. What we created before can now be seen to be the object of this verb. The Verb Phrase could answer the question, "What did Sue do?".

    Ultimately we arrive at a structure for the complete **Sentence**, abbreviated S:

```
                    S
                   ╱╲
                    VP
                   ╱╲
                     NP
                    ╱ ╲
                        PP
                       ╱ ╲
    NP              │      NP
    │               │     ╱╲
    N    V   Art  N    P   Art   N
    │    │   │   │    │    │    │
   Sue  saw the man with  the  telescope
```
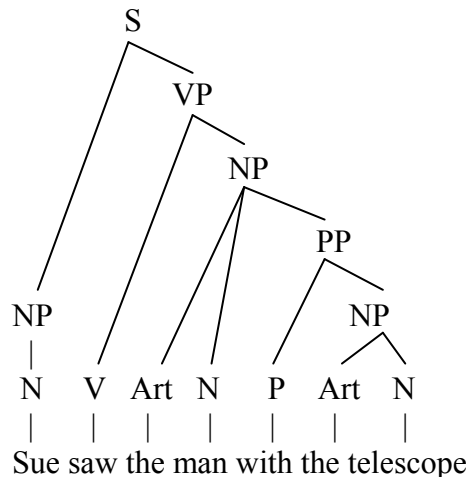
Here, we have a **subject**, in the form of the NP *Sue,* and a **predicate**, in the form of the VP *saw the man with the telescope*.[39]

Trees in syntax are also referred to as **phrase structure diagrams**.

4. Phrase structure and ambiguity

As mentioned above, one of the first and most obvious descriptive benefits of constituent structure is that it provides a clear account of the ambiguity of many sentences and phrases. For example, with the tree just given, the meaning we had in mind was that "with the telescope" identifies the particular man that Sue saw (for example, he was walking down the street holding the telescope in its carrying case). For the (probably more obvious) meaning that Sue used the telescope to see the man, we would have:

---

[39] For why we are treating *Sue* as a full NP, not just an N, see below.

```
                S
               / \
              /   VP
             /   /| \
            /   / |  \
           /   /  |   PP
          /   /   |  / \
         /   /    | /   \
        NP  /    NP      NP
        |  /    / \     / \
        N  V  Art  N   P Art   N
        |  |   |   |   |  |    |
       Sue saw the man with the telescope
```

N = Noun
V = Verb
Art = Article
P = Preposition
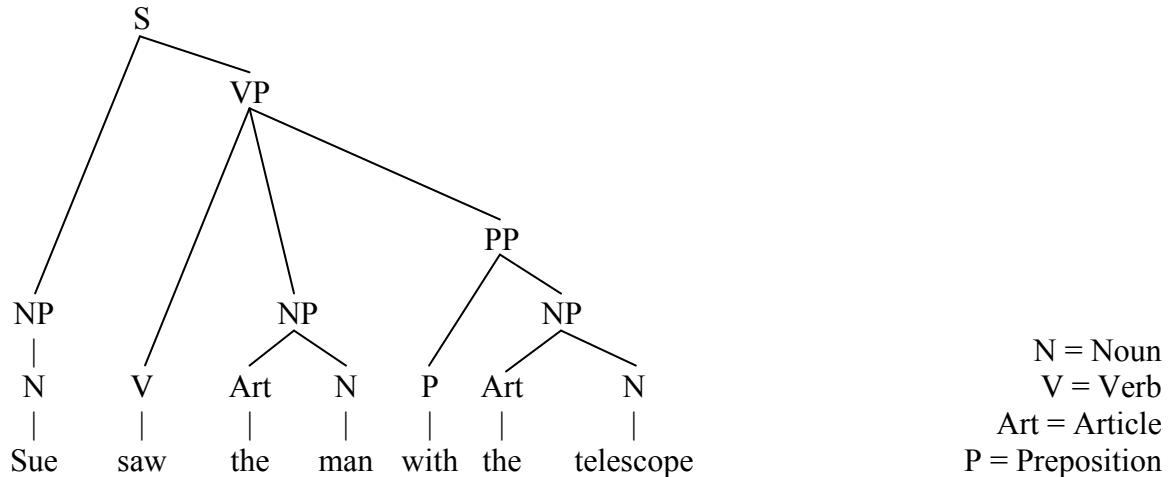
What is at issue is where "with the telescope" is *attached* in the tree: is it part of VP or of NP? We can clarify this concept a bit further with some terminology.

5. Heads and modifiers

Many (but not all) syntactic constituents possess a **head**. In a Noun Phrase (NP), the head is a Noun, and similarly the head of a Verb Phrase is a Verb, of a Prepositional Phrase is a Preposition, and (as we'll see) of an Adjective Phrase is an Adjective. Intuitively, the head is the "core" of a constituent, what expresses the essence of its meaning. With just a few exceptions, heads are in one-to-one correspondence with phrases; every XP has a head X and vice versa.[40]

You can think of heads either formally (as a property of tree structures), or semantically. Semantically, the thing denoted by NP *is a* Noun, where Noun is the head of NP; thus, *the tall boy* is a *boy*. The action denoted by VP "is an" instance of Verb-ing, where Verb is the head of VP. Thus, in the VP "slowly eat pies", the action described is an act of eating.

Everything within a phrase that is not the head can be termed a **modifier**, so long as we are willing to use the word "modifier" in a rather loose sense. This terminology may differ from what you learn in later linguistics courses, but it will be useful for our purposes.

Getting the concept of head and modifier right is, in my teaching experience, one of the trickier parts of learning syntax, so here are some examples.

 (a) *tall women*

The head of this NP is the N *women* (tall women are instances of women). The word *tall* is a modifier, specifying what kind of women.

---

[40] The exceptions, in this book, are that S has no head; and that for Comp, Conj, Art, and Aux there is no phrase of which they are the head. If you study more syntax, you may encounter theories that rearrange the system of categories so that the one-to-one correspondence works exceptionlessly.

(b) *the book*

The head of this NP is the N *book*; when we say *the book* we are speaking of a book. The meaning of *the* is somewhat elusive, but essentially its purpose is to tell the listener that the speaker expects that she will be able to know (through overt presence, prior discourse, or reasoning) which book is being discussed — it says, "You know, somehow, which book I am talking about". The "opposite" of *the* is *a*, which signals that a book of which the listener is not necessarily aware is under discussion.

(c) *the man with the telescope*

The head of this NP is the noun *man*, and both the article *the* and the PP *with a telescope* are modifiers.

(d) *read the book*

The head of this VP is the V *read*; the VP describes an instance of reading, and *the book* is in some sense a modifier; it indicates what sort of reading-event took place by specifying one of the participants.

(d) *on Sepulveda*

The head of this PP (prepositional phrase) is the P(reposition) *on*. The meaning or function of the PP is to express location, and the word *on* serves to express this core meaning (*Sepulveda* has no inherent locative meaning; one can say "Sepulveda is a busy street", "They are repaving Sepulveda", and so on.)

(e) *very tall*

Looking ahead a bit, this is an Adjective Phrase, with an Adjective head *tall*, preceded by an Adverb modifier *very*.

6. Parsing sentences

The starting point for syntactic analysis of a language is to **parse** (provide a parse for; find the tree structure of) a variety of sentences. In the theory taught here, the basic principles of parsing are quite simple.

(90) *Principles of Parsing*

a. For the phrases NP, VP, PP, AP, locate the head, and include all its modifiers in the same phrase.

b. Sentences (including sentences inside sentences; see Chapter 1) are assumed to consist of a **subject** (which is an NP), and a **predicate** (which is a VP.)

Just as in traditional school grammar, the subject indicates what the sentence is about, and the predicate says something about the subject.

The hard part seems to be to make sure you find *all* the modifiers of each head, and include them in the phrase of which it is the head; so exercise care here.

Returning to the two structures of *Sue saw the man with the telescope*, the crucial distinction is what the PP *with a telescope* is a modifier of: in one reading, it modifies *man* (that is, it specifies which man), and thus belongs as part of NP; in the other reading, it modifies *see* (that is, it specifies what kind of act of seeing took place), and thus belongs as part of VP.

Study Exercise #12

Diagram (that is, parse) both readings of the sentence *Bill gave the Chinese dishes*. The answer is given on the next page.

Answer to Study Exercise #12

This ambiguity is slightly more complex than the previous one, since it hinges not just on tree structure but also on the fact that *Chinese* can serve as either a noun (as in *the Chinese,* meaning "the Chinese people") or an adjective. [41] With both readings, we can get two parses, as follows:

```
                    S
                   / \
                  /   VP
                 /   / \
               NP   /   NP
                |  /    /|\
                N V  Art A   N
                |  |   |  |   |
                |  |   |  AP  |
                |  |   |  |   |
              Bill gave the Chinese dishes
```
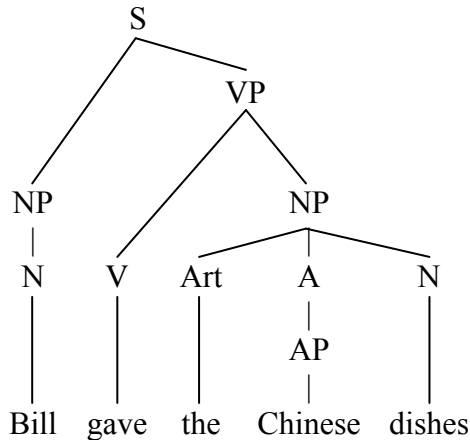
(That is, gave the Chinese dishes to someone, unspecified. *Chinese* is an adjectival modifier of *dishes*.)

```
                    S
                   / \
                  /   VP
                 /   /|\
               NP   / | \
                |  /  NP  NP
                N V  /\    |
                |  | Art N  N
                |  |  |  |  |
              Bill gave the Chinese dishes
```
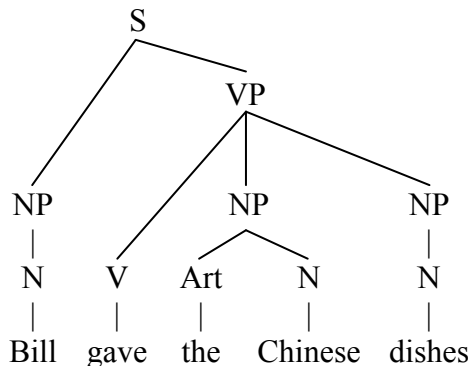
(That is, Bill gave dishes to the Chinese. The noun *Chinese* is the head of a NP; *gave* as head of VP takes two modifying NP, one the recipient of the giving, the other the thing given.)

---

[41] The two "versions" of the word *Chinese* are the result of morphological conversion. *Chinese* is fundamentally an Adjective, but from it is derived the Noun Chinese, by the conversion rule given in Chap. 4, (80).

$$[\text{ X }]_{\text{Adj}} \rightarrow [[\text{ X }]_{\text{Adj}}]_{\text{Noun}} \quad \text{meaning: "person who is X"}$$

A curious property of the rule is that the output can only be used in the plural; hence it should also attach the inflectional feature [Number:plural] to the morphosyntactic representation of its output.

The example illustrates the point that differing parses of the same string are only one source of ambiguity in language. To mention some others in passing:

- Homophonous words: *We walked to the bank.*
- Multiple quantifier words: *Three men were examined by each doctor.*
- Phonological merger: *We were patting/We were padding*, which are identical in many North American English dialects

---

Study Exercise #13

Here is one more ambiguity with its two parses (check that you know the answer before you look). The sentence is: *The hungry bear fishes*, and the answer is on the next page.

Answer to Study Exercise #13

The far more likely reading uses the noun meaning of *bear*, making it the head of an NP; *fishes* is the head of VP.[42]

```
                    S
            ┌───────┴───────┐
           NP              VP
      ┌─────┼─────┐         │
     Art   AP     N         V
      │     │     │         │
     The    A    bear     fishes
            │
          hungry                    (, scooping the salmon with its paw.)
```
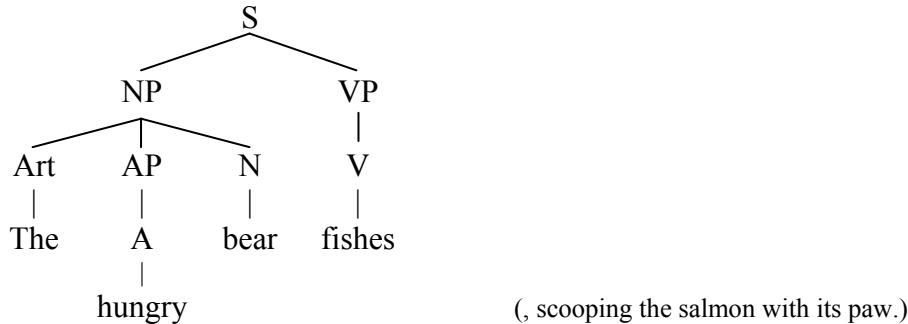
In the less likely reading, *hungry* is treated as a noun,[43] and *bear* as a verb:[44]

```
               S
         ┌─────┴──────┐
        NP           VP
      ┌──┴──┐      ┌──┴──┐
     Art    N     V     NP
      │     │     │      │
      │     │     │      N
      │     │     │      │
     The  hungry bear  fishes     (holding them in both hands because they are slippery)
```

---
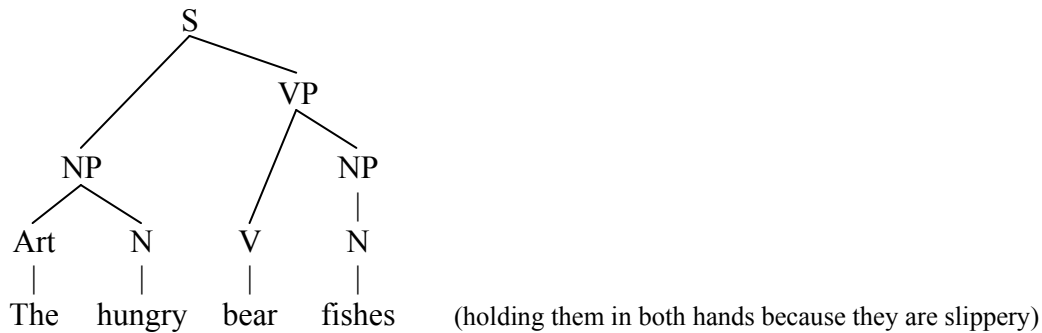
7. Possessive constructions

People are taught in school that adjectives are words that modify nouns. I think this is basically true; provided that you don't say they are the *only* words that modify nouns; there are quite a few other possibilities.

One very common noun modifier is the possessive construction, as in *the tall student's books*. *The tall student's* modifies *books*, but in its internal structure it looks just like an NP. (except for the extra material *'s*). It couldn't possibly be an Adjective; an Adjective is a word, but *The tall student's* is a whole phrase.

---

[42] You may be wondering why we bother with a VP symbol when there is no modifier present; see below on phrase structure rules for some justification.

[43] *Hungry* as a noun is, just as with *Chinese*, derived in the morphology by the conversion rule [X]$_{\text{Adjective}} \rightarrow$ [[X]$_{\text{Adjective}}$]$_{\text{Noun}}$.

[44] As a student once pointed out to me, there's yet a third parse: "the hungry bear-fishes", an NP modeled on *catfishes*. This involves *bearfishes* as a compound word, discussed in Chapter 2. Multiple parses lurk everywhere.

We will assume here that *the tall student's* is in fact an NP, and it sits inside the larger NP *the tall student's books*, modifying the head *books* (i.e., it says in effect, "whose books?"). Thus the structure is:

```
                      NP
                 ____/  \____
              NP               \
           __/|\__              \
          /   |   \              \
        Art   A    N             N
         |    |    |             |
        the   AP  student's    books
              |
             tall
```
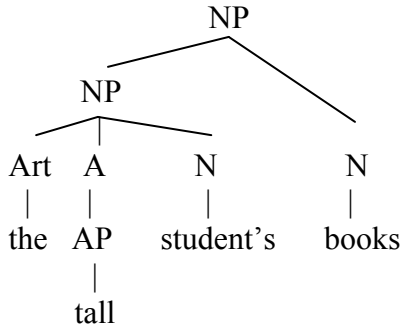
There's a debt to pay here: where does the *'s* morpheme come from, and where should it sit in the tree? We'll cover this in detail later on; the brief answer is that the *'s* is inflectional morphology. What we need is a way to relate the inflectional morphology to the syntax.

8. Conjoined structures

Conjunctions like *and* and *or* are fairly straightforward: we'll assume that they link together two identical units, forming a large unit of the same kind. Thus *the boy and the girl* is

```
                    NP
            _____/ | _____
           /        |        \
         NP        Conj        NP
        / \         |         / \
      Art   N       |       Art   N
       |    |       |        |    |
      the  boy     and      the  girl
```
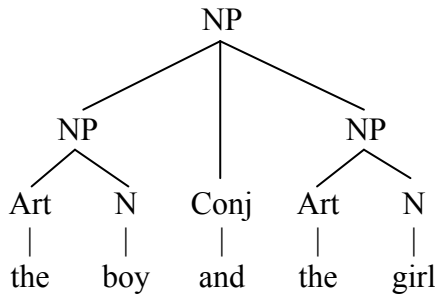
We say that the two NPs *the boy* and *the girl* are **conjoined** by *and* into a larger NP, the entire structure. Similarly, *Sue chopped wood and made syrup* has a VP made of two conjoined VP's:

```
              S
          ___/ \___
         /         VP
        /      ___/|\___
       /      /    |    \
     NP     VP     |     VP
      |    /  \    |    /  \
      N   V    N  Conj  V    N
      |   |    |   |    |    |
     Sue chopped wood  and  made syrup
```
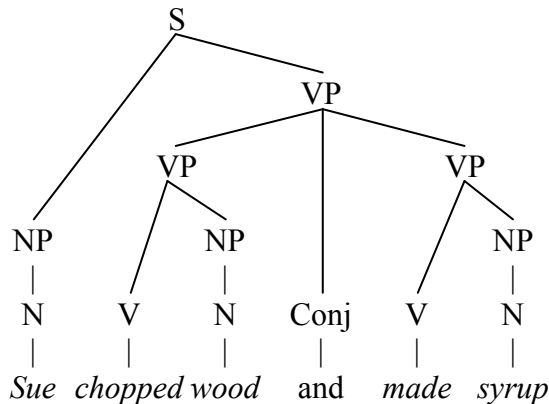
Several other categories, including Adjective Phrases, PP, and S, can participate in this construction: examples of these (same order) are *very tall but quite thin*; *over the river and through the woods*; *I like coffee and you like tea*.

Study Exercise #14

   Parse *the king and the queen's throne*.

Answer to Study Exercise #14

```
                         NP
                    NP
             NP              NP
       Art    N    Conj  Art    N        N
        |     |     |     |     |         |
       the   king  and   the  queen's  throne      [= the throne of the king and the queen]
```

```
                    NP
                              NP
             NP             NP
       Art    N    Conj  Art    N        N
        |     |     |     |     |         |
       the   king  and   the  queen's  throne      [= a person (the king) and a throne]
```
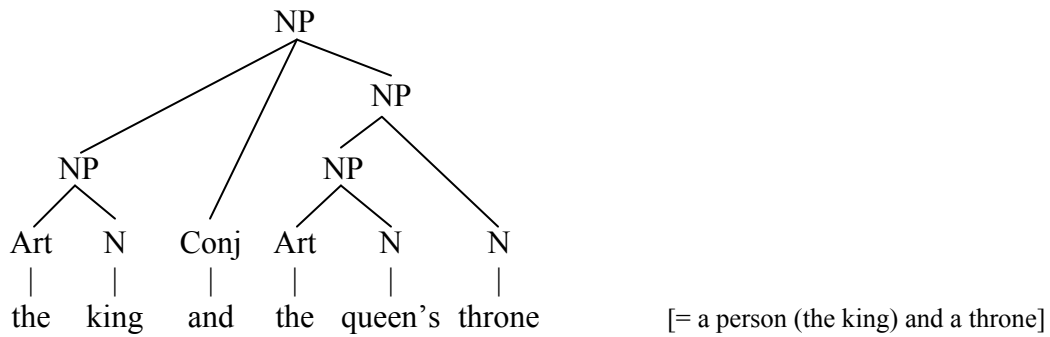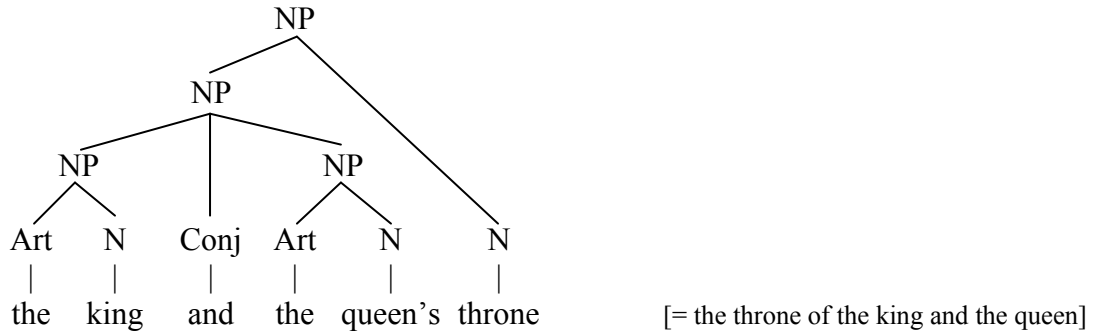
9. Terminology for trees

Here is some terminology that will be useful in referring to trees. I will use the following tree to illustrate the various terms:

```
                    S
                          VP
                              NP
                                    PP
             NP                          NP
       Art    N    V    Art  N    P    AP    N
        |     |    |     |   |    |     |     |
       the   man bought  a  book about  A   vases
                                        |
                                     Chinese
```
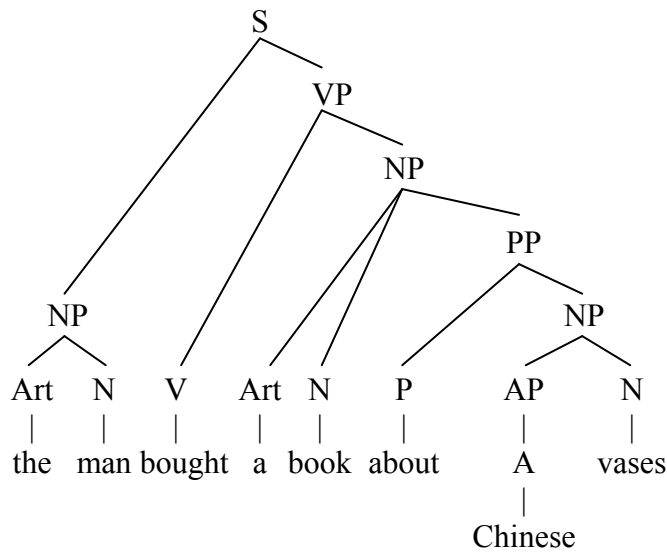
(91) *Defn.:* **dominate**

Node X **dominates** node Y if you can get from X to Y by going "downhill" in the tree and never uphill. For example, S dominates everything in the tree; the NP on the right dominates an A, an N, and the words *Chinese* and *vases*. The NP on the right does not dominate the VP, nor does it dominate the word *man*.

(92) *Defn.:* **constituent**

A **constituent** is a node, plus all the nodes that it dominates.

As noted above, one usually refers to constituents by the words they contain. Thus one can say that the following:

the man   a book about Chinese vases   bought   bought a book about Chinese vases

are constituents (in this particular sentence). Note that sequences like

bought a book
the man bought a book
a book

are not constituents in this particular sentence, *though they could be in other sentences*.[45]

(93) *Defn.:* **directly dominate**

X **directly dominates** Y if Y is "one node down the tree" from X. Thus the NP *a book about Chinese vases* directly dominates the PP *about Chinese vases*.

(94) *Defn.:* **daughter**

If X directly dominates Y, then Y is X's **daughter**.

(95) *Defn.:* **sister**

Two daughters of the same node are **sisters**.

head: We've defined this casually, but can now give the tree-based formal version: the head of an NP is the N that it directly dominates. The head of a VP is the V that it directly dominates. For example, the head of the NP *a book about Chinese vases* is *book*. The head of the VP *bought a book about Chinese vases* is *bought*. And similarly, the head of the AP *very tall* is the Adjective *tall*. (One could extend this definition to PP as well, though it won't matter for us.)

---

[45] As mentioned above, this is one of the principal difficulties in parsing; that is, not to get distracted by mere "potential" constituents like these, and instead choose *complete* constituents.

10. Becoming a skilled parser

Of the practical skills needed to do linguistic analysis well, parsing sentences is probably #1. Many things we will do with grammar and meaning depend on having the right parse. So it's worth practicing your parsing, especially if it doesn't come to you naturally. This section offers some principles that will help you become a fluent and reliable parser.

The first principle is:

(96) **Start with the obvious constituents you can get by proceeding "from the bottom up."**

By "bottom up", I mean, first of all, to label each word for it part of speech. So if you trying to parse these two sentences:

A. Alice owns the book on the table   B. Alice placed the book on the table

it makes sense to begin with the very low-level structure that assigns each word to its part of speech:

```
       N     V  Art  N   P Art   N              N     V   Art   N  P  Art  N
       |     |   |   |   |  |    |              |     |    |    |  |   |   |
    A. Alice owns the book on the table    B. Alice placed the book on the table
```
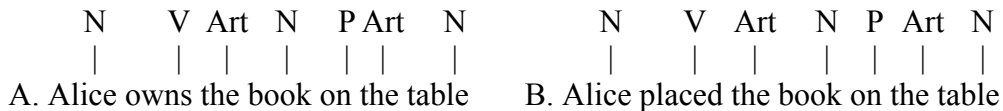
That's the very bottom. But moving upward, you could then start grouping the words into into bigger phrases, like this:

```
                    P                                          P
                   /\                                         /\
      NP          /  NP                  NP                  /  NP
      |          /   /\                  |                  /   /\
      N     V  Art  N   P Art   N        N     V   Art   N  P  Art  N
      |     |   |   |   |  |    |        |     |    |    |  |   |   |
   A. Alice owns the book on the table  B. Alice placed the book on the table
```
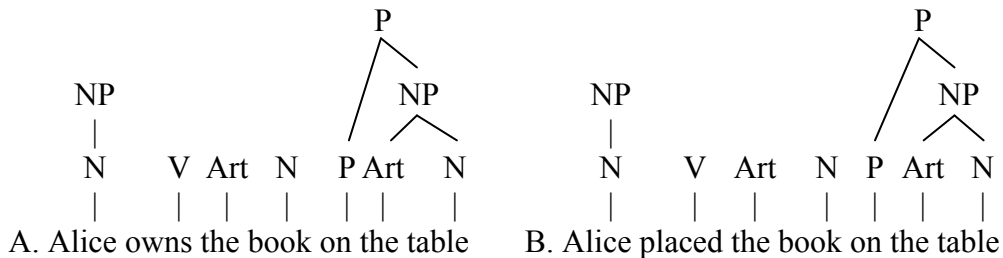
Observe what I've done here. Nouns have to belong to Noun Phrases, and there is nothing else in sight that could plausibly be part of the same Noun Phrase as *Alice*, so we've got an NP node more or less for free. *The table* is plainly a simple NP, with the common Article + Noun structure, and moreover it is the object of the preposition *on*, so we have a Prepositional Phrase, too.

The second principle of accurate parsing requires that you think consistently about heads, and about grouping modifiers into the same phrase as their heads. For example, in diagramming sentence A above, the crucial question is what *on the table* belongs to. If you think about the meaning of the sentence, it is clear that *on* the table modifies *book;* that is, it specifies which book is under discussion. The rest of the reasoning goes like this: 'book' is a noun; it must be the head of a NP; anything that modifies it (namely 'the' and 'on the table' must be its sister; therefore the full NP is 'the book on the table'.

```
                            NP
                          /   \
                          |     PP
                          |    / \
          NP              |   /   NP
          |               |  /   / \
          N     V  Art  N  P Art  N
          |     |   |   |  |  |    |
        Alice owns the book on the table
```
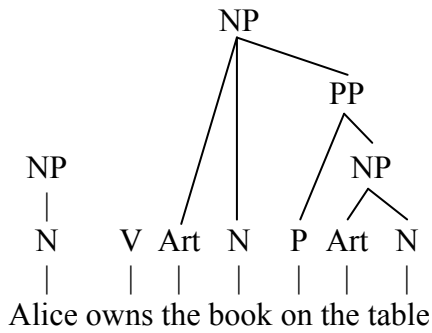
From there on, the diagramming is straightforward; you just need a VP (verb and object) plus the whole sentence:

(97) *Final structure for* "Alice owns the book on the table"

```
                 S
               /  \
               |    VP
               |   /  \
               |  |    NP
               |  |   /  \
               |  |   |    PP
               |  |   |   /  \
          NP   |  |   |  /    NP
          |    |  |   | /    / \
          N    V Art  N P  Art  N
          |    |  |   | |   |    |
        Alice owns the book on the table
```
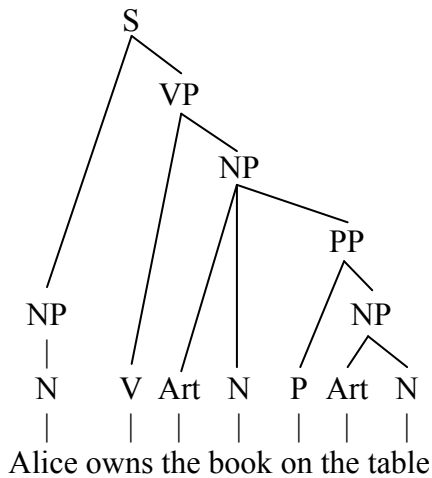
Note that *the book* is not an NP; it is only *part* of an NP because the head is missing one of its modifiers. More on this below.

Suppose this time that you are diagramming sentence B above, *Alice placed the book on the table*. In this case, the PP *on the table* modifies the verb *placed* (it indicates the target of placing). Accordingly it must be the sister of the verb within the VP. *The book* is left as an NP on its own.

(98) *Final structure for* "Alice placed the book on the table"

```
                    S
                  /  \
                  |    VP
                  |   /|\
                  |  / | \
                  | /  |  PP
                  |/   | / \
          NP      |   NP   NP
          |       |  / \  / \
          N       V Art N P Art  N
          |       |  |  | |  |   |
        Alice placed the book on the table
```
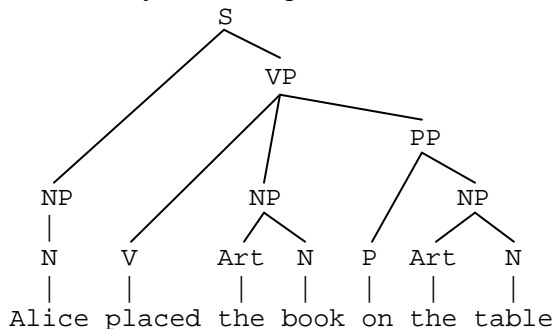
Let us now codify more carefully the principle we've been following:

(99) **The modifiers of a head must be sisters to the head.**

In *Alice owns the book on the table*, the PP *on the table* tells you what book it is; it modifies *book*, it must be a sister of book, and in (97) this is so. In *Alice placed the book on the table*, the PP *on the table* tells you the destination of the act of placing; it modifies *place*, it must be a sister of *place*, and in (98) this is so.

We can illustrate the principle (99) with a more complex sentence that has has two PP's. They get placed in different positions according to what they modify:

```
                          S
                         / \
                          \  VP
                           \  |
                            \ NP
                             \ | \
                              \|  \
                          NP   |   PP              PP
                          |   /|\ / \             / \
                          N  V Art A  N  P   Art   N   P   Art    N
                          |  |  |  |  |  |    |    |   |    |     |
                        Bill put those long letters to the president in the wastebasket
```

The PP *to the president* says what kind of letters are being discussed; it modifies *letters* and must be a sister of *letters* within NP. The PP *in the wastebasket* specified the destination of the act of putting; it modifies the verb *put* and must be a sister of *put* within VP.
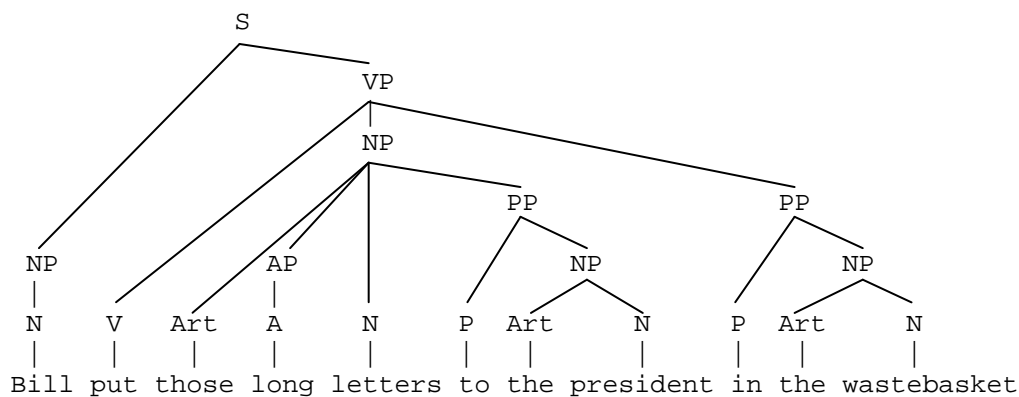
Here is another point that often stumps beginners learning to parse:

(100) **Just because some word sequence is a constituent in some other sentence, it is not necessarily a constituent in the sentence you are trying to parse.**

Look at example (97) above, and think about the sequence *owns the book*. It is unquestionably true that in all sorts of English sentences, *owns the book* is a constituent (example: *in Alice owns the book*, *owns the book* is a VP). Another of putting (100) is **Make your constituents maximal**; or **Don't leave stuff out**.

I have one other handy hint in parsing. For long sentences, once you've done the low-level stuff according to principle (96), it's often helpful to parse English sentences going backwards, starting with the end of a sentence.[46]

---

[46] Why so? It has to do with a property of English called "right-branchingness". When a constituent has two daughters, rather often the daughter on the left is a single word, whereas the daughter on the right has some internal structure. When you have a right-branching system, right-to-left implies bottom-up. Japanese, which is mostly left-branching, is probably easier to parse left-to-right.

11. Constituency tests

I'm a bit uncomfortable with the discussion so far because it consists simply of directions to you, the student, on how to parse sentences. This is merely being tyrannical unless it can be shown that the structures we're creating have some scientific purpose and validity. As at least a move in this direction, we can note the following evidence.

The following are examples of what linguists often call "cleft sentences:"

(101) *Some cleft sentences*

It's Bill that they don't like.
It's on Mulberry street that they live.
It was the flowers that Mary sent to Bill.

Such sentences are clearly related to simpler sentences, such as

They don't like Bill.
They live on Mulberry Street.
Mary sent the flowers to Bill.

We can express the relation between simple sentences and cleft sentences by writing a syntactic rule (we'll cover this more formally later on):

(102) *Clefting Rule*

To form a cleft sentence, take a simple sentence and perform the following operations on it:

1. Add *it* and an appropriate form of the verb *be* to the beginning.
2. Find a NP or PP constituent inside the sentence and reorder it so that it directly follows *be*.
3. Insert the word *that* just after the reordered NP or PP.

You can see for yourself that the cleft sentences cited above are derived from the corresponding simple sentences.

The crucial part of the rule is where it says "find an NP or PP *constituent*". It predicts that if we apply Clefting to a sequence of words that is *not* a constituent, the result should be ungrammatical. If you look at the tree drawn earlier in (90) for *Alice placed the book on the table*, you will see that *the book on the table* is not a constituent. The rule thus correctly predicts that if we attempt to do Clefting with this sequences of words, the result will be ungrammatical:

*It was the book on the table that Alice placed.

On the other hand, in (97) *Alice owns the book on the table*, the sequence *the book on the table* is a constituent, so that Clefting produces a grammatical result:

It's the book on the table that Alice owns.

In summary: neither the principle (99) that modifiers form constituents with their heads, nor the rule of Clefting can be assumed in advance to be correct. We can only test them out against the facts. The more correct predictions they make, the greater is our confidence that they are true. If we want to be really confident about these principles, we must test them out against a much larger set of facts. We will carry out part of this task later on.

Study Exercise #15

(a) In *They sent the king to Barataria* is *the king to Barataria* a constituent? Support your answer with evidence from Clefting.
(b) Replace *to* with *of* in the same sentence and answer the same question.
(c) What are the grammatical clefted versions of *Alice put the book on the table*? (There are about four).

Answers on next page.

Answers to Study Exercise #15

(a) In *They sent the king to Barataria'*, the sequence *the king to Barataria* is not a constituent. If it were, the rule of Clefting could apply to it, producing the sentence

*It was the king to Barataria that they sent

We can explain the ungrammaticality of this sentence by supposing that 'the king to Barataria' is *not* a constituent.

(b) We have seen that Clefting can move only constituents. Since when we apply Clefting to *They sent the king of Barataria* we get a grammatical sentence:

It was the king of Barataria that they sent

we infer that *the king of Barataria* must be a constituent.

(c)

It was Alice that put the book on the table.	(clefting the NP *Alice*)
It was the book that Alice put on the table.	(clefting the NP *the book*)
It was on the table that Alice put the book.	(clefting the PP *on the table*)
It was the table that Alice put the book on.[47]	(clefting the NP *the table*)

---

12. Grammars for syntactic structure I: Phrase structure rules

The discussion so far has been about structures; we now turn to the grammars that are responsible for these structures.

Phrase structure is language specific. To be sure, it does appear to be true that all languages have S and NP. However, the VP, AP, PP that we have in English appears to be missing in certain languages,[48] and moreover the order of the constituents of a phrase varies from language to language. Perhaps other languages include phrase types that English lacks.

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[47] For the "stranded preposition" *on* in this sentence, see Chapter 3 above. Normative feeling in English is that you should not leave prepositions at the end of a sentence.

[48] It seems pretty clear that all languages have NP and S. It's less clear that there is a Verb Phrase in languages where the subject comes between the verb and the object (for example, Verb-Subject-Object order, as in Malagasy). AP clearly cannot exist in a language without adjectives, and PP cannot exist in a language without prepositions (or postpositions). Korean has been claimed to be an adjectiveless language; like most adjectiveless languages it uses verbs for the same purpose; see http://webpages.acs.ttu.edu/minjkim/KimHUMIT02.pdf. Klamath (N. California) has been claimed to be a language without prepositions or postpositions; see https://www.academia.edu/3876363/Adposition_as_a_non-universal_category. These gaps hardly imply speakers of these languages are crippled in their ability to communicate! (See Chapter 3.)

Persian (also called Farsi) is very distantly related to English and has a similar inventory of phrasal categories in its syntax. But the order of elements within constituents is often different, as is illustrated by the following English sentence and its literal Persian translation:
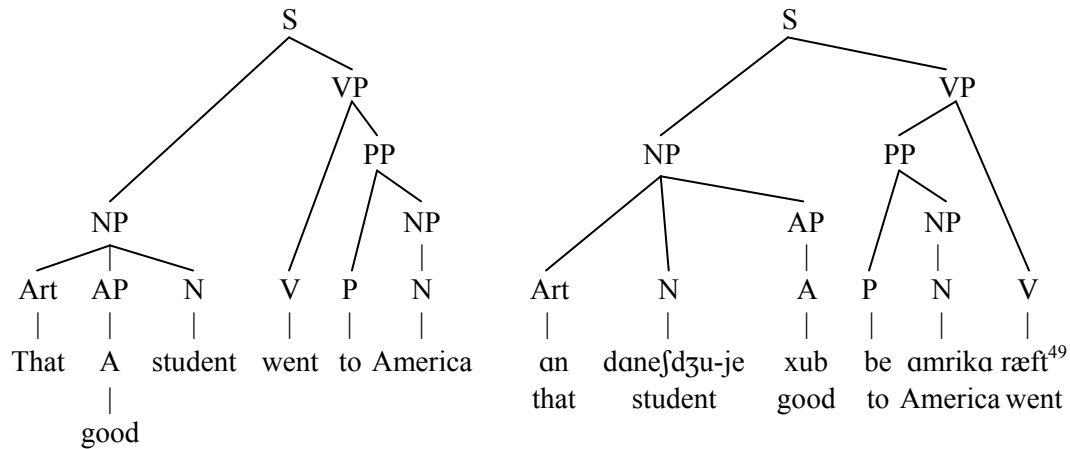
Because of this, every language must include rules that specify its grammatical word orders.

The rules that specify word order are called *phrase structure rules*. Some examples of phrase structure rules are as follows:

English: NP → Art AP N   *Persian*: NP → Art N AP
             VP → V PP   VP → PP V

You can read the rules as follows: "an NP may consist of the sequence *Art, AP, N.*"

There is a more interesting way of interpreting phrase structure rules. If we have a complete set of them for a given language, we can think of the set of rules as an abstract machine that *generates* syntactic structures. For example, assume for the moment the following (obviously incomplete) set of phrase structure rules for English:

    S   → NP Aux VP   (Aux = "helping verb", like *can*, *will*, *be*, etc.)
    NP → Art AP N
    VP → V NP
    AP → A[50]

In this respect, the phrase structure rules are like the rules of inflectional morphology given earlier: given a starting point, they *generate* a sentence. For inflectional morphology, the starting point is the stem with its morphosyntactic representation. For syntax, the starting point is a single symbol, such as NP or (most often) S, which designates the category that we wish to generate.

---

[49] IPA symbols: ɑ = somewhat like *ah*; ʃ = *sh*, dʒ = *j*, x as in *ch* of German *Bach*, æ = the vowel of *cat*.

[50] This rule looks trivial right now—we'll beef it up a bit later by allowing Adverbs and Preposition Phrases.

Here is the procedure.

(a)   Provide the rules with the symbol S (or NP, or whatever) to start out with.
(b)   Whenever a symbol appears in a tree that is found on the left side of the rule, give that symbol daughters according to what the rule says;
(c)   Do this over and over until you can't apply any more rules.

If we start with S, the stages of this process would be as follows:

1. Starting point:

S

2: apply S → NP Aux VP

```
        S
    ┌───┼───┐
   NP  Aux  VP
```
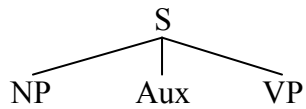
3: apply NP → Art AP N

```
            S
        ┌───┼───┐
       NP  Aux  VP
     ┌──┼──┐
   Art AP  N
```

4: Apply VP → V NP
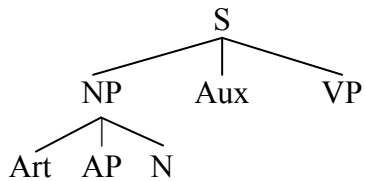
```
             S
        ┌────┼────┐
       NP   Aux   VP
     ┌──┼──┐    ┌──┴──┐
   Art AP  N    V    NP
```

5: Apply NP → Art AP N (again)

```
              S
         ┌────┼────┐
        NP   Aux   VP
      ┌──┼──┐    ┌──┴──┐
    Art AP  N    V    NP
                    ┌──┼──┐
                  Art AP  N
```

6: Apply AP→ A

```
                    S
        ┌───────────┼───────────┐
       NP          Aux          VP
     ┌──┼──┐                 ┌───┴───┐
    Art AP  N                V      NP
         │                        ┌─┼──┐
         A                       Art AP  N
                                  
                                Art AP  N
```

7: Apply AP→ A (again)

```
                    S
        ┌───────────┼───────────┐
       NP          Aux          VP
     ┌──┼──┐                 ┌───┴───┐
    Art AP  N                V      NP
         │                        ┌─┼──┐
         A                       Art AP  N
                                      │
                                      A
```
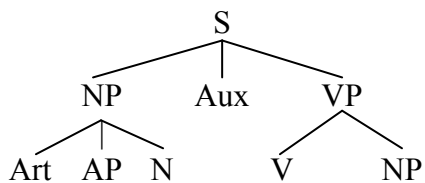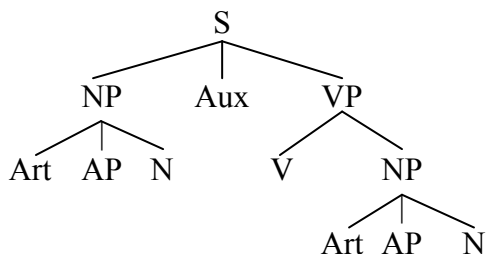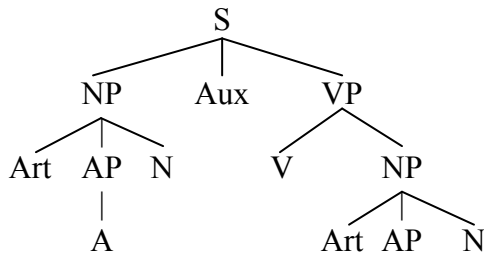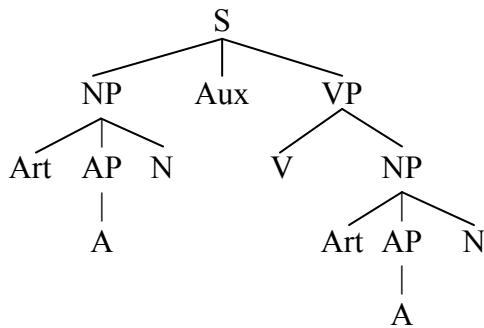
All that remains is to insert actual words into the tree (a process called **lexical insertion**), and you get sentences:

```
                          S
        ┌─────────────────┼─────────────────────────┐
       NP                Aux                        VP
   ┌────┼─────┐                            ┌─────────┴─────────┐
  Art   AP    N                            V                  NP
   │    │     │          │                 │         ┌─────────┼─────┐
   │    A     │          │                 │        Art        AP    N
   │    │     │          │                 │         │         │     │
  The short lumberjack  will             chop       the        A    tree
                                                               │
                                                              tall
```
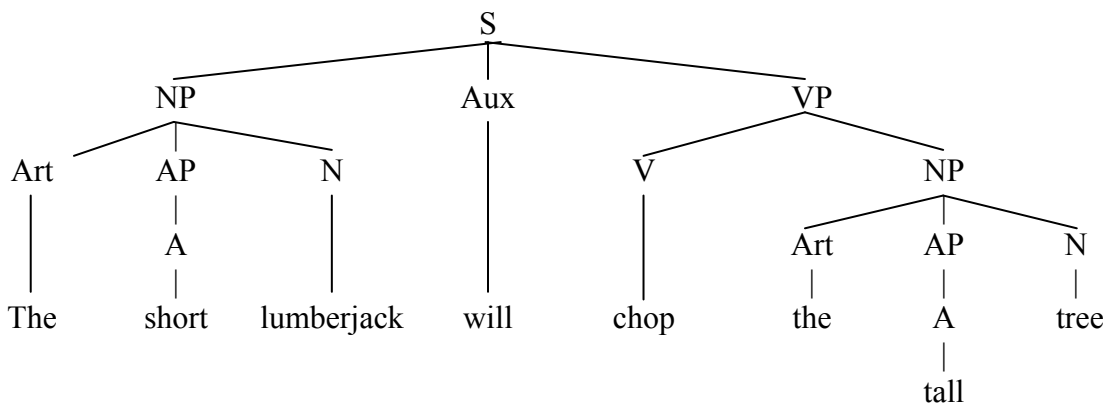
or, with different choices for lexical insertion:

The sleepy student might ignore the noisy alarm.
The green idea will paint the blue intellect.

Note that these sentences will not necessarily be sensible; they are merely grammatical.

A note on applicability of phrase structure rules. We saw that in inflectional morphology, the rules apply in a rigid order, like machines on an assembly line. Rules of word formation are more

"opportunistic"; they can reapply freely when they get the chance (see Chapter 2, §16). Phrase structure rules are likewise opportunistic; they keep applying until there are no more nodes to be expanded.

The phrase structure rules just proposed are obviously primitive, since they generate only one single structure. We can improve the rules by observing that some of the daughters introduced by a rule are optional. In particular, the NP rule has to introduce a N, but it doesn't have to introduce an Art or an A. The standard notation in linguistics for expressing optional elements is parentheses:

S → NP (Aux) VP
NP → (Art) (A) N
VP → V (NP)

These more flexible rules can provide the syntactic structures of sentences like these:

The lumberjack will chop the tree
Frogs will eat flies
Fish can see
Those students read books.
Sue won

and so on. (Diagram these if it is not obvious what the structure is.)

We can also make our AP rule less trivial, so that Adverbs are allowed.

AP → (Adv) A

For instance: *very tall*.

13. Curly brackets for "or"

One other complication in the notation for phrase structure rules. We find that a NP can begin *either* with an Article *or* with a possessive NP, but not both.

Article:

   the book, a book, this book, those books

NP:

   Fred's book, the king of England's book, my book

not both:

   *the Fred's book, *the king of England's this book, *those my books

Here is a simple way to account for this: we use curly brackets in the rules to mean "one or the other, but not both" (logicians call this "exclusive or"). The basic NP phrase structure rule for English comes out something like this:

$$NP \rightarrow \left(\begin{Bmatrix} \text{Art} \\ \text{NP} \end{Bmatrix} \right) (AP) \ N \ (PP)$$

This means that you can start out an NP with an Article, or an NP, then continue with the rest (optional Adjective, obligatory Noun, optional PP). Examples of each type:

> the long book about linguistics   (beginning with Article)
> the king's long book about linguistics   (beginning with NP)

14. Phrase structure rules for English sentences given so far

As we continue through syntax in this text, we will gradually build up an ever-improving grammar of phrase structure rules. Just to catch us up so far, I believe the following set of rules can generate most of the examples given in this book so far, as well as the sentences in the Study Exercises.

(103) *Phrase structure rules for English: Version I*

S   →   NP (Aux) VP

$NP \rightarrow \left(\begin{Bmatrix} \text{Art} \\ \text{NP} \end{Bmatrix} \right) (AP) \ N \ (PP)$

NP   →   Pronoun
VP   →   V (NP)(NP)(PP)
PP   →   P NP
AP   →   (Adv) A

S   →   S Conj S
NP   →   NP Conj NP
VP   →   VP Conj VP
PP   →   PP Conj PP
AP   →   AP Conj AP
V   →   V Conj V

15. Parsing: using the phrase structure rules as a guide
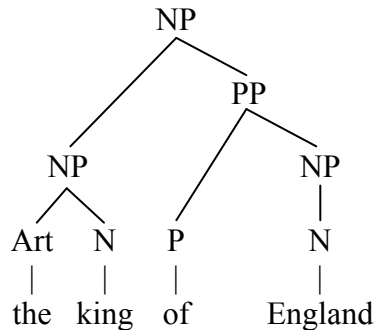
Once you've got a grammar like this to work with, then in principle it becomes easier to diagram sentences—any particular set of rules represents a claim about the inventory of phrase types a language allows, and thus constrains what kind of structures you can set up. Thus:

(104) **When diagramming sentences, make sure every structure you set up is licensed by the rules.**

In other words, you can't set up an NP whose structure is N AP, unless there is a phrase structure rule that specifies this sequence (either directly, or by leaving out parenthesized material). Thus you can be guided to an answer by both the meaning of the sentence and by the rules of the grammar.

Example: if you're thinking of the structure below for *the king of England*:

```
                NP
                 \
                  PP
                 /  \
      NP            NP
     /  \            |
   Art    N    P     N
    |     |    |     |
   the  king  of  England
```

you can tell it's not right because the grammar in (103) contains no rule that permits NP to dominate NP followed by PP.[51] This is a very easy principle to apply; you just need a printed copy of the grammar on your desk, then you can check every single node in your tree to see if it is legal. If you're having trouble in parsing, it is definitely worth taking the time to apply this mechanical procedure.

There actually is one way you can legitimately diagram a structure that the grammar doesn't allow—namely, *change the grammar*. In other words, you have to say something like "This sentence shows that our grammar was wrong, and has to be fixed like this [offer substitute rules here]." In this book I have included only sentences that can be parsed with the grammar given so far. But of course real life is different: a grammar that could parse all of English would be quite large and a big challenge to create. Expanding the grammar so it can cover more of the legal sentences of a language is something linguists do all the time when they work with language data.

16. Further details of our current grammar

A few of our phrase structure rules in (103) need clarification.

16.1 Pronouns

The phrase structure rule of (103) that introduces Pronouns is very simple:

NP $\rightarrow$ Pronoun

Pronoun, appearing in trees, is often abbreviated as Pro. Thus:

---

[51] Note that there is a rule NP $\rightarrow \left(\begin{Bmatrix} \text{Art} \\ \text{NP} \end{Bmatrix} \right)$(AP) N (PP). But it won't help, because it *requires* there to be an N daughter.

```
              S
             ╱ ╲
            ╱   VP
           ╱   ╱ ╲
         NP   ╱   NP
          |  ╱     |
         Pro V    Pro
          |  |     |
         She saw  him
```
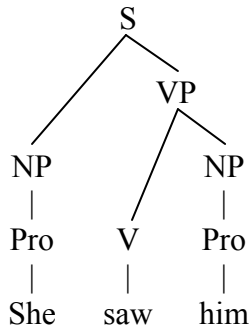
The reason to have a separate rule for pronouns is that, unlike nouns, they do not admit modifiers, except in special circumstances we'll defer for now.[52] This is one reason to give them their own phrase structure rule, rather than just calling them a kind of Noun. The other reason is that, later on, we will need rules of semantic interpretation that indicate what the pronouns refer to, and these rules need to identify the pronouns.

Incidentally, pronouns in English are unusual in that they are inflected for case. English has a three-way case system, with Nominative, Objective, and Genitive. Objective covers what in many other languages (including English, centuries ago) was Accusative or Dative. Different authors will give different names to these cases.

(105) *English pronouns in outline form*

		Nominative	**Objective**	**Genitive**
Singular	**1**	*I*	*me*	*my*
	2	*you*	*you*	*your*
	3	*he/she/it*	*him/her/it*	*his/her/its*
Plural	**1**	*we*	*us*	*our*
	2	*you*	*you*	*your*
	3	*they*	*them*	*their*

Part of what a grammar must do is ensure that the correct case form of each pronoun is used in the right context; we will turn to the sort of rules that are needed later on.

16.2 Aux

"Aux", meaning "auxiliary verb", is the "helping verb" taught in school. In our phrase structure rules, it is the optional second daughter of S (S → NP (Aux) VP). Here is a list of auxes:

"Modal" verbs: *can, could, shall, should, may, might, will, would*
> Example: *I can go*.

Forms of *have*: *have, has, had*
> Example: *I have gone*.

---

[52] Examples: *Poor me*, a "frozen" memorized expression; *He who dares to go…*, with a relative clause.

Forms of *be*: *be*, *am, are, is, was, were*
　　Example: *I am going.*

You can see that the choice of Aux also determines the inflectional morphology of the following verb—this involves rules we haven't yet covered.

　　Be aware that *have* and *be* can serve as either Auxes or main Verbs. Thus:

　　He is having a fit

involves *be* as an Aux and *have* as a main Verb.

　　He has been President.

has *have* as an Aux and *be* as a main Verb.

Study Exercise #16

　　Parse. Give one parse for each meaning. The number of parses is given in parentheses.[53] I suggest you keep a printed copy of the Version I grammar ((103) above) next to you as you parse.

　　a. We have captured the turtle with the net. (2)
　　　　i.　　　　... it was quite interesting because most turtles don't carry a net.
　　　　ii.　　　　... we felt sad to see the noble reptile caught in the webbing.

　　b. The great import sinks. (2)
　　　　i.　　　　... because, like many imports, it weighs a lot.
　　　　ii.　　　　... because powerful people feel that their sinks ought to come from overseas.

　　c. We offered the mighty bruins. (2)
　　　　i.　　　　... because the mighty bruins were a good choice to offer them.
　　　　ii.　　　　... because mighty people like to keep bruins in their personal zoo

　　d. UCLA and USC's departments (2)
　　　　i.　　　　the departments that belong to UCLA and to USC
　　　　ii.　　　　a university and a batch of departments
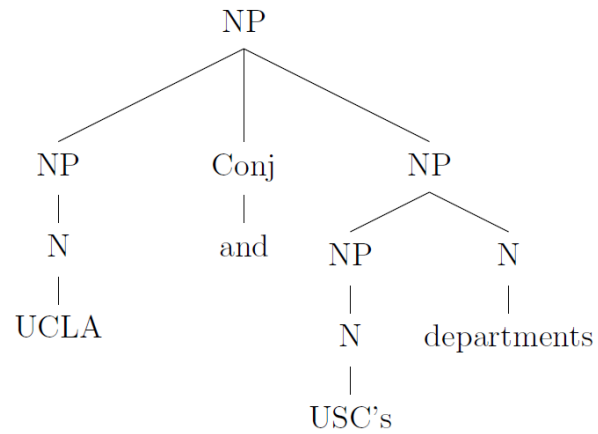
　　e. We robbed the King of England of his money. (1)
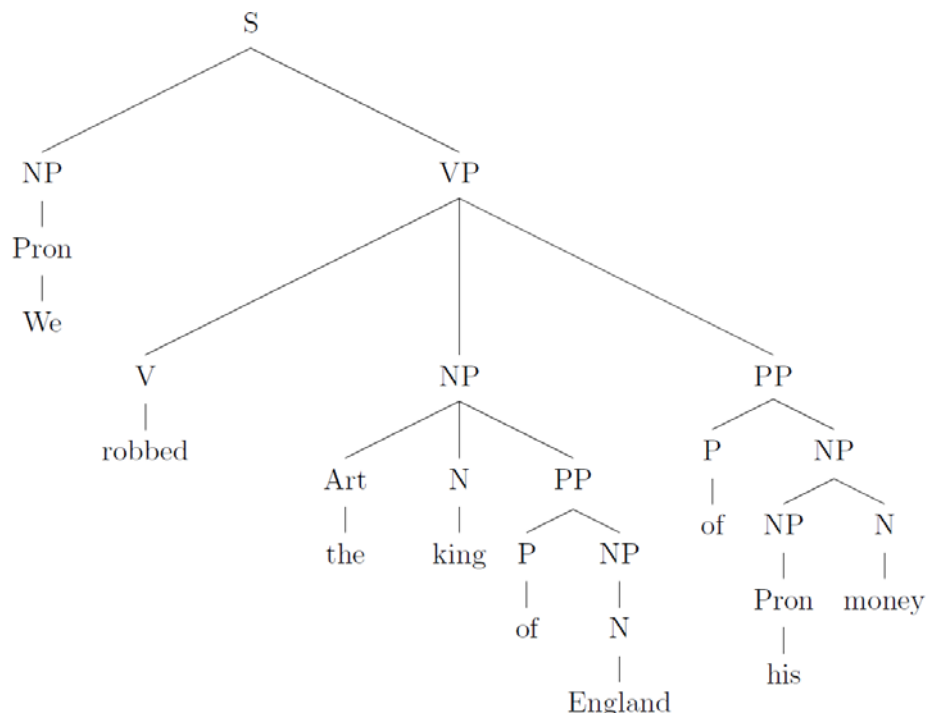
　　f. We despise the King of England and France (2)
　　　　i.　　　　We despise the person who is the king all at once of two countries.[54]
　　　　ii.　　　　We despise both a person and a country.

---

[53] Through maybe you can think of more …

[54] This happened once, more or less, and the Hundred Year's War was the result.

g. We despise the King of England and of France (1)
    i.   We despise the person who is the king all at once of two countries.
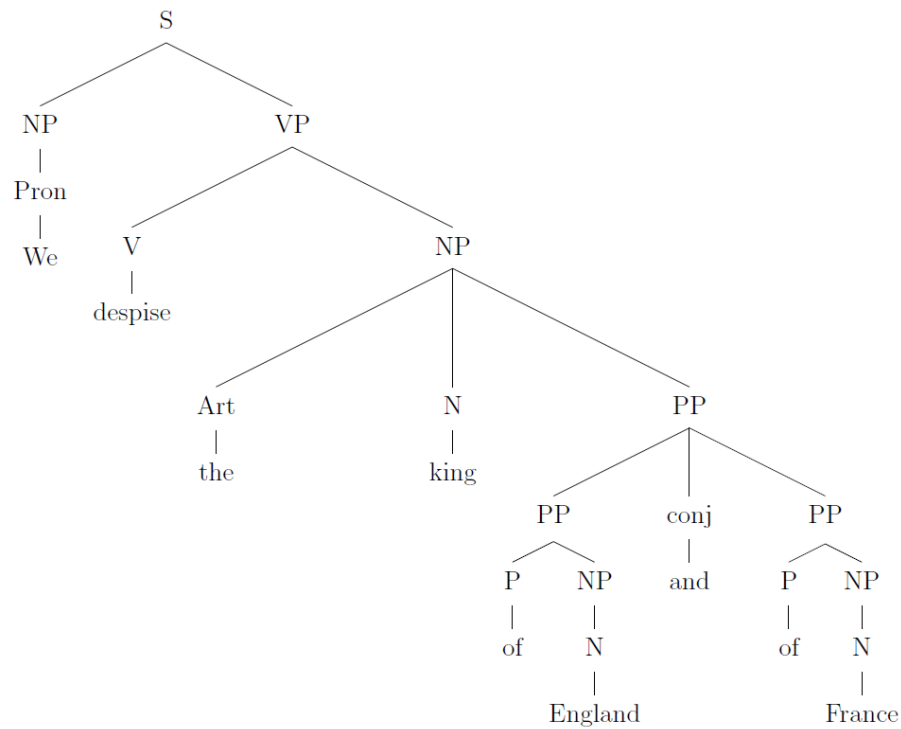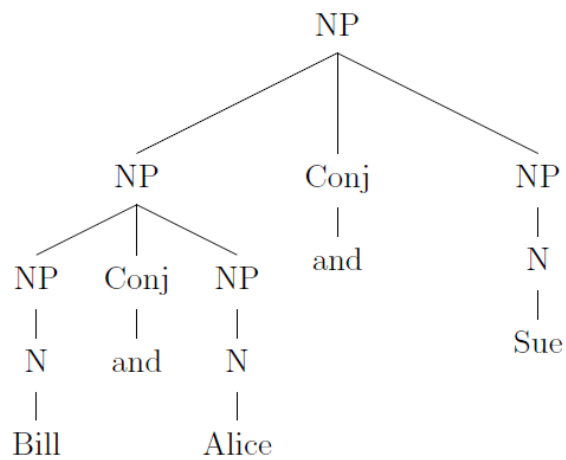
h. Bill and Alice and Sue (2)
    i.   a group consisting of Bill and Alice, and also a single person, Sue
    ii.   a single person, Bill, and also a group consisting of Alice and Sue
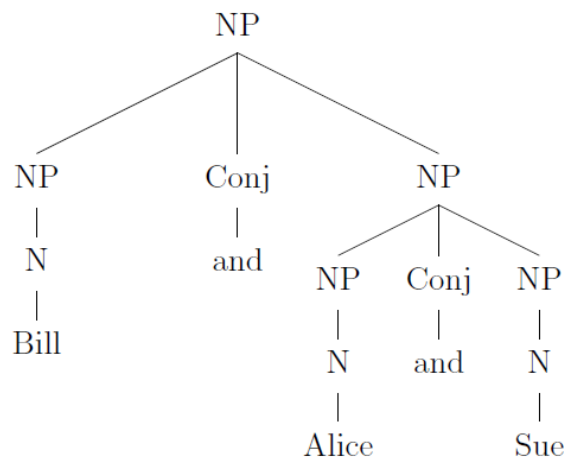
i. the cover of Bill's book about the very dry climate of Australia (1)
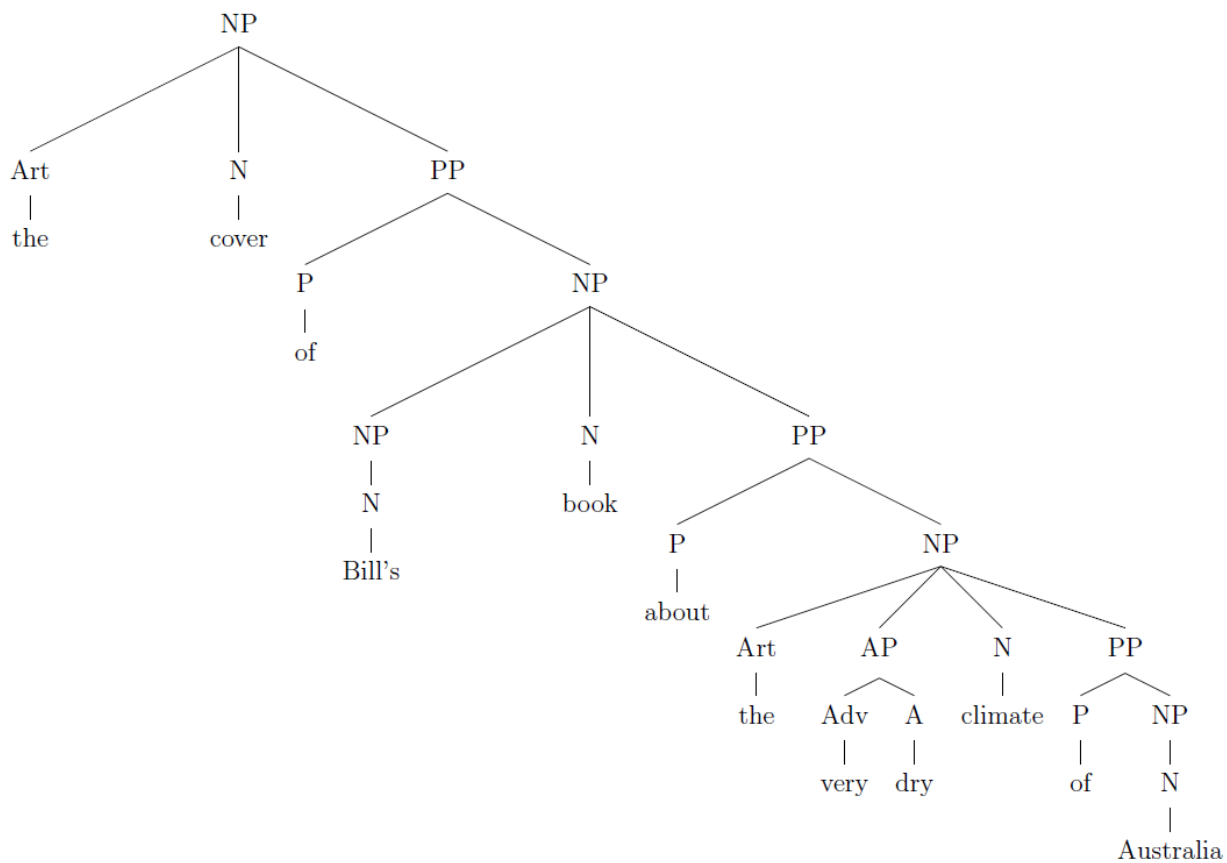
j. They might cook and serve the vegetables. (2)
    i.   what they do to the vegetables is cook and serve them
    ii.   They do two things: cook, and serve the vegetables

k. a long and very unpleasant episode (1)

m. Bill's mother's brother's shaggy dog (1)

n. We sent the ambassador to Venezuela to Columbia. (1)

o. We sent the ambassador to Venezuela (2)
    i. We needed somebody to send, so we picked the ambassador to Venezuela
    ii.Venezuela is where we sent the ambassador

p. We have cooked her turnips. (2)
    i.   It's her turnips that we cooked.
    ii.   We cooked turnips for her.

Answers begin on the next page.

Answers to Study Exercise #16

a. We have captured the turtle with the net. (2)

    i.   ... it was quite interesting because most turtles don't carry a net.

    ii.   ... we felt sad to see the noble reptile caught in the webbing.

b. The great import sinks. (2)
   i.   ... because this wonderful import weighs so much

```
                    S
             _____/_____
            NP            VP
       ____/ | \____       |
      Art   AP    N        V
       |     |    |        |
      the    A  import   sinks
             |
           great
```

   ii.   ... because powerful people feel that their sinks ought to come from overseas.

```
              S
         ____/\____
        NP          VP
      _/ \_       _/ \_
     Art   N     V    NP
      |    |     |     |
    the  great import  N
                       |
                     sinks
```

c. We offered the mighty bruins. (2)
   i.   ... because the mighty bruins were a good choice to offer them.

```
              S
          ___/\___
        NP         VP
         |       _/ \___
        Pron    V       NP
         |      |     _/ | \_
        We   offered Art  AP   N
                      |    |    |
                    the    A  bruins
                           |
                        mighty
```

ii.   ... because mighty people like to keep bruins in their personal zoo

```
                              S
                      _____/_____
                    NP                  VP
                    |              _____/\_____
                   Pron           /      |      \
                    |            V       NP      NP
                    We           |      /\        |
                              offered  Art  N      N
                                       |    |      |
                                      the mighty bruins
```

d. UCLA and USC's departments (2)
    i.   the departments that belong to UCLA and to USC

```
                      NP
                  ___/_____
                NP                 N
              __/|\__              |
             /   |   \         departments
            NP  Conj  NP
            |    |    |
            N   and   N
            |         |
          UCLA      USC's
```

ii.   a university and a batch of departments

```
                        NP
            _____|_____
           NP          Conj          NP
           |            |        _____|_____
           N           and      NP          N
           |            |        |          |
         UCLA           N      departments
                        |
                      USC's
```

e. We robbed the King of England of his money. (1)

```
                    S
         _____|_____
        NP                      VP
        |            _____|_____
       Pron         V          NP           PP
        |           |      _____|_____    ___|___
        We        robbed  Art  N   PP    P      NP
                          |    |   |     |    __|__
                         the  king P  NP  of  NP   N
                               |   |      |    |
                              of   N     Pron money
                                   |      |
                               England   his
```

f. We despise the King of England and France (2)

   i.   We despise the person who is the king all at once of two countries.

```
                        S
              ┌─────────┴─────────┐
             NP                   VP
              │            ┌───────┴───────┐
            Pron           V               NP
              │            │       ┌───────┼───────┐
             We         despise   Art      N       PP
                                   │       │    ┌───┴────┐
                                  the    king   P        NP
                                                │    ┌────┴────┐
                                                of  NP   conj   NP
                                                    │    │      │
                                                    N   and     N
                                                    │           │
                                                England      France
```

   ii.   We despise both a person and a country.

```
                        S
              ┌─────────┴──────────────────┐
             NP                            VP
              │              ┌─────────────┴─────────────┐
            Pron             V                           NP
              │              │              ┌────────────┼──────────┐
             We           despise          NP           Conj        NP
                                      ┌─────┼─────┐      │           │
                                     Art    N     PP    and          N
                                      │     │   ┌──┴──┐              │
                                     the  king  P     NP           France
                                                │     │
                                                of    N
                                                      │
                                                   England
```
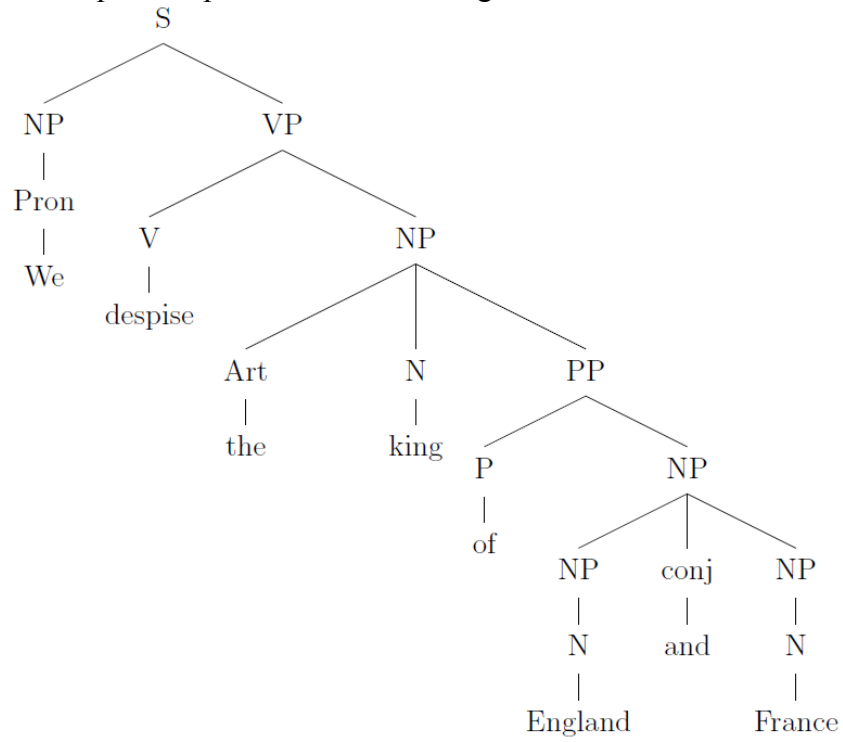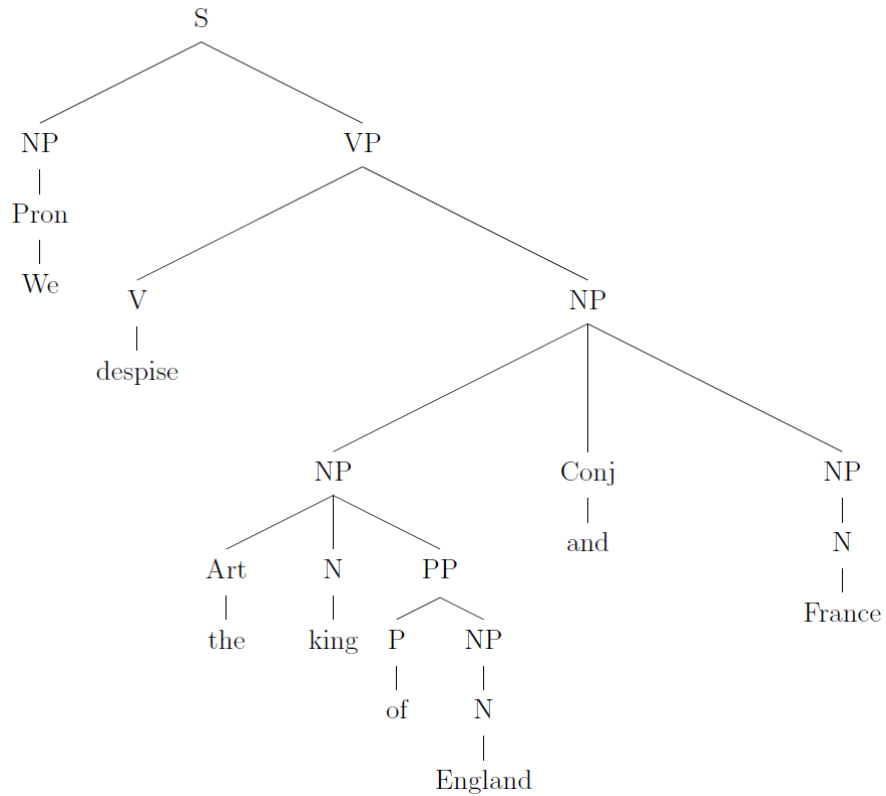
g. We despise the King of England and of France (1)
   i.   We despise the person who is the king all at once of two countries.

```
                         S
              ┌──────────┴──────────┐
             NP                     VP
              │              ┌───────┴────────┐
            Pron             V                NP
              │              │        ┌───────┼────────┐
             We           despise    Art      N        PP
                            │         │       │     ┌───┴────┐
                          despise    the    king   PP  conj  PP
                                                  ┌─┴─┐  │   ┌─┴─┐
                                                  P  NP  and  P  NP
                                                  │   │       │   │
                                                  of  N       of  N
                                                      │           │
                                                   England      France
```

h. Bill and Alice and Sue (2)
   i.   a group consisting of Bill and Alice, and also a single person, Sue

```
                    NP
          ┌─────────┼─────────┐
         NP        Conj       NP
     ┌────┼────┐    │          │
    NP  Conj  NP   and         N
     │    │    │               │
     N   and   N              Sue
     │         │
    Bill     Alice
```

ii.   a single person, Bill, and also a group consisting of Alice and Sue

```
                        NP
           ┌────────────┼────────────┐
          NP           Conj          NP
           |            |         ┌───┼───┐
           N           and       NP  Conj  NP
           |                      |    |    |
         Bill                     N   and   N
                                  |         |
                                Alice      Sue
```
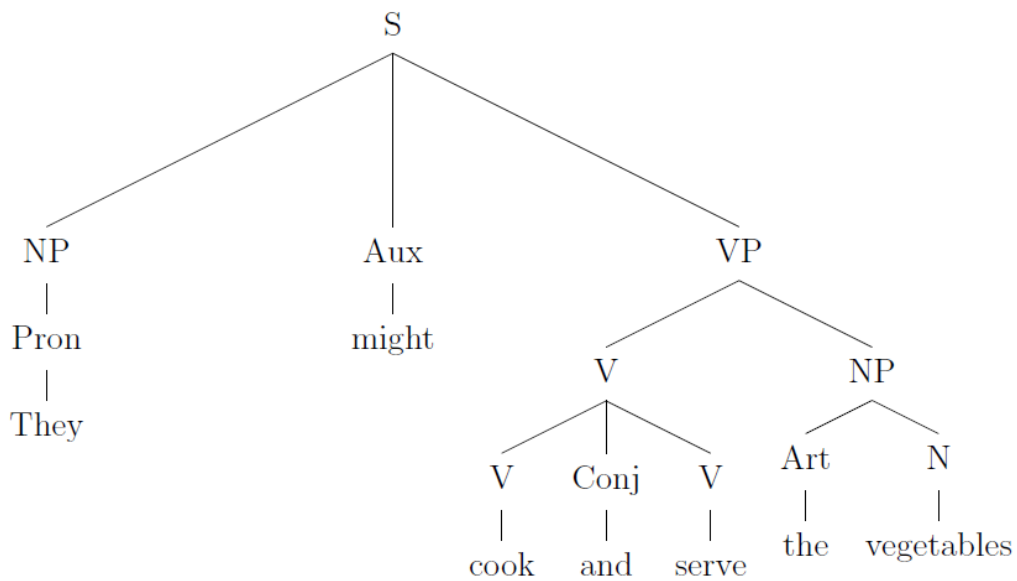
i. the cover of Bill's book about the very dry climate of Australia (1)

```
                    NP
         ┌──────────┼──────────┐
        Art         N          PP
         |          |       ┌───┴───────────┐
        the       cover     P              NP
                            |        ┌──────┼──────────┐
                            of      NP      N          PP
                                     |      |      ┌────┴────────┐
                                     N     book    P            NP
                                     |             |     ┌───┬───┼───┐
                                   Bill's        about  Art  AP  N   PP
                                                         |  ┌─┴─┐  |  ┌─┴─┐
                                                        the Adv A climate P  NP
                                                             |  |        |   |
                                                            very dry     of  N
                                                                             |
                                                                          Australia
```
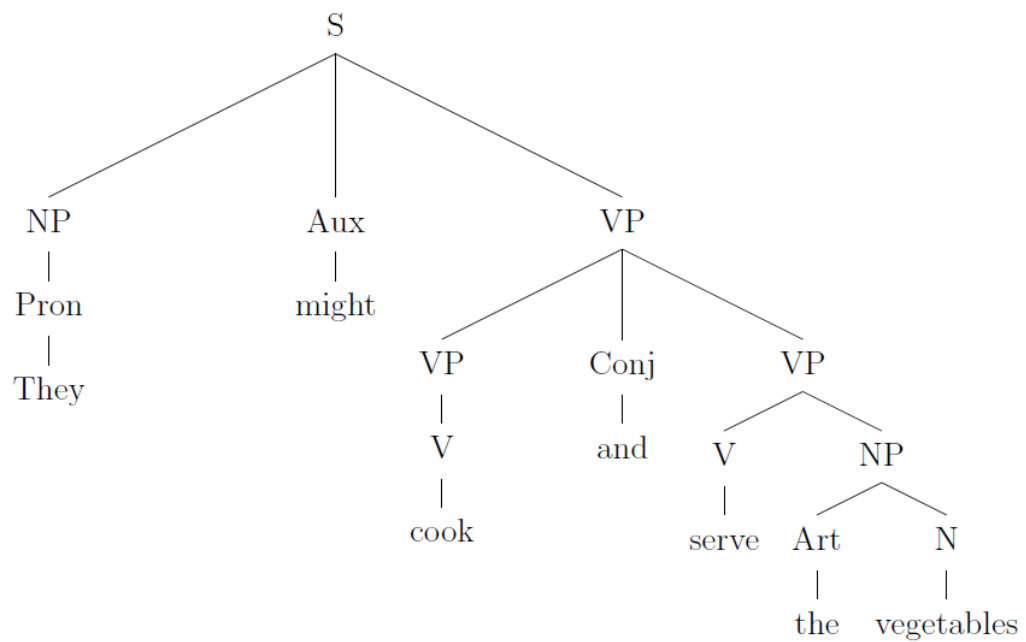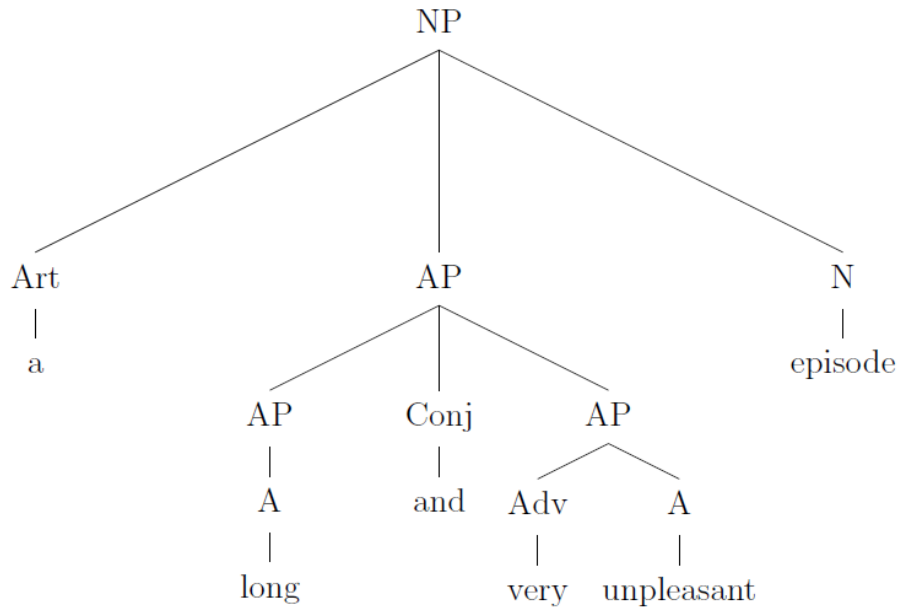
j. They might cook and serve the vegetables. (2)
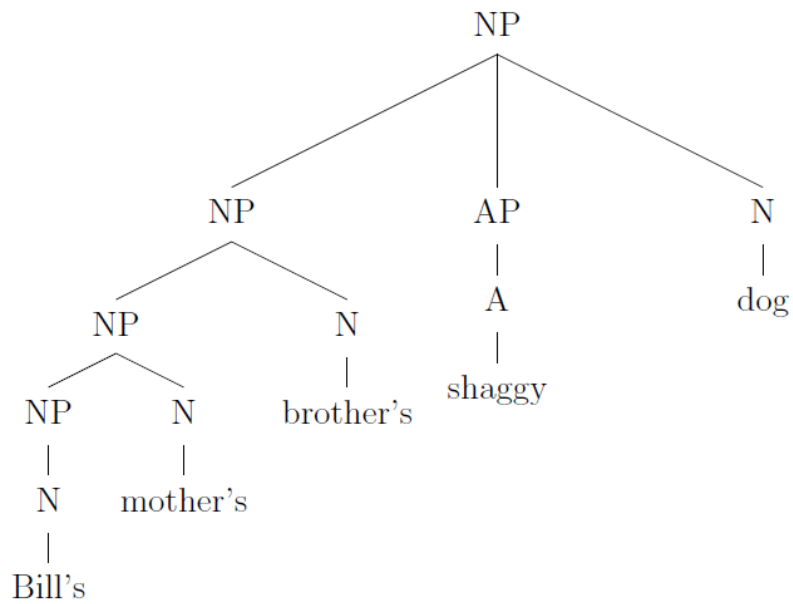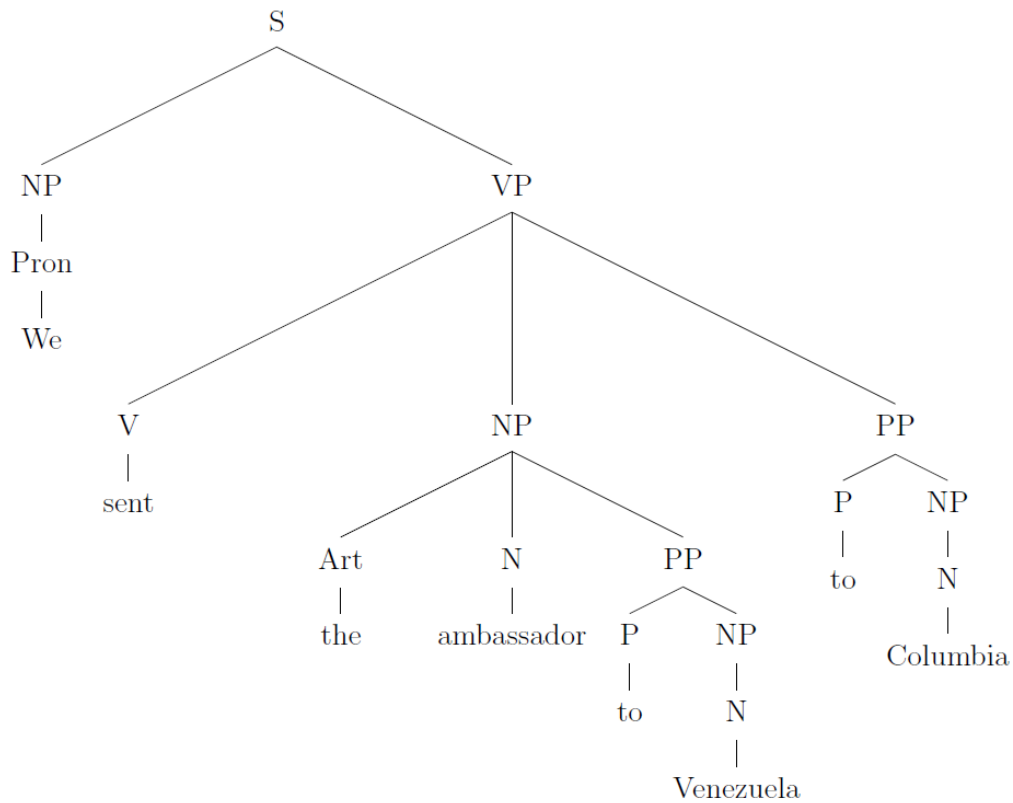   i.   what they do to the vegetables is cook and serve them

```
                         S
          ┌──────────────┼──────────────┐
         NP             Aux             VP
          │              │         ┌─────┴─────┐
        Pron           might       V          NP
          │                    ┌───┼───┐    ┌──┴──┐
        They                   V  Conj  V   Art    N
                               │   │    │    │     │
                             cook and serve the  vegetables
```

    ii.   they do two things: cook, and serve the vegetables

```
                         S
          ┌──────────────┼──────────────┐
         NP             Aux             VP
          │              │        ┌──────┼──────┐
        Pron           might      VP    Conj    VP
          │                       │      │    ┌──┴──┐
        They                      V     and   V     NP
                                  │          serve ┌─┴─┐
                                cook              Art   N
                                                   │    │
                                                  the vegetables
```
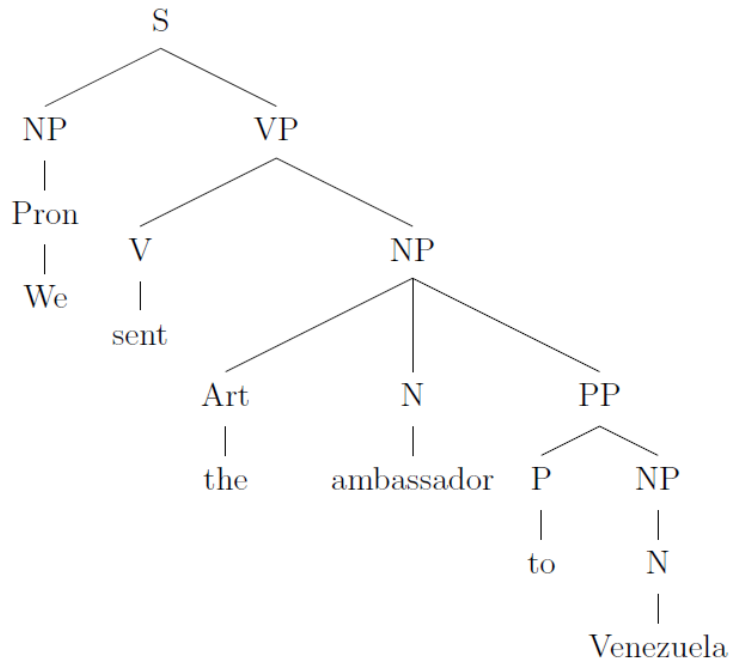
k. a long and very unpleasant episode (1)

```
                          NP
          ┌───────────────┼───────────────┐
         Art             AP                N
          |        ┌──────┼──────┐         |
          a       AP     Conj    AP     episode
                  |       |    ┌──┴──┐
                  A      and  Adv    A
                  |            |     |
                long         very unpleasant
```

m. Bill's mother's brother's shaggy dog (1)

```
                          NP
              ┌───────────┼───────────┐
             NP          AP           N
         ┌────┴────┐      |           |
        NP         N      A          dog
     ┌───┴───┐  brother's |
    NP       N          shaggy
    |        |
    N     mother's
    |
  Bill's
```

n. We sent the ambassador to Venezuela to Columbia. (1)

```
                              S
                 ┌────────────┴──────────────┐
                NP                            VP
                 |            ┌───────────────┼───────────────┐
                Pron          V              NP               PP
                 |            |       ┌───────┼───────┐      ┌──┴──┐
                We          sent     Art      N       PP     P    NP
                                      |       |     ┌──┴──┐   |    |
                                     the  ambassador P    NP  to   N
                                                     |    |        |
                                                     to   N     Columbia
                                                          |
                                                      Venezuela
```

o. We sent the ambassador to Venezuela (2)
    i. We needed somebody to send, so we picked the ambassador to Venezuela

```
                     S
           ┌─────────┴────────┐
          NP                  VP
           |           ┌──────┴──────┐
          Pron         V            NP
           |           |       ┌─────┼──────┐
          We          sent    Art    N      PP
                               |     |    ┌──┴──┐
                              the ambassador P  NP
                                             |   |
                                             to  N
                                                 |
                                             Venezuela
```

ii. Venezuela is where we sent the ambassador

```
                         S
              _____
             |                        |
            NP                        VP
             |              _____
           Pron           |            |             |
             |            V            NP            PP
            We           |        _____       _____
                        sent     |        |      |       |
                                Art       N      P       NP
                                 |        |      |        |
                                the   ambassador to       N
                                                          |
                                                      Venezuela
```

p. We have cooked her turnips. (2)
  i.   It's her turnips that we have cooked.

```
                       S
           _____
          |          |              |
         NP         Aux             VP
          |          |         _____
        Pron        have      |           |
          |                   V           NP
         We                   |        _____
                           cooked     |        |
                                      NP        N
                                      |         |
                                    Pron     turnips
                                      |
                                     her
```

ii.   We cooked turnips for her.

```
                           S
            _____|_____
           |                |                |
          NP               Aux               VP
           |                |          _____|_____
         Pron             have        |       |       |
           |                |         V      NP      NP
          We               have       |       |       |
                                    cooked   Pron     N
                                             |        |
                                            her     turnips
```

16.3 Complementizers and subordinate clauses

Much of the most intricate syntax arises when one "puts a sentence inside a sentence"; that is, when one uses a **subordinate clause**. This showed up in Chapter 1 when we looked at the patterning of *each other*. Thus, *[John and Bill think [I like each other]s]s* is impossible, because *each other* is allowed to refer only to Noun Phrases that are within the smallest clause containing it — in this case, [*I like each other*]s. Subordinate clauses often occur when the verb of the main clause is a *verb of saying or belief*—the subordinate clauses serves to express the content of the thought that is said or believed. With the notions of syntax we've developed so far, we can now be much more explicit about subordinate clauses than we were in Chapter 1.

To analyze subordinate clauses, we need to provide a slot in phrase structure for the grammatical words that often introduce them—*that* in sentences like:

I think *that* [John and Bill like each other]s

There is also *for*, as in:

I would prefer *for* [John and Bill to like each other]s.

Such words are called **subordinating conjunctions** in traditional terminology. Linguists use the slightly shorter term **complementizer**,[55] abbreviated **Comp**. Other complementizers include *if, (al)though, when, whether*, and some others we'll mention later.

---

[55] For why the complementizers is so called: the subordinate clause is sometimes classified as a "sentential complement", meaning it functions as the object of the verb. A complementizer renders a simple S suitable for appearing as a complement; the bare sentence is made into a possible object.

With this apparatus, we can set up rules like these (I'm omitting optional material; see below for the full rules):

VP → V CP
CP → Comp S

CP is the category that provides the syntactic "slot" for the complementizer. Here is an example sentence that can be generated by these rules:
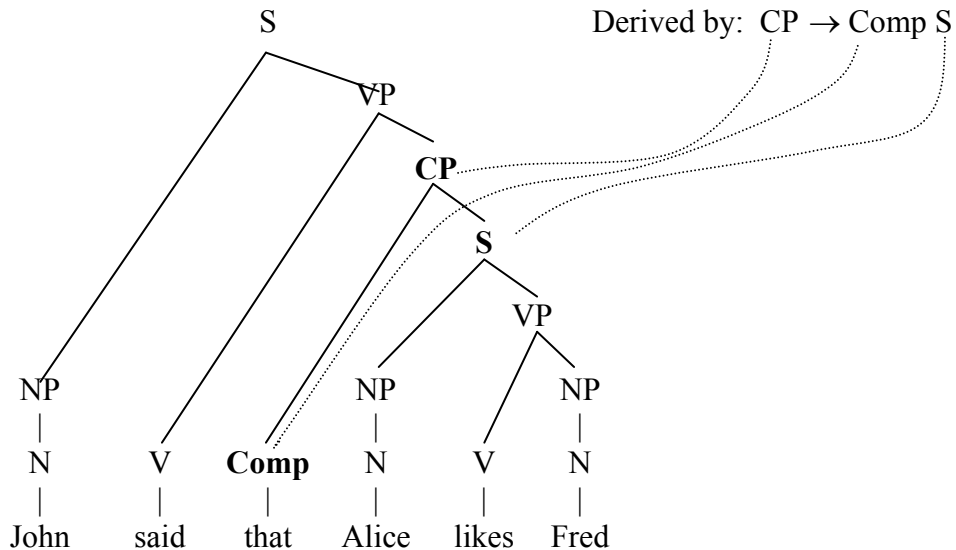
16.4 Phrase structure rules for subordinate clauses

Subordinate clauses in English most often occur the last constituent of the VP, indicating what was said or thought. Here are some examples:

(106) *Four sentences with subordinate clauses*

We said [that we were going]$_{CP}$
We told Alice [that we were going]$_{CP}$
We gave Bill notice [that we were going]$_{CP}$
We sent word to Jane [that we were going]$_{CP}$

From these sentences, you can see that the Verb Phrase can, in addition to its subordinate clause, include one or two NP objects and a PP, all of them preceding the CP. Thus the phrase structure rule needed is something like this:

(107) *A phrase structure rule for VP that incorporates CP*

VP → V (NP)(NP)(PP)(CP)

Study Exercise #17

Parse the four sentences given in (106) above. Answers on next page.

Answers to Study Exercise #17

```
                    S
                    ╱ ╲
                       VP
                      ╱ ╲
                         CP
                        ╱ ╲
                           S
                          ╱│╲
    NP        V    Comp  NP│  VP
    │         │     │    Pro Aux  V
    Pro       V    Comp  │   │    │
    │         │     │    Pro Aux  V
    We       said  that  we  were going
```

```
                   S
                   ╱ ╲
                     VP
                    ╱│╲
                         CP
                        ╱ ╲
                           S
                          ╱│╲
  NP       V     NP    NP │  VP
  │        │     │     │  │   │
  Pro      V     N   Comp Pro Aux  V
  │        │     │     │   │   │    │
  We      told  Alice that we  were going
```

```
                 S
                 ╱ ╲
                   VP
                  ╱│╲╲
                        CP
                       ╱ ╲
                          S
                         ╱│╲
  NP     V    NP   NP   NP │  VP
  │      │    │    │    │  │   │
  Pro    V    N    N  Comp Pro Aux  V
  │      │    │    │    │   │   │    │
  We    gave Bill notice that we  were going
```

```
                      S
                      |
                      VP
                      |
                      |
                              CP
            NP      NP    PP         NP      VP
            |       |     |          |       |
            Pro  V  N   P   N   Comp Pro Aux  V
            |    |  |   |   |   |    |   |    |
            We sent word to Jane that we were going
```
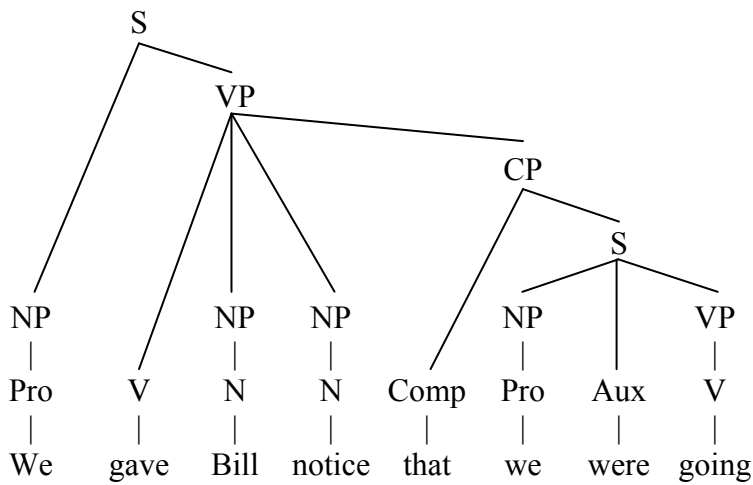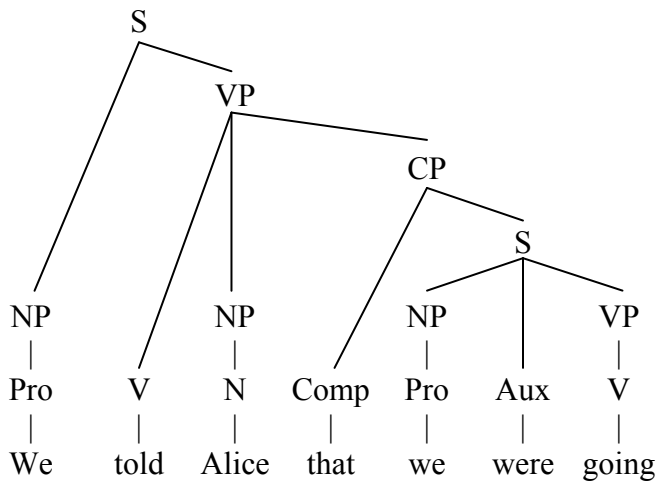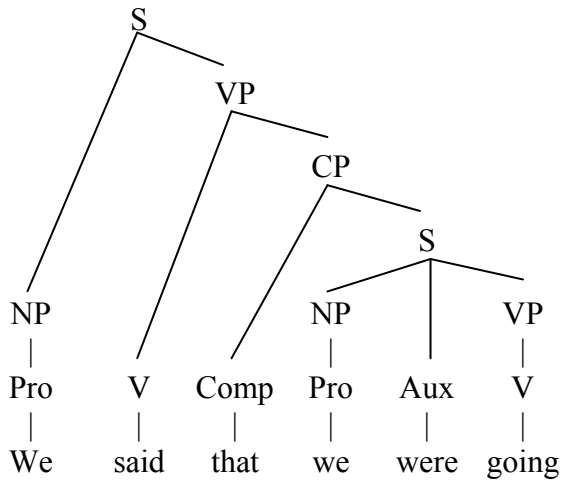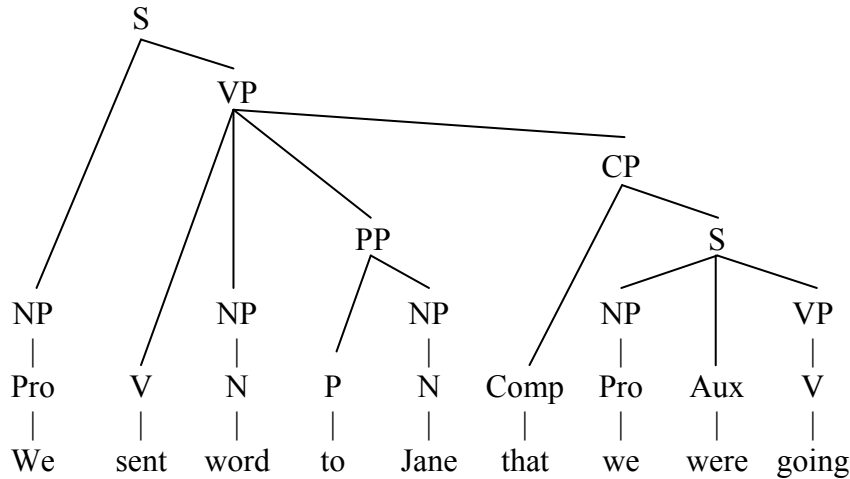
The rule for CP needs to let Comp be optional, since we have sentences like (108):

 (108) *We said we were going.*

The conditions under which the Comp can be left out are somewhat complicated and will not be covered here.

Note that the tree for given below must have a "vacuous" CP node, at least under the phrase structure rules we've got, since with those rules only CP, not S, can be a daughter of VP.

```
                 S
                 |
                 VP
                 |
                 **CP**
                  |
                 **S**
                  |
                         VP
            NP      NP        NP
            |       |         |
            Pro  V  Pro   V   N
            |    |  |     |   |
            We said we   like Fred
```
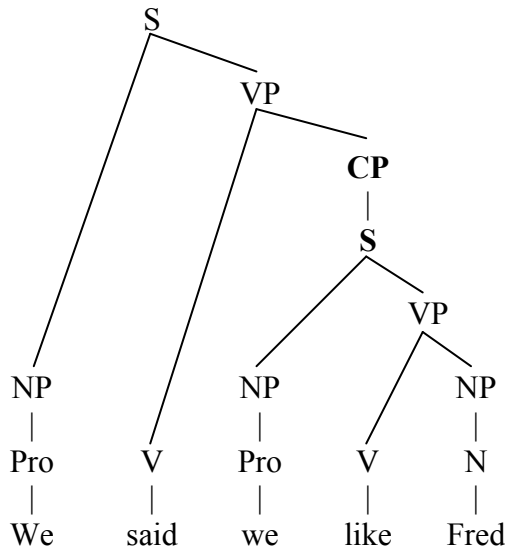
17. Recursive application of phrase structure rules

I mentioned above (p. 69) that the speaker's knowledge of syntax is large but finite (that is, it fits somehow encoded in a single brain), yet permits the creation of an infinite number of sentences. The following partial list was meant as a demonstration:

> Alice likes Fred
> John said that Alice likes Fred
> Bill believes that John said that Alice likes Fred
> …etc.

We can now examine the cause of this infinite property. It results, by and large, from a particular property of phrase structure rules, namely that they permit application in **loops**. In (109), I demonstrate one of these loops, taken from the phrase structure rules already given. That is, by looping through application of phrase structure rules given above in (103) and (107), we can generate structures as large as we please.

(109)   *A loop consisting of three phrase structure rules*

S → NP (Aux) **VP**

VP → V (NP) (NP) (PP) (**CP**)

CP → (Comp) **S**
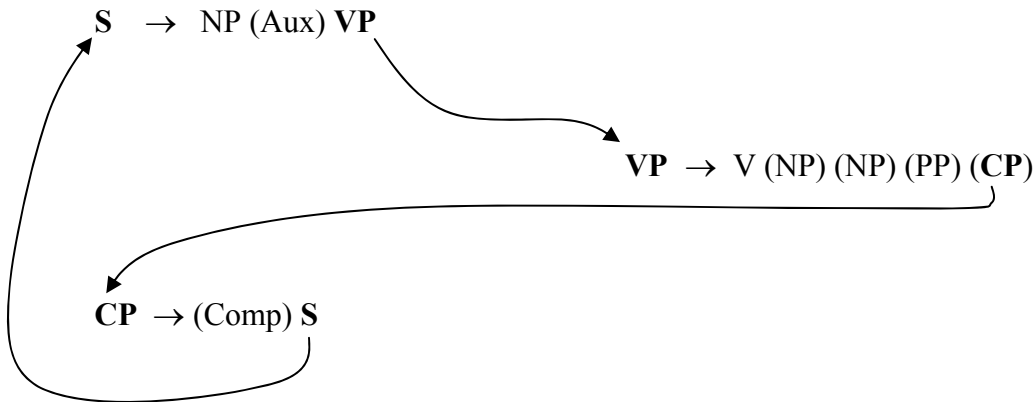
If we employ loop (109) in deriving a sentence and lexically insert appropriate words, we can generate a sentence as long as we like:
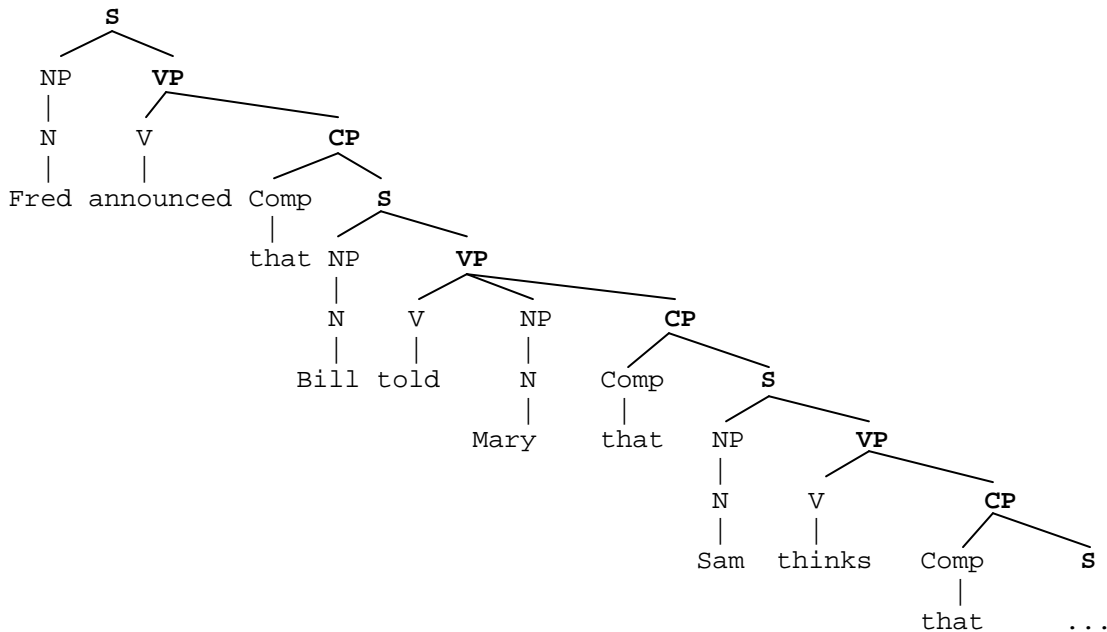
This is because there is an infinite number of places where we could stop the loop. Thus there are an infinite number of possible sentences that the grammar can generate.

In this sense, the phrase structure rules of (103) and (107) may be considered **recursive**; that is, their application "recurs" when they apply in loops to create structures of unlimited length.

As far as is known, *every* human language allows an infinite number of sentences. In every case, the principal reason is the same: the phrase structure rules of all languages contain recursive loops, which allow infinitely long syntactic trees to be generated. The recursive loop of phrase structure rules is the device that allows a finite number of rules to generate an infinite number of structures.

Study Exercise #18

The phrase structure grammar in (103) has several other loops in it. The loop in (109) is a three-rule loop; find a two-rule loop and a one-rule loop and for each one give an example of the long structures they can generate.

Answer to Study Exercise #18

a. *Two rule loop*

$$\mathbf{NP} \rightarrow \left(\begin{Bmatrix} \text{Art} \\ \text{NP} \end{Bmatrix} \right) (\text{AP})\ \text{N}\ (\mathbf{PP})$$

and

$$\mathbf{PP} \rightarrow \text{P}\ \mathbf{NP}$$

form a two-rule loop (see boldface items)

example: books about articles about articles about …

b. Any of the phrase structure rules with a conjunction forms a one-rule loop. For the rule

$$\text{V} \rightarrow \text{V Conj V}$$

you can get a massively ambiguous structure like *danced and sang and acted and …*

18. Relating syntax to inflectional morphology

We are now in a position to tie together our two course units so far (morphology and syntax). The crucial notion is the morphosyntactic representation, covered earlier in Chapter 2. You can think of the morphosyntactic representation as the means by which the syntax communicates essential information to the inflectional morphology.

The features in a morphosyntactic representation can have three sources.

18.1 Inherent features

First, some features of a morphosyntactic representation are **inherent**. They are properties of particular words or stems.

It is normal to use the word **lexicon** to refer to the speaker's mental dictionary; their store of memorized stems, words, and other entities.[56] Since a feature like [Gender] on nouns is memorized, it must be listed in the lexicon. Here are three examples of inherent inflectional features.

I. Gender in German. The German word *Messer* (knife) is inherently, and arbitrarily, neuter. Its lexical entry must look something like this:

Messer [Gender:Neuter]

---

[56] We also memorize a great number of word sequences, often called **idioms**.

That is, attached to *Messer* is a partial morphosyntactic representation that indicates that *Messer* is a neuter noun.

  II. The English pronoun *his* is inherently [Case:Genitive,Gender:Masculine].

  his [Case:Genitive,Gender:Masculine]

  III. All nouns derived by the English word formation rule [X]$_{Adj}$ → [[X]$_{Adj}$]$_{Noun}$ (example: *The <u>French</u> care a lot about food*) are inherently [Number:Plural].[57] This is also true for a small number of words for "pairlike" things, such as *trousers*, *scissors*, and so on, which must be lexically listed as [Number:plural].

18.2 *Speaker-selected features*

  Other features of the morphosyntactic representation are meaningful; they represent **choices made by the speaker**, as part of the meaning of what they are trying to say. When we say *book* in English we are implicitly conveying the partial morphosyntactic representation [Number:singular], and when we say *books* we are similarly conveying [Number:plural]. (This raises the question of how linguistic entities bear meaning, a question addressed in Chapter 9.)

18.3 *Features derived by syntactic rules*

  The remaining source for the features in morphosyntactic is **syntactic rules**. These attach the features that depend on what else occurs in the tree. Two important kinds of rule in syntax are rules of **case marking** and rules of **agreement**.

19. Case marking

19.1 *Genitive case in English*

  Genitive case in English is the case that we spell with the suffix *-'s*. Semantically, it denotes the relationship of possession. To derive it, we need a syntactic case marking rule, and a morphological suffixation rule.

  Here is a tree to serve as an example. The phrase structure rules given so far generate this:

---

  [57] Thus, a fully explicit version of the conversion rule would actually attach a partial morphosyntactic representation: [X]$_{Adj}$ → [[X]$_{Adj}$]$_{Noun,[Number:Plural]}$.

(110)   *A sample English configuration that requires genitive case*

```
                        NP₁
              NP₂
       Art    AP       N       AP      N
        |      |       |        |      |
       the     A     student    A    books
               |                |
              tall            heavy
```
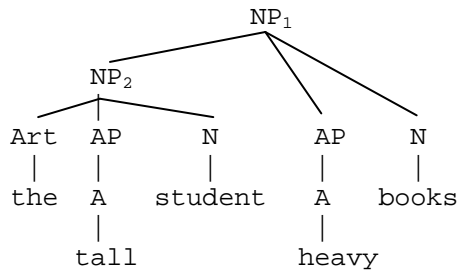
Choices employed: for NP₁: NP → ($\left\{ \begin{matrix} \text{Art} \\ \text{NP} \end{matrix} \right\}$)(AP) N (PP) (CP)

for NP₂: NP → ($\left\{ \begin{matrix} \underline{\text{Art}} \\ \text{NP} \end{matrix} \right\}$)(AP) N (PP) (CP)

The syntactic rule of case marking that is needed is as follows:

(111) **Genitive Case Marking (English)**

```
In                    NP₁
            NP₂
```
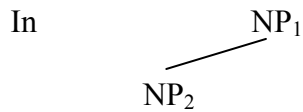
where NP₂ is leftmost in NP₁, assign the feature [Case:Genitive] to the rightmost word of NP₂.

Genitive Case Marking can be applied to the above as shown. I use dotted lines to show what part of the rule matches up to what part of the form

(112)   *Applying the rule of Genitive Case Marking*

In

where NP₂ is leftmost in NP₁, assign the feature [Case:Genitive] to the rightmost word of NP₂.
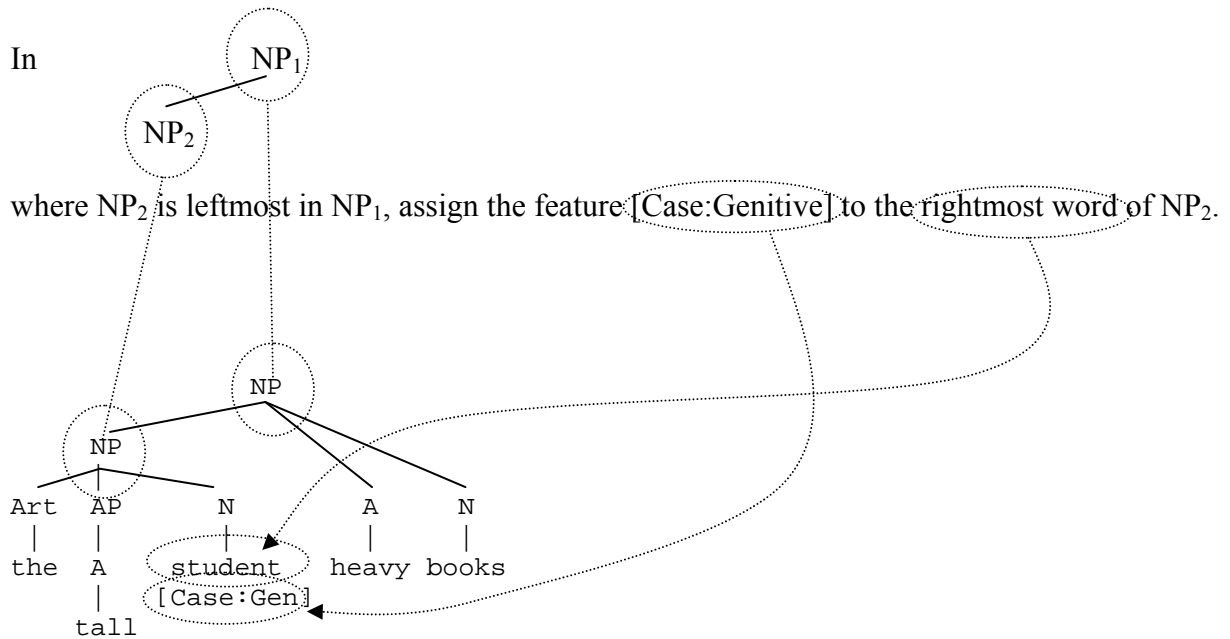
where [Case:Genitive] is the morphosyntactic representation of *student*.

That is the most complicated part. Once the syntactic rules have placed the feature [Case:Genitive] on the word *student*, then we move on to the inflectional morphology. Here, it is straightforward to get the suffix in place, with an ordinary rule of inflectional suffixation, as follows:

Inflectional morphology: Genitive Inflection (English)

Suffix -*s* if [Case:Genitive].

Thus the full NP *the tall student's* is the combined result of syntactic and morphological rules.

19.2 Where to inflect? Edges vs. heads

The rule of Genitive Case Marking in English perhaps unusual for putting the relevant feature on the *rightmost word* of NP. We need this for cases like [*the king of England's*]ₙₚ *hat*, where *England* is the rightmost word of its NP. The matchup is shown below:

Genitive Case Marking

In NP₁

NP₂

where NP₂ is leftmost in NP₁, assign the feature [Case:Genitive] to the rightmost word of NP₂.

NP

NP   N

Art   N   PP   hat

the   king   P   NP

of   N

England
[Case:Gen]
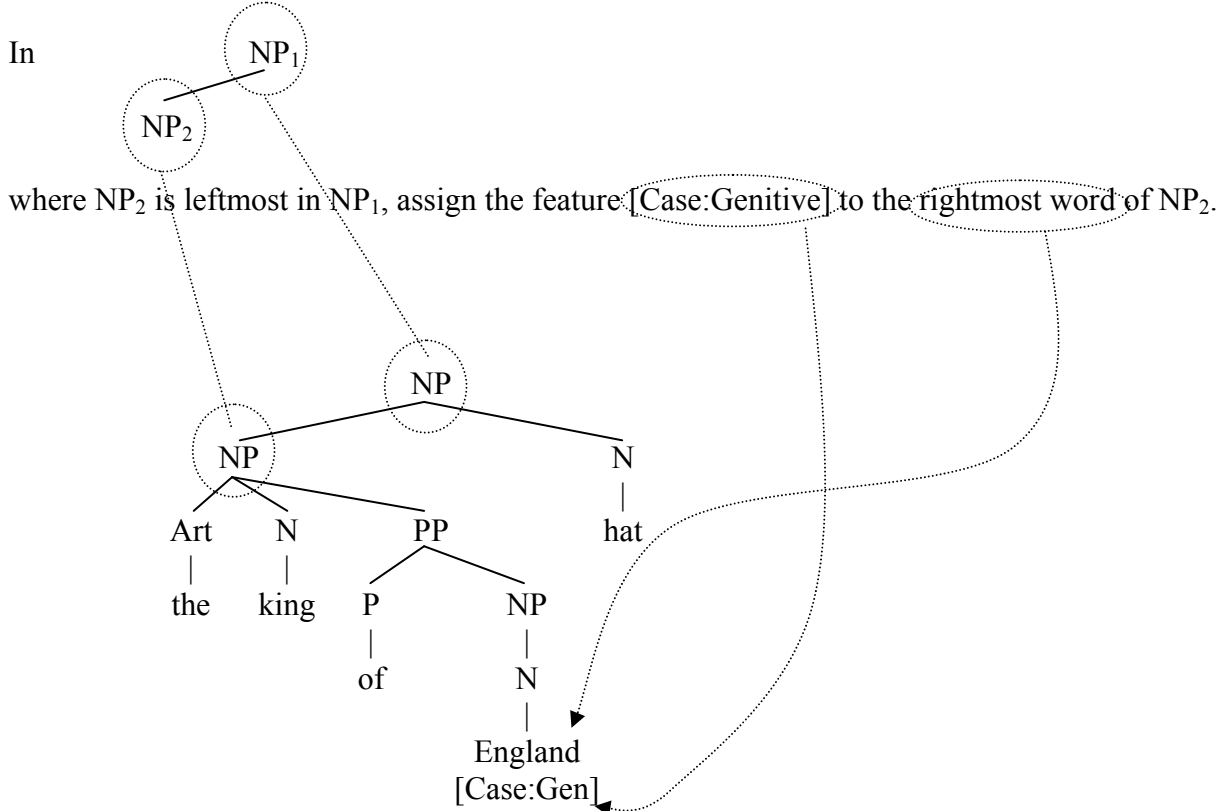
The other major form of case marking targets the *head* of the NP that is to bear case. Let us consider an example from German. On German Amazon I found an entry for a book with this title:

Schliemanns	Erben,	Von	den	Herrschern	der	Hethiter
Schliemann's	legacy	from	the	ruler-dative-plural	the	Hittite-genitive plural

zu	den	König-en	der	Khmer
to	the	king-**dative plural**	the	Khmer-genitive plural

'Schliemann's legacy: from the rulers of the Hittites to the kings of the Khmers'[58]

We're interested in *zu den König-en der Khmer*, meaning 'to the kings of the Khmers'.[59] Prior to case marking, the structure looks like this (for this particular construction, the relevant phrase structure rules of German are the same as in English):

---

[58] Hermann Schliemann was the archaeologist who excavated the ruins of Troy.

[59] The Khmers are the Cambodians.

```
                       PP
                  ┌─────┴─────┐
                  P           NP
                  |       ┌────┼──────┐
                 zu      Art   N      NP
                          |    |    ┌──┴──┐
                         den König Art    N
                            [Num:Pl] |    |
                                    der  Khmer
```
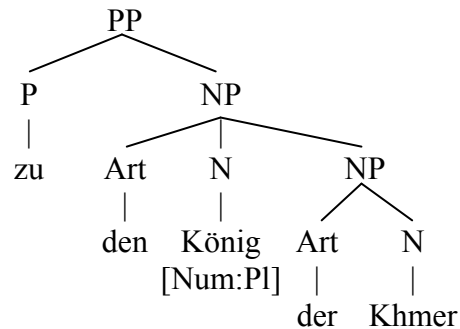
[Number:Plural] is already attached to *König* 'king'; this reflects a semantic choice made by the person who made up this title.

A crucial fact about German is that the various prepositions take (more formally: **govern**) different cases. The preposition *zu*, pronounced [tsu] and meaning 'to', is one of the prepositions that governs the dative case. A partial dative-case marking rule for German can be written as follows:

German Dative Case Marking

In the configuration shown:

```
        PP
      ┌──┴──┐
      P     NP
```
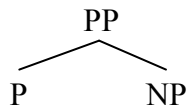
where P is one of { *zu, aus, ausser, bei, mit, nach, seit, von* },[60] assign [Case:Dative] to the morphosyntactic representation of the head of NP.

This rule targets the *head* of NP for dative case realization, hence applies to our example as follows. You should check every arrow in the diagram to make sure it makes sense.

---

[60] 'to', 'from', 'except', 'at X's home', 'with', 'after', 'since', 'of'

```
        PP
       /   \
      P     NP
```

where P is one of { *zu, aus, ausser, bei, mit, nach, seit, von* }, assign [Case:Dative] to the morphosyntactic representation of the head of NP.

```
                 PP
                /  \
               P    NP
               |   / | \
              zu Art  N   NP
                  |   |  /  \
                 den König Art  N
                    ⎡Num:Pl⎤ |   |
                    ⎣Case:Dat⎦ der Khmer
```
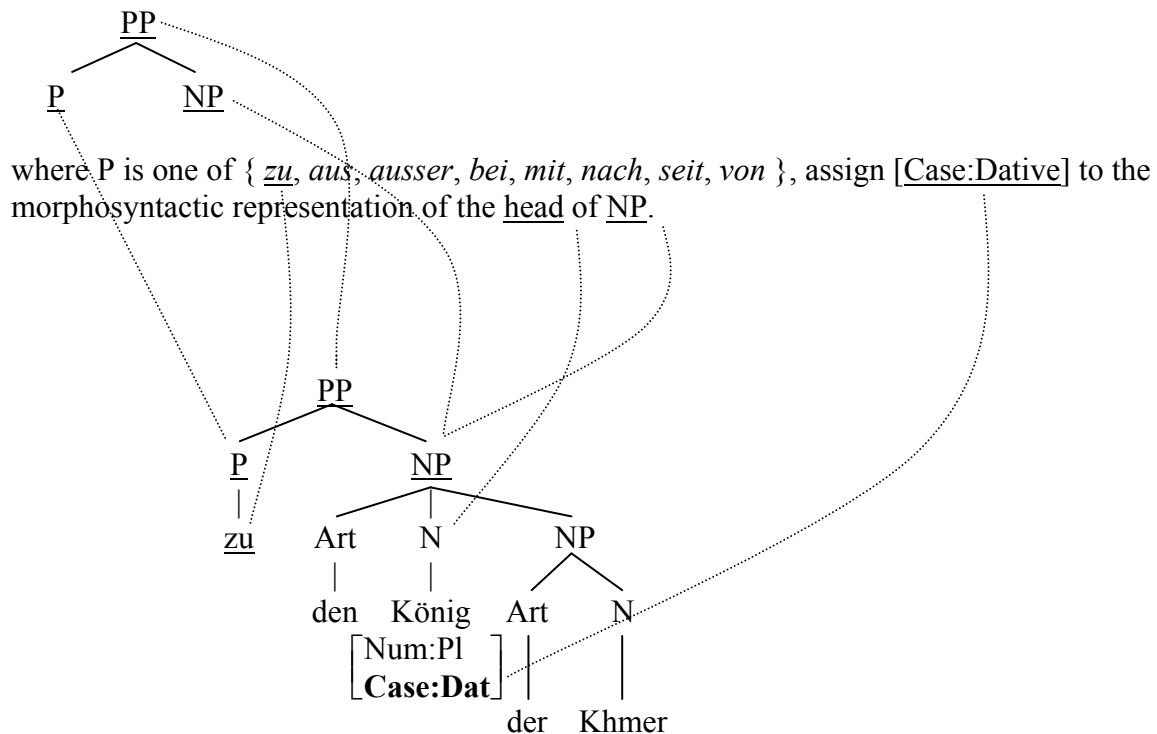
The dative plural is then realized in the morphology with suffixation:

Inflection morphology: Dative Plural Realization (German)

Suffix -*en* if morphosyntactic representation contains $\begin{bmatrix} \text{Num:Pl} \\ \text{Case:Dat} \end{bmatrix}$,

This will derive the boldfaced material in *zu den König**en** der Khmer*.

There are further details about German we'll pass over here quickly. Case is generally also realized, through additional agreement rules (see below), on the Article beginning a Noun Phrase. Thus, *den* is in fact the dative plural form of the definite article.

The crucial distinction illustrated here is the edge-based case marking of the English genitive vs. the head-based marking of German datives. If each language used the opposite language's strategy, we'd get very different results: **the king's of England hat* (marking of genitive on the head), and ** zu den König der Khmer**en*** (marking of dative on the rightmost word).

There are other differences between edge-based and head-based case marking. Marking on heads tends to get complicated, with different affixes for different nouns and so on; marking on edges tends to be a simple, single morpheme like English -'*s*. Marking on heads probably is more often accompanied by agreement on modifying adjectives and articles.

20. Agreement

Features also get assigned in syntax when one phrase **agrees** with another. For instance, in English we have a very simple agreement paradigm in verbs.

I jump	*we jump*
you jump	*you jump*
he/she/it jumps	*they jump*

There is only one ending, *-s*, which marks three features at once; occurring when the subject is [Person:3, Number:Singular, Tense:Present]. Note, however, that for the special verb *be* there is a richer system, with difference between all three persons in the singular and a separate form for the plural:

I am	*we are*
you are	*you are*
he/she/it is	*they are*

The point at hand is that agreement with the subject is inherently syntactic; the verb needs to "know," as it were, what the subject is in order to bear the right inflectional features.

Again, our strategy is to write a syntactic rule that assigns the features of the morphosyntactic representation, then a rule of inflectional morphology to add the appropriate affix.

The syntactic rule can be written provisionally as follows:

Verbal Agreement (English)

In
```
          S
        /   \
      NP     VP
```

assign the [Person] and [Number] features of the head of NP to the head of VP.

An application is shown as follows.

Verbal Agreement (English)

In

assign the [Person] and [Number] features of the head of NP to the head of VP.

$$
\begin{array}{ccc}
\text{Fred} & \text{jump} & \rightarrow \\
\left[\begin{array}{l}Number{:}sg \\ Person{:}3\end{array}\right] & [\text{Tense:pres}] &
\end{array}
\qquad
\begin{array}{cc}
\text{Fred} & \text{jump} \\
\left[\begin{array}{l}Number{:}sg \\ Person{:}3\end{array}\right] & \left[\begin{array}{l}Tense{:}Pres \\ Number{:}sg \\ Person{:}3\end{array}\right]
\end{array}
$$
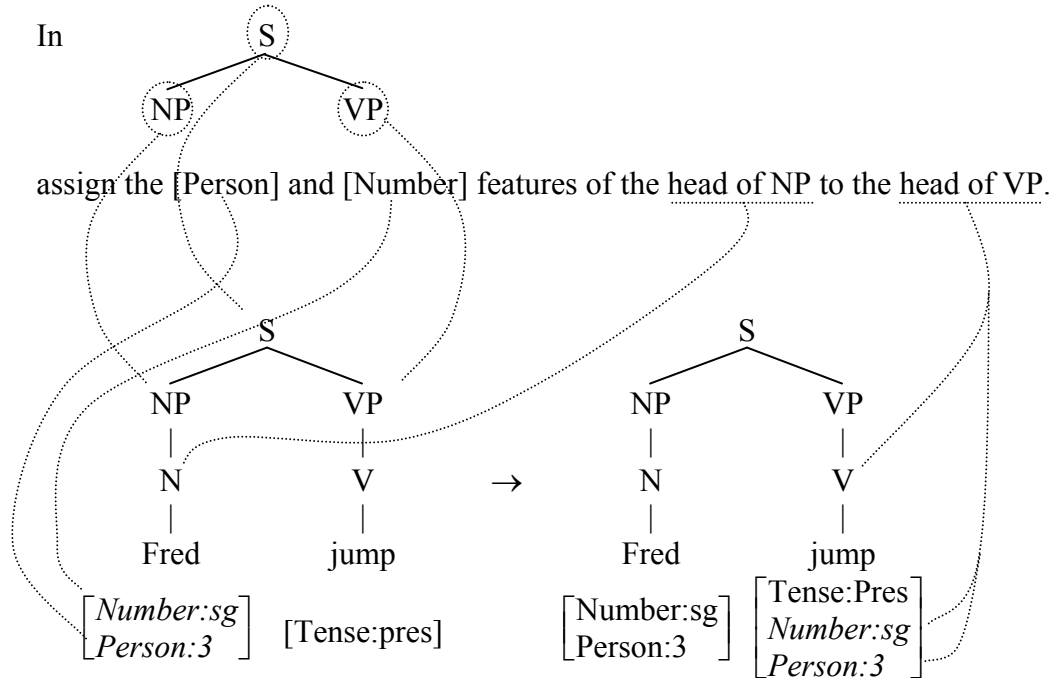
The rule of inflectional morphology that generates the *-s* suffix is given below:

3rd Singular Present Rule

Suffix *-s*   if the morphosyntactic representation contains:
          [Person:3, Number:Singular, Tense:Present]

which will produce convert the stem *jump* in the tree above to the correct form *jumps*.

Compare: *I jump*, *they jump*, etc.

20.1.1 Agreement in general

In languages with rich inflection, agreement rules like the above copy a great deal of information around the tree: verbs agree with their subjects (and sometimes their objects, too), adjectives and articles agree with the nouns they modify, and in at least one language (Lardil, Australia) nouns agree with the verb of their clause in tense.

Summing up, agreement and case marking are the main phenomenon in which syntax determines morphosyntactic representation, and hence the inflectional form of the words of the sentence.

21. An example of phrase structure rules in another language: Hittite

Languages differ quite a bit in their word order, a fact which can be described in grammars by writing different phrase structure rules.

One kind of analytic skill to be developed here is to formulate the phrase structure rules needed to analyze any particular language. Assuming you have a representative batch of sentences to work with, this involves two steps:

- Parse the sentences.
- Look at the trees, and see which daughters any given type of node can have.
- Express what you find with a reasonably economical set of rules.

The data below involve sentences in Hittite, taken from an exercise created by Jay Jasanoff of Harvard University. The transcription and syntactic analysis were guided by input from my UCLA colleague Prof. Craig Melchert; both are experts on this language.

Hittite was spoken in early ancient times in what is now Turkey. It is known from a hoard of about 25,000 cuneiform tablets discovered early in the last century and deciphered in the decades that followed. Some of the texts date back to about 1700 B.C. and thus count as the oldest attestation of any Indo-European language.[61] We accept here on Jasanoff's authority that the sentences below, which he made up, would be grammatical to real Hittite speakers if we could somehow bring them back.

Phonetic symbols are necessarily based on educated guesses. [x] is as in Spanish *jamon* or German *Ba<u>ch</u>* (voiceless velar fricative).

1. nu   xassus   salli   parn-i   anda estsi
   comp king   big-dative   house-dative   in   is
   'The king is in the big house.'

2. nu   antuxsas   akuwakuwan   istamastsi
   comp man-nominative   frog-accusative   hears
   'The man hears the frog.'

3. nu   antuxsas   sallin   akuwakuwan   parn-a   pexutetsi
   comp man-nominative   big-accusative frog-accusative   house-allative brings
   'The man brings the big frog home.'

4. nu   akuwakuwas   westar-i   assun   memijan   tetsi
   comp frog-nominative   shepherd-dative   good-accusative   word-acc. says
   'The frog says a good word to the shepherd.'

---

[61] Indo-European is the very large language family that includes (for example) English, Russian, Hindi, Latin, Irish, etc. See Chapter 13.

5. nu   westaras   sallin   akuwakuwan pir-i   anda   xassussar-i katta
   istamastsi
   comp shepherd-nom. big-acc. frog.-acc.   house-dative in   queen-dative with
   hears
   'The shepherd hears the big frog in the house with the queen.'

6. nu   akuwakuwas   antuxsan   natta   istamastsi
   comp frog-nominative man-accusative   not   hears
   'The frog doesn't hear the man.'

7. nu   xassussaras xassui   piran   salli   akuwakuwi katta tijatsi
   comp queen-nom. king-dat. before big-dative frog-dative   with   comes
   'The queen comes before the king with the big frog.'

8. nu   westaras   assui   xassui   akuwakuwan   pexutetsi
   comp shepherd good-dative   king-dative frog-accusative   brings
   'The shepherd brings the frog to the good king.'

One can do both syntactic and morphological analysis on these texts. At the level of morphology, it is possible to collect some partial noun paradigms, as follows.

xassu-s	king nominative
xassu-i	king-dative
antuxsa-s	man-nominative
antuxsa-n	man-accusative
akuwakuwa-s	frog-nominative
akuwakuwa-n	frog-accusative
akuwakuw-i	frog-dative
westara-s	shepherd-nominative
westar-i	shepherd-dative (*a* drops before *i*? not known)
memija-n	word-accusative
parn-i	house-dative
parn-a	home-allative
xassussara-s	queen-nominative
xassussar-i	queen-dative

It looks at least roughly that the nominative suffix is *-s*, the accusative suffix is *-n*, and the dative suffix is *-i*. This predicts **akuwakuwa-i* and **xassussara-i* for the datives of "frog" and 'queen'; in fact, there's a bit of phonology going on: the vowel *a* is dropped before this suffix. We express the rules of inflectional morphology as follows.

Hittite Nominal Inflection (sketch)

Suffix -*s* when [Case:Nominative]
Suffix -*n* when [Case:Accusative]
Suffix -*i* when [Case:Dative]

There also appears to be verbal inflection, for which we can conjecture this rule:

Suffix -*tsi* when [Person:3, Number:singular, Tense:present]

But in fact we know almost nothing about -*tsi* from these few data.

Turning now to the phrase structure rules, the idea is to inspect the sentences, parse them according to the principles of the theory, and generalize over what we see to produce the rules.

An intriguing aspect of the sentences is that they all begin with *nu*. This is most likely a complementizer: Hittites usually spoke in CP's, not S's, though it certain contexts it was possible to say just a plain S. Thus we will start our derivations with CP and assume this phrase structure rule:

CP → Comp S

NP could be derived by the following rule:

NP → (A) N

Probably the A should be an AP, but we will skip this for brevity.

Another simple rule is for PP, which is this language is evidently not a phrase for prepositions but for **postpositions**, which are just like prepositions but come after their NP rather than before. The phrase structure rule needed is:

PP → NP P

In sentences, the subject evidently comes before the predicate, justifying the rule

S → NP VP

The trickiest phrase structure rule to write here is for VP. Here there is a question of methodology: what is the best way to figure out simple phrase structure rules when we are given the data? I suggest putting together what I will call a **phrase structure table**. The table puts each example in a separate row, and aligns the contents of the phrase (here, as VP) in columns.

(113) *A phrase structure table for the Hittite VP*

	NP	NP	PP	PP	Adv	V
1			salli piri anda big-dat. house-dat. in			estsi is
2		akuwakuwan frog-acc.				istamastsi hears
3	sallin akuwakuwan big-acc. frog-acc.	parn-a house-dative				pehutetsi brings
4	westari shepherd-dat.	assun memijan good-acc. word-acc.				tetsi says
5		sallin akuwakuwan big-acc. frog.-acc.	piri anda house-dat. in	hassussari katta queen-dat. with		istamastsi hears
6		antuhssan man-acc.			natta not	istamastsi hears
7			hassui piran king-dat. before	salli akuwakuwi katta big-dat. frog-dat. with		tijatsi comes
8	assui hassui good-dat. king-dat.	akuwakuwan frog-acc.				pehutetsi brings

If we collect all of the various items that evidently fit within a VP, and (going out on a limb) put them in a single rule, we get:

VP → (NP)(NP)(PP)(PP)(Adv) V

This completes the set of phrase structure rules, stated all in one place thus:

Phrase structure rules for Hittite

CP → Comp S
S → NP VP
VP → (NP)(NP)(PP)(PP)(Adv) V
NP → (A) N
PP → NP P

"P" must be read "postposition", rather than "preposition."

21.1 Example diagrammed sentence

The rules suffice to generate all the sentences; here is one particularly long example.

CP

S

VP

PP   PP

NP   NP   NP   NP

Comp   N   A   N   N   P   N   P   V

nu   westara-s   salli-n   akuwakuwa-n   pir-i   anda   xassussar-i   katta
istamas-tsi
the   shepherd-nom.   big-acc.   frog.-acc.   house-dative   in   queen-dative   with   hears
'The shepherd hears the big frog in the house with the queen.'
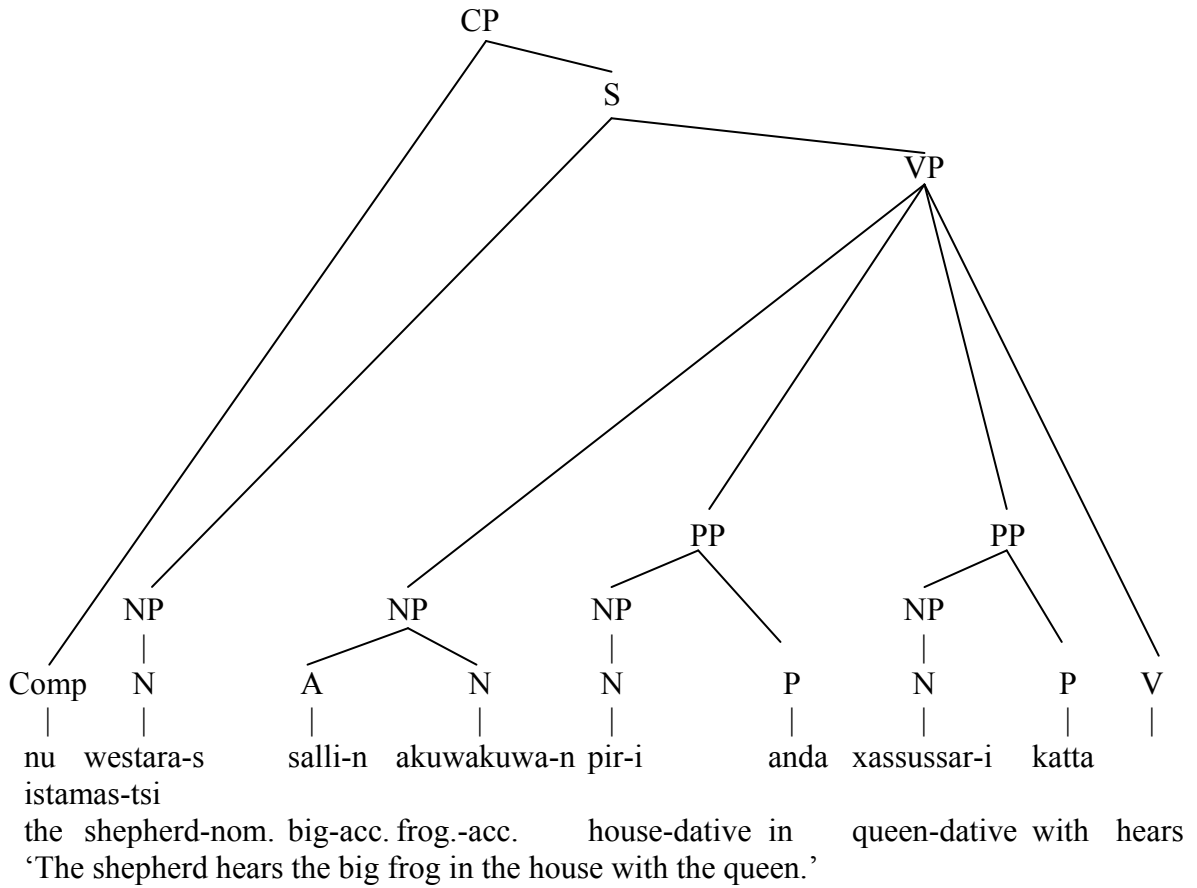
Study Exercise #19

Parse the Hittite sentence

nu	akuwakuwas	westari	assun	memijan	tetsi
the	frog-nominative	shepherd-dative	good-accusative	word-acc.	says

'The frog says a good word to the shepherd.'

Answer on next page.

Answer to Study Exercise #19


```
                              CP
                           ╱     ╲
                        ╱          S
                     ╱          ╱    ╲
                  ╱          ╱        VP
               ╱          ╱        ╱  │  ╲
            ╱          ╱        ╱    │    ╲
         ╱          NP       NP    NP     ╲
       ╱           │         │    ╱  ╲      ╲
    Comp           N         N  Adj    N     V
      │            │         │   │     │     │
     nu       akuwakuwas   westari   assun      memijan  tetsi
     the      frog-nominative shepherd-dative good-accusative word-acc. says
     'The frog says a good word to the shepherd.'
```
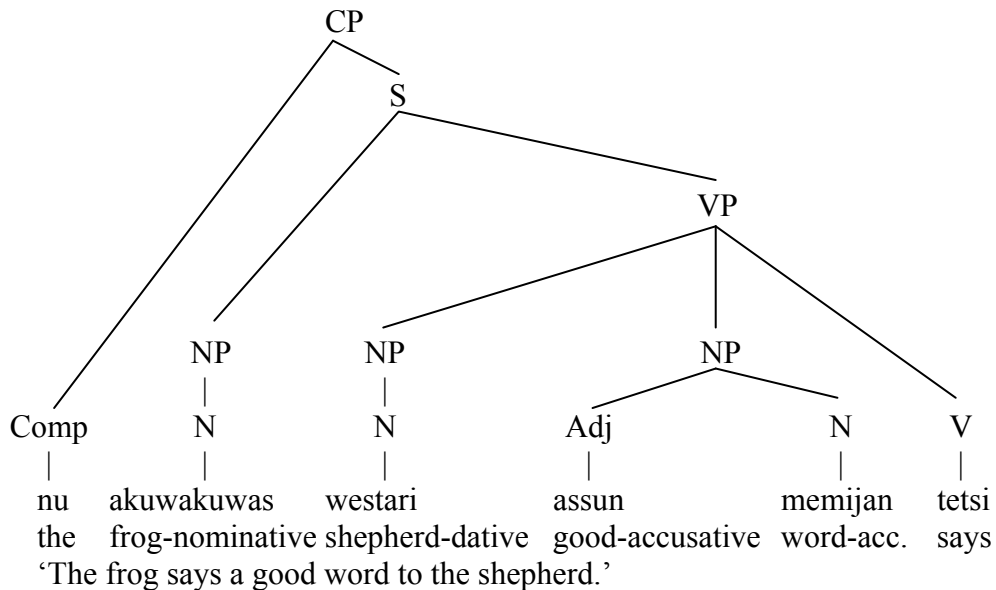
21.2 *Hittite as a head-final language*

It can be seen that, at least in these data, Hittite is a **head-final** language: N is last in NP, P is last in PP, V is last in VP (and we don't know about AdjP).

Some other well-known head-final languages are Japanese, Korean, Bengali, and Turkish. The Bantu languages, such as Swahili and Zulu, tend to be strongly head-initial. English tends towards being head-initial, but is conflicted, in the sense that it puts adjectives before the head noun in NP. Hence some English noun phrases have the head noun in the middle:

[the long [**book**]$_N$ about linguistics]$_{NP}$

21.3 *Case marking in Hittite*

Hittite has a richer case system than English, with overt suffixes marking the Nominative, Dative, and Accusative. We can write syntactic rules that place the appropriate value for the feature [Case], based on the configuration of the tree.

For instance, Dative case is assigned in Hittite by postpositions. It can be attached by a similar rule:

Dative Case Marking (Hittite)

In the configuration

```
          PP
        /    \
     NP        P
```
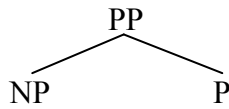
add [Case:Dative] to the morphosyntactic representation of the head of NP.

Getting Accusative and Dative objects right is trickier, and we also have very few data, so the following is really something of a guess:

Case Marking for Objects (Hittite)

In verb phrases containing one or more NP, then
- if there are two NP, assign [Case:Dative] to the head of the first and [Case:Accusative] to the head of the second.
- if there is just one NP, assign [Case:Accusative] to its head.

Here is an example with two NPs inside the VP:
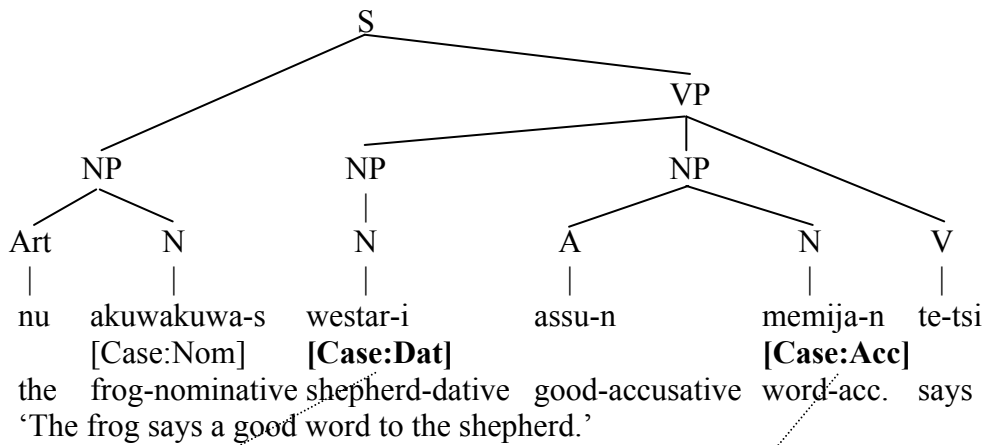
"assign [Case:Dative] to the head of the first and [Case:Accusative] to the head of the second"

A further rule, not stated here, would cause adjectives (such as *assun* above) to agree with their head nouns in case.

Study Exercise #20:   Turkish Phrase Structure Rules

Examine the Turkish sentences below. Provide a syntactic tree for each (you might find it more convenient to use the English glosses in the tree, rather than that actual Turkish words). Then

examine all your trees and come up with a terse, economical set of phrase structure rules that derive all of them.

Spelling: I've replaced some Turkish letters with English equivalents or IPA symbols:

- *sh* is IPA [ʃ], Turkish letter ş.
- *ch* is IPA [tʃ], Turkish letter ç.
- [ɨ] is IPA, pronounced somewhat like the sound of the second vowel in *roses*; Turkish letter ı.
- Turkish letter *ü* (which in IPA is [y]) is made by uttering the vowel [i] ("ee") and simultaneously rounding the lips.
- Turkish letter *ö* (which in IPA is [ø]) is made by uttering the vowel [e] ("bay") and simultaneously rounding the lips.
- [dʒ] is IPA for the consonants that occur at the beginning and end of English *judge*. In Turkish it is spelled with a *c*.

1. Shirin uyudu
   Shirin slept   'Shirin slept'

2. Vezir   uyudu
   vizier   slept   'The vizier slept'

3. Uzun   vezir   uyudu
   tall   vizier slept   'the tall vizier slept'

4. Chok   uzun   vezir   uyudu
   very   tall   vizier slept   'the very tall vizier slept'

5. Sarɨshɨn   uzun   vezir   uyudu
   blond   tall   vizier slept   'The tall blond vizier slept'

6. Yorgun   sarɨshɨn   uzun   vezir   uyudu
   tired   blond   tall   vizier slept
   'The tired tall blond vizier slept'

7. Defter   düshtü
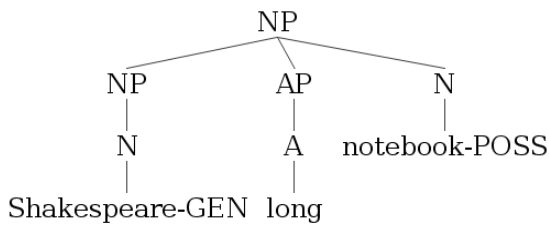   notebook   fell   'the notebook fell'

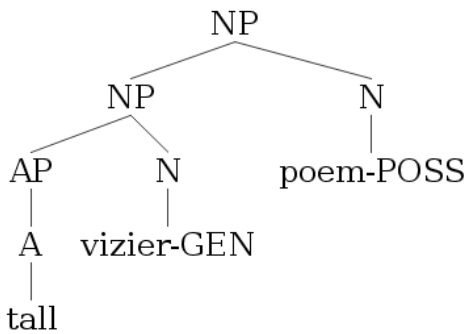8. Shekspir-in   defter-i   düshtü
   Shakespeare-GEN   notebook-Poss   fell
   'Shakespeare's notebook fell'
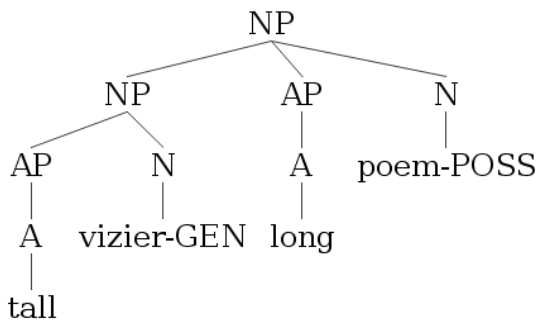
9. Shekspir-in   uzun   defter-i
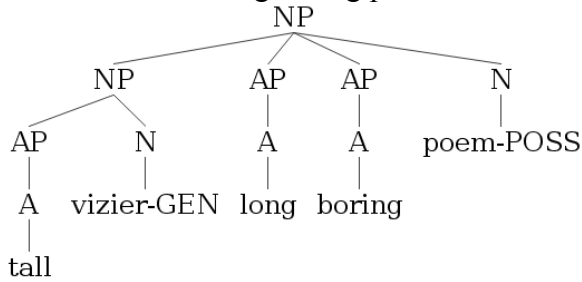   Shakespeare-GEN   long   notebook-Poss
   'Shakespeare's long notebook'

10.   uzun   vezir-in   shiir-i
   tall   vezir-GEN   poem-Poss
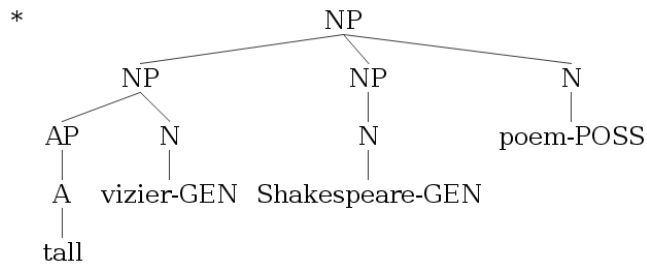   'the tall vizier's poem' (i.e. the poem by him)

11. uzun   vezir-in   uzun   shiir-i
   tall   vizier-GEN   long   poem-Poss
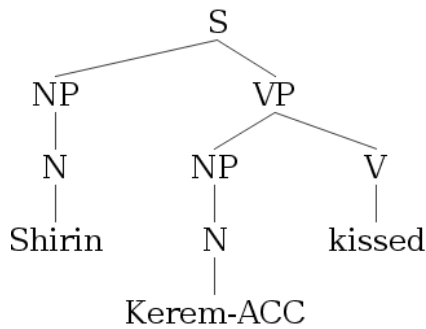   'the tall vizier's long poem'

12. uzun   vezir-in   uzun   sɨkɨdʒɨ shiir-i[62]
   tall   vizier-GEN   long   boring poem-Poss
   'the tall vizier's long boring poem'
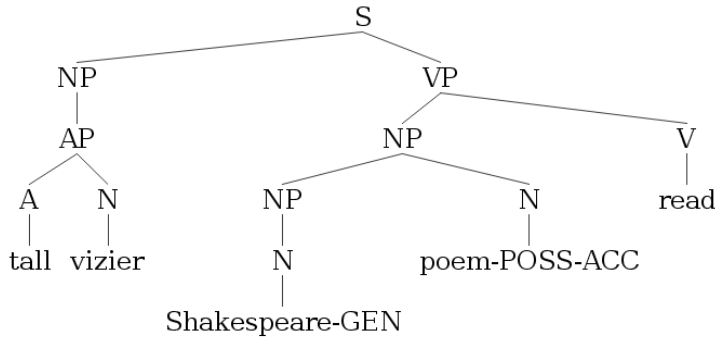
13. *uzun vezir-in   Shekspir-in   shiir-i
    tall   vizier-GEN   Shakespeare-GEN   poem-Poss
    'the tall vizier's Shakespeare's poem'
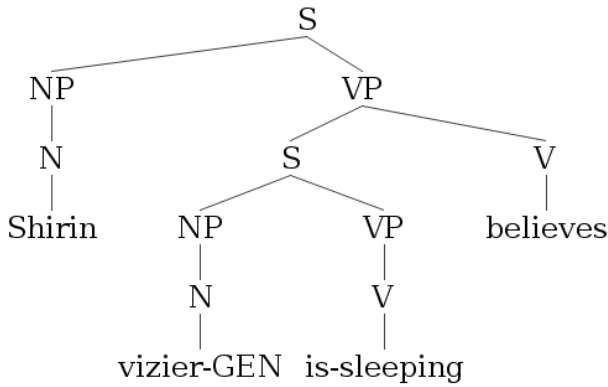
14. Shirin Kerem-i   öptü
   Shirin Kerem-ACC   kissed
   'Shirin kissed Kerem'

15. Uzun   vezir   Shekspir-in   shiir-i-ni   okudu
    tall   vizier   Shakespeare-GEN   poem-Poss-ACC   read
   'The tall vizier read Shakespeare's poem'

16. Shirin vezir-in   uyuduuna   inanɨyor
   Shirin vizier-GEN   is-sleeping   believes
   'Shirin believes the vizier is sleeping'

17. Kerem   Shirin-e   vezir-in   uyuduuna   söyledi
   Kerem   Shirin-DAT   vizier-GEN   is-sleeping   told
   'Kerem told Shirin that the vizier is sleeping'

18. Kerem   Shirin-in   vezir-in   uyuduuna   inandɨɨnɨ   zannediyor
   Kerem   Shirin-GEN   vizier-GEN   is-sleeping   believes   imagines
   'Kerem imagines that Shirin believes that the vizier is sleeping'

19. Orhan   Kerem-in   Shirin-in   vezir-in   uyuduuna   inandɨɨnɨ   zannettiini
          itirafetti
   Orhan   Kerem-GEN Shirin-GEN vizier-GEN is-sleeping   believes   imagines
          confessed
   'Orhan confessed that Kerem imagines that Shirin believes that the vizier is sleeping'

---

[62] dʒ is IPA for the English "j" sound

Answer to Study Exercise #20

1. Shirin uyudu
   Shirin slept   'Shirin slept'

```
          S
        /   \
      NP     VP
      |      |
      N      V
      |      |
   Shirin  slept
```

2. Vezir uyudu
   vizier slept   'The vizier slept'

```
          S
        /   \
      NP     VP
      |      |
      N      V
      |      |
   vizier  slept
```

3. Uzun   vezir   uyudu
   tall   vizier slept   'the tall vizier slept'

```
             S
          /     \
       NP         VP
      /   \        |
    AP     N       V
    |      |       |
    A   vizier   slept
    |
   tall
```

4. Chok   uzun   vezir   uyudu
   very   tall   vizier slept   'the very tall vizier slept'

```
             S
          /     \
       NP         VP
      /   \        |
    AP     N       V
   /  \    |       |
 Adv   A  vizier  slept
  |    |
 Very tall
```

4. Sarishin   uzun   vezir   uyudu
   blond   tall   vizier slept   'The tall blond vizier slept'

```
                    S
             _____/ _____
           NP               VP
        __/ | \__            |
      AP   AP   N            V
       |    |   |            |
       A    A  vizier       slept
       |    |
     blond tall
```

5. Yorgun   sarishin   uzun   vezir   uyudu
   tired   blond   tall   vizier slept
   'The tired tall blond vizier slept'

```
                      S
              _____/ _____
            NP                  VP
       ___/ | | \___            |
     AP   AP   AP   N           V
      |    |    |   |           |
      A    A    A  vizier     slept
      |    |    |
    tired blond tall
```
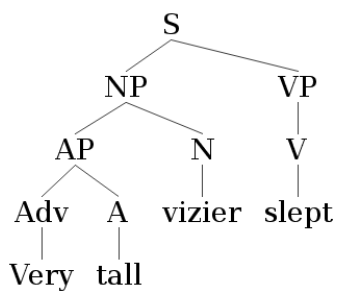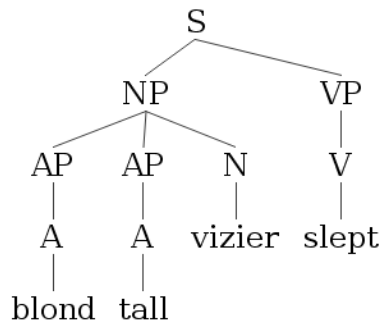
6. Defter   düshtü
   notebook   fell   'the notebook fell'
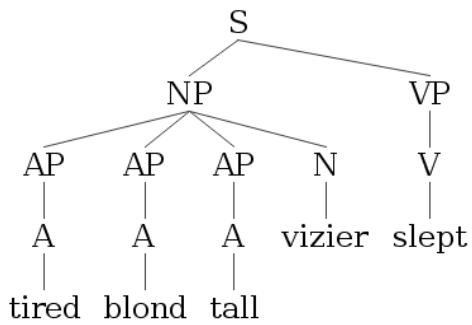
```
          S
        _/ \_
      NP     VP
       |      |
       N      V
       |      |
   notebook  fell
```

7. Shekspir-in   defter-i   düshtü
   Shakespeare-GEN   notebook-Poss   fell
   'Shakespeare's notebook fell'

```
                        S
                 ┌──────┴────────┐
                NP              VP
            ┌────┴──────┐        │
           NP           N        V
            │                    │
            N         notebook-POSS  fell
            │
       Shakespeare-GEN
```

8. Shekspir-in   uzun   defter-i
   Shakespeare-GEN   long   notebook-Poss
   'Shakespeare's long notebook'

```
                    NP
            ┌───────┼───────┐
           NP      AP        N
            │       │
            N       A    notebook-POSS
            │       │
    Shakespeare-GEN  long
```

9. uzun   vezir-in   shiir-i
   tall   vezir-GEN   poem-Poss
   'the tall vizier's poem' (i.e. the poem by him)

```
                 NP
           ┌─────┴─────┐
          NP           N
       ┌───┴───┐        │
      AP        N    poem-POSS
       │        │
       A     vizier-GEN
       │
      tall
```

10. uzun   vezir-in   uzun   shiir-i
    tall   vizier-GEN   long   poem-Poss
    'the tall vizier's long poem'

```
                 NP
           ┌──────┼──────┐
          NP      AP      N
       ┌───┴───┐   │       │
      AP        N   A    poem-POSS
       │        │   │
       A    vizier-GEN  long
       │
      tall
```

11. uzun   vezir-in   uzun   sɨkɨdʒɨ shiir-i
    tall   vizier-GEN   long   boring poem-Poss
    'the tall vizier's long boring poem'

```
                              NP
                 _____/ /  \ _____
               NP         AP    AP          N
             /    \        |      |           |
           AP      N       A      A        poem-POSS
            |       |       |      |
            A   vizier-GEN long  boring
            |
           tall
```

12. ***uzun vezir-in   Shekspir-in   shiir-i
      tall   vizier-GEN   Shakespeare-GEN   poem-Poss
      'the tall vizier's Shakespeare's poem'

```
    *                           NP
                  _____/   |   _____
                NP             NP              N
              /   \             |               |
            AP     N            N           poem-POSS
             |      |            |
             A  vizier-GEN  Shakespeare-GEN
             |
            tall
```

13. Shirin Kerem-i   öptü
    Shirin Kerem-ACC   kissed
    'Shirin kissed Kerem'

```
                 S
            ____/ \____
          NP          VP
           |        /   \
           N      NP     V
           |       |      |
        Shirin    N     kissed
                   |
               Kerem-ACC
```

14. Uzun vezir Shekspir-in   shiir-i-ni   okudu
     tall   vizier Shakespeare-GEN   poem-POSS-ACC   read
    'The tall vizier read Shakespeare's poem'

```
                         S
          _____|_____
        NP                           VP
         |                 _____|_____
        AP                NP                    V
       __|__         _____|_____              |
      A     N       NP            N            read
      |     |        |            |
    tall  vizier     N      poem-POSS-ACC
                     |
             Shakespeare-GEN
```

15. Shirin vezir-in   uyuduuna   inanɨyor
     Shirin vizier-GEN   is-sleeping   believes
     'Shirin believes the vizier is sleeping'

```
                    S
          _____|_____
        NP                     VP
         |              _____|_____
         N             S                 V
         |        _____|_____            |
       Shirin    NP         VP        believes
                  |          |
                  N          V
                  |          |
             vizier-GEN  is-sleeping
```

16. Kerem   Shirin-e   vezir-in   uyuduuna   söyledi
     Kerem   Shirin-DAT   vizier-GEN   is-sleeping   told
     'Kerem told Shirin that the vizier is sleeping'

```
                    S
          _____|_____
        NP                     VP
         |                      |
         N                      S
         |          _____|_____
       Kerem       NP           S            VP
                    |      _____|_____      |
                    N     NP           VP      V
                    |      |            |       |
              Shirin-DAT   N            V      told
                           |            |
                      vizier-GEN    is-sleeping
```
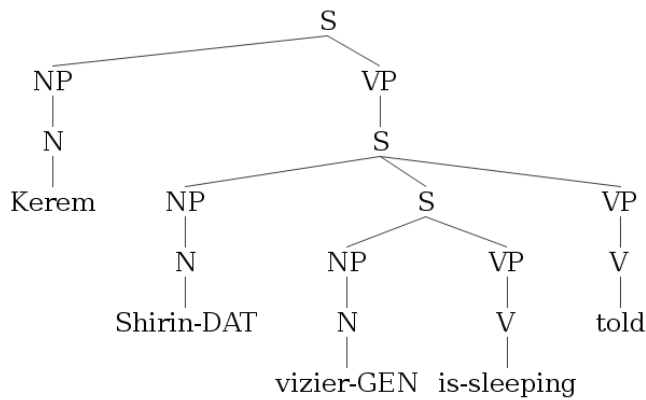
17. Kerem   Shirin-in   vezir-in   uyuduuna   inandiini   zannediyor
    Kerem   Shirin-GEN   vizier-GEN   is-sleeping   believes   imagines
    'Kerem imagines that Shirin believes that the vizier is sleeping'
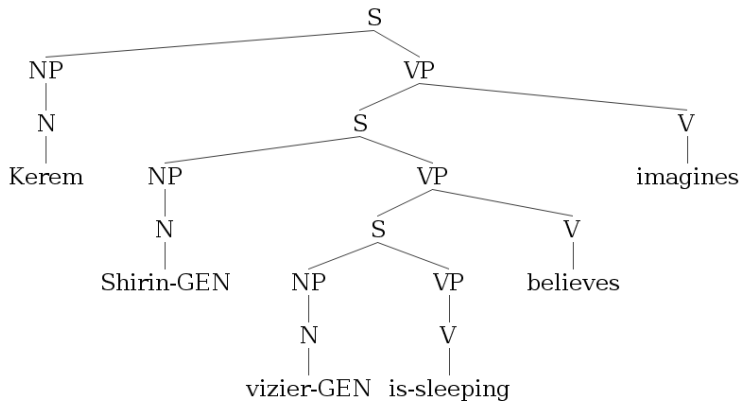
18. Orhan   Kerem-in Shirin-in vezir-in   uyuduuna inandiini zannettiini   itirafetti
   Orhan   Kerem-GEN Shirin-GEN   vizier-GEN is-sleeping   believes   imagines   confessed
   'Orhan confessed that Kerem imagines that Shirin believes that the vizier is sleeping'
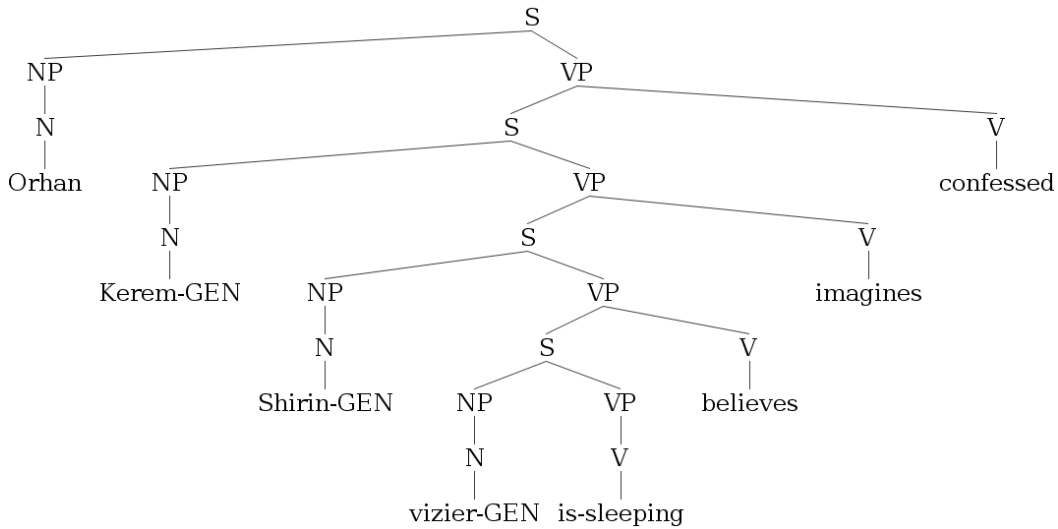
PS Rules for Turkish

S → NP VP
NP → (NP) (AP)* N
VP → (NP) (S) V
AP → (Adv) A

If you're curious you might try to figure out how Turkish assigns Genitive, Possessive, Accusative, and Dative case. The data aren't really sufficient to solve the problem but they are suggestive.

22. A bit more on phrase structure rules: Kleene star

Let us beef up the system of phrase structure rules once more. Some phrase structure rules allow for any number of daughters of a certain type. For example, the rule for NP allows for an unlimited number of Adjective Phrases preceding the noun, as in 'a very long, dull, unusually boring movie'. A formalism for this often employed is to enclose in brackets the element that can be repeated indefinitely, and place an asterisk after the right bracket (the asterisk is known as "Kleene star", after the mathematician who proposed the notation).[63] For example, the phrase structure rule for NP can be written as follows:

   NP → (Art) (AP)* N (PP)*.

An NP that uses both (AP)* and (PP)* would be *the very big blue book about linguistics on the counter*. AP's: *very big* and *blue*; PP's: *about linguistics, on the counter*.

Quite a few of the items on our previous phrase structure grammar would be more accurately depicted with Kleene star; the following is a list:

(114) **Phrase structure rules for English: Version II, improved with Kleene star**

S	→ NP (Aux) VP	
NP	→ $\left(\left\{\begin{matrix} \text{Art} \\ \text{NP} \end{matrix}\right\}\right)$ (AP)* N (PP)*	Example: *his noble, wonderful inspiring gift of $1,000,000 to X on Tuesday*
NP	→ Pronoun	
AP	→ (Adv) A	
VP	→ V (NP) (NP) (PP)* (CP)	Ex.: *sold books to students for $50 on Wednesdays*
PP	→ P NP	
CP	→ (Comp) S	
NP	→ NP (Conj NP)*	Ex. *Alice and Sally and Bill left.*
VP	→ VP (Conj VP)*	Ex. *We sang the song and danced the dance and played the tune.*
PP	→ PP (Conj PP)*	Ex. *We tossed it over the fence and through the window and under the house.*
S	→ S (Conj S)*	Ex. *He said that he was sick and he would go and he would get better soon.*
CP	→ CP (Conj CP)*	Ex. *He said that he was sick and that he would go and that he would get better soon*

---

[63] Nobody knows for sure how to pronounce "Kleene". Many people say [ˈklini] ("KLEE-nee"; IPA vowel symbols are fairly close to Spanish spelling).

V   →   V (Conj V)*   Ex. *They washed and diced and sliced the*
                                              vegetables.

Chapter 5:   Syntax II — Transformations

1. Syntax beyond phrase structure: the need for transformations

As seen already, our overall goal is to beef up the grammar so that it becomes an ever better approximation to the grammar internalized by speakers of English. We have done this by amplifying the system of phrase structure rules, and also by adding rules of agreement and case marking to govern the distribution of inflectional features. This section introduces the next major type of syntactic rule, the **transformation**, and argues for why it is needed.

English contains a construction called the **Tag Question**. Tag questions appear after the comma in the following examples:

(115) *Examples of tag questions*

> Frogs can eat flies, can't they?
> The president has resigned, hasn't she?
> Bill was watching the stew, wasn't he?

As the data show, a tag question contains three parts in order:

- A copy of the Aux of the main sentence (*can…can*, *has … has*, *was … was*).
- A contracted form of the word *not*
- A pronoun expressing the person and number of the subject of the main sentence.

1.1 Digression: spell-out rules

Before going on, we need a bit of clarification: we are assuming, as seems intuitively reasonable, that *can't* is the normal realization of *can not*, *hasn't* is the normal realization of *has not*, and (more interestingly) *won't* is the normal realization of *will not*. For such contractions (as traditional grammar calls them), we need minor morphological "spell-out" rules, of which the following are a partial list:

(116) **Some spell-out rules of English**

> | *will not* | $\rightarrow$ | *won't* |
> | *can not* | $\rightarrow$ | *can't* |
> | *am not* | $\rightarrow$ | *aren't*[64] |
> | *do not* | $\rightarrow$ | *don't* |
> | *shall not* | $\rightarrow$ | *shan't*[65] |
> | etc. | | |

---

[64] As in *I'm tall, aren't I?*, used only in vernacular speech. (Remember your white lab coat…)

[65] Archaic, at least for Americans.

1.2 Phrase structure rules inadequate for tags

It is in the nature of phrase structure rules that they *can't copy*: they specify the daughter nodes of a particular kind of mother node, as well as the order in which the daughters appear, but that is all. If we naively attempted to generate tag questions simply by extending our set of phrase structure rules, we would derive many ungrammatical instances with a mismatched Aux, because these rules lack the copying capacity. Here is the failed approach in detail:

(117) **A Failed Grammar for English Tags**

    (a) Change the phrase structure for S to:

        S → NP (Aux) VP (Tag)

    (b) Add the phrase structure rule:

        Tag → Aux *not* Pro

This hypothesis derives *Alice will kiss Bill, won't she?* as follows:

```
                         S
        ┌──────┬─────────┼──────────────┐
       NP     Aux        VP            Tag
        |      |        ┌─┴──┐      ┌───┼───┐
      Alice   will      V    NP   Aux  not  Pro
                        |    |     |        |
                       kiss  N    will     she
                             |
                            Bill
```
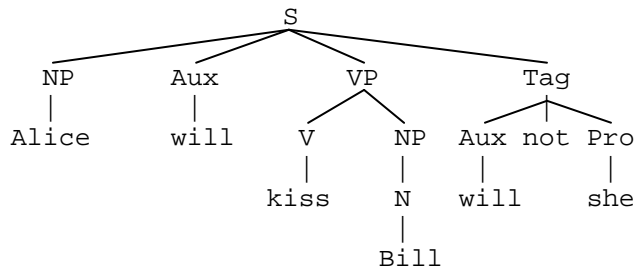
(The tree shows the pre-spelled-out version of the sentence; the spell-out rule would convert *will not* to *won't*.)

This hypothesis fails because it doesn't enforce the copying requirement. We can apply the very same rules and derive preposterous sentences:

```
                         S
        ┌──────┬─────────┼──────────────┐
       NP     Aux        VP            Tag
        |      |        ┌─┴──┐      ┌───┼───┐
      Alice   will      V    NP   Aux  not  Pro
                        |    |     |        |
                       kiss  N    has      she
                             |
                            Bill
```
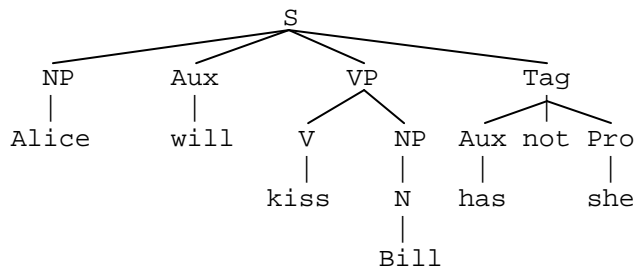
    By Spell-Out: *Alice will kiss Bill, hasn't she?

and similarly:

*Alice will kiss Bill, can't he?
*Alice will kiss Bill, hasn't it?
*Alice will kiss Bill, won't they?

1.3 Terminology of failed grammars

Linguists are always dealing with failed grammars like the one just given, taking them back to the drawing board and trying either to improve them or replace them with a better approach. Failed grammars are not a pointless activity; they lead us to explore the data more thoroughly and force us to refine our analysis or replace it with something better.

Some terminology for failed grammars that is widely used:

undergenerate: A grammar *undergenerates* when there are grammatical sentences that it cannot generate.

overgenerate: A grammar *overgenerates* when it generates ungrammatical sentences

The grammar we just looked at overgenerates, as the * examples above indicate. A grammar that can't generate tag questions at all (what we had before) undergenerates.

1.4 Diagnosing failure

As already noted, the failed grammar given in (107) above fails because nothing in the rule apparatus developed so far can copy. Grammar (107) can be thought of as providing a poor substitute for copying: it copies the structure, but not the actual words involved, which is what we really need. Plainly, we need more kinds of rules.[66]

More generally, phrase structure grammars don't allow for cases where the constituents present in one part of a tree depend on the constituents present in another part, which may be some distance away. In fact, tag questions are a rather out-of-the-way instance of this phenomenon; the really important cases are yet to come. The tag questions will suffice, however, to give the basic idea.

1.5 Transformations

Faced with phenomena like tag questions, linguists generally assume that phrase structure rules do not alone suffice as a grammar formalism for languages. An additional kind of rule takes as its input a sentence generated by the phrase structure rules and alters it in some way.

- A syntactic rule that alters a tree structure is called a **transformation**.

---

[66] For honesty's sake, I should add that you *could* produce a phrase structure grammar that copies Auxes, but intuitively speaking it would be a really crummy grammar. The trick is to replace S and Tag with a whole set of nodes like S_{can} "S with *can* as its Aux", S_{will} "S with *will* as its Aux", each allowing a matching daughter Tag_{can}, Tag_{will}, etc. This gets the facts but fails to characterize the tags as involving *copying in general*.

- A grammar that includes transformations as well as phrase structure rules is a **transformational grammar**.

The rules of case marking and agreement given earlier in this book could be considered a kind of transformation, although their effects are not as dramatic as the copying and movement transformations we will cover in what follows; case marking and agreement only change the morphosyntactic representation, not the tree as a whole.

The general strategy seen in transformations is to let the phrase structure rules define the "basic inventory" of sentences in the language, and let the transformations apply to generate the wider variety of sentences that go beyond the capacity of phrase structure rules. For example, the sentence *Alice will kiss Bill* is in some sense a basic sentence (being generable by phrase structure rules alone), and *Alice will kiss Bill, won't she* is in a sense a syntactic elaboration of the simple sentence.

What can transformations do? This is a rather open question, whose answer forms a large part of the theory of syntax. At the moment, it's best to simply formulate the transformations we need and later on see what general theoretical principles are applicable.[67]

1.6 A transformation for tag questions

Here is a copying transformation that can derive tag questions. As you can see, it uses notation seen earlier in morphology, where we used numeral subscripts to make clear what changes into what for rules of infixation and reduplication. However, the syntactic transformation also contains reference to the tree structure that is manipulated.

(118) **Tag Question Transformation**

```
         S                          S
       /─┴─\                    /──┬──────\
     NP  Aux  VP     →        NP   Aux  VP      Tag        where [MS] = morphosyntactic
    [MS]                     [MS]             /─┴──\                     representation
     1    2    3              1    2    3  Aux not Pro                  of head of NP
                                                   [MS]
                                            2        1
```
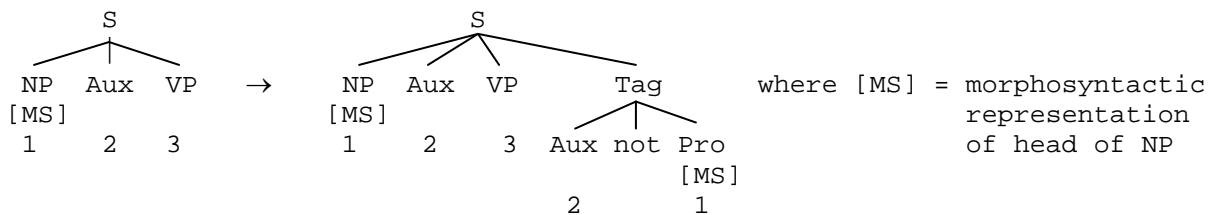
Here is an explication of this rule. It assumes you have an S, consisting of an NP, an Aux, and a VP. The NP is assumed to have a morphosyntactic representation, that is, a feature bundle located on the head of the NP. These three items (NP, Aux, VP) are subscripted 1, 2, and 3.

On the right side of the arrow in the rule, the change is shown. A new daughter of S is added at the right edge, with the category Tag. Its internal content consists of an Aux, the word *not*, and a Pronoun. The Aux is a copy of the Aux in the original sentence (this is shown by its bearing the number 2), and the Pronoun is assigned a copy of the morphosyntactic representation of the subject (this is indicated by the numerical subscript 1). Assuming that the features [Gender], [Person],

---

[67] To be honest, we're really going to stop at the first step here; for a deeper theory of transformations you'll have to take more advanced syntax courses.

[Number], and [Case] are part of the morphosyntactic representation, this will place the appropriate kind of pronoun into the tag; masculine subjects will get masculine pronouns, plural subjects will get plural pronouns, and so on.

For explicitness, here are the nominative pronouns of English with their morphosyntactic representations (for the non-nominative pronouns, see p. 98 above).

(119) *Morphosyntactic representations for English nominative pronouns*

I	[Case:Nominative, Person:1, Number:Singular]	(Gender is free)[68]
you	[Case:Nominative, Person:2]	(Gender and number are free)
he	[Case:Nominative, Person:3, Number:Singular, Gender:Masculine]	
she	[Case:Nominative, Person:3, Number:Singular, Gender:Feminine]	
it	[Case:Nominative, Person:3, Number:Singular, Gender:Neuter]	
we	[Case:Nominative, Person:1, Number:Plural]	(Gender is free)
they	[Case:Nominative, Person:3, Number:Plural]	(Gender is free)

Indeed, in what we are about to do, it is sensible to think of the pronouns simply as the way that the English language happens to spell out the category Pro when it bears one of these morphosyntactic representations. Thus, for instance that an abstract entity like (109) is spelled out as the pronoun *she*.

(120) *A spell-out rule that creates the word* she

$$\text{Pro} \begin{bmatrix} \text{Case:Nominative} \\ \text{Person:3} \\ \text{Number:Singular} \\ \text{Gender:Feminine} \end{bmatrix} \rightarrow \textit{she}$$
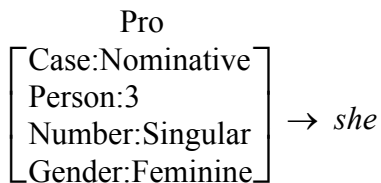
With this apparatus in place, we can provide a full derivation for the sentence *Alice can sing, can't she?*

First step: application of the phrase structure rules to derive *Alice can sing*

```
              S
      _____|_____
     |        |        |
     NP      Aux       VP
     |        |        |
     N       can       V
     |                 |
   Alice             sing
```

---
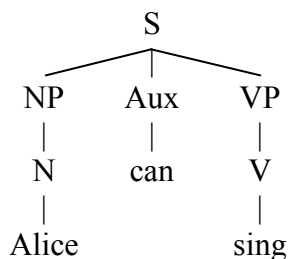
[68] By "free", I mean that you can use this pronoun no matter what the specification in the morphosyntactic representation.

$$\begin{bmatrix} \text{Pers:3} \\ \text{Num:sg} \\ \text{Gen:fem} \end{bmatrix}$$

Note that *Alice,* by its very meaning, is inherently 3rd person, singular, and feminine.

Second step: since *Alice* is the subject, a rule of case marking makes it Nominative:

```
              S
      ┌───────┼───────┐
      NP     Aux      VP
      │       │        │
      N      can       V
      │                │
    Alice            sing
 ⎡Pers:3  ⎤
 ⎢Num:sg  ⎥
 ⎢Gen:fem ⎥
 ⎣Case:nom⎦
```
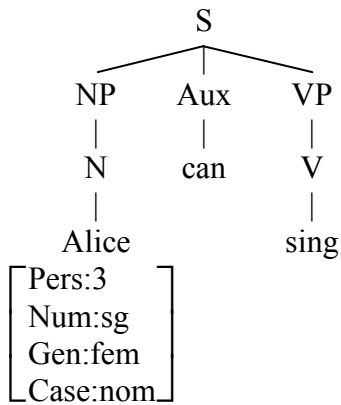
Third step: application of Tag Question Transformation (stated in (108); matchup shown with dotted lines):

(121) *Tag Question Formation applied*

```
            S                                  S
    ┌───────┼───┐                  ┌───────┬────┬────────┐
   NP     Aux   VP      →         NP     Aux   VP       Tag
  [MS]                           [MS]               ┌────┼────┐
   1      2     3                 1      2    3    Aux  not  Pro
                                                              [MS]
                                                     2         1

where [MS] = morphosyntactic
            representation
            of head of NP
```

```
                  S                                          S
          ┌───────┼───┐                      ┌───────┬────┬────────────┐
         NP     Aux    VP        →           NP     Aux   VP           Tag
          │      │      │                     │      │     │        ┌───┼────┐
          N     can     V                     N     can    V       Aux  not  Pro
          │             │                     │            │        │      ⎡Pers:3  ⎤
        Alice          sing                 Alice        sing      can     ⎢Num:sg  ⎥
     ⎡Pers:3  ⎤                          ⎡Pers:3  ⎤                        ⎢Gen:fem ⎥
     ⎢Num:sg  ⎥                          ⎢Num:sg  ⎥                        ⎣Case:nom⎦
     ⎢Gen:fem ⎥                          ⎢Gen:fem ⎥
     ⎣Case:nom⎦                          ⎣Case:nom⎦
```
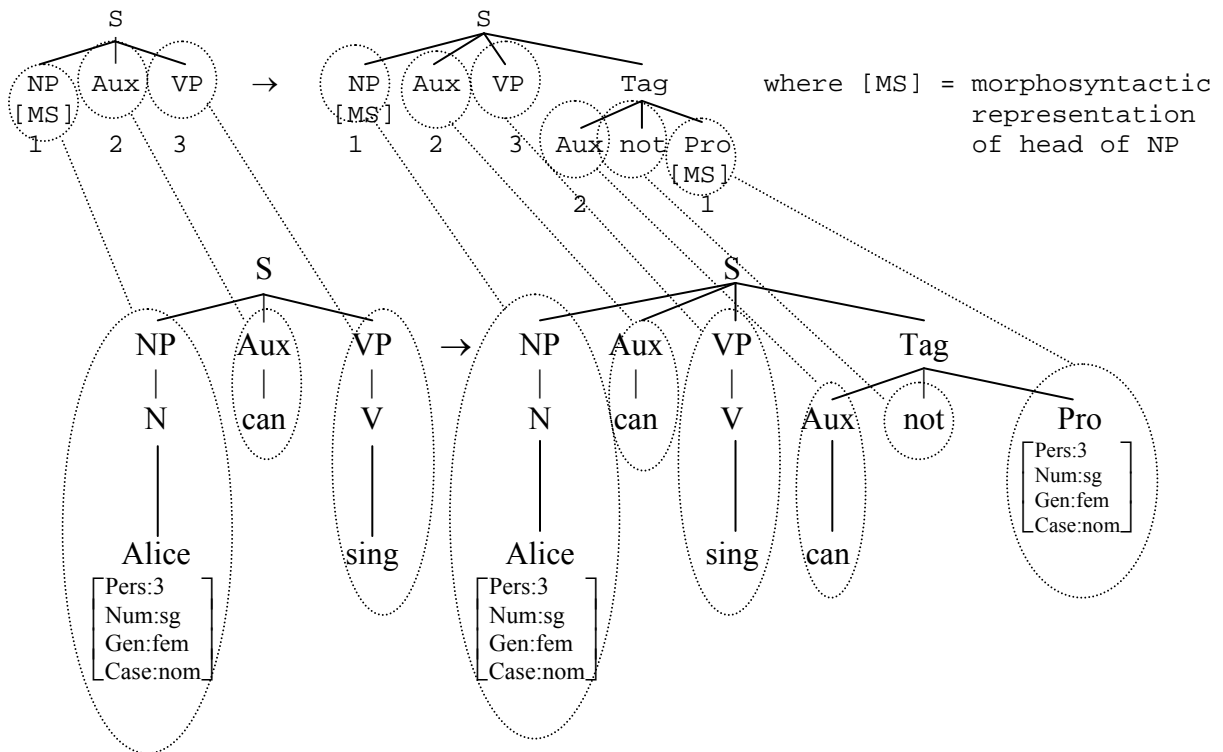
The dotted lines may look initially like spaghetti, but you would probably find it worthwhile to inspect every strand! This is the way to make sure you are correctly applying a transformation to a tree.

Fourth step: apply rule (109) above, which spells out a pronoun that is [Pers:3, Num:sg, Gen:fem, Case:nom] as *she* (tree omitted):

Alice can sing, can not **she**?

Last step: using one of the spell-out rules in (106), spell out the sequence *can not* as *can't*:

Alice can sing, can't she?

Study Exercise #21

Derive *The frogs will sing, won't they?*

The steps should include Phrase Structure rules, Tag Question formation, spelling out of the pronoun *they*, spell-out of *won't*, and attachment of the plural suffix (inflectional morphology) to *frog*.

Answer to Study Exercise #21

I. Phrase structure rules and lexical insertion:

```
                          S
            ┌─────────────┼──────────┐
           NP            Aux         VP
         ┌──┴──┐          │           │
        Art    N         will         V
         │     │                      │
        the   frog                   sing
            ┌─────────┐
            │Pers:3   │
            │Num:plur │
            │Gen:neuter│
            └─────────┘
```
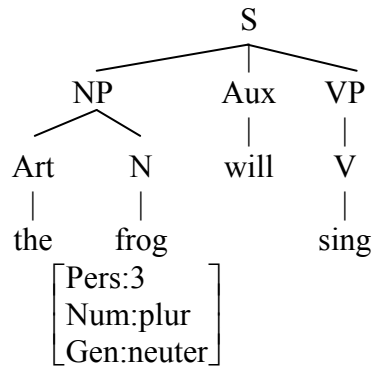
II. Nominative Case Marking:

```
                          S
            ┌─────────────┼──────────┐
           NP            Aux         VP
         ┌──┴──┐          │           │
        Art    N         will         V
         │     │                      │
        the   frog                   sing
            ┌─────────┐
            │Pers:3   │
            │Num:plur │
            │Gen:neuter│
            │Case:Nom │
            └─────────┘
```
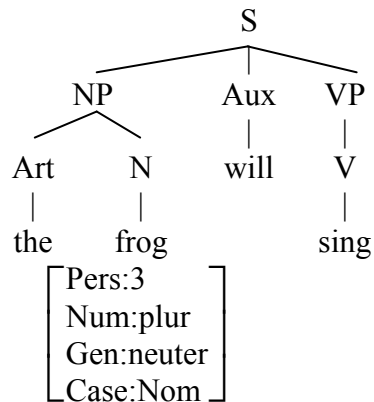
III. Tag Question Transformation (see (108))

```
                              S
          ┌──────────┬──────────┬───────────────────┐
         NP         Aux         VP                  Tag
       ┌──┴──┐       │           │              ┌────┴────┐
      Art    N      will         V             Aux       not
       │     │                   │              │         │
      the   frog                sing           will      Pro
          ┌─────────┐                              ┌──────────┐
          │Pers:3   │                              │Pers:3    │
          │Num:plur │                              │Num:plur  │
          │Gen:neuter│                             │Gen:neuter│
          └─────────┘                              │Case:Nom  │
                                                   └──────────┘

          1              2      3          2              1
```
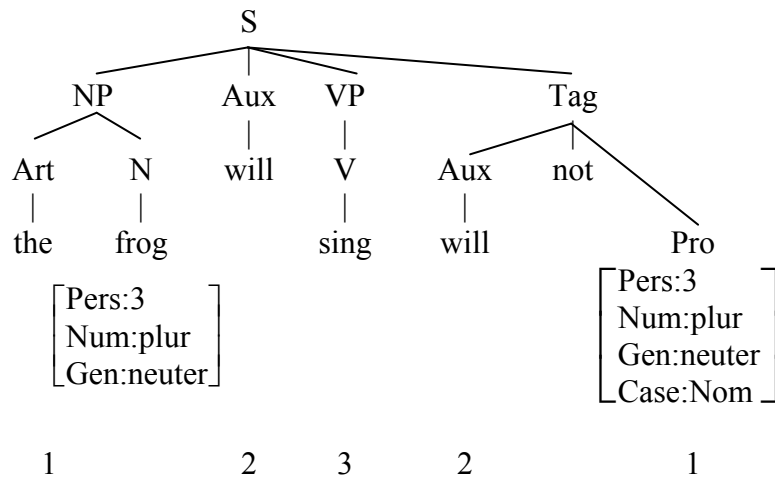
IV. Spell out the pronoun that is [Pers:3, Num:plur, Gen:neuter, Case:nom] as *they*:

The frog[Pers:3,Num:plur,Gen:Neuter] will sing, will not **they**?

V. Spell out *will not* as *won't*:

The frog[Pers:3,Num:plur,Gen:Neuter] will sing, **won't** they?

VI. Suffix -s when [Number:Plural]

The frog**s** will sing, won't they?

---

2. Another Transformation: Yes/No Questions

Consider a second transformation. Every sentence in English that is a statement has a corresponding question. Thus for

Bill is leaving

we have

Is Bill leaving?

and for

The frog might hop.

we have

Might the frog hop?

Such questions are called **Yes/No questions**, to distinguish them from questions that begin with 'who', 'what', 'where', etc., which are called **Wh- questions**. It is plausible to regard a yes/no question as a syntactic variant of the corresponding statement; thus the phrase structure rules will derive the statement, which is converted to a yes/no question. The crucial transformation is as follows:

(122) **Yes/No Question Formation**

```
        S                       S
      / | \                   / | \
   NP Aux VP     →         Aux  NP  VP
   1   2   3                2   1   3
```
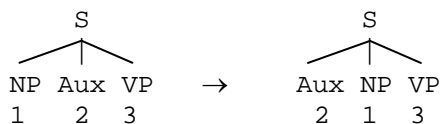
Here is a derivation; dotted lines show the matchup between rule and form:

(123) *Yes/No Question Formation applied to a sentence*

```
          S                         S
     NP  Aux  VP      →        Aux  NP  VP
     1    2    3               2    1    3

              S                                      S

     NP          Aux      VP          Aux        NP              VP

  Art  N   PP   will   V     Part  →  will  Art   N    PP    V      Part

  the king  P   NP          sit   down       the  king P    NP  sit   down?
            |    |                                      |    |
            of   N                                      of   N
                 |                                           |
              England                                     England
```
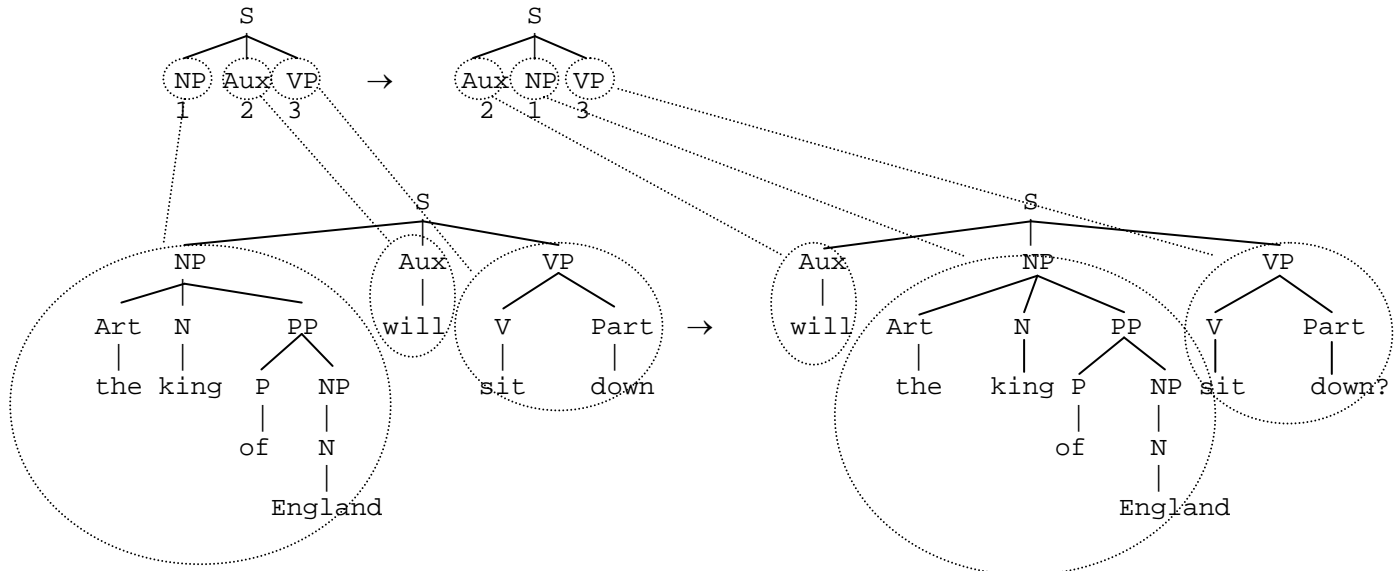
You may be worried at this point that we have no way of forming Yes/No questions from a sentence that lacks an Aux. This issue addressed in the next section.

For now, it's worth considering Yes/No Question Formation as a transformation. In this case (unlike for tag questions), it would be quite possible to derive the sentences just by using phrase structure rules, something along the lines of:

S → Aux NP VP

However, there seem to be at least two reasons that at least suggest that the transformational approach is better. First, speakers seem to recognize that (for example) *Is Bill leaving*? is the yes/no question that "goes with", or is appropriately paired with, *Bill is leaving*. We can characterize this sense of relatedness if we derive the question from the statement. Moreover, Auxes in English agree with their subjects (see previous readings for English agreement):

Bill is leaving. (3rd person singular)
Bill and Fred are leaving. (3rd person plural)

This agreement is carried over into the questions:

Is Bill leaving?
Are Bill and Fred leaving?

A clean analysis of this is possible, in which we only state the agreement rule once, if the questions are derived from the statements. In brief, the derivation would like this:
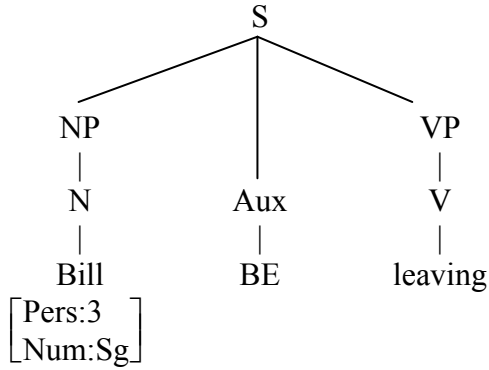
```
                            S
                ┌───────────┴───────────┐
               NP                       VP
                │                ┌───────┴───────┐
                N               Aux              V
                │                │               │
               Bill             BE            leaving        output of phrase structure rules
            ⎡Pers:3 ⎤
            ⎣Num:Sg⎦                                         features of Bill are inherent in this noun
```
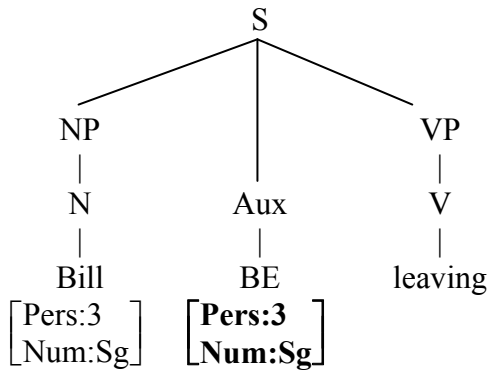
```
                            S
                ┌───────────┴───────────┐
               NP                       VP
                │                ┌───────┴───────┐
                N               Aux              V
                │                │               │
               Bill             BE            leaving        Agreement:  copy the subject features onto
            ⎡Pers:3 ⎤        ⎡Pers:3 ⎤
            ⎣Num:Sg⎦        ⎣Num:Sg⎦                         the Aux
```

```
                            S
                ┌───────┬───────┐
               Aux     NP       VP
                │       │        │
                │       N        V
               Aux      │        │
                │      Bill   leaving        Yes/No Question formation
               BE
            ⎡Pers:3 ⎤ ⎡Pers:3 ⎤
            ⎣Num:Sg⎦ ⎣Num:Sg⎦
```
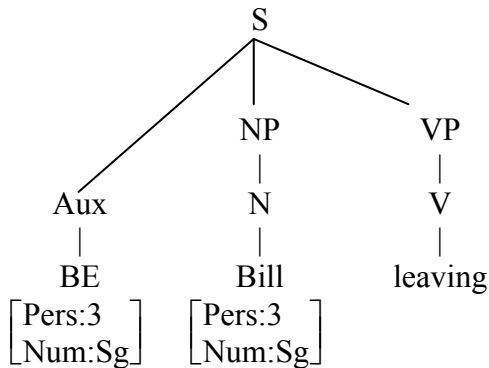
Is Bill leaving?   Morphology converts   BE   into *is*.
                                                                           ⎡Pers:3 ⎤
                                                                           ⎣Num:Sg⎦

This, then, is at least some justification for saying that Yes/No questions are formed by a transformation.

3. Inserted *do* in English

It's clear that tag questions and yes/no questions *can* be formed, even if there is no Aux in the base sentence. The method used in English is to insert the verb *do*, which could be described as the "default Aux" of the language.

For tag questions:

John likes turnips, <u>doesn</u>'t he?
We left early, <u>didn</u>'t we?

For yes/no questions:

<u>Does</u> John like turnips?
<u>Did</u> we leave early?

This phenomenon is an unusual aspect of English, and seems to be completely general. To give three additional examples:

- **Negation**: English negates a sentence by placing *not* directly after its Aux.

  I <u>have not</u> done my practicing.
  I <u>will not</u> take out the trash.
  He <u>cannot</u> play this concerto.

  Where the basic sentence has no aux (as in "He likes turnips"), *do* is inserted to provide one:

  I <u>do not</u> like turnips.

- **Polarity focus**: one can emphasize the truth of what one is saying (for example, to contradict someone who doubts it) by putting a strong accent on the Aux.[69]

  I *have* done my practising.
  You *will* take out the trash.
  He *can* play "Chopsticks".

  Where there would otherwise be no Aux, *do* is provided:

  I *do* like turnips.

- **VP elision**. The second of two identical Verb Phrases can be elided, provided an Aux is left behind:

  You should take up hang gliding. Sue has. [that is, has taken up hang gliding]

  This Aux will be *do* if no other Aux is present:

---

[69] Meaning of "polarity focus": focus is emphasis on one particular item in a sentence as the new material being contributed by the speaker. "Polarity" refers here to the "poles" yes and no, or affirmative vs. negative.

I wonder if there are any people who grow turnips around here. / Well, Bill does.

It would appear then, that some kind of process provides the aux *do* as the "backup Aux" whenever a syntactic transformation is applicable that requires an Aux to apply. A number of ways to formalize this idea have appeared, but I will not attempt this here, simply noting the general point that *do* is the "backup Aux" of English. We can at least state "what happens" as follows:

For all syntactic rules of English that refer to Aux, the Aux *do* is inserted prior to their application when the input sentence contains no Aux.

Having said this, I will mostly avoid sentences that require this unformalized operation in what follows, for simplicity.

4. Summing up so far

Transformations have been posited to perform a variety of functions, as follows:

- **Assignment of inflectional features** to morphosyntactic representations (agreement and case marking)
- **Copying** of material (as in tags)
- **Movement** of parts of the tree (as in Yes/No Question Formation)
- **Insertion** (not formalized here) of semantically empty words like the Aux *do*.

What remains to be covered are the most dramatic of transformations, the so-called long-distance movements. These will be covered shortly, but to present them clearly, a preliminary concept, subcategorization, is needed.

5. Architecture of the theory: deep structure and surface structure

It may be useful at this point to back off and consider the architecture of the theory as developed so far. By this I mean the various kinds of rules and the order in which they are arranged; or the "direction of information flow" that the theory assumes. Such information can be expressed with diagrams containing boxes and arrows, and indeed is sometimes jokingly referred to as the "boxology" of the theory.

The following diagram of this sort incorporates the terms **deep structure** and **surface structure.**

(124) *An architecture for grammatical theory with deep and surface structure*

```
        ┌─────────┐
        │    S    │                          (initial symbol fed to the grammar)
        └─────────┘
             │
             │        Phrase structure rules
             ▼
        ┌──────────────┐
        │  (bare tree) │
        └──────────────┘
             │
             │     Lexical insertion        ┌─────────────┐
             │──────────────────────────────│   lexicon   │
             │                              └─────────────┘
             ▼
        ┌──────────────────┐
        │  Deep structure  │
        └──────────────────┘
             │
             │        Transformations
             ▼
        ┌──────────────────┐
        │ Surface structure│
        └──────────────────┘
             │
             │        (and on to other components:   inflectional morphology, phonology)
             ▼
        [phonetic form]
```
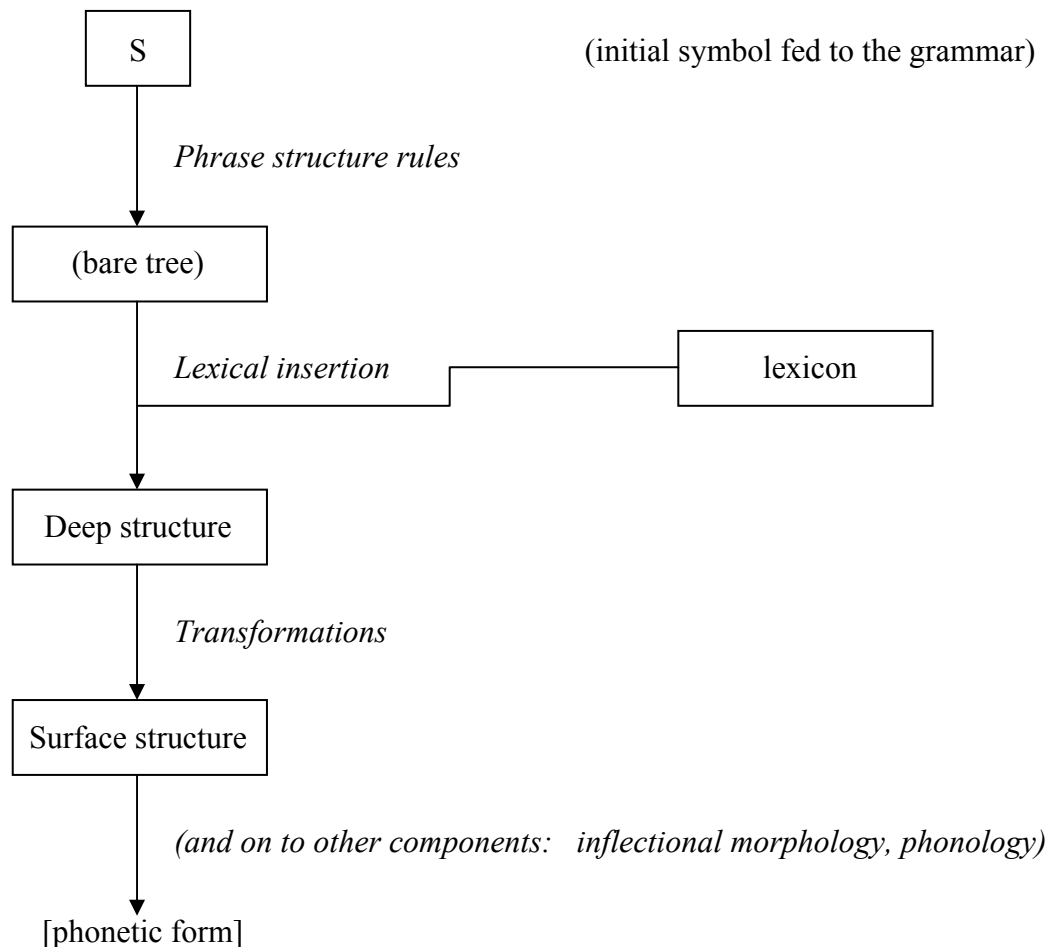
The terms "deep" and "surface" involve no notion of profundity or superficiality. Deep structure is simply the output of the phrase structure rules with words plugged in by lexical insertion. Surface structure is the output of the syntax as a whole. In a sentence in which no transformations are applicable, the deep and surface structures are the same.

A caution to bear in mind is that a diagram of this sort is simply depicting the logical structure of the model; we are not (necessarily) making any claim that this represents the time course of sentence production in humans; but rather a claim about the structure of the language; that what we observe can be described in terms of a fixed number of perturbations of a simple structure that is generable by a phrase structure grammar.

Chapter 6:   Syntax III — Subcategorization and Wh- Movement

1. One more update of the phrase structure rules

For purposes of this chapter we will need a slightly more powerful set of phrase structure rules.

1.1 CP as daughter of NP

In English it is possible to have an NP that contains a CP as its daughter. One place where this occurs is when the head noun of the NP is one that express a belief or a statement — such nouns include *belief*, *claim*, *assertion*, and so on. Some examples of CP-within-NP are given in (125).

(125) *Some examples of NPs that have CP as a daughter*

      a. Fred's *belief* [_{CP} that he is a genius]
      b. George's *insistence* [_{CP} that he be included]
      c. the *claim* [_{CP} that this structure is an island]
      d. Sally's *assertion* [_{CP} that we should eat pasta]

It should be clear that the fundmental principle of phrase structure we have been working with, "the modifier of the head is the sister to the head" ((90) above) is obeyed by these examples; for example *that he was a genius* specifies what particular belief Fred holds.

We can also establish that the normal position of CP within NP that include it is last:

      George's insistence [_{PP} to John] [_{CP} that he be included]
     *George's insistence [_{CP} that he be included][_{PP} to John]

I suggest the following version of the main phrase structure rule for NP:

(126) *A modified version of the NP phrase structure rule (allows CP)*

$$\text{NP} \quad \rightarrow \quad \left(\left\{ \begin{matrix} \text{Art} \\ \text{NP} \end{matrix} \right\} \right) (\text{AP})^* \ \text{N} \ (\text{PP})^* (\text{CP})$$

To justify this rule, we can consider a long NP that includes every possibility for the main NP phrase structure rule is the following:

```
                                    NP
                         _____|_____
                        |    |    |    |    |     CP
                        |    |    |    |    |    __|____
                        |    |    |    |    |   |       S
                        |    |    |    |    |   |    ___|____
                        |    |    |    PP   |   |   |        VP
                        |    |    |   _|_   |   |   |      __|__
                        NP   AP   |  |   NP |   NP  |     |    NP
                        |    |    |  |   |  |   |   |     |   _|_
                        N    A    N  P   N Comp N   V    Art  N
                        |    |    |  |   |  |   |   |     |    |
                      Bill's forthright assertion to Fred that television has no future.
```
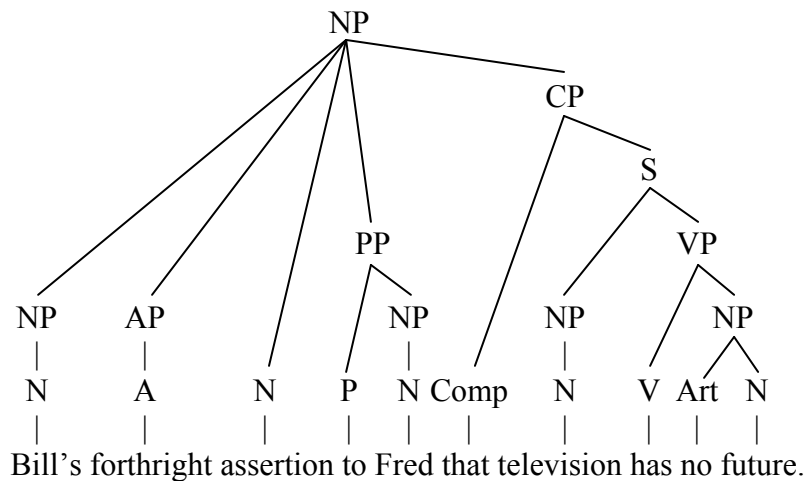
Many of the nouns that occur in such structures share a morphological property: they are derived (within the word formation component) from verbs. This can hardly be a coincidence, and we will discuss this further below. There are, however, a few nouns that take a CP that are not derived from verbs: *hypothesis*, *hunch*.

1.2 AP as daughter of VP

VP can sometime include an AP (Adjective Phrase). The most common instance of this is when the verb is some form of *be*: *Alice is quite tall.* Sentences with other verbs are given in (116).

(127) *Some sentences in which the VP includes an Adjective Phrase*

    a. Fred is sick.
    b. Bill looks tired.
    c. Alice seems very friendly.
    d. Jack appeared angry to Sam.

As far has handling such cases in the grammar, it seems sensible not to amplify our existing phrase structure rule for VP (VP → V (NP) (NP) (PP)* (CP), given in (104)), but rather to introduce a new rule that only allows V and AP:

(128) *A new phrase structure rule for VP, permitting an AP daughter*

    V → V AP (PP)*

The alternative of beefing up our existing rule VP → V (NP) (NP) (PP)* (CP) with an AP position, as in VP → V (NP) (NP) (PP)* (AP)(CP), would overgenerate (as with *Bill told Fred Sam very angry.*)

1.3 Final phrase structure rule list

Putting all of these together, we have the phrase structure rules shown:

(129) *Final[70] version of phrase structure rules for English, improved with two new rules*

S   → NP (Aux) VP

NP → $\left(\left\{\begin{matrix}\text{Art}\\ \text{NP}\end{matrix}\right\}\right)$ (AP)* N (PP)*(CP)

NP → Pronoun
AP → (Adv) A
VP → V (NP) (NP) (PP)* (CP)
VP → V AP (PP)*
PP → P NP
CP → (Comp) S

NP → NP (Conj NP)*
VP → VP (Conj VP)*
PP → PP (Conj PP)*
S   → S (Conj S)*
CP → CP (Conj CP)*
V   → V (Conj V)*

2. Lexical insertion and subcategorization

The phrase structure rules for English as we have developed them so far generate, among many others, the following trees:

A.
```
        S
      /   \
    NP     VP
    |      |
    N      V
```

B.
```
        S
      /   \
    NP     VP
    |     /  \
    N    V    NP
             /  \
           Art   N
```
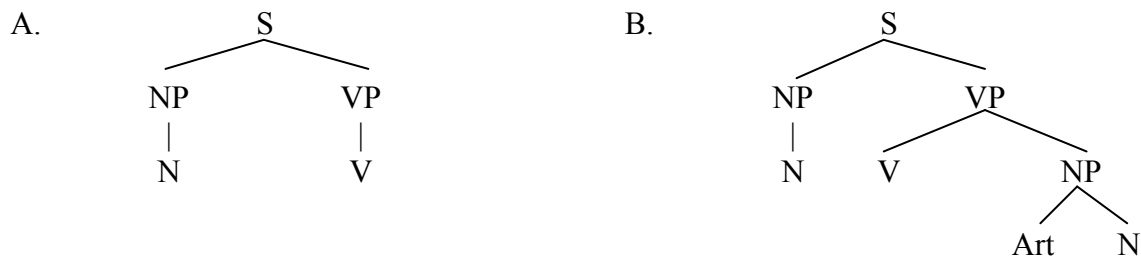
We have so far assumed that words are inserted whose part of speech matches up to the appropriate node in the tree. However, closer inspection shows that this procedure frequently overgenerates. Thus, for instance, a verb like *sigh* may appear in tree A but not tree B:

Fred sighed.
*Fred sighed his fate.

A verb like *destroy* behave in the reverse fashion: it can appear in B but not in A:

---

[70] Final for purposes of this introductory textbook!

    Bill destroyed his car.
    *Bill destroyed.

Verbs like *destroy* that must take an object are called **transitive** verbs; verbs like *sigh* that cannot take an object are called **intransitive**. Some verbs, such as *eat*, fit into both categories; they can be called "optionally transitive".

    To avoid overgenerating in the way just shown, the theory needs a means of specifying the requirements of particular words for what tree structures they may appear in. This problem is becomes especially acute for the two new structures introduced in the preceding section. Only a few nouns in English (like *belief, insistence, claim*) can occur with a CP sister. Only a very small number of verbs (like *be, seem, appear*) may occur with an AP sister. So our theory currently has a big gap in it; we need some way of specifying what trees particular words are allowed to occur in. The method we'll cover in this book is called **subcategorization frames**.

    To start, let us agree that the process of "inserting words into the tree" will be called **lexical insertion**. Underlying this is the idea that speakers possess a mental dictionary, generally referred to as the **lexicon**.[71] Lexical insertion consists of extracting a word from the lexicon and inserting it into a syntactic tree. The entries in the lexicon contain the crucial information about what kinds of tree the words can be inserted into, in the form of a **subcategorization frame**.

    Under this approach, the lexical entry for *destroy* would be like this:

destroy:
Pronunciation: /dɪsˈtrɔɪ/   (more on this later)
Meaning: "violently cause no longer to exist"   (we lack a better way to represent meaning)
Syntactic category: Verb
subcategorization frame: [___ NP].

    The subcategorization frame indicate the sisters that *must be present* in order for the word to be legally inserted into the tree. *Destroy*, being a verb, will be inserted as the head of a VP. The subcategorization frame says that for insertion of *destroy* to be legal, the VP must contain an NP, occurring immediately to the right of V within VP. The diagram in (119) is meant to explicate this notation:

---

[71] Or even "mental lexicon", if we want to be perfectly clear we are talking about the knowledge of a person rather than a lexicon as a book or database.

(130) *Matching a tree and subcategorization frame*

tree

subcategorization frame for *destroy*
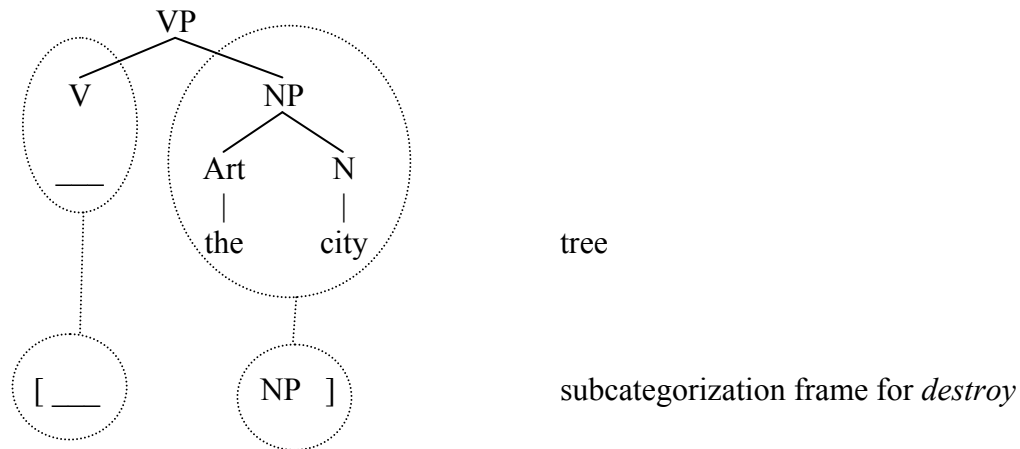
Since *destroy* subcategorizes for an object NP, a sentence like *John destroyed fails to match the subcategoriaation frame of its verb and is therefore ungrammatical.

It goes the other way as well: where a subcategorization frame does *not* include some particular type of phrase, then lexical insertion is impossible, and ungrammaticaly is predicted, when that phrase type is present. Thus, for instance, the intransitive verb *sigh* would have the following subcategorization frame:

Here is a lexical entry for *sigh*:

> **sigh**: pronunciation: /saɪ/
> meaning: "exhale loudly to express sorrow"
> syntactic category: verb
> subcategorization: [___]

The frame [___] indicates that *sigh* may not have sisters in the VP. It accounts for the ungrammaticality of **John sighed the misfortune*.

Optionally-transitive verbs like *sing* (*John sang*, *John sang the song*) have subcategorization frames that employ parentheses to show the optionality. Here is a lexical entry for *sing*:

> **sing**: pronunciation: /sɪŋ/
> meaning: "use one's voice to produce music"
> syntactic category: verb
> subcategorization: [___ (NP)]

More generally, optional elements in subcategorization frames are indicated with parentheses. Grammaticality results if *some* version of the frame (leaving out, or keeping in, parenthesized material) matches the sentence. Thus *Jane sang* and *Jane sang the song* are both good.

Verbs of saying and belief often subcategorize for a CP. For example, *say* has the subcategorization [___ (PP) CP] and *tell* has the subcategorization [___ NP (CP)]. This can be justified by the following sentences:

(131) *Data to justify the subcategorization frames of* say *and* tell

    a. *Alice said.
       Alice said to Bill that she would be going.
       Alice said that she would be going.

    b. *Fred told.
       *Fred told that he would be going.
       Fred told us.
       Fred told us that he would be going.[72]

Nouns have subcategorization frames as well. For example, here are the data that could be used to justify the subcategorization frame of *gift* as [___ (PP) (PP)]

(132) *Data to justify the subcategorization frame of* gift

    a. a gift of $10 to the Red Cross
    b. a gift of $10
    c. a gift to the Red Cross
    d. a gift

The subcategorization frame of *picture* is [___ (PP)], as in *picture of Alice* (again the PP is optional since *picture* is fine by itself.) The subcategorization of *dog* is [___] (there are no noun phrases like, say, **dog of teeth*).

2.1 Two rarer cases: Nouns that subcategorize for CP; verbs that subcategorize for AP

    I introduced the two changes in the phrase structure rules of the previous section $(NP \rightarrow \left(\begin{Bmatrix} Art \\ NP \end{Bmatrix} \right) (AP)^* N (PP)^* \textbf{(CP)}$ and $\textbf{VP} \rightarrow \textbf{V AP (PP)}^*)$ precisely because these rules seem to be especially "sensitive", as it were, to subcategorization. There are only a few nouns that take CP and only a few verbs that take AP; see (125) and (127) for examples.

    With regard to N that subcategorize for CP, there is an intriguing relationship to morphological rules; specifically the rules of word formation (see Chapter 2). Specifically, when a noun is morphologically derived from a verb that subcategorizes for CP, the resulting noun tends also to subcategorize for CP:

---

[72] *Tell* also has the subcategorization [___ (NP)(NP)]: *Fred told us his sorrows, Alice told them her name*.

(133) *Parallel subcategorization of some verbs and their derived nouns*

    a.   They believe that Sue left
         their belief that Sue left

    b.   They assert that Sue left.
         their assertion that Sue left

    c.   They claim the Sue left.
         their claim that Sue left.

Before we leave the topic of N subcategorizing for CP, it's important to note that there is another kind of CP that can occur as part of an NP. It is *not* subcategorized. These structures are called **relative clauses**; we won't have the time to analyze them in this book, but they are a major topic you will study if you go on to take a syntax course. You can detect relative clauses because they have a silent location (rather like the silent locations of Chapter 1) that refers to the head noun of the NP; often called a **gap**.

(134) *Examples of relative clauses (gaps shown as ___)*

    a. the turtles [CP that we caught ___ in the pond]
    b. the beliefs [CP that we hold ___]
    c. the king [CP who the peasants deposed ___ last year]

Thus (123) means something like "the turtles such that we caught (those turtles) in the pond"; I've filled the gap informally by spelling it out as "those turtles."

To see the difference between subcategorized CP's and relative clauses, it may help to observe that you can get both of them in the same NP:

(135) *An NP that has both a subcategorized* CP *and a relative clause*

the assertion [CP that we should eat pasta] [CP that you made ___]

head of NP

Subcategorized CP   CP forming a relative clause

2.2 Items not included in the subcategorization frame

Some constituents evidently get to appear "for free" in the syntactic tree; they don't have to be subcategorized. This is true for PP's with general adverbial meaning of place, time, or manner can occur with virtually any verb:

(136) *Some unsubcategorized PP*

      John sighed on Tuesday.
      John sighed in the garden.
      John sighed with great feeling.

The general practice for subcategorization is this: if any element *is always able to occur* as a sister, then we don't bother to mention it in the subcategorization frame. Basically, we are interested only in the restrictions that hold of individual words. This aspect of the grammar will not be formalized in this book.[73]

      What is true of verbs is also true of nouns: PP's of place, time, and manner are ignored in determining noun subcategorizations, so cases like (126) would not justify a frame like [___ PP] for their nouns.

(137) *Some unsubcategorized PP within NP*

      the dog in the garden
      the party on Tuesday
      a person in a good mood

Likewise, articles and possessors are not considered in the subcategorization frame, since they are possible for any noun (*the dog*, *Alice's dog*).

2.3 Subcategorization and meaning

      It's a somewhat vexed question to what extent subcategorization should be treated (as it is above) as a straightforward matter of syntax. An alternative view is that heads occur in particular syntactic locations simply because of what they mean. For example, the verb *say* is entitled to occur in the syntactic frame [___ PP CP] because an act of saying generally has someone who is being spoken to (in *I said to Fred that I was leaving*, this is *Fred*), and a thing which is said (*I was leaving*). Similarly, *put* occurs [___ NP PP] because it involves a thing that is put, and location into which the thing is put. *Sigh* occurs [___] because nothing is affected when you sigh.

      Although there is probably a grain of truth to this "semantics, not subcategorization" view, there are also reasons to treat it with skepticism.

      First, there are cases of verbs that have very similar meanings, but different patterns of occurrence. Consider for instance *say* and *tell*.

    I told Bill that I was leaving.
    *I told to Bill that I was leaving.
    *I said Bill that I was leaving.
    I said to Bill that I was leaving.

---

[73] In a more thorough grammar, we might adopt a bit more structure: some kind of node higher than VP but lower than S, which would contain the unsubcategorized PP.

It's not clear how semantics alone could tell us which verb requires an NP object and which a PP. Likewise, the pattern below:

I like jumping.	I like to jump.
I prefer jumping.	I prefer to jump.
I enjoy jumping.	*I enjoy to jump.

where only one of the three similar verbs can't take an infinitive subordinate clause (see Chapter 1), suggests that meaning won't suffice to tell us everything about subcategorization.

The verbs *give* and *donate* are semantically similar, but have different syntactic behavior:

She gave the library $1,000,000.	She gave $1,000,000 to the library.
*She donated the library $1,000,000.	She donated $1,000,000 to the library.

Only *give* has a subcategorization for [___ NP NP].

There is one more phenomenon that suggests that subcategorization cannot be reduced to meaning. Consider verbs like these:

He ate.
She sang.
We raked.

These have what are sometimes called "implicit arguments"—it's understood that "he" ate *something*; and that likewise she sang something (song unspecified), and we raked (leaves or grass unspecified). In other words, the syntax does not always have to provide overt expression for all the participants in an act. Yet in other cases, an implicit argument evidently is not allowed:

*We took.
*We own.

2.4 Solving subcategorization problems

The best method seems to be the following:

- Think of words and sentences that include the word you're considering. [74]
- Look at the phrase structure rule that introduces the word (for example, if you're dealing with a noun, look at the phrase structure rule NP → (Art)(A) N (PP)* (CP)). This will tell you the sisters that at least *might* be present.

---

[74] I admit that this is harder for non-native speakers, a problem hard to avoid in linguistics teaching. If you don't have native intuitions in English, I suggest doing one of two things when you solve subcategorization problems on your assignments: either find a native speaker consultant and get their intuitions, or else add verbal discussion to your answer, with wording like "assuming that xxx is grammatical in English; I'm not sure." It would be fair to grade your answer based on the facts as you give them.

- Remember that a subcategorized expression usually has a kind of intimate relation to the meaning of the word that subcategorizes it. The noun *claim* subcategorizes for an CP because the CP is used to designate the conceptual content of the claim.
- Try collecting as many individual frames for the word that you can, then use parentheses to collapse them into one or more simpler expressions.
- Don't be distracted by PP's of place, manner and time that can occur with anything; they don't belong in the subcategorization frame.

Study Exercise #22

Give subcategorizations for the following words, justifying them with example sentences.

a. Verbs: *elapse*, *award*, *tell*, *shout*, *die*
b. Nouns: *turtle*, *bowl*, *announcement*, *reason*

Answer to Study Exercise #22

a. Verbs:

elapse: [__]

    Time elapsed
    *Time elapsed me
    *Time elapsed to the losing team.
    *Time elased that it was a great misfortune.

award: [___ NP (PP)]

    *They awarded.
    They awarded a prize
    They awarded a prize to the winner.
    *They award to the winner.

    [___ (NP) NP]
    They awarded the winner a prize.

tell: [___ NP (CP)]

    They told Bill that they were leaving.
    They told Bill.
    *They told that they were leaving.

    [___ NP (PP)]

    They told the truth to Bill.
    They told the truth.
    They told Bill.
    *They told to Bill.

    [___ NP (NP)]

    They told Bill the truth.
    They told Bill.
    They told the truth.

shout: [___ (PP)(CP)]

    They shouted.
    They shouted to Sally.
    They shouted that they were leaving.
    They shouted to Sally that they were leaving.

    [___ (NP)(PP)]
    They shouted the words.
    They shouted the words to Sally.

die: [___]

>   Jefferson died.
>   *Jefferson died Washington.
>   *Jefferson died to Washington.
>   (Note: *Jefferson died in 1826, Jefferson died in Virginia* don't count, since PP's of place
>   and time can occur with any verb.)

b. Nouns

turtle: [___]

>   turtle
>   *turtle of shell
>   *turtle that they were leaving

bowl: [___ (PP)]

>   bowl
>   bowl of soup

announcement: [___ (PP) (CP)]

>   the announcement
>   the announcement to Bill
>   the announcement that they were leaving
>   the announcement to Bill that they were leaving

reason: [___ (CP)]

>   the reason
>   the reason that we are going
>   *the reason to Fred
>   *the reason to Fred that we are going

---

3. Wh-Movement

3.1 Backdrop

This section returns to the topic of transformations. Thus far, we've seen two reasons to move beyond simple phrase structure grammars to transformational grammars:

- Phrase structure rules cannot copy material—only a copying transformation can generate the legal array of tag questions.
- Phrase structure rules cannot relate sentences to one another (for example, simple statements to yes-no questions).

We now move on to what many linguists would probably agree is the most important basis for transformations, sometimes called "long distance gap-filler dependencies". The first example of such a case will be Wh- Movement.

3.2 Basics and terminology

A ***wh- word*** is one of a fixed inventory of words used for asking questions. They are so called because most of the wh-words in English begin with these letters.

The *wh-* words of English can be various parts of speech:

which	Article
whose	Article
who	Pronoun
whom	Pronoun
what	either an Article or Pronoun
how	Adverb
when	Adverb
why	Adverb
where	Adverb

A ***wh- question*** is a question that involves a *wh*-word. For example, the following are wh-questions:

Who did you see?
What book did you read?
Which chocolates did you like?
In which hotel are you staying?
How do you feel?

You can see that the wh- word usually comes at or near the beginning of the sentence. It constitutes, or is part of, a phrase that (intuitively), the sentence is about; i.e. the item that is being questioned.

A **wh- phrase** is an NP, PP, or AdvP (Adverb Phrase) that contains a *wh-* word and is placed at the beginning of a clause. In the wh- questions just mentioned, the wh- phrases are
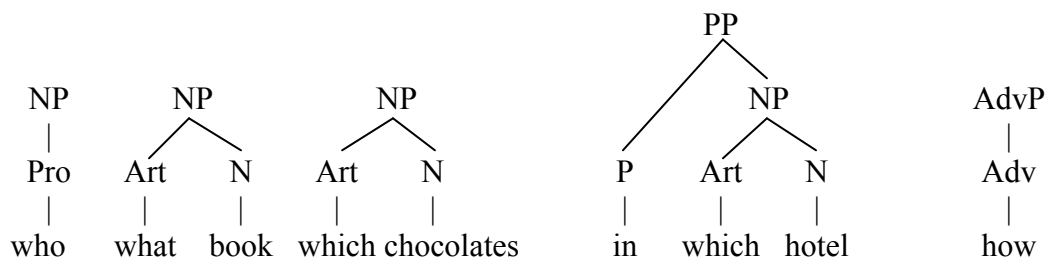
This permits a more precise definition of **wh- question**; it is a question that begins with a wh-phrase.

3.3 Wh- questions, subcategorization, and gaps

Wh- questions are interesting in that they appear to violate otherwise-valid principles of subcategorization. Here is an example. The verb 'put' has the subcategorization [___ NP PP]. Because of this a sentence like the following:

Fred will put the chicken in the oven

is grammatical; the subcategorization of *put* is satisfied. But

*Fred will put in the oven

is ungrammatical because of the missing NP, and

*Fred will put the chicken

is ungrammatical because of the missing PP.[75] This is an unusual case in which there are two subcategorized elements and both are obligatory.

In light of the subcategorization fact, it is a bit surprising that the following sentences, both Wh- questions, should be grammatical:

(138) *Two Wh-questions that appear to violate subcategorization*

Into what oven will Fred put the chicken?
What chicken will Fred put into the oven?

These sentences contain gaps: instead of the NP or PP that the subcategorization of *put* calls for, one finds nothing. The gaps are shown below, denoted with an underscore:

(139) *Two Wh-questions that appear to violate subcategorization — marked for their gaps*

What chicken will Fred put ___ into the oven?
Into what oven will Fred put the chicken ___ ?

Most people who ponder the question will judge that these gaps are (intuitively speaking) "filled" by the wh- phrase. We understand *what chicken* to be the object of *put* in the first sentence, and in the second sentence we understand *into what oven* to be the PP indicating where Fred put the chicken.

Let us define "gap", for precision:

---

[75] As elsewhere we are ignoring extended uses of verbs, which often change the subcategorization. *John put the chicken* is fine in a fantasy world in which Olympic medals are awarded in the chicken-put.

- A **gap** is a location in syntactic structure where the subcategorization requirements would lead one to expect a phrase, but none occurs.

Such gaps are widely observed in English and in many other (not all) languages.

There is an intimate connection between wh- phrases[76] and gaps: to a rough approximation, gaps are allowed only when a wh- phrase is present; recall

    *Fred will put in the oven
    *Fred will put the chicken

This goes the other way around: if there is no gap, then we can't have the Wh-phrases either:

    *What chicken will Fred put the dinner into the oven?
    *Into what oven will Fred put the chicken into the pan?

Moreover, most people who ponder the question will judge that gaps are somehow "filled" by the wh- phrase. In (140):

(140) What chicken will Fred put ___ into the oven?

we understand *what chicken* to be the object of *put*, and in (141):

(141) Into which oven will Fred put the chicken ___ ?

we understand *into which oven* to be the PP indicating where Fred put the chicken.

    Summing up, wh-questions in English have what are often called **filler-gap dependencies**, which we can detect in a rigorous way by working out subcategorizations.

    The two questions that demand to be answered here, then, are

- Why should wh- questions, and only wh- questions, permit gaps?
- How do we account for the filler-gap dependency; that is, the fact that the wh- phrase at the beginning of the sentence intuitively fills the gap?

As you might be imagining already, the answer will involve a transformation.

3.4 Further background: echo questions

    Before we proceed to the analysis, let us ponder a further phenomenon of English syntax, the so-called **echo question**. These are questions that contain a Wh- phrase, but have no gap; the Wh- phrase occurs in the ordinary position for its type, and satisfies the subcategorization requirements of the relevant head. Echo questions are not all that common, because they can only be used to offer an astonished reply to a parallel statement:

---

[76] And, as we'll see later on, phrases that behave quite similarly to wh- phrases.

(142) *Examples of echo questions*

The Romans destroyed the television set.
The Romans destroyed *what*?

I saw Marilyn Monroe in Westwood last Saturday.
You saw *who*?

Fred will put the chicken in the Socratic Oven.
Fred will put the chicken in *what* oven?

Echo questions make an important point: it is possible to generate a wh-phrase in the 'normal' position for an NP or PP; wh- phrases do not always have to appear at the beginning of sentence.

A bit of terminology: the wh- phrases of echo questions are sometimes said to be **in situ**, which is Latin for "in its original position".[77]

3.5 A transformation for Wh- questions

The grammatical problem at hand is that Wh- questions have subcategorization gaps that match up with the initial wh- phrases. This is a dependency that cannot be expressed with the phrase structure rules we have been using. These rules can only say what daughters a node may have, and thus they have no ability to regulate matchups between elements in the tree that are far apart. A transformation is needed.

The intuitive idea behind our transformation analysis will be to let normal questions be derived from *deep structures that look like echo questions*. That is, we will have a transformation that will move the wh- phrase out of its *in situ* deep structure position (where it satisfies the subcategorization of the verb) to the beginning of the sentence. As a first approximation:

(143) **Wh- Movement (first version)**

Move a wh- phrase to the beginning of the sentence as daughter of S, leaving a trace.

The term "trace" will be defined shortly.

In a minute, we can use this transformation to derive some wh- questions, but in the mean time a detail must be attended to. It's clear that in typical Wh- questions (such as (127)), the Aux comes before the subject: *What chicken [will]$_{Aux}$ [Fred]$_{NP}$ put in the oven?* This is hardly something new, because we have already seen this in Yes/No questions, discussed in the previous chapter. It seem that the flipping of the order of subject and Aux is more general than we had imagined; it occurs in all normal (non-echo) questions, not just Yes/No questions. So a first act of tidying up will be to rename our earlier transformation of Yes/No Question Formation (from

---

[77] *Situ* is an inflected form ([Case:ablative, Number:singular]) of *situs* 'place'.

(111)), and assume that it applies in all normal questions. Here is the transformation with its new name.

(144) **Subject/Aux Inversion**

```
        S                      S
      ⟋ | ⟍                  ⟋ | ⟍
   NP  Aux  VP      →      Aux  NP  VP
    1   2   3               2   1   3
```
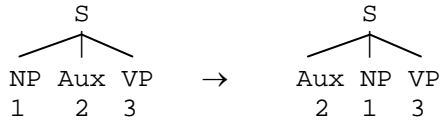
Applies in all non-echo questions.

We will assume, moreover, that Subject/Aux Inversion is ordered to apply *before* Wh-Movement; the concept of ordering the rules is one we've already seen for inflectional morphology in Chapter 2.

Now that we have the rules and their ordering, we can do a full derivation of a Wh- question under the proposed analysis. We begin with the phrase structure rules (on the left), then do lexical insertion (on the right):

(145) *Application of phrase structure rules and lexical insertion*

```
            S                                        S
      ⟋     |     ⟍                            ⟋     |     ⟍
   NP    Aux        VP                      NP    Aux        VP
   |              ⟋ |  ⟍                    |     |      ⟋  |     ⟍
   N            V   NP      PP               N    will  V    NP       PP
              ⟋⟍    ⟋⟍                      |        |   ⟋⟍      ⟋ ⟍
            Art  N  P     NP               Fred    put  Art  N   P      NP
                        ⟋⟍                              |   |   |     ⟋⟍
                      Art  N                          what chicken in Art  N
                                                                      |    |
                                                                     the  oven
```
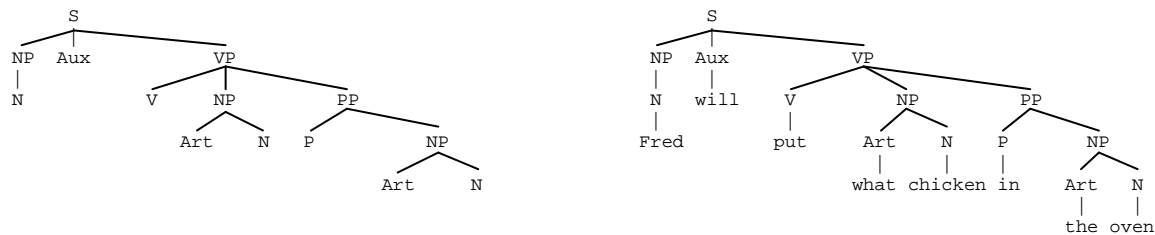
This creates the stage of deep structure, with *what chicken* in situ. The crucial point at this stage is that we have *not* violated the subcategorization of *put*, which in deep structure does have the required NP and PP sisters. In fact, with the theory we are working on, ultimately this will be seen to be true even in surface structure (more on this below).

Following our assumed rule ordering, the first transformation to apply in Subject/Aux Inversion, from (144):

(146) *Application of Subject/Aux inversion*

```
      S                      S
     /|\                    /|\
 NP Aux VP      →       Aux NP VP
  1  2  3                2  1  3
```


Deriving:

```
      S                      S
     /|\                    /|\
 NP Aux VP      →       Aux NP VP
  1  2  3                2  1  3
```
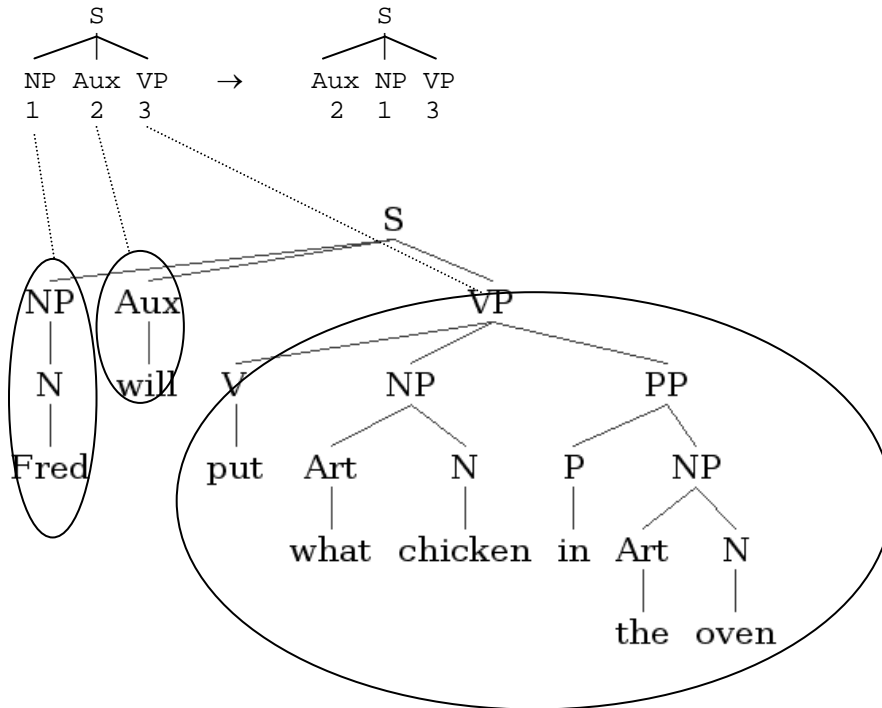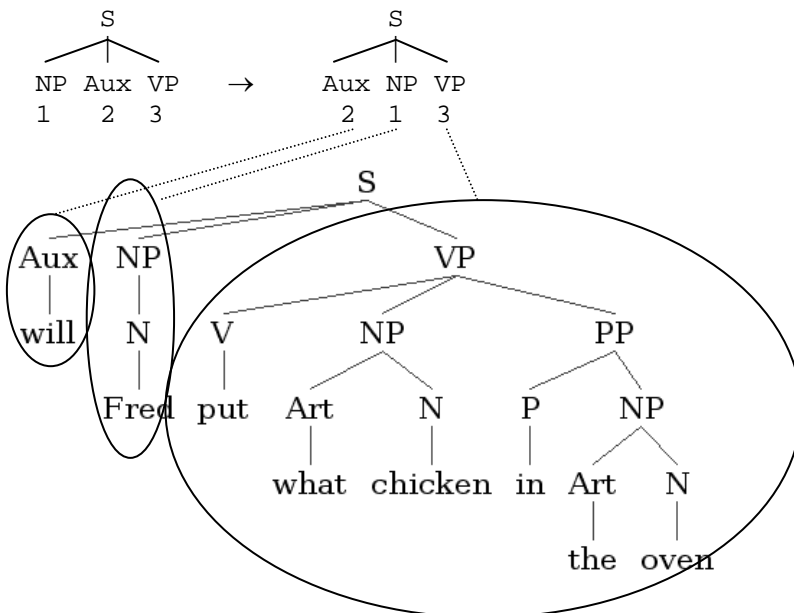

Now we apply Wh-Movement. I show this below first by drawing arrows to show what moves where, then showing the surface structure that results. A caution: the destination of *what chicken* is provisional; we will change the analysis a bit below.

(147)   *a. Output of Subject/Aux Inversion, with arrow showing application of (130) Wh-Movement*

```
                              S
                   _____|_____
                  Aux        NP           VP
                   |          |      _____|_____
                 will       Fred    V     NP          PP
                                    |   __|__       __|__
                                   put Art   N     P     NP
                                        |    |     |    _|__
                                      what chicken in  Art   N
                                                        |    |
                                                       the  oven
```

b. Surface structure

```
                           S
            _____|_____
           NP      Aux     NP              VP
         __|__      |       |       _____|_____
        Art    N  will    Fred     V    NP           PP
         |     |                   |     |        ____|____
       what chicken               put    t      P        NP
                                          |    __|__
                                         in   Art    N
                                               |     |
                                              the   oven
```
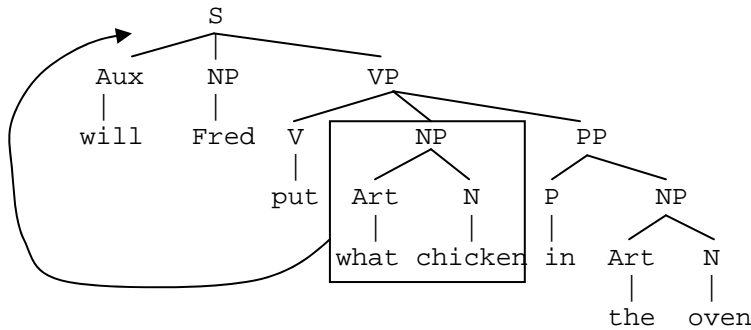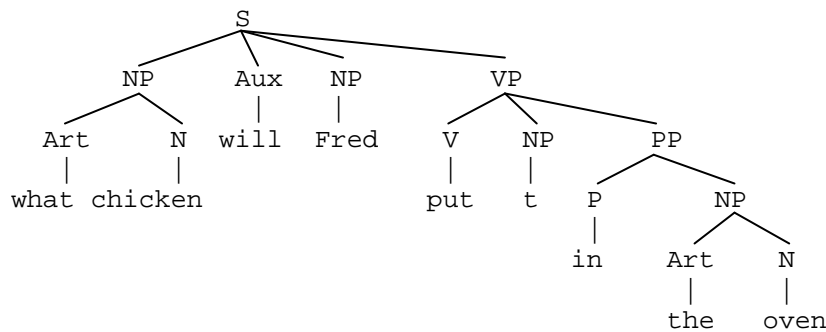
As stated in the Wh- Movement rule of (130), the movement of *what chicken* is assumed to leave a **trace**. A trace is more or less our formalization of a gap: it is an empty copy of what got moved; it has the same category, but it contains no phonetic material. To show that a trace is empty, we use the letter *t*, as the daughter of the trace's category. For now, the trace is just an arbitrary choice, but we later on it will play an important role in the semantics of wh- questions and similar constructions. For now, we can observe that the trace NP means that the subcategorization requirements of *put* are satisfied (albeit by an empty, abstract entity) at surface structure as well as deep structure.

I will now restate the point of what we're currently doing: we're trying to provide a solution to the problem of subcategorization gaps, and why these gaps characteristically are matched with a Wh-phrase at the start of the sentence. In this approach, gaps only arise from movement,[78] so the fronted wh- phrase will always match the gap. This ability to capture a **long-distance dependency** ("X here only if Y there") is a common justification for a transformational analysis.

---

[78] A caution: there are many other sources of gaps, such as the subject gaps mentioned in Chapter 1, or the dropped subject pronouns of Spanish, Persian, and many other languages. But these tend to have a special distribution, so the general point still holds.

Study Exercise #23

Provide a step-by-step syntactic derivation, mimicking that just given in the text, for

Into what oven will Fred put the chicken?

Study Exercise #24

Explain how our grammar predicts that

*What city have the Romans destroyed Carthage?

is ungrammatical.

Study Exercise #25

Explain how our grammar predicts that

*Who will the princess sigh?

is ungrammatical.

Study Exercise #26

Derive the question

Who will leave?

using the rules given above. What is odd about this derivation?

Answer to Study Exercise #23

Phrase structure rules:
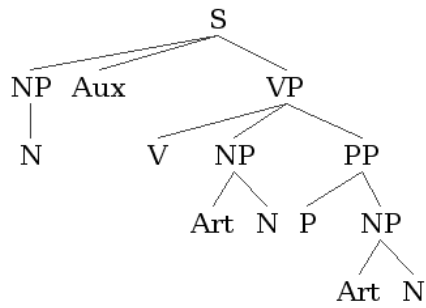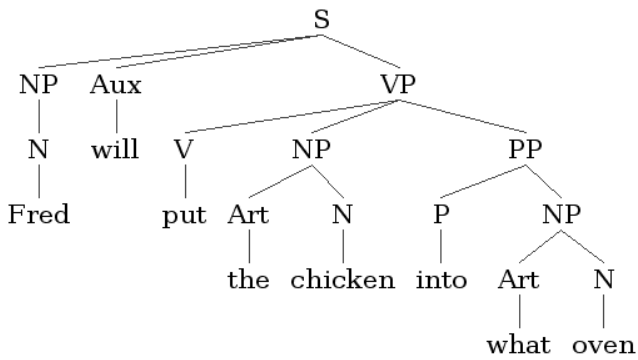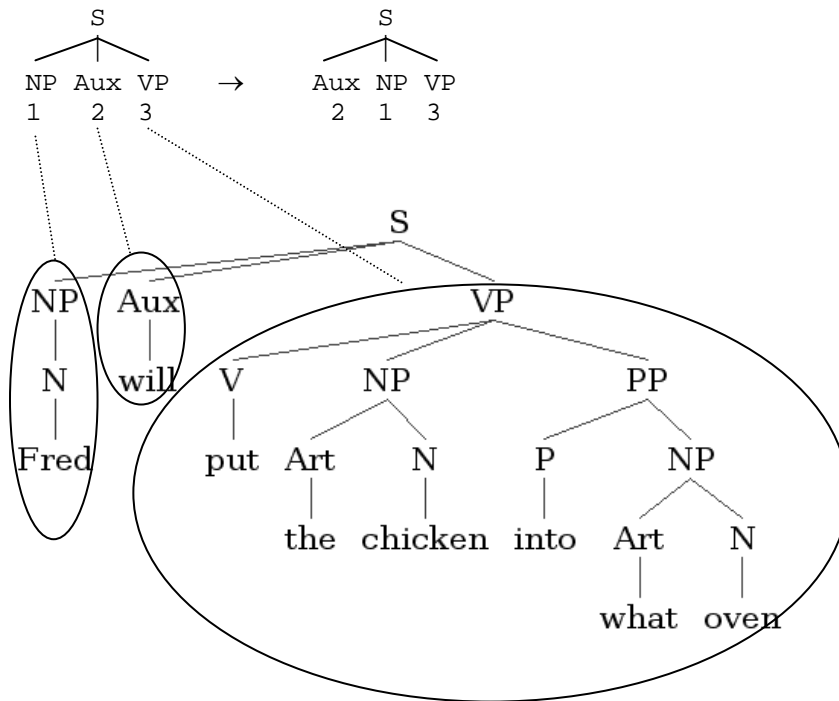
```
                   S
        _____|_____
     NP  Aux              VP
     |              ____|____
     N           V   NP       PP
                    _|_      _|_
                  Art N P   NP
                           _|_
                         Art  N
```

Lexical insertion:

```
                       S
        _____|_____
     NP    Aux                  VP
     |      |        _____|_____
     N     will    V       NP              PP
     |            |      __|__         ____|____
    Fred        put   Art   N        P        NP
                      |     |        |       __|__
                     the  chicken  into    Art    N
                                           |      |
                                         what   oven
```

Application of Subject/Aux inversion:

```
        S                  S
      __|__              __|__
   NP Aux VP    →      Aux NP VP
   1   2  3            2   1  3
```

Deriving:

S
NP Aux VP   →   Aux NP VP
1   2   3   2   1   3

S
Aux NP   VP
will N   V   NP   PP
     Fred   put Art   N   P   NP
               the chicken into   Art   N
                                    what oven

Output of Subject/Aux Inversion, with arrow showing application of (130) Wh-Movement

S
Aux   NP   VP
will   N   V   NP   PP
      Fred   put Art   N   P   NP
              the chicken into Art   N
                                  what oven
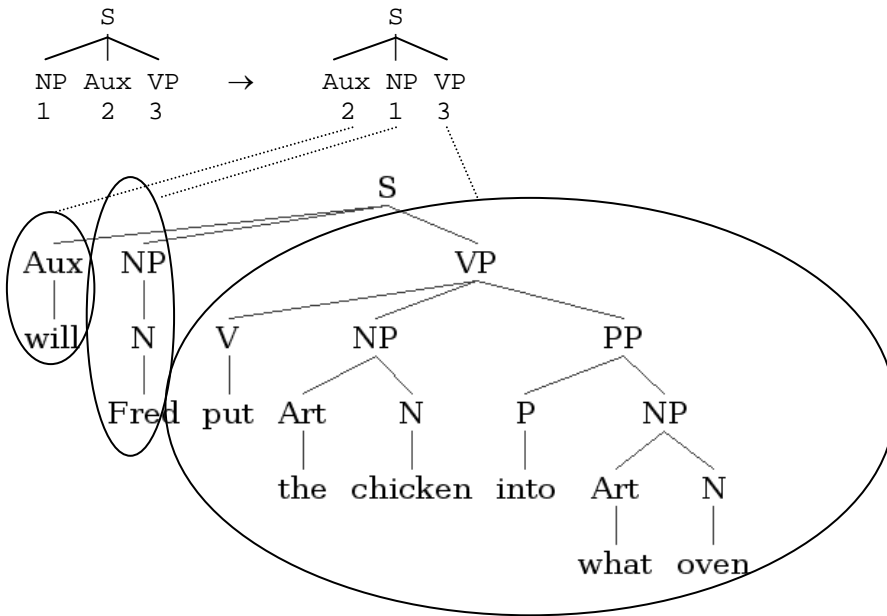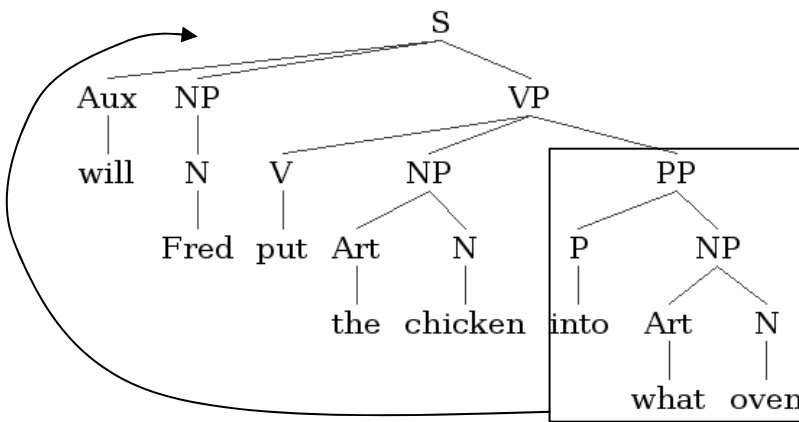
Surface structure results from Wh-Movement, including trace:

S
PP   Aux   NP   VP
P   NP   will   N   V   NP   PP
into Art   N   Fred put Art   N   t
     what oven   the chicken
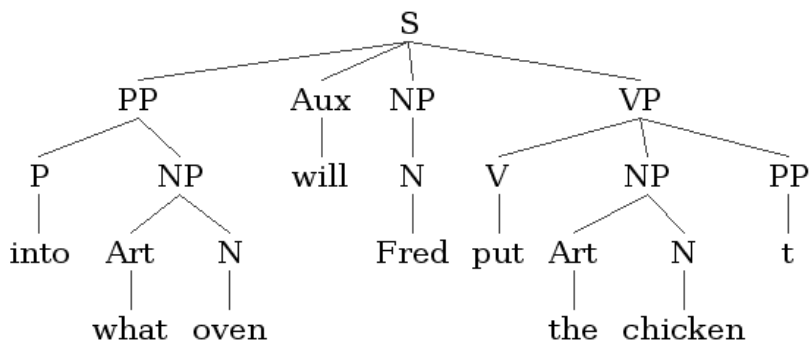
Answer to Study Exercise #24

This sentence is a wh- question. Accordingly to our analysis, the wh- phrase in such a question must have originated in deep structure in some position inside the sentence. But there cannot be any such position. The subject position is already filled by *the Romans*, and the verb *destroy* subcategorizes for only one sister NP position, which is already occupied by the NP *Carthage*. Since our grammar cannot generate an appropriate deep structure, it is unable to generate the surface structure. It therefore predicts that the sentence should be ungrammatical.

Answer to Study Exercise #25

This sentence has essentially the same problem as in Study Exercise #24: there is no place that the NP 'who' could have come from: the subject position is already taken up by *the princess*, and *sigh* doesn't subcategorize for any sister NPs. Thus there is no possible deep structure, so our grammar cannot generate the surface structure. It therefore predicts ungrammaticality.

Answer to Study Exercise #26

a. Deep structure, showing Subject/Aux Inversion:

```
                 S
      ┌──────────┼──────────┐
     NP         Aux         VP
      │          │           │
     Pro        will         V
      │          │           │
     who                   leave
```
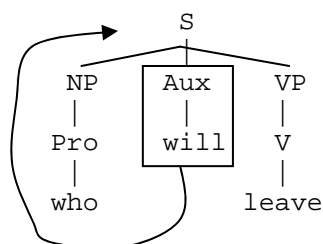
b. Result of Subject/Aux Inversion, showing Wh-movement

```
                    S
           ┌────────┼────────┐
         Aux  ┌───NP───┐    VP
          │   │   │    │     │
         will │  Pro   │     V
              │   │    │     │
              │  who   │   leave
              └────────┘
```

c. Surface structure
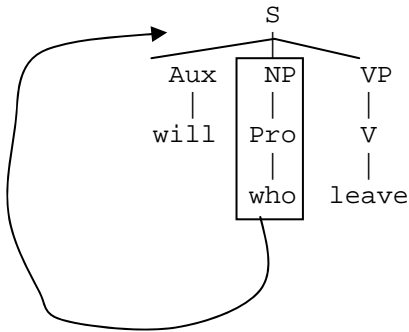
```
                S
        ┌──────┬───┴──┬──────┐
       NP     Aux     NP     VP
        │      │      │      │
       Pro    will    t      V
        │                    │
       who                 leave
```
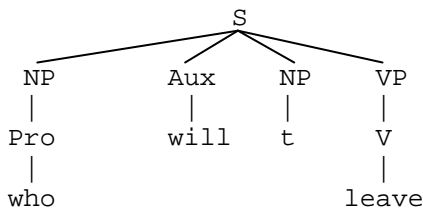
What's odd? The input reads just like the output! This is sometimes call a **string-vacuous** derivation; the surface structure word order hasn't changed (trace being silent), but the structure is different.

String-vacuous derivations test the ability of the student to "think like a computer" (see p. 31 above). As humans, we may sometimes feel that derivations that in the end do essentially nothing waste our time. But the real payoff here is that we've applied the rules of the grammar, showing we got the right answer — what we win from the seemingly pointless activity is reassurance. And the rules, of course, aren't pointless because often the derivations they create are not string-vacuous at all.

---

4. The "landing site" of Wh- Movement

Wh- Movement doesn't always move words to the beginning of the sentence. In so-called **embedded Wh- questions**, movement is to the beginning of a subordinate clause. A wh-question is a subordinate clause that is itself a wh- question, as in the following examples.

(148)   *Some instances of embedded questions*

I wonder what city the Romans destroyed.
We asked for whom the bell tolls.

They are found when the main clause has a verb like *wonder* and *ask*, which takes a question as its sister node. I'll assume that these verbs have a special categorization, not formalized here, under which they take a CP that is not a declarative (the usual case), but a wh- question.

A further observation about embedded questions is that they don't occur with the complementizer *that*:

*I wonder what city that the Romans destroyed.
*We asked for whom that the bell tolls.

*I wonder that what city the Romans destroyed.
*We asked that for whom the bell tolls.

These facts suggest a refine of our analysis of Wh- Movement. An influential idea in syntactic theory that the order of words in sentences can be explicated in terms of **slots**, which the words compete to fill. We've already said that the Complementizer *that* occupies the position Comp, a daughter of CP. The idea to be developed here is that in an embedded Wh- question, the moved Wh- phrase actually *occupies* the Comp slot. When Comp is thus occupied, there is no room for *that* (there's no problem in leaving it out; it is semantically empty in any event).

Under this approach, we can arrange lexical insertion simply to leave Comp empty for embedded clauses introduced by verbs like *wonder* and *imagine.* Then, Wh- Movement acts to fill the empty slot by moving the wh- phrase into it, as follows:

(149)   *A derivation, using empty Comp, of* I wonder what city the Romans destroyed?

   a. Deep structure
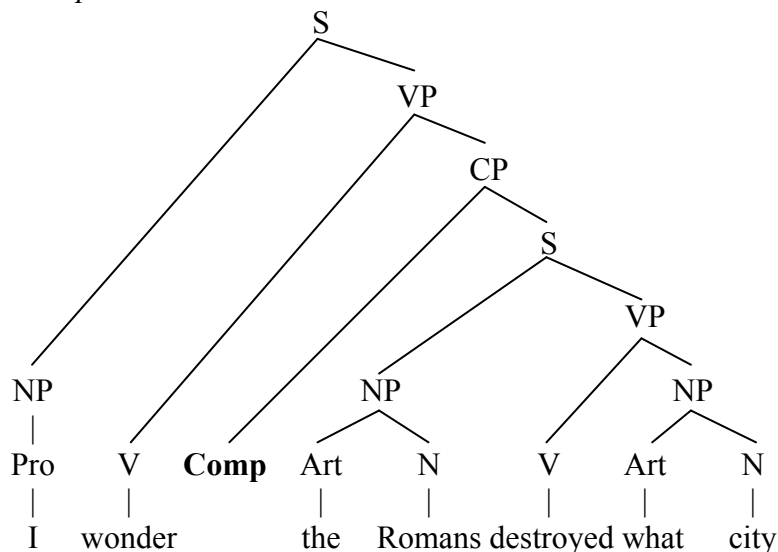
b. Wh- Movement and surface structure
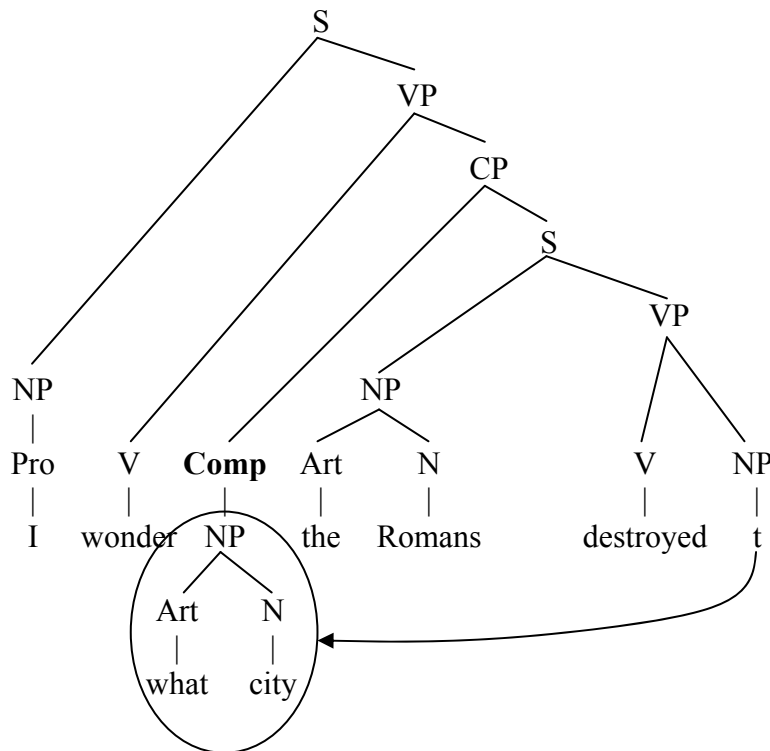
In this approach, the empty Comp node provides a kind of "landing site" for the moved Wh-phrase.

4.1 Cleaning up the analysis I: fixing Subject/Aux inversion

Before going on, I should confess to a minor cheat: in the sentence just derived, I simplified matters by leaving out an Aux. In fact, there's a nice puzzle at hand here: if there *is* an Aux in a subordinate clause, it does *not* flip with the subject as it would in a main clause. Here is the crucial comparison:

(150)   *Aux inverts with subject only in main clauses*

a. Main clause

What city [have]~Aux~ [the Romans]~NP~ destroyed?

b. Subordinate clause

I wonder what city [the Romans]~NP~ [have]~Aux~ destroyed?

Let us modify Subject/Aux Inversion to acknowledge this fact.

(151) **Subject/Aux inversion (revised)**

```
         S                        S
        /|\                      /|\
      /  |  \                  /  |  \
   NP  Aux  VP    →         Aux  NP  VP
   1    2   3               2    1   3
```
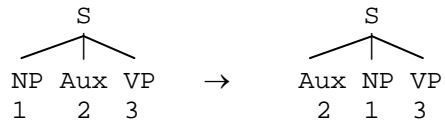
Restrictions:
   Applies in non-echo questions.
   Applies in main clauses only

Study Exercise #27

Give an example, based on the sentence in the text, of what ungrammatical sentences would be
generated if we allowed Subject/Aux Inversion to apply in subordinate clauses.

Answer to Study Exercise 27

*I wonder what city [have]$_{Aux}$ [the Romans]$_{NP}$ destroyed.

Note that the intended reading is different from the one you would spell with a comma, colon, or three periods:

(Y'know), I wonder, what city have the Romans destroyed?
(Y'know), I wonder: what city have the Romans destroyed?
(Y'know), I wonder … what city have the Romans destroyed?

It seems that in these cases, the sequence is being treated as two sentences: *I wonder* and *What city have the Romans destroyed?* In these case the use of Subject/Aux Inversion is completely expected.

4.2 Cleaning up the analysis II: Non-embedded Wh-questions

So at this point we have a working analysis for embedded Wh- questions. But to be consistent, we also need to cover the wh- questions that are *not* embedded, that is, the ones we started out with. There is a fairly reasonable tack that can be taken here, namely that *these sentences also have Comp*, which provides the landing site for the sentence-initial wh-phrase. Specifically, the assumptions we need to make are as follows:

- Wh- questions are not instances of S, but of CP.
- They require (by means not stated here) that the initial Comp be empty in Deep Structure.[79]

Under this analysis, the derivation of *What chicken will Fred put in the oven?* comes out slightly differently:

---

[79] There are alternatives to this, for instance letting the moved Wh- phrase displace a *that*, and adding a transformation that deletes *that* from the topmost complementizer of the sentence.

(152) Revised syntactic derivation for What chicken will Fred put in the oven?*, using empty Comp*

a. Deep structure

```
                        CP
                       /  \
                          S
                         /|\
   Comp               /  |   VP
                     /    |   / \____
                   NP    |  /    \    PP
                    |    |  |     NP   /\
                    N   Aux V   Art  N  P   NP
                    |    |  |    |   |  |   / \
                                         Art   N
                   Fred will put what chicken in the oven
```

b. Subject-aux inversion
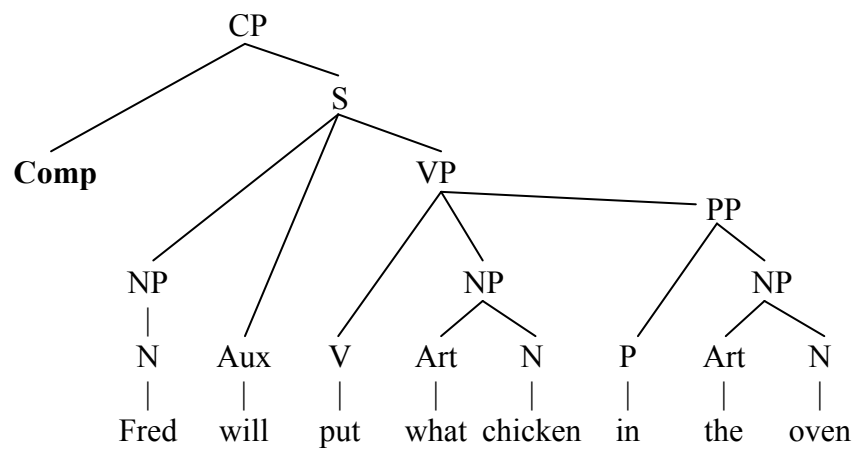
```
                        CP
                       /  \
                          S
                        //|\
   Comp               / / |  VP
                     /  NP  / \____
                    /   |  /    \    PP
                  Aux   N  V   NP    /\
                   |    |  |  Art N  P   NP
                   |    |  |   |  |  |   / \
                                         Art   N
                   will Fred put what chicken in the oven
```
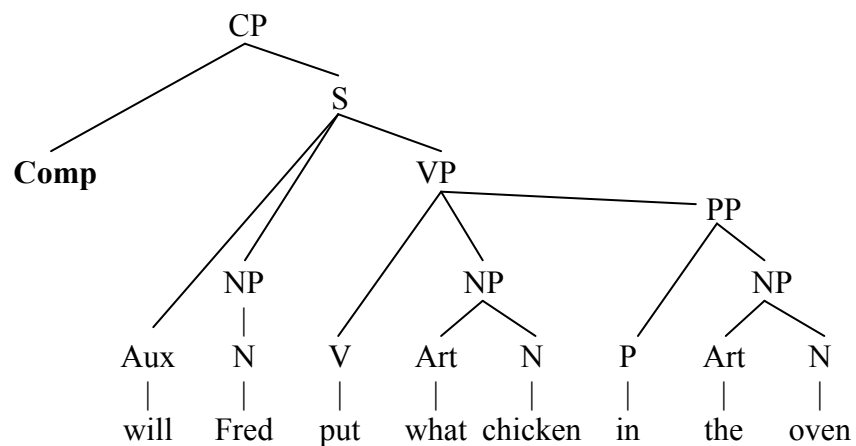
c. Wh- movement (and Subject-Aux inversion), yielding surface structure
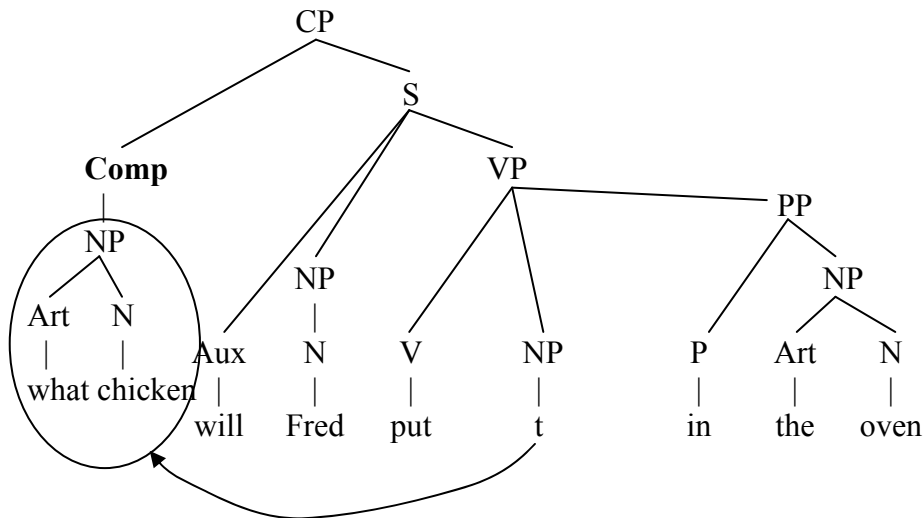
With this in mind, we can express the Wh- Movement transformation more explicitly.

(153) **Wh- Movement (revised version)**

> Move wh- into an unfilled Comp, leaving a trace.

Here is the Wh- Movement transformation lined up with the tree given above:

(154) *Applying Wh- Movement to the deep structure of* What chicken will Fred put in the oven?

4.3 Slots in syntax

This sort of analysis, in which an empty position is available for anything that moves (or, as we'll see, is copied), has been extended by linguists to a consistent, across-the-board practice, essentially "a place for everything and everything in its place." Thus, in more refined theories, there is a slot into which the Aux moves in questions, and many others. You will probably encounter this approach further if/when you study more syntax.

5. Typology of Wh-movement

Many languages other than English form Wh- questions by moving the wh- phrase to the beginning of the sentence. Here are three examples:

French:	Tu	as	vu	Paris			(normal statement)
	you	have	seen	Paris			
	Quelle	ville	as-	tu	vu	*t* ?	(wh- question)

what　city　have　you　seen (trace)?

Chamorro (South Pacific):

Hafahan　si-Maria　i-sanhilo　gi　tenda　　　　(normal statement)
bought　Maria　the-blouse　at　the-store
'Maria bought the blouse at the store'

Hafa　hafahan　si-Maria　*t*　gi　tenda　　　　(wh- question)
what　bought　Maria　(trace)　at　store
'What did Maria buy at the store?'

Vata (Ivory Coast, West Africa) Tones: 1 = highest, 4 = lowest

　4 1　3　　2 1
Kofi　le　saka　　　　　　　　　　　　(normal statement)
Kofi　ate　rice

　3　　41　3　　　　2
yi　Kofi　le　*t*　la　　　　　　　(wh- question)
what　Kofi　eat　(trace)　question-particle
'What did Kofi eat?'

Many other languages work in the same way; for example Modern Hebrew, Russian, and Spanish.

However, a large number of languages do not have Wh-Movement. These languages form Wh- questions simply by leaving the Wh- phrase in situ. An example of a non-Wh- Movement language is Persian:

Ali　aːn　ketaːb-raː　xaːnd
Ali　that　book　　read
'Ali read that book'

Ali　tʃe　ketaːb-i　　xaːnd?[80]
Ali　what　book-indef.　read
'What book did Ali read?'

*tʃe　ketaːb-i　Ali　xaːnd?
what　book　　Ali　read

Japanese is similar:

---

[80] If you're thinking about case marking here, the answer to your question is that the Accusative suffix *-raː* only attaches to *definite* Noun Phrases, the kind that would be translated with *the* in English. In the wh-question, the expression for 'what book' is indefinite and takes the indefinite suffix.

John-wa   **naze** kubi-ni natta   no?
John-Topic why   was fired   question particle
'Why was John fired?'

Bill-wa   [John-ga **naze**   kubi-ni natta   tte   ]   itta   no?
Bill-TOP   John-nom why   was fired   Comp   said   question particle
'Why did Bill say that John was fired?'[81]

It's striking that the languages seem to pattern together; for instance, unbounded movement to the *right* is apparently exceedingly rare.[82] Moreover, there are logical possibilities for Wh- movement that seem to be unattested:

- *Move a wh- phrase to the exact middle of a sentence.
- *Move a wh- phrase so that it follows the second word of a sentence.
- *Move all the words that precede the wh- phrase so that they follow the wh- phrase, and move all the words that follow the wh- phrase so that they precede the wh- phrase.

No such rules have been found in any language. We will discuss such cross-linguistic patterns in greater detail later on.

6. Why Wh- Movement?

It's something of a puzzle why languages have Wh- Movement at all—why not adopt the sensible Persian/Japanese/Chinese strategy, and just leave your Wh- words in situ? Surely it would be clearer for the listener to interpret the wh- word in its proper syntactic location.[83]

A clue, I think, can be found in pairs of sentences that have the same gap, but where the Wh- phrase appears in a different location:

[What song] can Sue imagine that Bill sang *t* ?
Sue can imagine [what song] Bill sang *t* ?

Such pairs are often said to illustrate a difference of **scope**: the location of the wh-phrase indicates the domain in which the wh- phrase is acting as a logical operator. Thus, in the first sentence above, the wh- phrase *what song* is used to ask something about the content of Sue's imaginings— its scope is the entire sentence. The second sentence reports a thought of Sue's. Within this thought, *what song* is being used to ask something about Bill's singing (that is, Sue is mentally answering the question, "What song did Bill sing?"). Therefore, the scope of *what song* in the

---

[81] An odd custom of linguists writing in English about Japanese syntax is to use English first names.

[82] Proposed instances are in Navajo, Circassian, and American Sign Language. Such claims often trigger scholarly replies suggesting alternative interpretations of the data.

[83] Indeed, experimental work by psycholinguists has documented the increased cognitive load and memory burden that listeners experience when they have heard a wh- phrase and are "looking for" the corresponding gap later in the sentence.

second sentence is just the subordinate clause. It can be seen, then, that the linear position of the wh- phrase is suited to expressing a distinction of scope. (We will cover more about scope later on when we turn to semantics.)

What emerges, if this speculation is correct, is that there's no perfect design available. Languages without wh- movement make it clear where the inherent location of the wh- phrase is, but are less clear in indicating scope; languages with wh- movement mark scope clearly, but impose a burden on listeners, who need to carry out gap detection.

7. The unbounded nature of Wh- Movement

An important aspect of Wh- Movement is that it can move a wh- phrase over very long stretches of syntactic structure. Consider the following deep structures and corresponding surface structures:

You have seen who.
[Who] have you seen *t* ?

Joan thinks that you have seen who.
[Who] does Joan think that you have seen *t* ?

Bill would imagine that Joan thinks that you have seen who.
[Who] would Bill imagine that Joan thinks that you have seen *t* ?

Sally believes that Bill would imagine that Joan thinks that you have seen who.
Who does Sally believe that Bill would imagine that Joan thinks that you have seen?

Study Exercise #28

Provide a syntactic derivation (that is, deep structure, arrows showing what moves where, surface structure) for the sentence 'What city will Fred say that Judy thinks that you live in?'.

Answer to Study Exercise #28

Deep structure. The wh- phrase is in situ, so that the preposition has an object. The arrow shows the movement attributed to Subject/Aux Inversion:
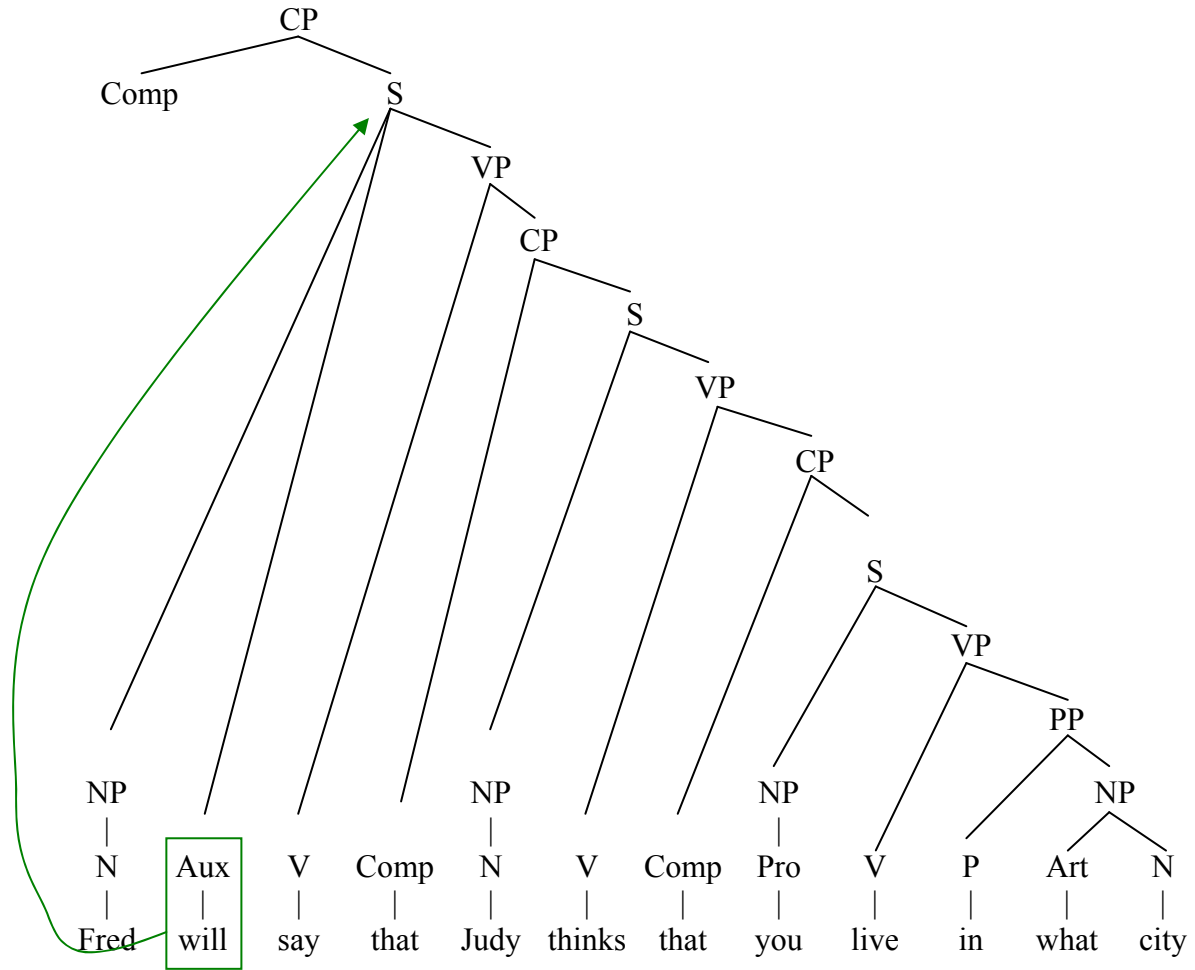
Output of Subject/Aux Inversion, with arrow showing action of Wh- Movement:
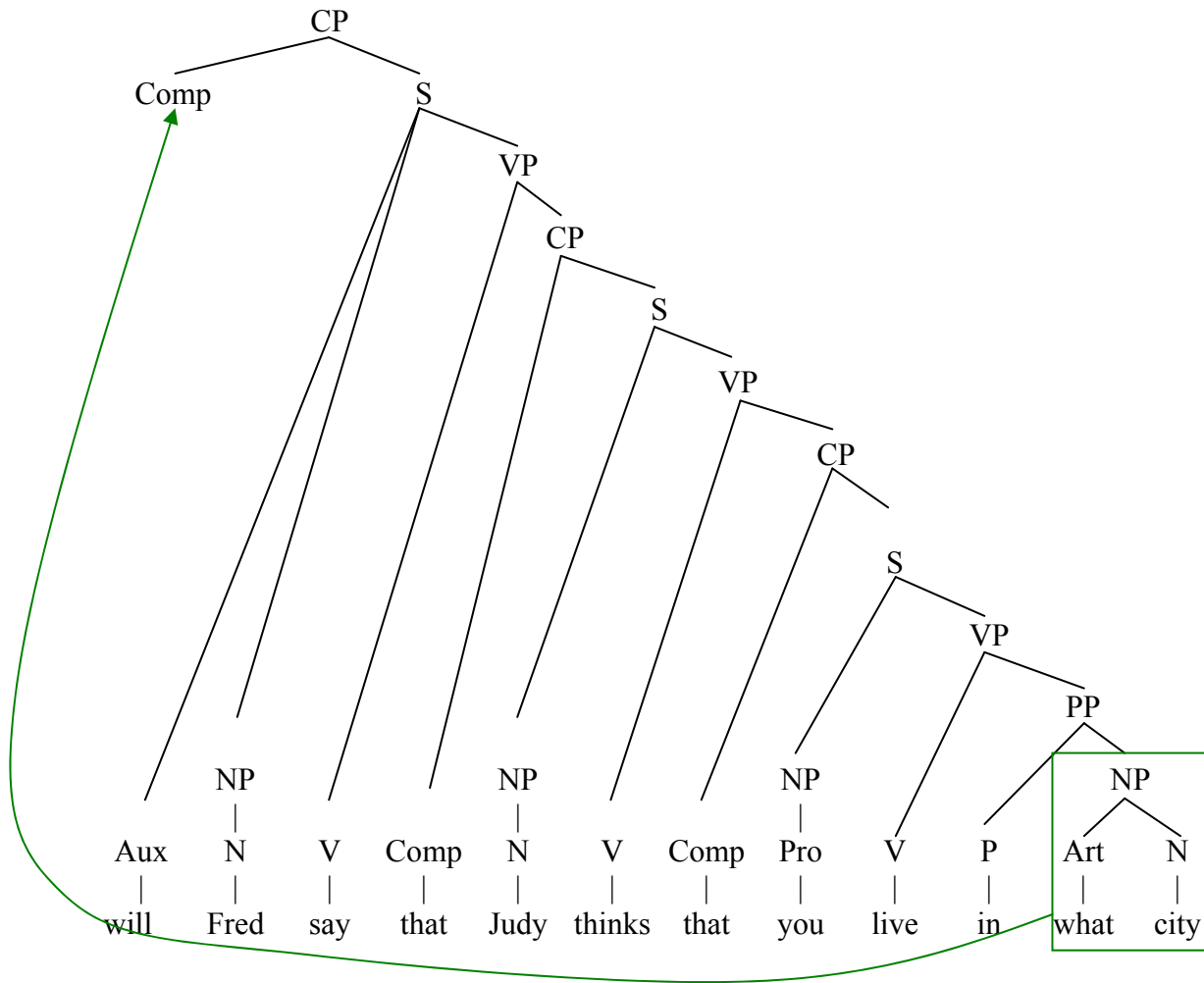
Surface structure, with trace of *what city*:

```
                          CP
                 _____/  _____
              Comp                    S
               |              _____/ _____
               NP                              VP
             /    \                          /    \
          Art      N                        CP
           |       |                      /    \
         what     city                   S
                                       /    \
                                      VP
                                    /    \
                                    CP
                                  /    \
                                  S
                                /    \
                                VP
                              /    \
                                    PP
                                  /    \
        NP          NP          NP        V     P    NP
         |           |           |        |     |     |
 Aux  N   V  Comp  N   V  Comp  Pro      live  in     t
  |   |   |   |    |   |   |     |
 will Fred say that Judy thinks that    you
```
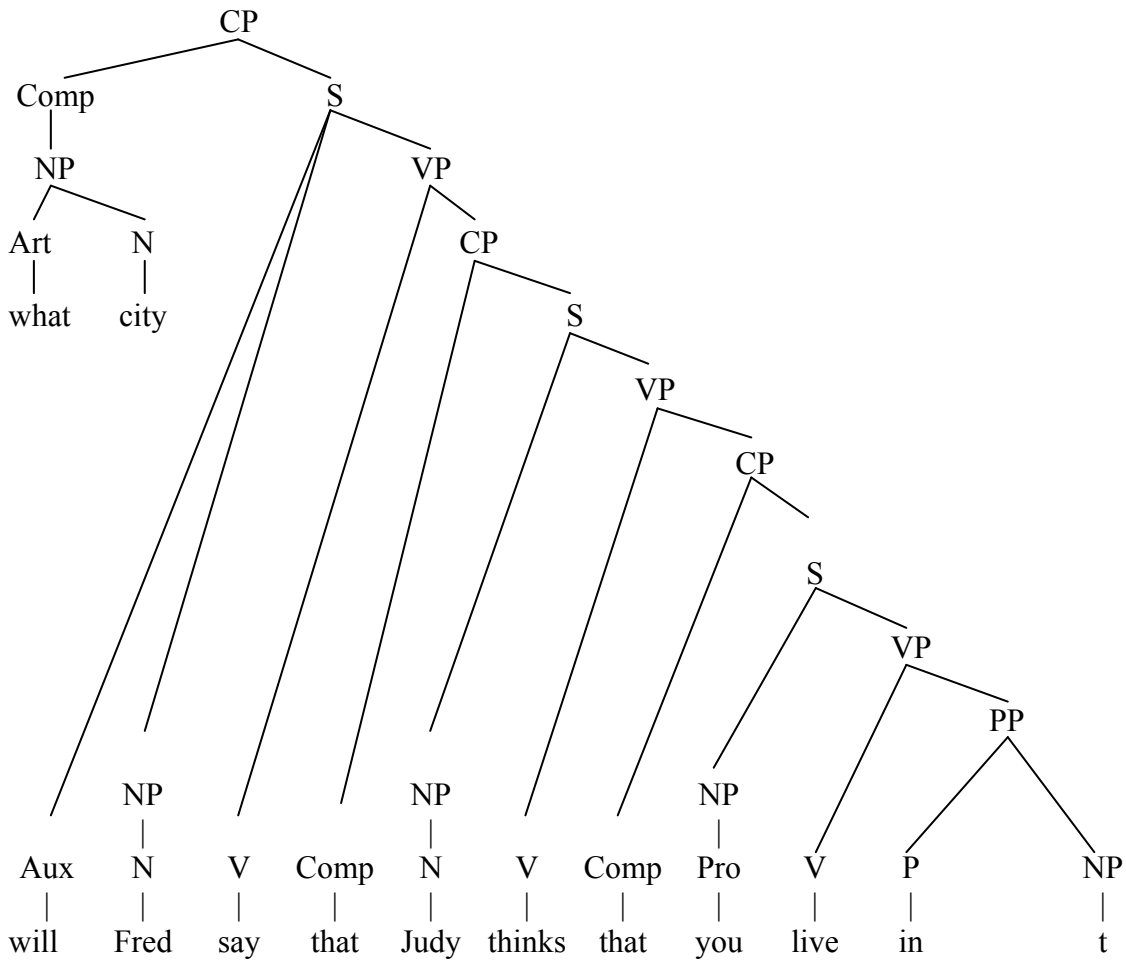
Study Exercise #29

Provide a syntactic derivation (that is, deep structure, arrows showing what moves where, surface structure) for the following sentences:

a. Which book will Sue ask that we study?
b. Sue will ask which book we should study.

Assume the transformations of Subject/Aux Inversion and Wh- Movement.

Answer to Study Exercise #29

a. Which book will Sue ask that we study?

Deep structure, with *which book* in situ.
Note presence of empty Comp, the "landing site" for wh-phrases.
Arrow shows application of Subj/Aux Inversion:

```
                    CP
              ┌──────┴──────┐
          Comp             S
                      ┌──┬──┬──┴───┐
                             VP
                        ┌────┴──┐
                              CP
                         ┌─────┴──┐
                                  S
                             ┌────┴───┐
                                     VP
                                  ┌───┴───┐
       NP              NP              NP
       │               │           ┌───┴──┐
       N    Aux    V   Comp Pro    V   Art    N
       │     │     │    │    │     │    │     │
      Sue   will  ask  that  we  study which book
```
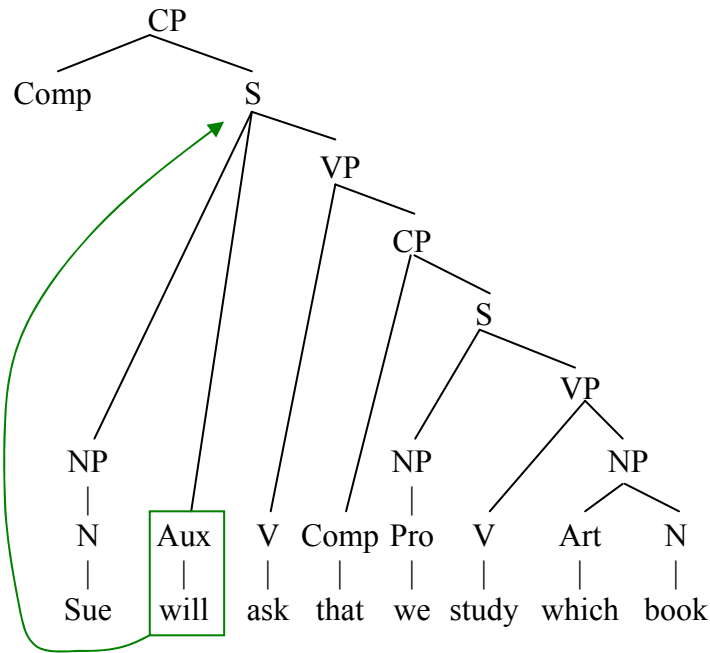
Output of Subject/Aux Inversion. Arrow shows application of Wh-Movement, moving the wh- phrase into Comp.

```
              CP
         ┌─────┴─────┐
       Comp          S
                ┌────┴──────┐
                            VP
                      ┌──────┴────┐
                               CP
                          ┌─────┴───┐
                                    S
                              ┌─────┴───┐
                                        VP
                                    ┌───┴────┐
              NP               NP              NP
              │                │             ┌─┴─┐
       Aux    N    V  Comp Pro   V     Art     N
        │     │    │    │    │    │      │      │
       will  Sue  ask that  we  study  which  book
```
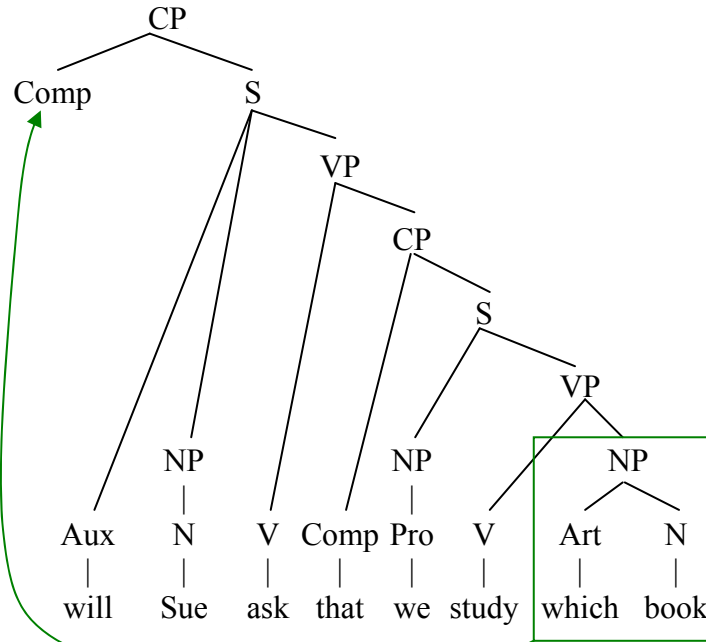
Surface structure, with wh- phrase in Comp and a trace left behind:

```
              CP
         ┌─────┴─────┐
      Comp            S
       │         ┌────┴────┐
       NP                  VP
     ┌─┴─┐           ┌──────┴───┐
   Art   N                     CP
    │    │                ┌─────┴───┐
  which book                        S
                               ┌────┴────┐
                                         VP
                                    ┌────┴───┐
              NP               NP            NP
              │                │             │
       Aux    N    V  Comp Pro   V            t
        │     │    │    │    │    │
       will  Sue  ask that  we  study
```
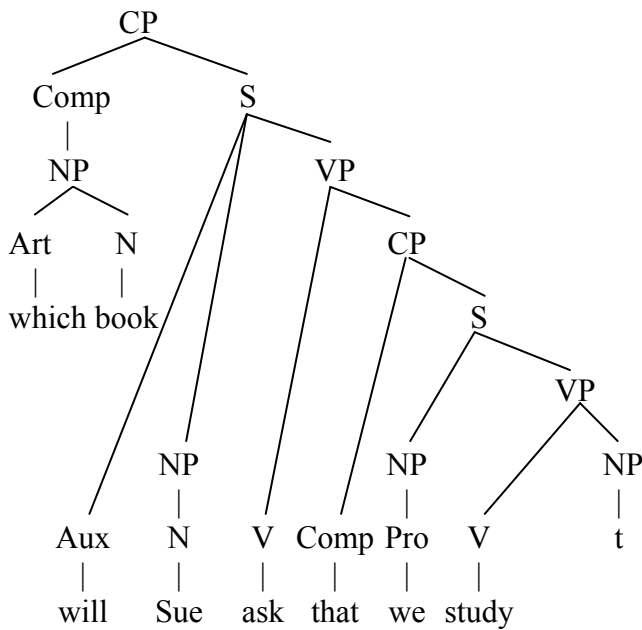
b. Sue will ask which book we should study

     Deep structure, with *which book* in situ.
     Now the empty Comp is an embedded Comp.
     The full sentence, being a statement, is an S, not a CP.
     Subject/Aux Inversion ((185)) does not apply in embedded questions.
     Arrow shows application of Wh-Movement:

```
              S
               \
                VP
                  \
                   CP
                     \
                      S
                       \
                        VP
                         \
  NP     Aux  V  Comp  NP  Aux  V    NP
  |       |   |   |    |    |   |   /  \
  N      will ask      Pro       Art   N
  |                    |    |    |     |
  Sue    will  ask     we should study which book
```

Surface structure:

```
              S
               \
                VP
                  \
                   CP
                     \
                      S
                       \
                        VP
                       /    \
  NP     Aux  V  Comp  NP  Aux  V    NP
  |       |   |   |    |    |   |     |
  N      will ask  NP  Pro       V    t
  |       |   |   / \   |    |   |
  Sue    will ask Art N we should study
                  |   |
                which book
```
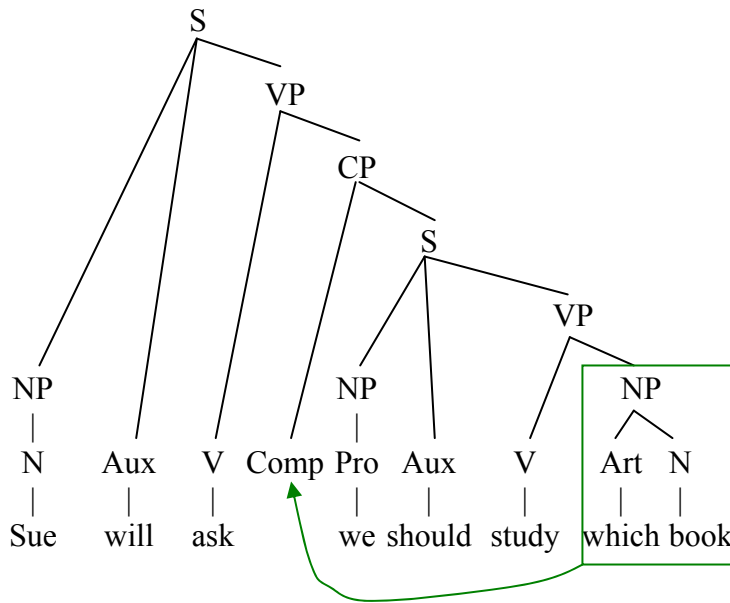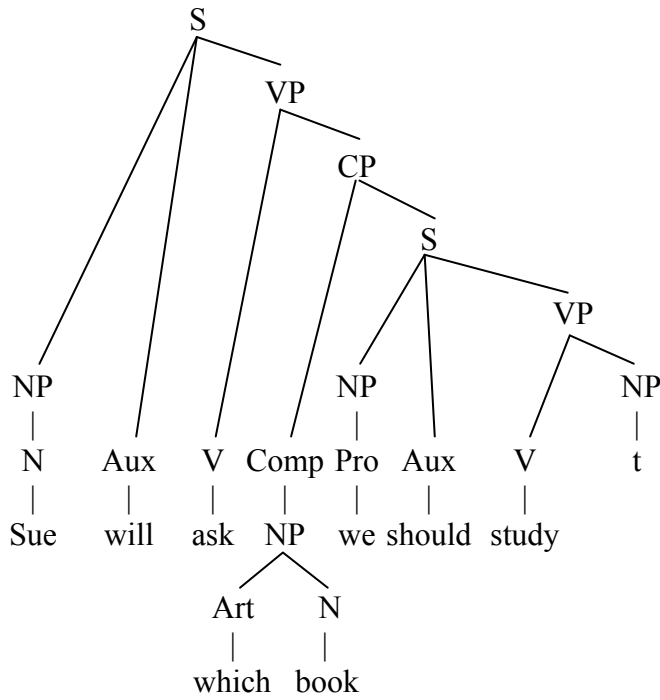
8. Another transformation: Topicalization

English has a number of transformations similar to Wh- Movement. Perhaps the simplest is the so-called Topicalization rule, used to account for sentences like these:

Linguistics, I can teach.
Those guys we would never give our credit cards to.
In that oven you should never put a chicken.

The name of the rule is from that fact that the fronted NP serves as the "topic" of its sentence; what it is about. These sentences have a distinctly rhetorical character, and often sound best if you imagine that the topic is being contrasted with some other topic:

Postmodernism, I'm clueless about, but linguistics, I can teach.

The "landing site" for fronted topics is *not* Comp, since you can get both *that* and the fronted topic in sequence:

I'd say that linguistics, I can teach.

This is of course very different from Wh- Movement, where you never get both at once, leading us to set up an analysis in which the wh- phrase moves *into* Comp (see (139), on p. 188).
Thus I will state the rule of Topicaliziation as simply moving a phrase to the left edge of S, as follows:

(155) **Topicalization**

Move an NP or PP to the left edge of an S, making it the daughter of S, and leaving a trace.

The justification for Topicalization is much the same as that for Wh- Movement: the presence of a topicalized element is correlated with a subcategorization gap later in the sentence.

Topicalization, like Wh- movement, appears to be unbounded, though the examples that show this tend to be a bit less natural:

John, I don't think a lot of people would like.
Fred, I'd imagine that you'd think that a lot of people wouldn't like.

As unbounded transformations, Wh- Movement and Topicalization (as well as others to come) have some crucial similar behaviors, which we'll examine later on in discussing "islands".

Study Exercise #30

Derive *I'd say that linguistics, I can teach*.

Answer to Study Exercise #30

I'd say that linguistics, I can teach.

Deep structure, with *linguistics* in situ.
Application of Topicalization is shown.
Note that movement is simply to the beginning of S, *not* into Comp as with Wh-Movement.

Surface structure, with trace.

9. It-Clefting

We will cover one more long-distance movement rule, one which was briefly discussed above in Chapter 4, section 11, under the name "Clefting". In this context we will use its more specific name, **It Clefting**.[84] The sort of data that justify the rule are given below.

a.   *Sean loaded the tricycles into the truck.*

It was Sean that loaded the tricycles into the truck.
or: It was the tricycles that Sean loaded into the truck.
or: It was into the truck that Sean loaded the tricycles.
or: It was the truck that Sean loaded the tricycles into.

b.   *Fred thinks Alice climbed up Mt. Everest.*

It is Fred that thinks Alice climbed up Mt. Everest.
or: It is Alice that Fred thinks climbed up Mt. Everest.
or: It is up Mt. Everest that Fred thinks Alice climbed.
or: It is Mt. Everest that Fred thinks Alice climbed up.

The idea is that the transformation "cleaves" the sentence, by moving one of its constituents into a high clause containing *it* plus *BE*. Intuitively it works like this:

The second through fifth sentences in each group are all clearly related to the first sentence, and can be derived from it with a transformation.

It-clefted sentences are clearly not neutral in their rhetorical force; they place strong emphasis of some kind (often called **focus**) on the clefted NP or PP.

I give a version of the transformation below.

(156) **It-Clefting**

- Input: an S containing NP or PP.
- Construct "on top" of S a new S, with subject *it*, verb *be*, and an CP sister to V within its VP.
- Assign to *be* the same value of the feature [Tense] as the original S.
- Move the NP or PP to a position following *be* as daughter of the new S.

---

[84] The other kind of clefting in English is often called the "wh- cleft", and is found in sentences like *What Bill needs is a vacation*; "vacation" is clefted here.

The mention of the copying of the feature [Tense] onto *be* is for completeness; we will generally skip this step in the derivations to follow.

It Clefting is another instance of an unbounded dependency, and for the same reason as in Wh- Movement requires a movement analysis.

Here is an example of how It Clefting applies. Structure added by the rules is shown in italics.

Deep structure and movement:

```
                    S
                   / \
                  /   VP
                 /   /|\
                /   / | \
               /   /  |  PP
              /   /   | / \
            NP   /   NP P   NP
            |   /   /\  |  / \
            N   V Art N P Art  N
            |   |  |  | |  |   |
          Sean loaded the tricycles into the truck.
```

Surface structure, with trace:

```
                         S
                        / \
                       /   VP
                      /   /|\
                     /   / | \
                    /   /  |  CP
                   /   /   | / \
                  /   /    |/   S
                 /   PP    |   / \
                /   / \    |  /   VP
               /   /   NP  | /   /|\
              /   /   /  \ |/   / | \
            NP   /  P Art N Comp NP NP PP
            |   /   |  |  | |    |  /\ |
           Pro  V  P Art N Comp  N V Art N t
            |   |  |  |  |   |   | | |  |
           It  was into the truck that Sean loaded the tricycles
```
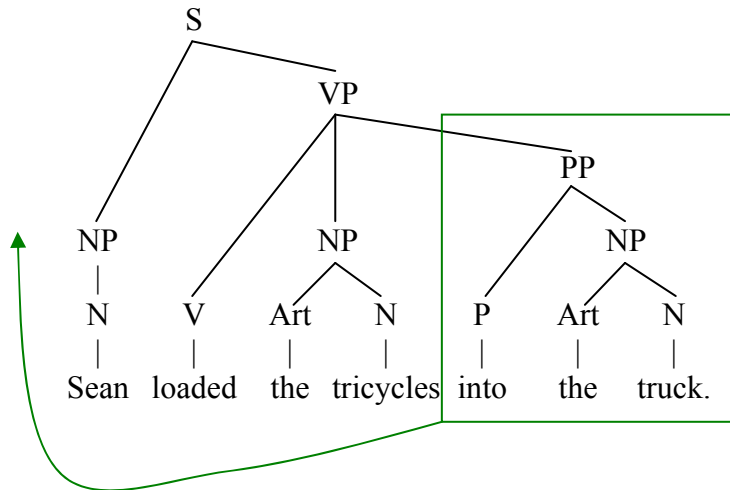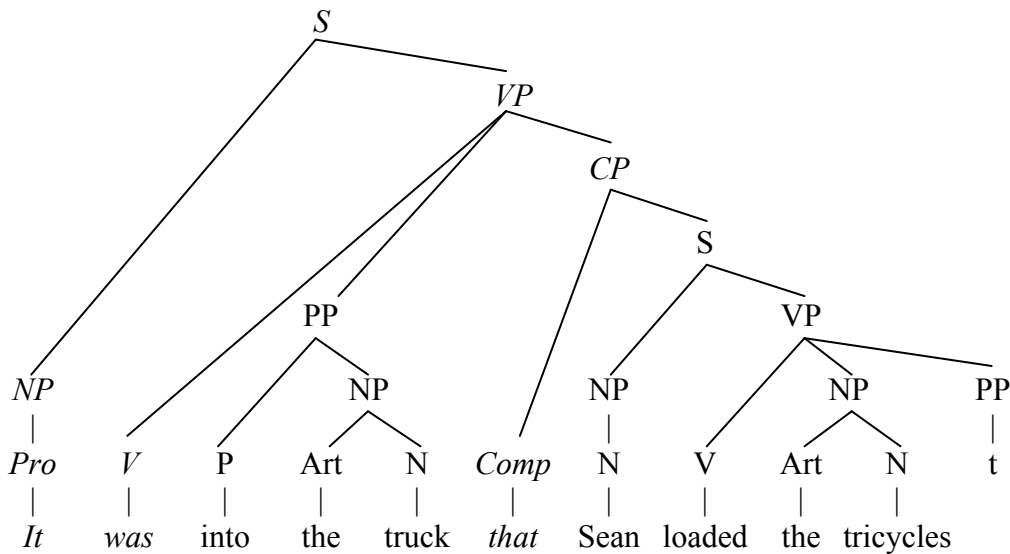
Like Wh- Movement and Topicalization, It Clefting is an unbounded rule:

It was [the tricycles]NP that Tom thinks Sue knows that Bill loaded ___ onto the truck.

Study Exercise #31

Provide deep structure, arrows showing movement, and surface structure for this case of unbounded movement:

It was the king that we told the knights that they must fight for.

Answer to Study Exercise #31

Deep structure, with arrow showing movement:
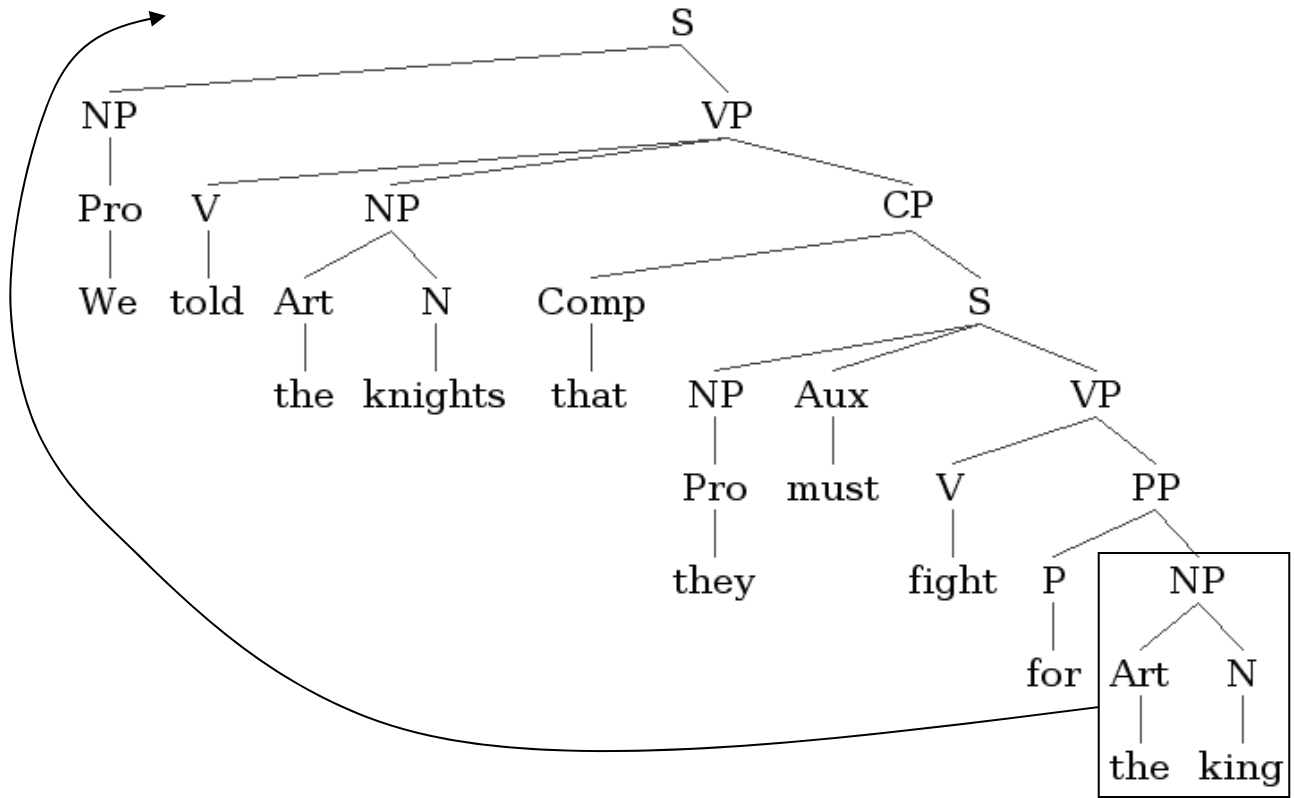
Surface structure, with inserted *it* as subject and *be* as verb; moved NP is replaced by trace:
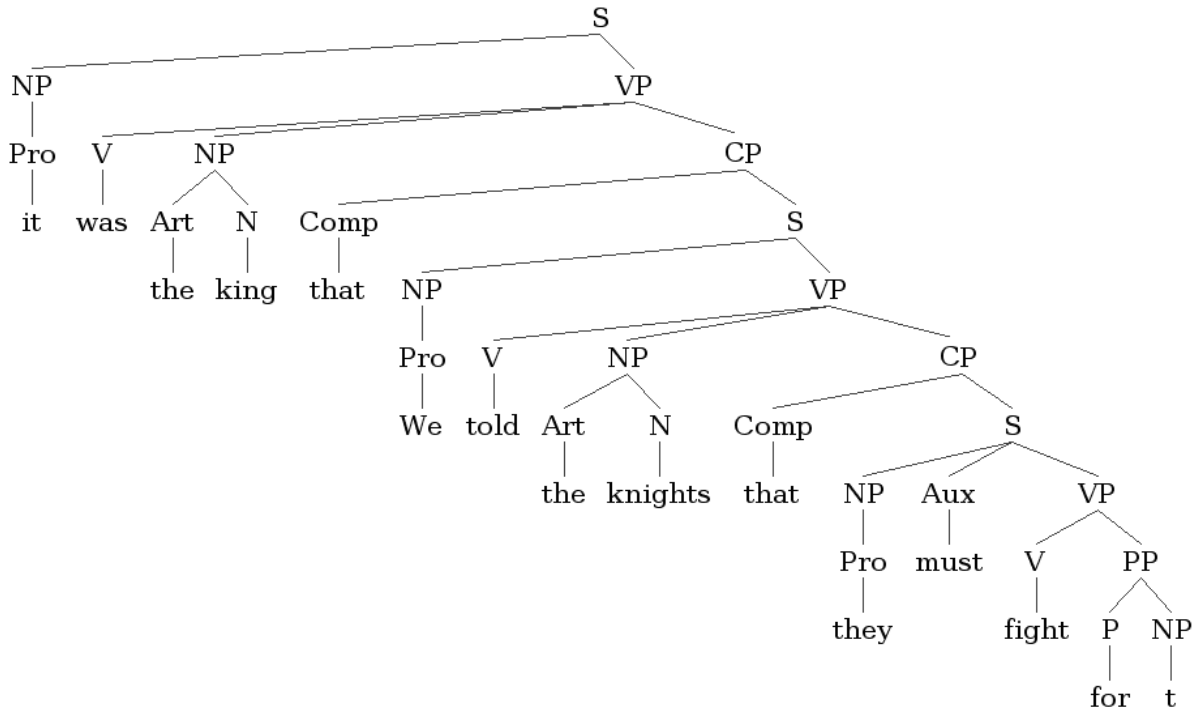
9.1 Constituency testing with It-Clefting

As noted in Chapter 4, section 11, It Clefting can be used as a **constituency test**. Here is the rationale: the rule requires there to be an NP or PP to move; so if you're not sure whether a particular sequence of words is an NP or a PP, try It Clefting it. (The other transformations also can be used, but It Clefting often seems to work smoothest, since the grammaticality judgment for It Clefting seem to be less sensitive to other factors.)

One example is the following pair:

Fred ran up a big hill.
Fred ran up a big bill.

The correct structures are evidently as follows:

```
                    S
                  /   \
                 /     VP
                /     /   \
               /     /     PP
              /     /     /   \
             NP    /     /     NP
             |    /     /    / | \
             N    V    P   Art AP  N
             |    |    |    |   |   |
           Fred  ran  up    a   A  hill
                                  |
                                 big
```
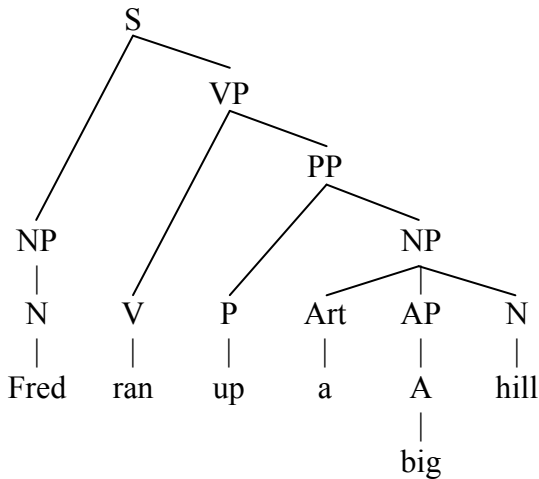
(Prepositional phrase *up a big hill*, indicating the direction Fred ran)

```
                    S
                  /     \
                 /       VP
                /      /     \
               /      V       NP
              /     /  \     / | \
             NP    /    \  Art AP  N
             |    /      \  |   |   |
             N    V      P  a   A  bill
             |    |      |      |
           Fred  ran    up     A
                               |
                              big
```
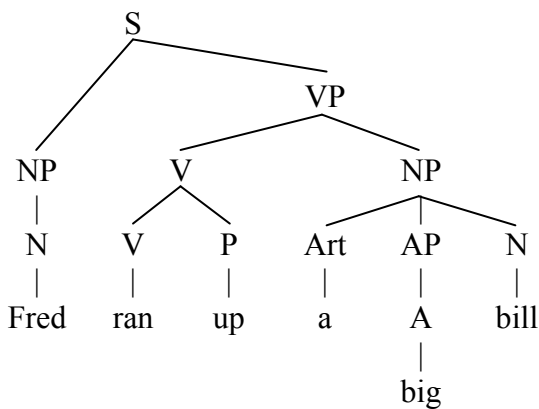
The structure here has a compound verb of the structure V + P. *A big bill* is the object of this verb, indicating what Fred ran up.

If we do constituency testing, we ought to find that:

- *up a big hill* is a constituent (PP)
- *a big hill* is a constituent (NP)
- *up a big bill* is **not** a constituent
- *a big bill* is a constituent (NP)

Applying It Clefting to the relevant bits of both sentences, we get:

It was <u>up a big hill</u> that Fred ran.　　　　(Fine, clefting PP)
It was <u>a big hill</u> that Fred ran up.　　　　(Fine, clefting NP)
*It was <u>up a big bill</u> that Fred ran.　　　　(Bad, result of trying to It-Cleft a nonconstituent)
It was <u>a big bill</u> that Fred ran up.　　　　(Fine, clefting NP)

As you can see, the pattern of grammaticality perfectly matches the constituency that we proposed—the result is grammatical only when a constituent is moved.

Constituency testing is commonly used in syntactic investigation, particularly for nonobvious cases. The most common other constituency test other than movement is probably conjunction (X and Y), since only constituents join together in conjoined structures. Thus, a parallel test for the same sentences would be:

Fred ran <u>up a big hill</u> and <u>down a big mountain</u>.	(Conjoining two PP's)
Fred ran up <u>a big hill</u> and <u>a big mountain</u>.	(Conjoining two NPs)
*Fred ran <u>up a big bill</u> and <u>over a cat</u>.	(Conjoining nonconstituents)[85]
Fred ran up <u>a big bill</u> and <u>a big tab</u>	(Conjoining two NPs)

10. Island constraints

Consider the following deep structure:

You have seen Alice and who?

This is clearly a possible deep structure, as it can be an echo question (p. 173) if nothing applies to it. However, if we make it part of a CP, in anticipation of making it into a Wh- question (see section 4.2 of this chapter for why), and then apply Wh- movement to this deep structure, the result is unexpectedly ungrammatical:

Deep structure, Subject/Aux Inversion, and Wh- Movement:

---
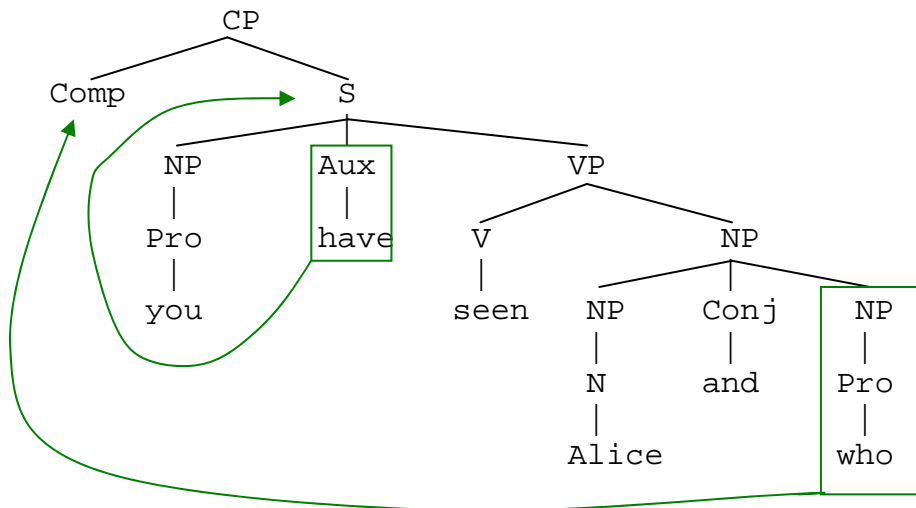
[85] If the example isn't clear to you, imagine: "Fred ran up a big bill and (then) ran over a cat (with his car)."

Surface structure:

```
                        CP
             _____|_____
          Comp                      S
           |            _____|_____
          NP          Aux     NP              VP
           |           |       |           ___|___
          Pro         have    Pro         V       NP
           |                   |          |    ___|_____
         *who                 you       seen  NP  Conj  NP
                                              |    |     |
                                              N   and    t
                                              |
                                            Alice
```
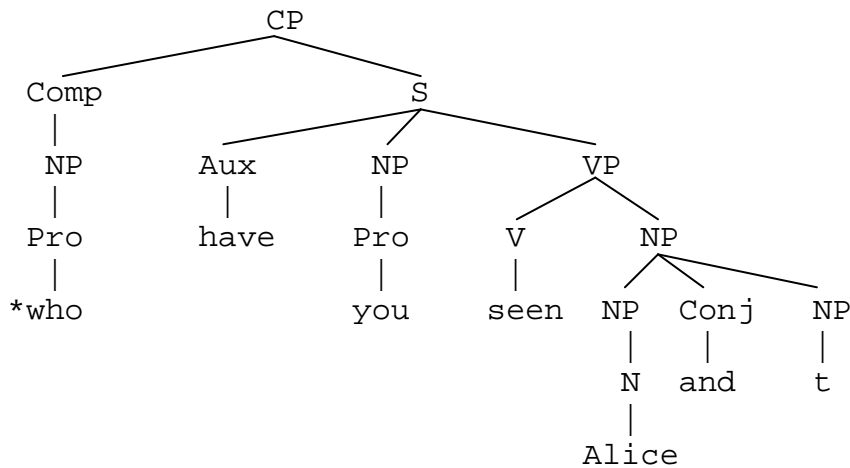
Note that we really are dealing with ungrammaticality rather than nonsense; the question is perfectly reasonable, and could mean roughly *Who did you see Alice with?*

   The ungrammaticality of this sentence is a serious overgeneration problem: we have applied the rules of the grammar in a perfectly legitimate way, but have derived a bad result. Here are some further data of the same sort:

   a. *Conjoined NP*

      You have seen who and Alice   (okay as echo question)
      *Who have you seen t and Alice?

   b. *Conjoined NP*

      Bill will take pictures of Fred and Alice   (not the same deep structure, but close enough)
      *Who will Bill take pictures of t and Alice?
      *Who will Bill take pictures of Fred and t?

   c. *Conjoined PP*

      Jay jumped onto the trampoline and into the pool.
      *What did Jay jump onto the trampoline and into t?
      *What did Jay jump onto t and into the pool?

   d. *Conjoined VP*

      Phil loves coffee and abhors tea.
      *What beverage does Phil love coffee and abhor t?
      *What beverage does Phil love t and abhor tea?

e. *Conjoined S*

Phil might thinks that Sue loves coffee and Alice abhors tea.
*What beverage might Phil think that Sues loves coffee and Alice abhor t?
*What beverage might Phil think that Sues loves t and Alice abhors?

The generalization here is that Wh- Movement produces an ungrammatical result if it tries to move a wh- phrase outside a structure in which two constituents are joined by a conjunction. Structures of this sort are called **coordinate structures**. In the four groups of sentences above, the structures are as follows:

(157) *Some coordinate structures*

```
a,b:          NP              c:          PP              d:          VP
          ___|___                     ___|___                     ___|___
         NP Conj NP                  PP Conj PP                  VP Conj  VP
```

```
e:          S
        ___|___
       S  Conj  S
```
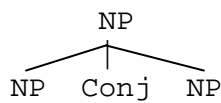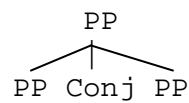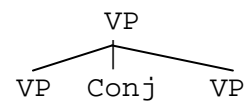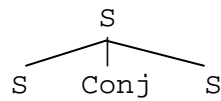
A general notation for coordinate structures is as follows:[86]

```
         X
     ___|___
    X   Conj   X
```
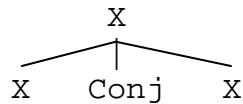
The next step is to fix the grammar so that it will no longer generate sentences in which a coordinate structure has been extracted from. The most obvious move would be to add a complication to the Wh- movement rule that would simply block the rule from doing this. However, we will see later on that all the other long-distance transformations are blocked in the same way. If we added exactly the same complication to all the other rules, we would be missing a generalization.

11. Constraints in grammar

A more general solution would be to add to grammar a **constraint** on possible derivations. A constraint could be thought of as a "filter" on the operation of the grammar: if the derivation of a sentence violates the constraint, then the constraint marks the sentence as ungrammatical, and it is eliminated from the (infinite) set of sentences that the grammar generates.[87]

---

[86] We could generalize this to cover the multiple conjuncts generated with Kleene star (p. 143; as in NP *and* NP *and* NP...), but won't take the time.

[87] If you study more linguistics you will likely find a major role for constraints in the theories taught to you. Indeed, some theoretical approaches eliminate rules entirely: in such theories a well-formed linguistic structure is simply one that obeys all the constraints.

The general organization of such a grammar can be imagined as follows:

(158) *An architecture for grammatical theory with deep and surface structure plus constraints*

S	(initial symbol fed to the grammar)

Phrase structure rules

(bare tree)

Lexical insertion ← lexicon

Deep structure

Constraints (acting as filter)

Transformations

Surface structure

(and on to other components: inflectional morphology, phonology)

[phonetic form]
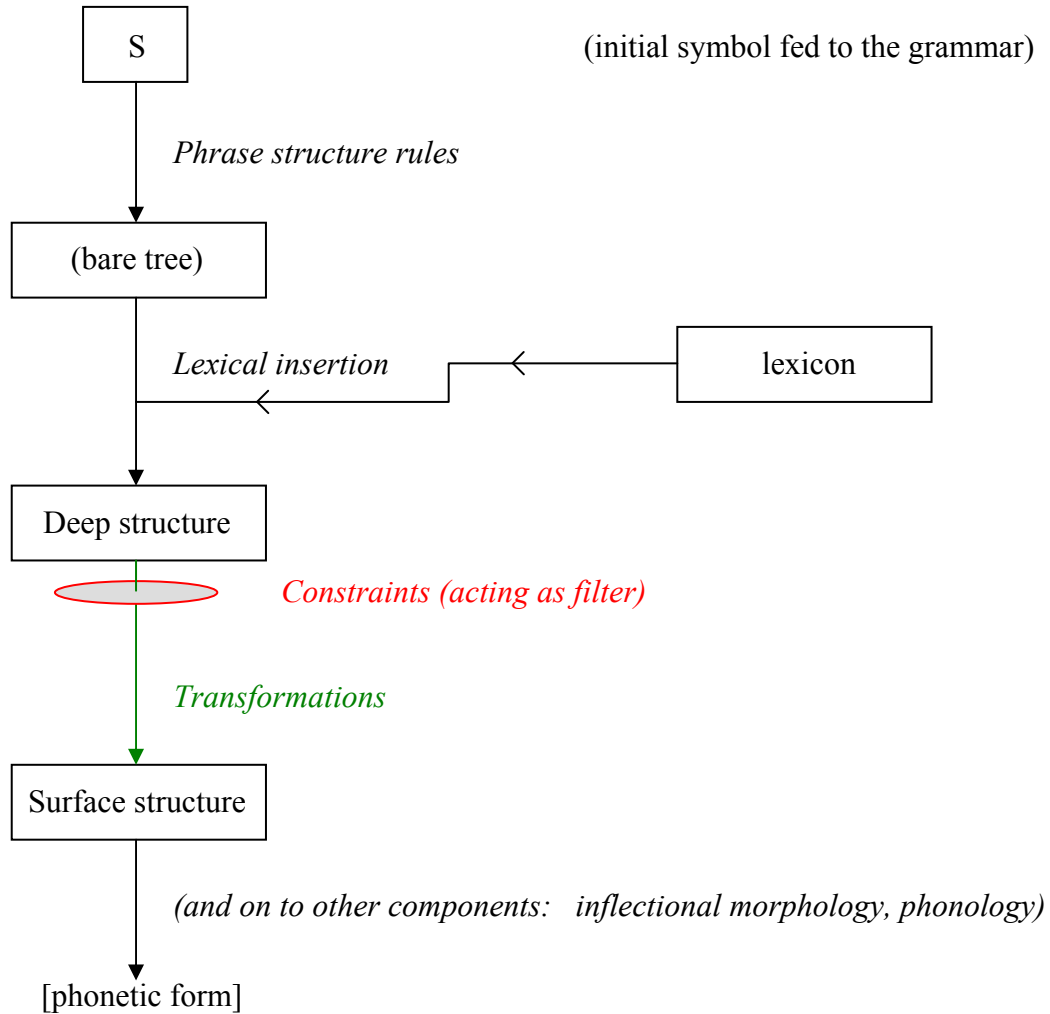
This conception includes three of (what I take to be) the four basic formal mechanisms of linguistic theory: (a) generative rules (here, phrase structure rules); (b) transformations (converting one structure to another); (c) filters (throwing out the result of a derivation).[88]

For the data under discussion, the constraint we need is the following:

---

[88] The fourth rule type is interpretation, which we will cover when we get to semantics.

(159) **Coordinate Structure Constraint**

Mark as ungrammatical any sentence in which a constituent has been extracted from inside a coordinate structure.

The notation of the triangle seen here means, "any structure dominated by X".

The Coordinate Structure Constraint is called an **island constraint**. A coordinate structure acts as an "island," in that it is inaccessible to the efforts of transformations to remove things out of it. The Coordinate Structure constraint will correctly rule out the ungrammatical sentences given earlier.

Here is one way to demonstrate how a constraint works: you draw the deep structure of a sentence, outline the constituent that moves, outline the island that contains it, and draw an arrow showing that the movement does indeed move a constituent outside of the island. (One also adds an asterisk, to indicate that this movement results in ungrammaticality.)

Deep structure (empty Comp is the landing site for Wh- Movement)
Arrow shows application of Subject/Aux Inversion.

Output of Subject/Aux Inversion:

```
                              CP
                             /  \
                                  S
                                /|\ \
                               / | \ VP
                              /  |  \ / \
                             /   |   \   NP
                            /    |    \ / \
                  Comp     /     |     \   PP
                          /      |      \ / \
                         /       |       \   NP
                        /        |        \ /|\
                       /   NP    |    |    / | \
                      /    |     |    |   NP | NP
                    Aux    N     V    N  P  N Conj Pro
                     |     |     |    |  |  |  |    |
                    will  Bill  take pictures of Fred and who
```
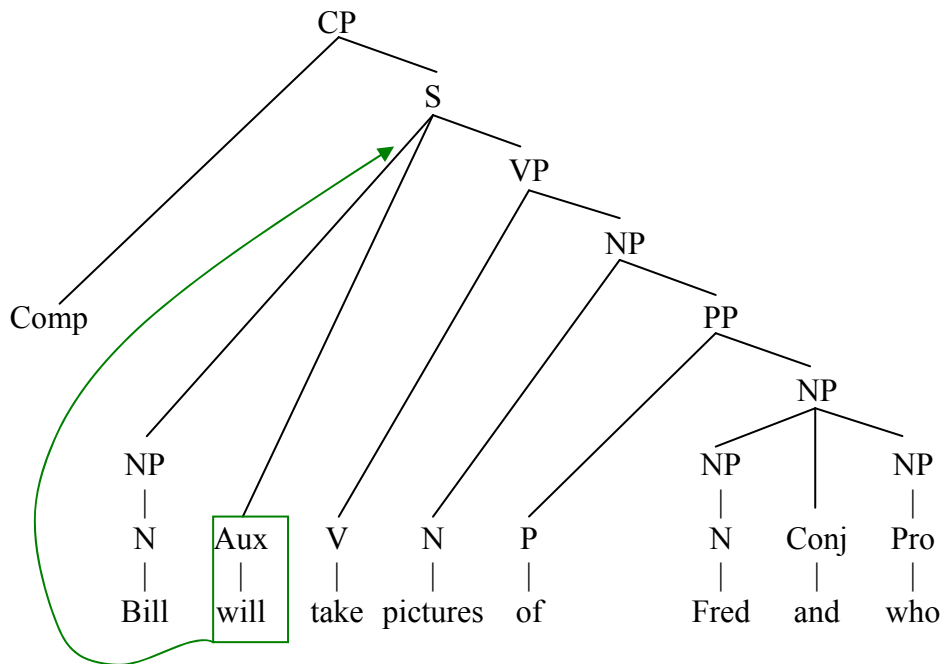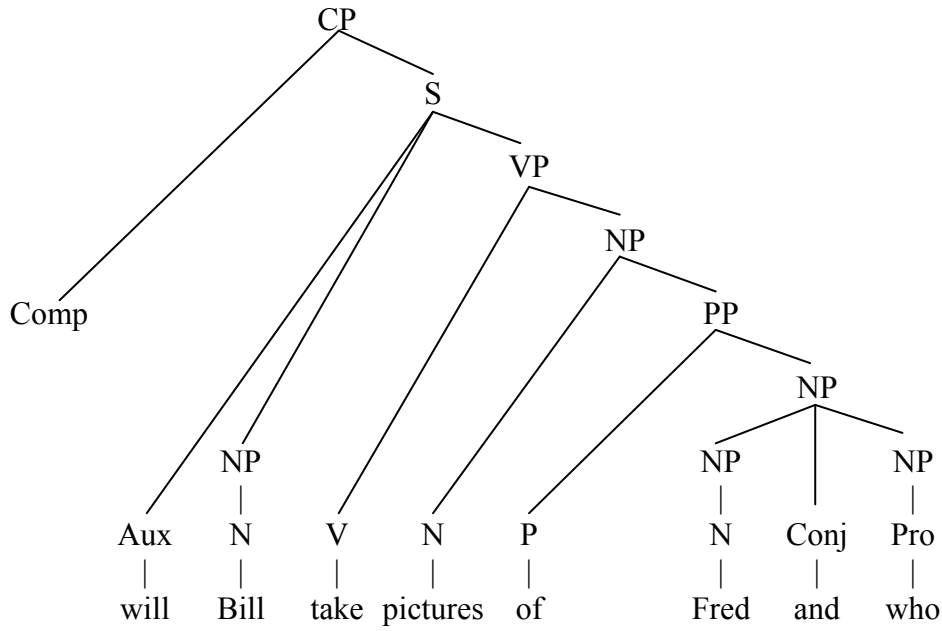
2nd transformation (attempted): Wh-Movement:

```
                              CP
                             /  \
                                  S
                                /|\ \
                               / | \ VP
                              /  |  \ / \
                             /   |   \   NP          Island:  coordinate
                            /    |    \ / \                      structure
                  Comp     /     |     \   PP
                          /      |      \ / \
                         /       |       \   NP
                        /        |        \ /|\
                       /   NP    |    |    / | \
                      /    |     |    |   NP | NP
                    Aux    N     V    N  P  N Conj Pro
                     |     |     |    |  |  |  |    |
                    will  Bill  take pictures of Fred and who
                                                            *
```
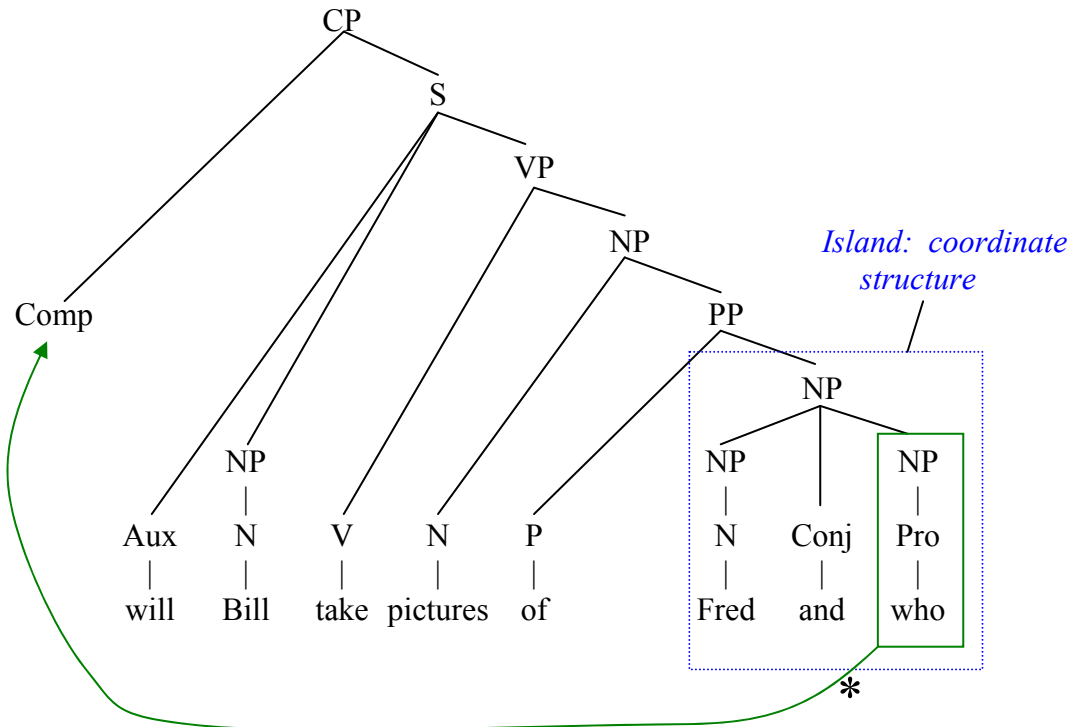
Result: *Who will Bill take pictures of Fred and?

Study Exercise #32

    Explain why the sentence

    *What city have the Romans destroyed and attacked Athens?

is ungrammatical. Illustrate with a derivation.

Answer to Study Exercise #32

What city have the Romans destroyed and attacked Athens?

    This sentence is a violation of the Coordinate Structure Constraint. The coordinate structure consists of the two conjoined VP's *destroyed what city* and *attacked Athens*. The wh- phrase *what city* is extracted out from inside the coordinate structure, resulting in an ungrammatical sentence.

    Deep structure, showing Subject/Aux Inversion:
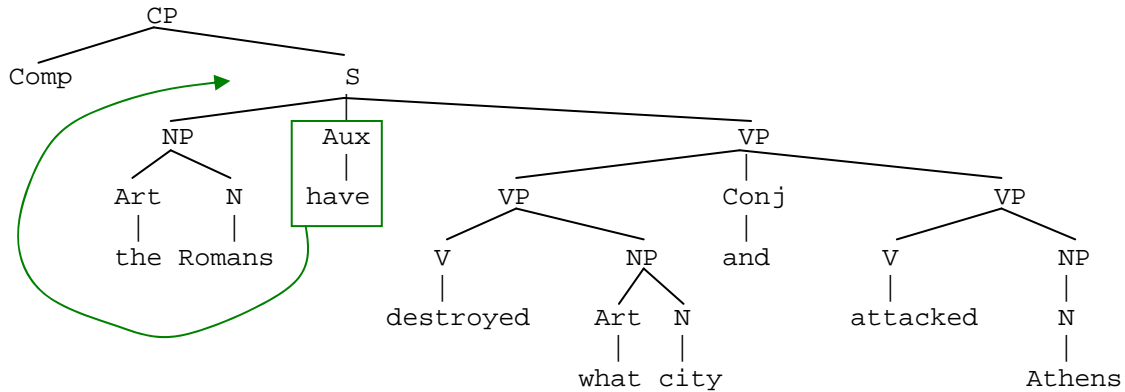
    Output of Subject/Aux Inversion:
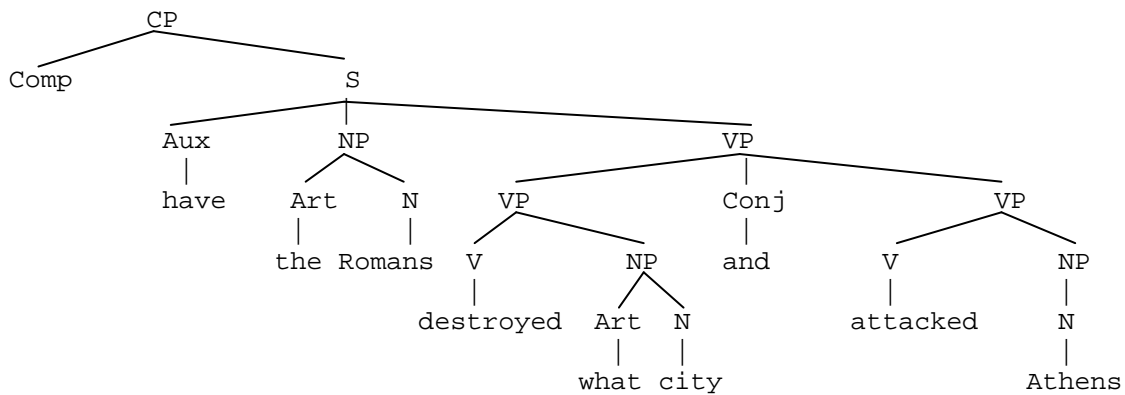
Wh- Movement, moving outside coordinate structure:

```
                CP
      Comp                    S
              Aux    NP                      VP
              |      /\              /         |         \
              have  Art   N       VP          Conj        VP
                    |     |     /    \         |          /    \
                  the  Romans  V      NP      and        V      NP
                              |      /\                  |      |
                         destroyed Art  N             attacked  N
                                   |    |                       |
                                  what city                   Athens
                                    *
```

Illegal surface structure:

```
                CP
      Comp                         S
       |
       NP          Aux     NP                       VP
      /\           |      /\               /         |         \
    Art   N       have   Art   N         VP          Conj        VP
    |     |             |     |        /    \         |         /    \
   what  city         the  Romans     V      NP      and       V      NP
                                     |       |                 |      |
                                 destroyed   t              attacked  N
                                                                      |
                                                                    Athens
```

_____
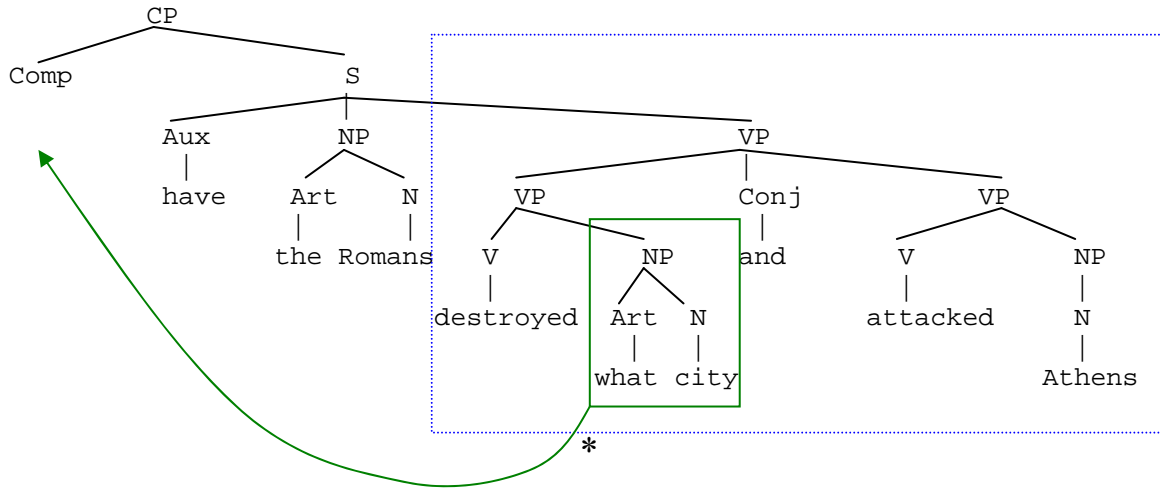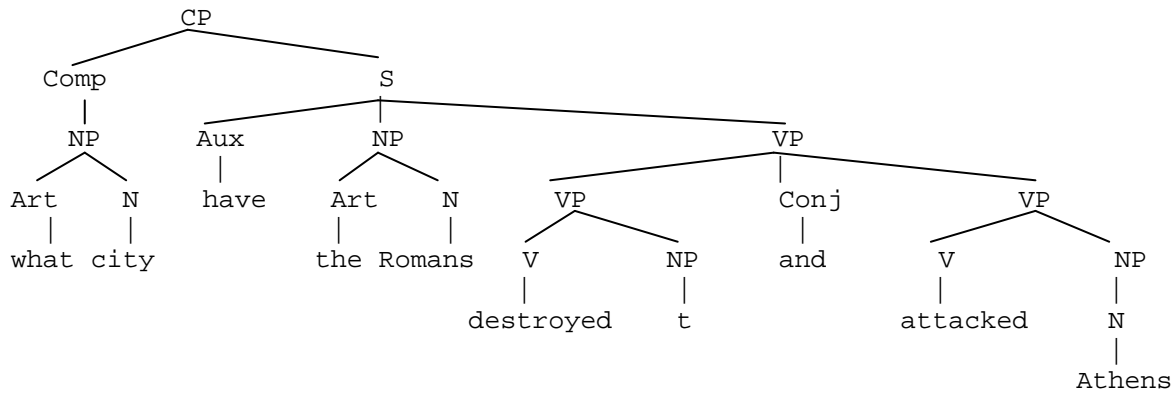
Study Exercise #33

Explain why the sentence 'What city have the Romans attacked and destroyed?' is grammatical. Illustrate with a derivation. Hint: take a look at the phrase structure rules (129) on p. 161.

Answer to Study Exercise #33

What city have the Romans attacked and destroyed?

      Here there is a coordinate structure, but the wh- phrase is not inside it. The coordinate structure is the two verbs *attacked* and *destroyed*. Since the wh- phrase *what city* is not extracted from inside the coordinate structure island, the sentence does not violate the Coordinate Structure Constraint and thus is grammatical. The following deep structure + movement arrows shows that the "extractee" is *not* inside the island:
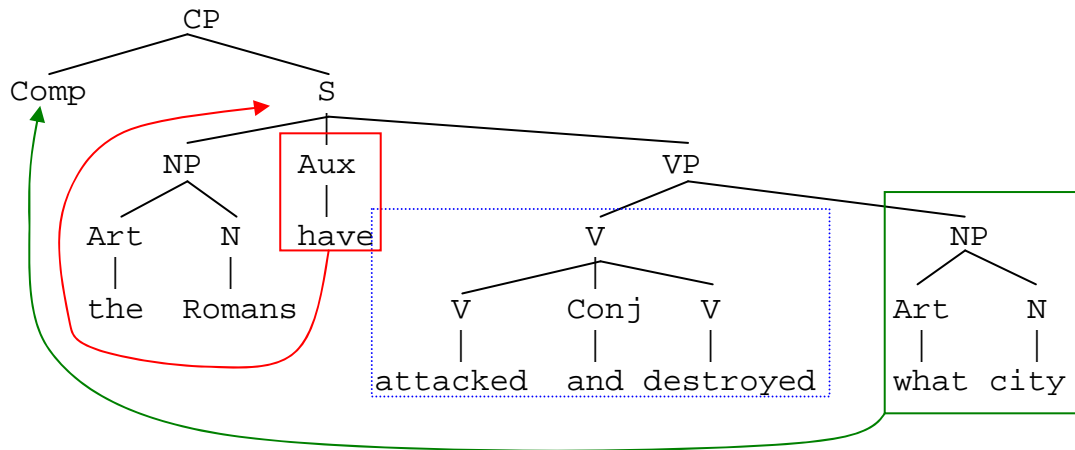
Study Exercise #34

    Explain why the sentence

    Which city and which province will the Romans destroy?'

is grammatical. Illustrate with a derivation.

Answer to Study Exercise #34

Which city and which province will the Romans destroy?

In this case, the wh- phrase (namely *which city and which province*) is again not inside the coordinate structure; rather, it *is* the coordinate structure. Thus applying Wh- movement does not extract a wh- phrase from inside a coordinate structure, and the Coordinate Structure Constraint is not violated. Here is the deep structure with movement shown.
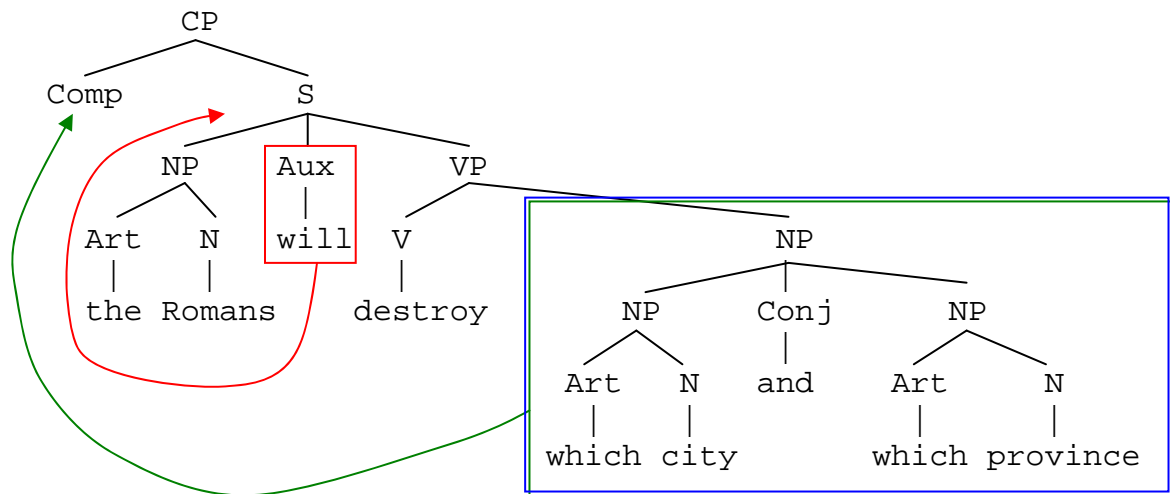
12. The universality of the Coordinate Structure Constraint

One of the goals sought by linguistics in writing formalized grammars is to locate **universals of language**. A linguistic universal is a property shared by all human languages. The explanation of linguistic universals is one of the key tasks of linguistic theory.

Linguistic universals are proposed and tested against data from the languages of the world; there are thought to be about 8000 of them.[89] No universal has been checked against all 8000, however, at least some proposed universals look fairly promising.

Some universals that have been proposed are fairly superficial, for example:

- All languages have nouns and verbs.
- All languages have wh- questions.
- All languages have consonants and vowels.
- All languages use the vowel [a][90] or something phonetically close to it.

---

[89] The number is declining steadily. Probably the best list of languages is the *Ethnologue*, at http://www.ethnologue.com/.

[90] IPA [a] is more or less the [a] vowel of Spanish, or in some dialects of English the vowel of *hot*.

Others are more subtle, and emerge only when we have submitted a large number of languages to formal analysis—that is, have constructed grammars for them.

As you might expect, it is common for linguists to propose universals, then be forced to abandon or modify their proposal in the face of falsifying evidence. This is only natural, and indeed one might argue that part of the job of the linguist is to be a bit "out on a limb", creating hypotheses about language that are interesting enough to be worth checking.

The Coordinate Structure Constraint was first noticed and proposed as a universal by the linguist John R. Ross, who pioneered the study of syntactic islands in the mid 1960's. The phenomenon of islands attracted a great deal of attention and has been extensively studied and analyzed since then. Today, there seems to be a consensus, based on study of a fair number of languages, is that the Coordinate Structure Constraint is universal. (The doubtful cases are instances in which we're not sure that the structure in question is really a coordinate structure.) To be more precise: in all languages that can be tested (because they have wh- movement; *in situ* languages don't count), extraction from coordinate structures is impossible. Here are some sample data from other languages:

German   Simple sentence: Du hast Fritz gesehen
                                              you have Fritz seen
                                              'You have seen Fritz.'

                    Wh- question (with gap): Wen hast du ___ gesehen?
                                              who have you (gap) seen

                    Extraction from   *Wen hast du Fritz und ___ gesehen?
                    coordinate structure: who have you Fritz and (gap) seen
                                             *'who have you seen Fritz and?'
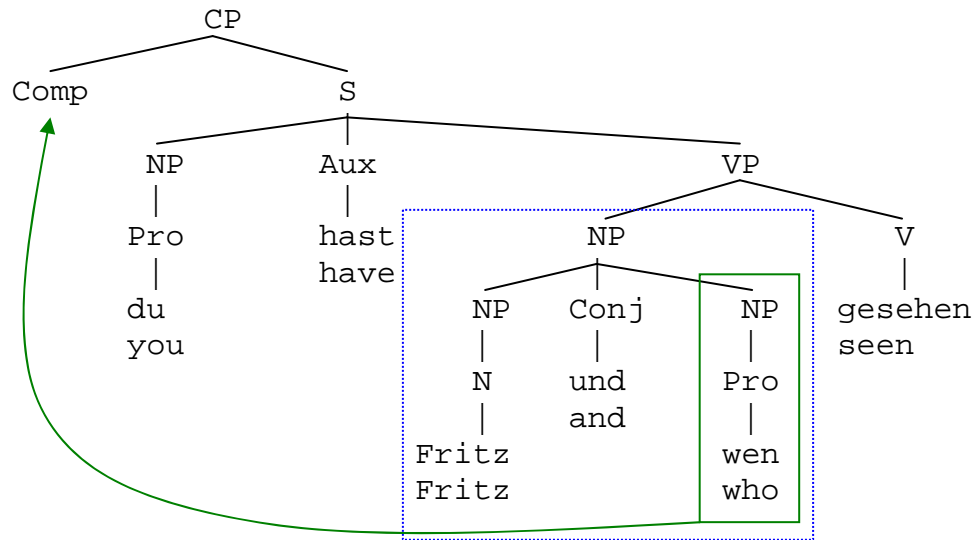
French: *Quelle   journal   as-   tu   lu   ___   et   ce   livre?
                          what   newspaper   have you read (gap) and this book

                         *Quelle   livre   as-   tu   lu   ce   journal   et   ___?
                          what   book   have you read this newspaper and (gap)

Russian: *Kovo Ivan   videl Petra ili   ___?
                     who   Ivan   saw   Peter or   (gap)
                     *'Who did Ivan see Peter or?'

                     *Kovo Ivan   videl   ___   ili Petra?
                     who   Ivan   saw   (gap) or Peter

Arabic (examples involve Topicalization)

                  *Zayd-an ʔintaqada xalīl-un ____   wa-ʕamr-an
                   Zaid   criticized Khalil-nom   and-Amr-acc.
                  *'Zaid, Khalil criticized and Amr'

                  * ʕamr-an ʔintaqada xalīl-un ____   Zayd-an   wa
                   Amr-acc criticized Khalil-nom   Zayd-acc. and
                  *'Amr, Khalil criticized Zayd and'

Choctaw (Oklahoma)

                  *Katah-oosh John-at   taloowa-tok anoti ___ hilhah-tok?
                   who-focus John-nom. sing-past   and   dance-past
                  *'Who did John sing and dance' (= 'Who was the person such that that person sang and John danced?')

American Sign Language (example involves Topicalization)

                                        ____t____
                  *FLOWER $_2$GIVE$_1$ MONEY, $_j$GIVE$_1$ ___
                  Flowers, he-gave-me money   but she-gave-me
                  *'Flowers, he gave me money but she gave me ___.'[91]

Formal universals like the Coordinate Structure Constraint have inspired a fair amount of theorizing about language and language learning, which we'll take on in the next chapter.

12.1 Looking ahead

The combination of long-distance transformations and islands leads to a fair amount of

---

[91] The underline represents a non-manual element produced in synchrony with the sign FLOWERS. Subscripts indicate, roughly, starting and ending points of verbal signs that serve the function of pronouns.

analytical work: for each transformation, you want to show that it respects the island, and for each island (we'll cover more) you want to show that the transformations all respect it.

13. Two more islands

To complete our general account of long-distance transformations and island constraints, here are two more islands (there are quite a few more, varying from language to language, but we will stick with just three total). The general point that emerges is that all the long-distance transformations obey all of the island constraints (since there will be three of each, we will need to check a total of nine cases).

13.1 The Wh- Island Constraint

Recall embedded wh- questions, like *I know what Bill saw*. We already have the means to derive this (see Chapter 6, section 4.2) and the example is reviewed below.

Deep structure and Wh- Movement:

Surface structure:

```
                    S
                   / \
                    VP
                   / \
                      CP
                     / \
                       S
                      / \
                         VP
                        / \
  NP       V    Comp   NP    V    NP
   |       |     |      |    |     |
  Pro               N
   |       |     |      |    |     |
   I     know    NP   Bill  saw    t
                  |
                 Pro
                  |
                 what
```
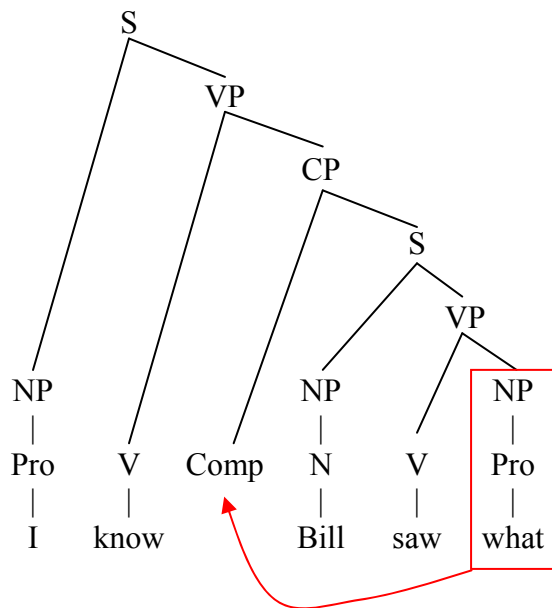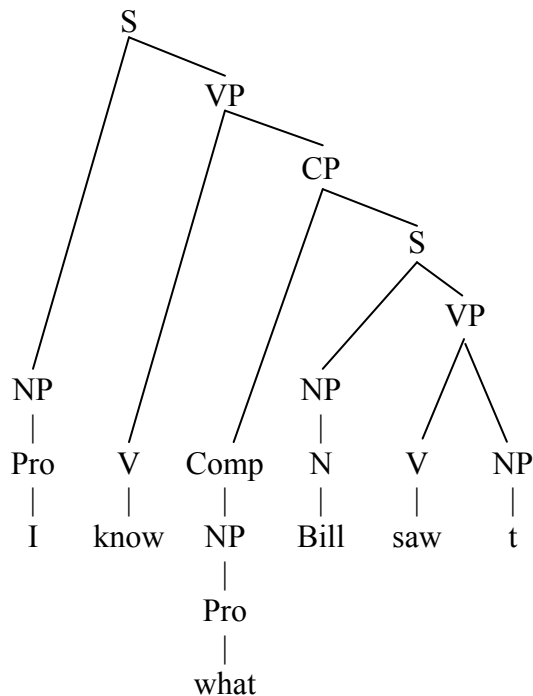
But now consider the following scenario: what if, at the level of deep structure, there were *two* wh- phrases in the same clause? This is not so absurd, since we actually have sentences like the following:

I know [who saw what]_{CP}

Here, the wh- word *what* remains in situ, as the object of *say*. We won't be able to cover here just what circumstances permit a wh- phrase to remain in situ in English, but for now this sentence suffices to show that it is quite possible to have a clause with two wh- phrases.

Now, consider this scenario: we take the above sentence as a deep structure, move *what* into the "lower" Comp, and *who* into the "higher" Comp, as follows:

Deep structure and first application of Wh- Movement:
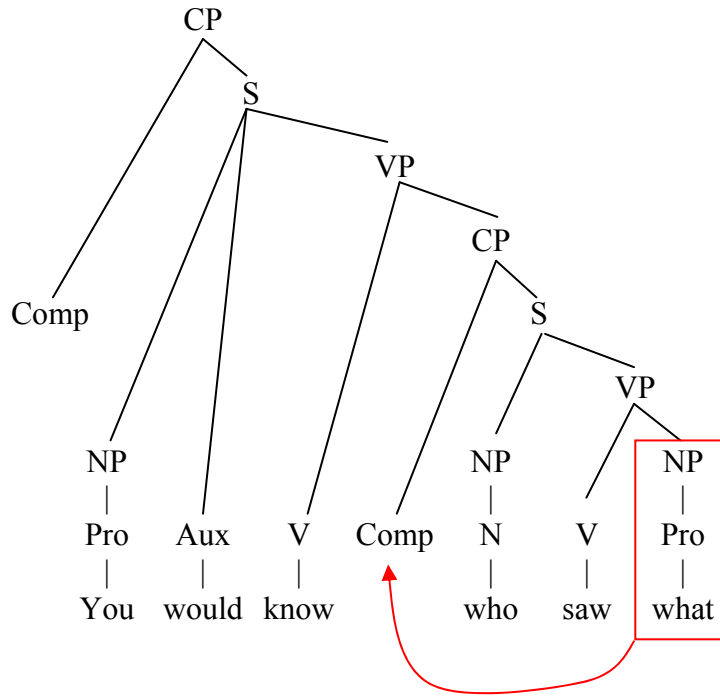
Result of first application of Wh- Movement, with arrow showing Subject-Aux inversion:
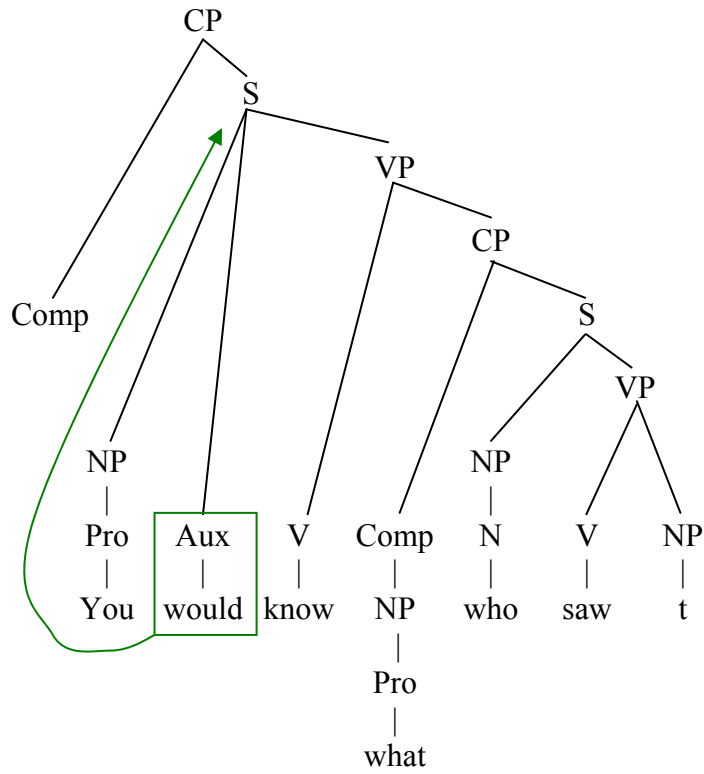
Result of Subject-Aux Inversion, showing second application of Wh- Movement:

```
                        CP
                       /  \
                      /    S
                     /    / \
                    /    /   VP
                   /    /   /  \
                  /    /   /    CP
                 /    /   /    /  \
                /    /   /    /    S
               /    /   /    /    / \
              /    /   /    /    /   VP
             /    /   /    /    /   /  \
         Comp    /   NP   /   NP   /    \
          ↑     /    |   /    |   /      \
          |   Aux   Pro  V  Comp  N      V    NP
          |    |     |   |   |    |      |     |
          |  would  you know NP  who    saw    t
          |                  |
          |                 Pro
          |                  |
          |                 what
```

Surface structure:

```
                        CP
                       /  \
                      /    S
                     /    /|\
                    /    / | \
                   /    /  |  VP
                  /    /   | / \
                 /    /    |/   CP
                /    /     /   /  \
               /    /     /   /    S
              /    /     /   /    / \
         Comp  Aux      /   /    /   VP
          |     |      /   /    /   / \
          NP  would   /   /    /   /   \
          |         NP   /  Comp NP  V   NP
          Pro       |   /    |   |   |   |
          |        Pro V    NP   t  saw  t
         who        |  |    |
                   you know Pro
                            |
                           what
```
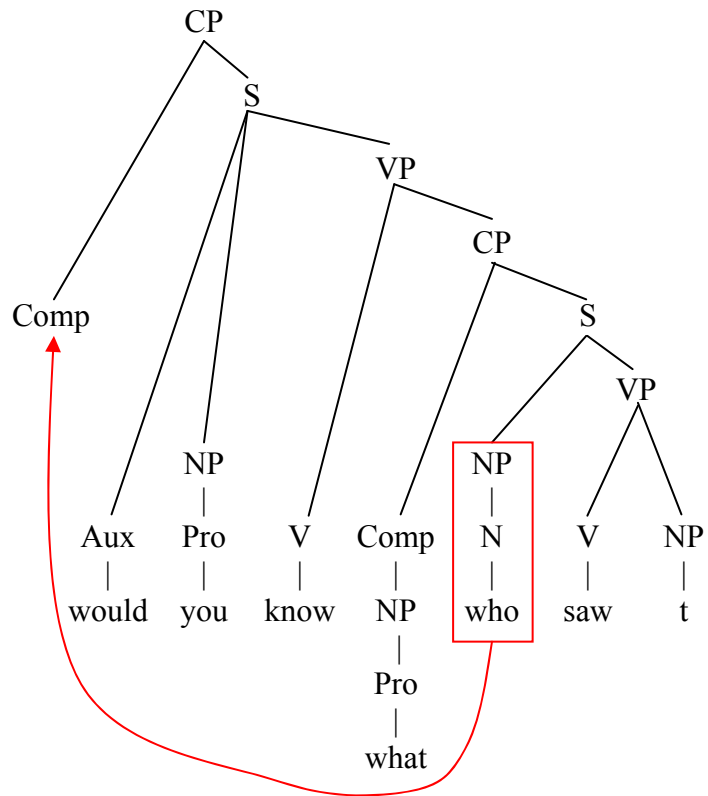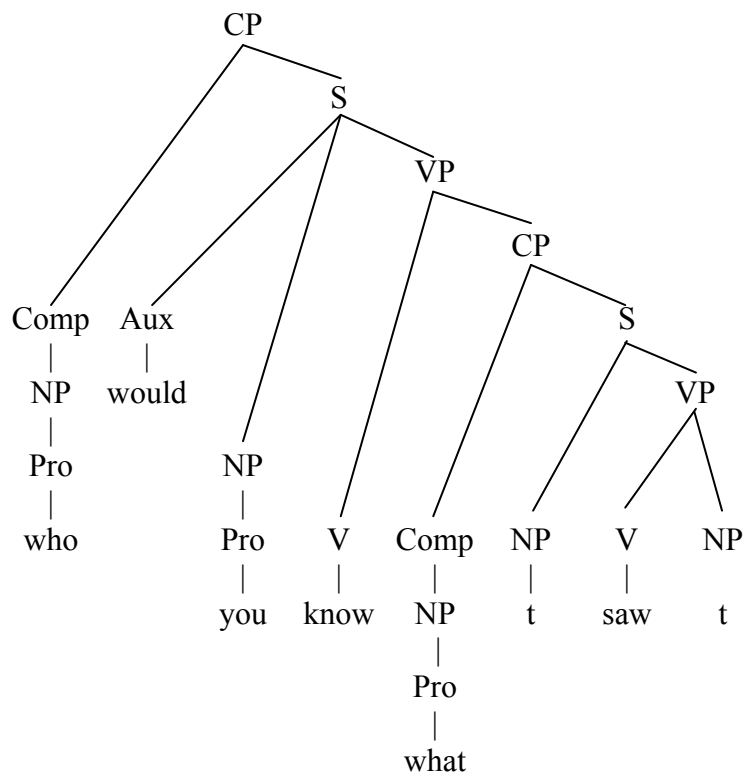
The result is **Who would you know what saw*?, which most speakers find crashingly bad. It is worth emphasizing that this is not due to its lacking a meaning; it's clear that it should mean the following:

"What is the person such that you know what that person saw?"

The meaning is hard to access, given the extreme ungrammatically of the sentence.

Linguists have proposed to explain the ill-formedness of sentences like *Who do you know what saw*? by positing yet another island, along the following lines:

(160) **Wh- Island Constraint**

Mark as ungrammatical any sentence in which a constituent has been extracted from inside an CP whose Comp contains a wh- phrase.
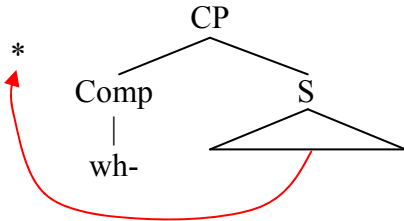
This island constraint is slightly different from the Coordinate Structure Constraint, because the island is actually created by a transformation. The "lower down" Wh- Movement forms an island that blocks any further Wh- movements higher up in the tree.

To illustrate: returning to the derivation given above, but this time drawing in the island, we can see that it is correctly excluded by the Wh- Island Constraint. The sequence *what who saw* is covered by the description of the island, and thus the sentence is ruled out.
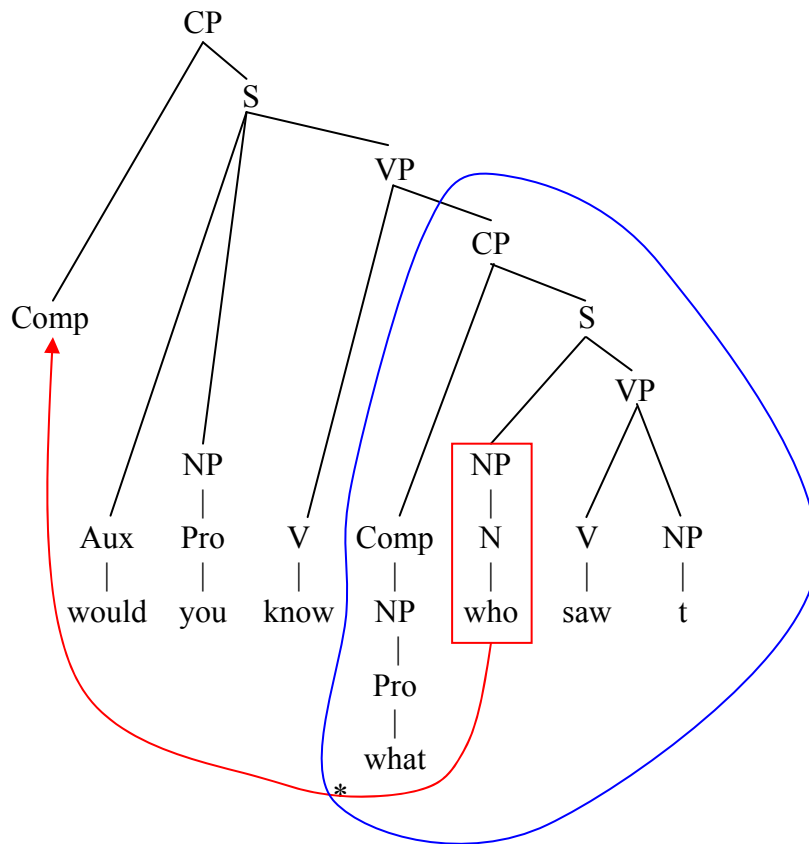
   The Wh- Island constraint covers a fair amount of data; here are some other sentences that it excluded. I've put brackets in to illustrate the S̄ that begins with a wh- phrase and thus forms a Wh- Island.

   Bill admitted who committed this crime.
   *[What crime] did Bill admit [who committed ___]CP ?

   Fred doesn't care how long you take on this exam.
   *[Which exam] doesn't Fred care [how long you take on ___]CP?

   Alice doesn't care which exam you take a long time on.
   *[How long] doesn't Alice care [which exam you take ___ on]CP?

   Observe further that there is nothing wrong with having two wh- phrases in the same sentence. It's only when one wh-phrase is moved *out of the CP that the other one begins* that you get a bad result. Here is an example. In the sentence

   Which student would you tell who you saw?

the two instances of wh- movement are non-overlapping. The movement that goes to the higher Comp is *not out of the island,* so the sentence comes out fine. Here is the full derivation.

Deep structure with lower wh- movement:
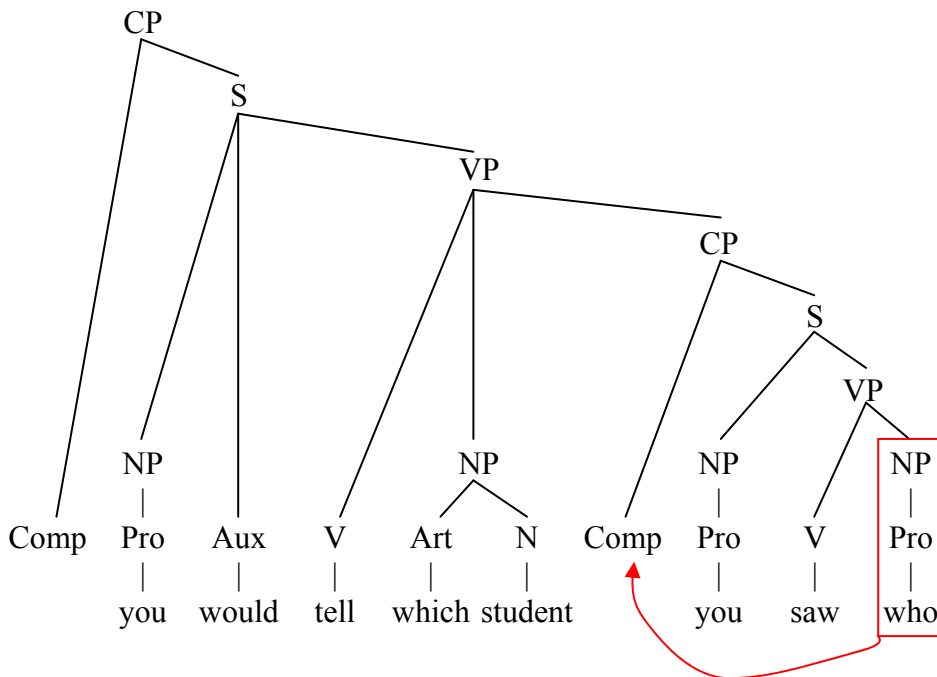
Output of lower wh- movement, showing Subject-Aux Inversion:
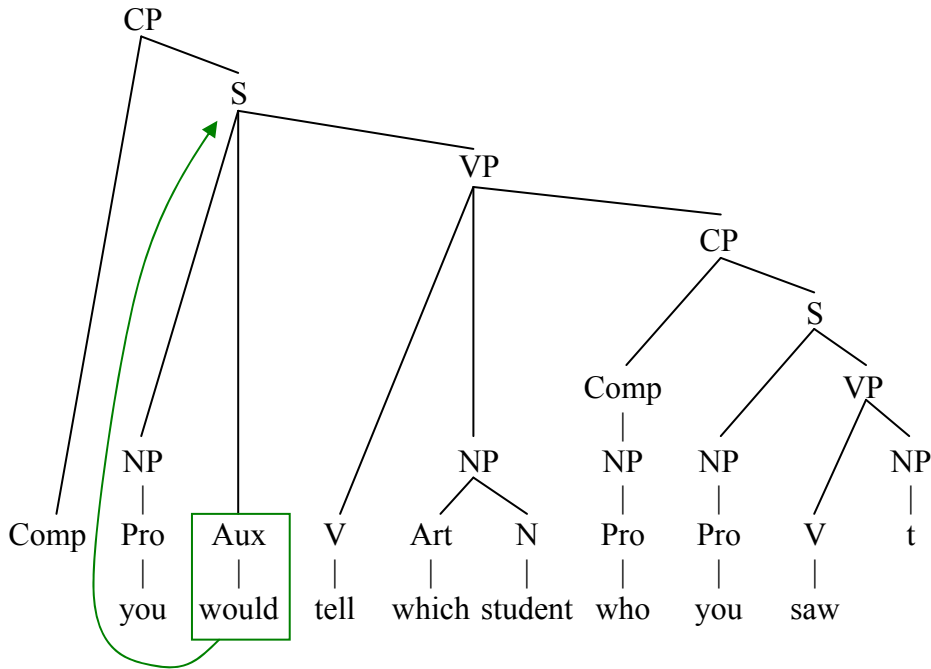
Output of upper wh- movement.
Note that this is *not* movement outside of the wh- island, shown in blue.

Surface structure:

```
                        CP
                        |
                        S
                              VP
                                      CP
                                          S
        Comp                    Comp          VP
         |                       |
        NP          NP          NP   NP         NP
         |          |           |    |          |
      Art   N   Aux  Pro   V    NP   Pro  Pro  V    t
       |    |    |    |     |    |    |    |    |
    which student would you  tell   t   who  you  saw
```
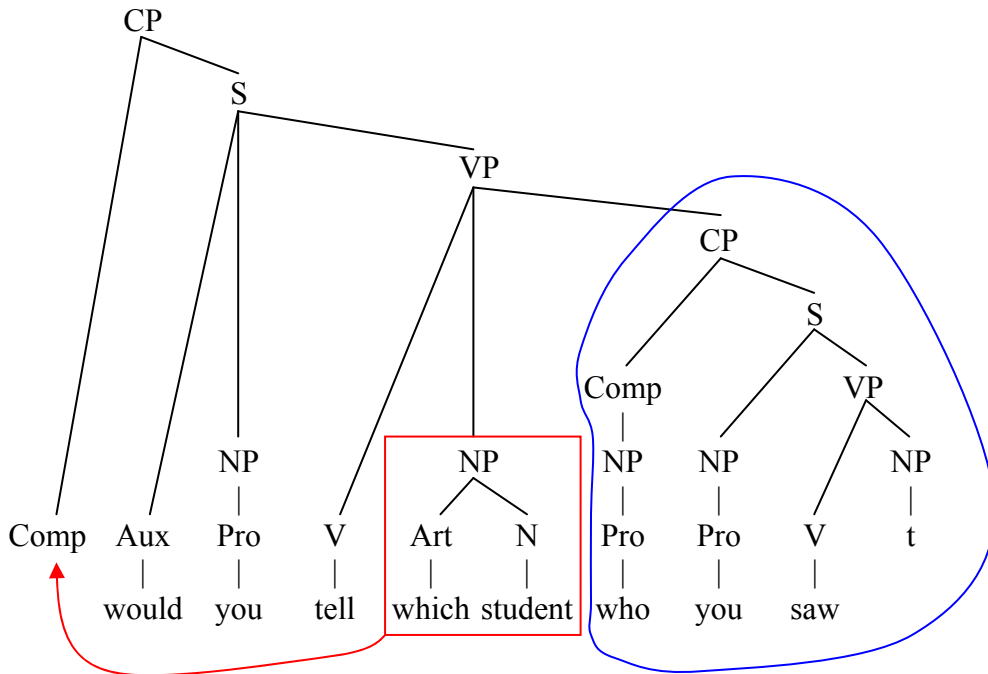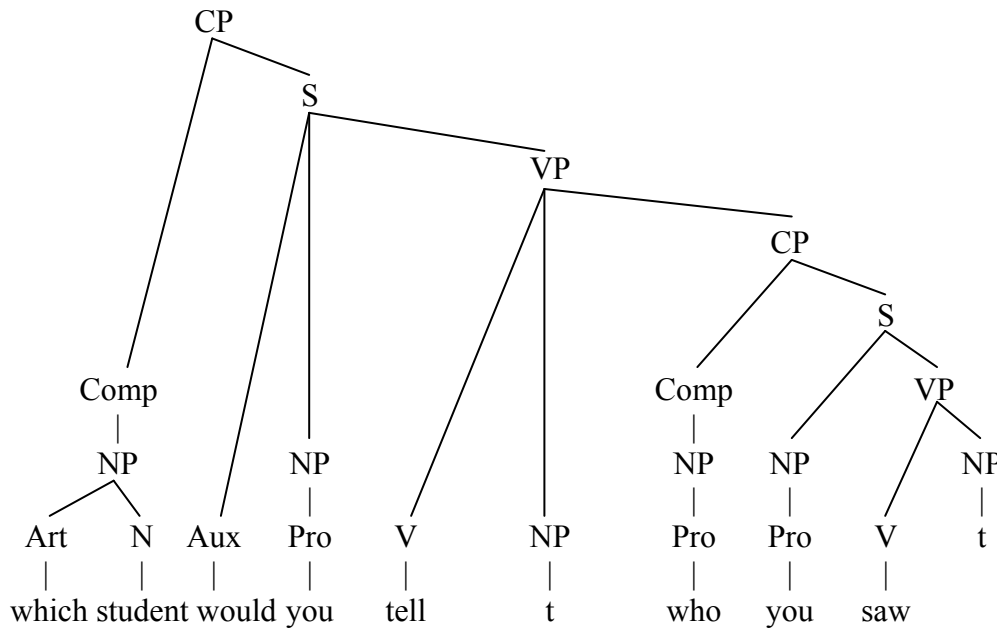
You can see this all at once if we put the material on just one line, showing only the two instances of Wh- Movement and the island:

[Who] would you tell ___ [[who] you saw ___]CP?

Note finally that Topicalization and It-Clefting obey the Wh- Island Constraint:

Topicalization:

*[Kate], I realized [to whom they would send ___]CP.

It-Clefting:

*It was [Oliver] that I wondered [which book ___ would read]CP.

13.2 The Complex NP Constraint

Another kind of island is the so-called "complex noun phrase". Recall (from p. 159) the main phrase structure rule in English for NP, the one to which we added a possible CP daughter:

NP → ({ $\begin{Bmatrix} NP \\ Art \end{Bmatrix}$ }) (AP)* N (PP)* (CP)

A complex NP is an NP having CP as a daughter (there may also be other modifiers). You get a complex NP if you include the boldface items below in applying the rule.

$$\text{NP} \rightarrow (\{\begin{matrix}\text{NP}\\\text{Art}\end{matrix}\}) \, (\text{AP})^* \, \textbf{N} \, (\text{PP})^* \, \textbf{(CP)}$$

Some examples of complex NPs include

Sue's belief that Sam is leaving Omaha
Alice's hunch that the burglar used this window
Bill's inane hypothesis that Frieda saw Jack[92]

The island constraint for complex NPs, called the Complex NP Constraint, is stated as follows:

(161) Complex NP Constraint

Mark as ungrammatical any sentence in which a constituent has been extracted from inside a complex NP.
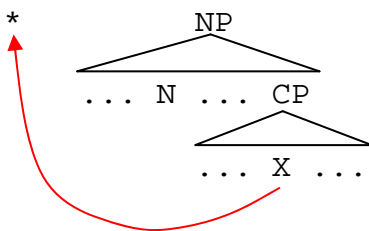
To demonstrate that complex NPs are islands, one does the following. (a) Set up a deep structure that contains a complex NP; (b) make sure that in this deep structure, there is a wh-phrase contained within the complex NP; (c) apply Subject Aux Inversion and Wh- Movement to the deep structure and see if the result is grammatical. I have done this in the following example. The Complex NP is circled, and the arrows show what moves where.

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[92] The relative clauses mentioned above (p. 165) are also islands; for instance: *What apples will you see the man who picked ___?*

Deep structure, Subject-Aux Inversion, and Wh- Movement:
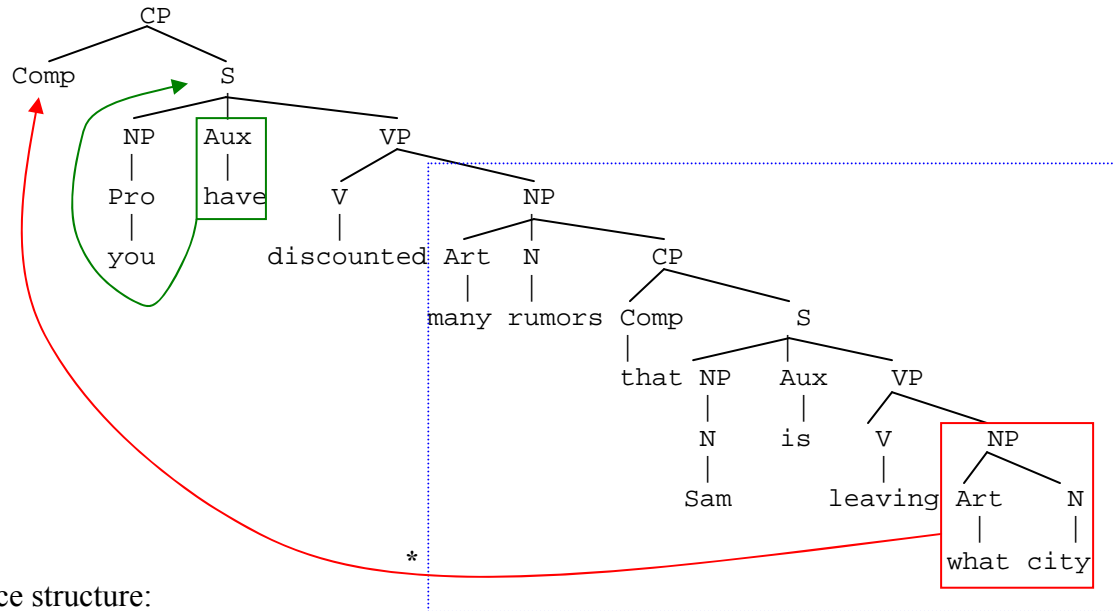
Surface structure:
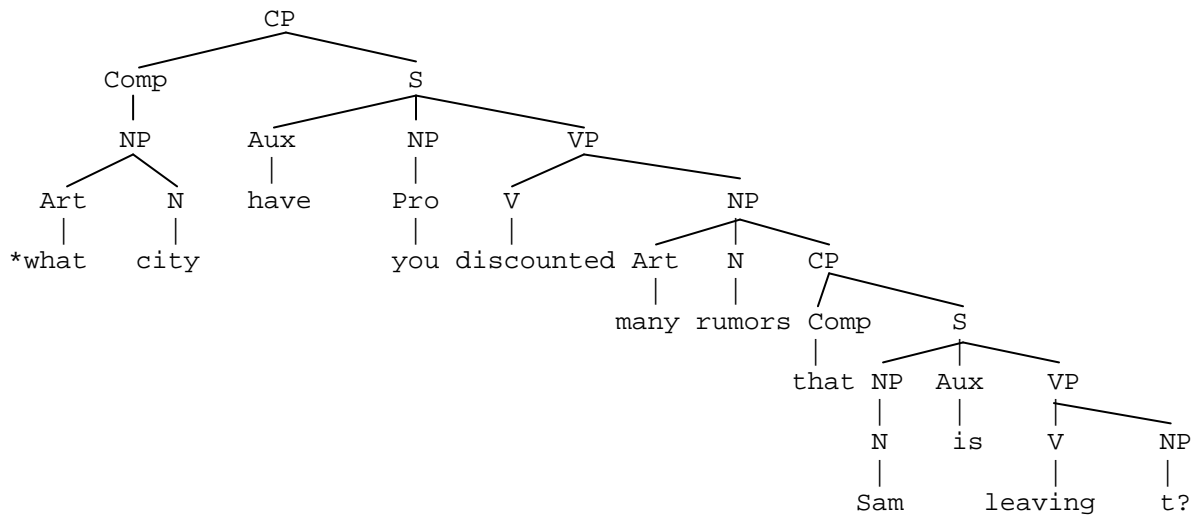
The fact that the surface structure is ungrammatical supports the existence of the Complex NP Constraint. Similar ungrammatical sentences would be

*Which window would you disagree with Alice's hunch that the burglar used?
*Who might you hear Bill's inane hypothesis that Frieda saw?

Study Exercise #35

Give a derivation, with boxes, arrows for movement, and a circled island, for the two sentences just given.

Answer to Study Exercise #35

Which window would you disagree with Alice's hunch that the burglar used?

Deep structure, with island shown with circle and arrows for Subject-Aux Inversion and Wh-Movement:
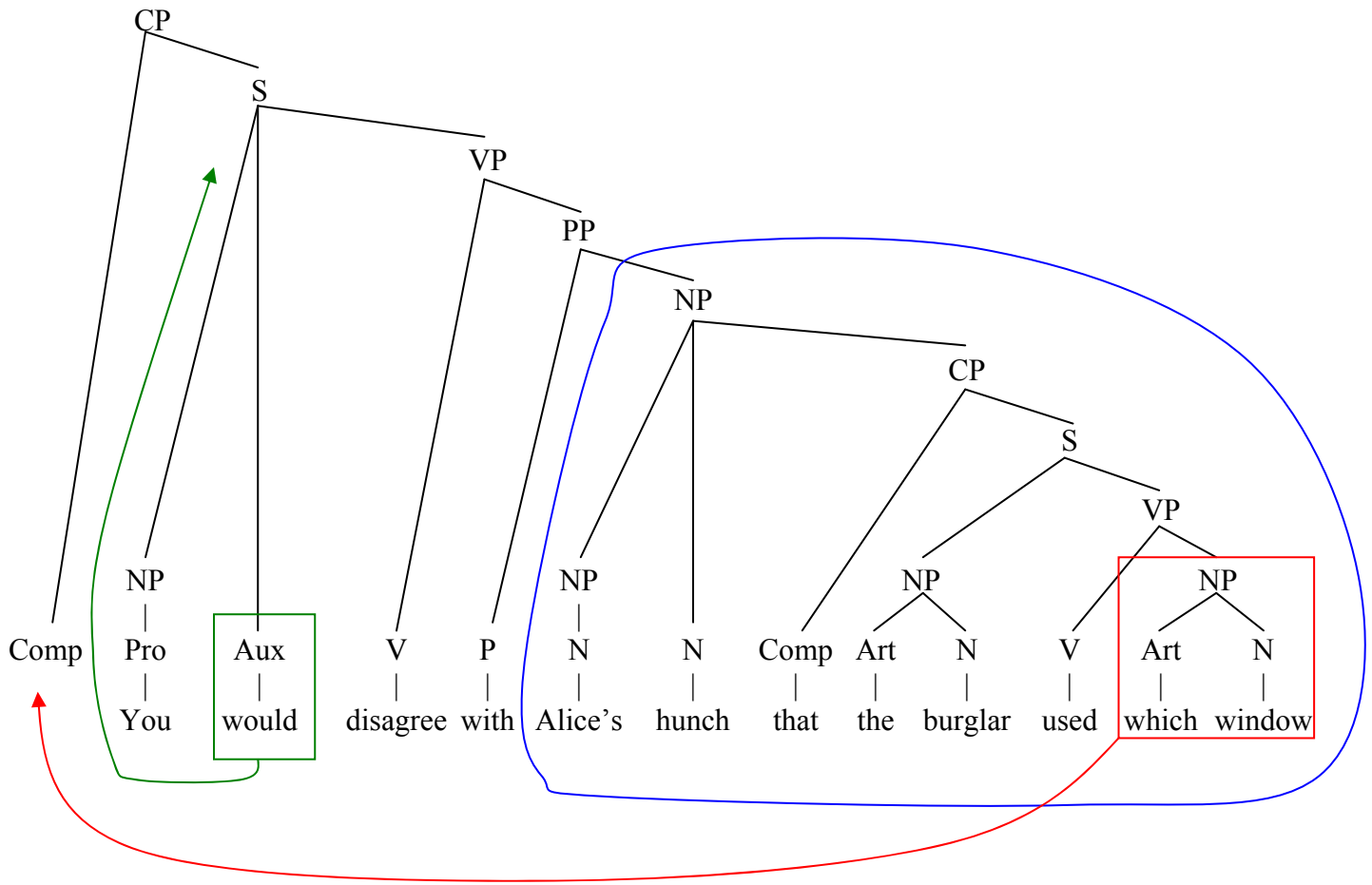
Ungrammatical surface structure:

CP
S
VP
PP
NP
CP
S
Comp
NP
NP
NP
NP
VP
Art N Aux Pro V P N N Comp Art N V NP
*Which window would you disagree with Alice's hunch that the burglar used t
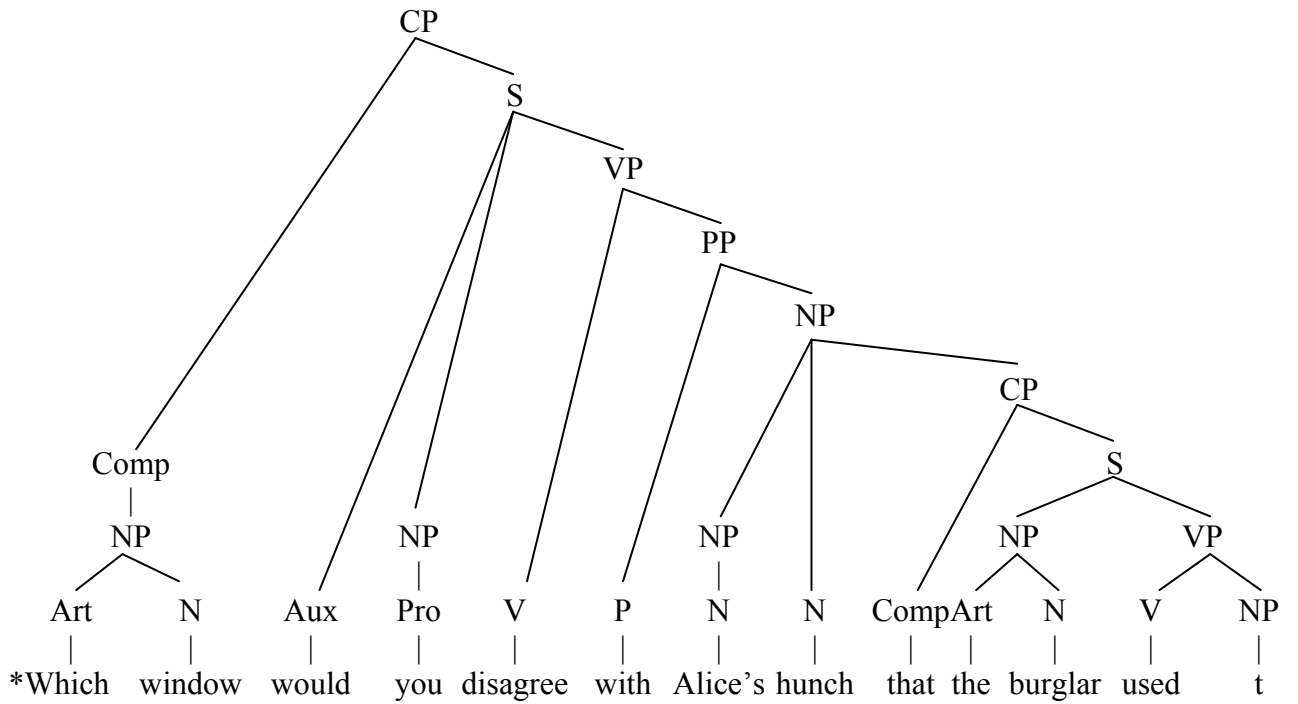
Who might you hear Bill's inane hypothesis that Frieda saw?

Deep structure, with Complex NP island, arrows for Subject-Aux Inversion

CP
S
VP
NP
CP
S
VP
NP Aux V N A N Comp NP V NP
Comp Pro Pro
You might hear Bill's inane hypothesis that Frieda saw who

Ungrammatical surface structure:

```
                              CP
                             /  \
                                 S
                                /| \
                                 |  \
                                 |   VP
                                 |  /|\
                                 | / | NP
                                 |/  |/|\
                                 |   | | \
                                 |   | |  CP
                                 |   | | / \
                                 |   | |/   S
                                 |   | /   / \
      Comp                       |   |/   /  / \
       |          NP       NP    /  / |  /  NP  VP
       NP         |        |    /  /  | /   |  / \
       |          |        |   /  /   |/    |  |  \
       Pro        Aux      Pro V  N   A  N  Comp N  V  NP
       |          |        |   |  |   |  |   |   |  |  |
       Who       might    you hear Bill's inane hypothesis that Frieda saw t
```
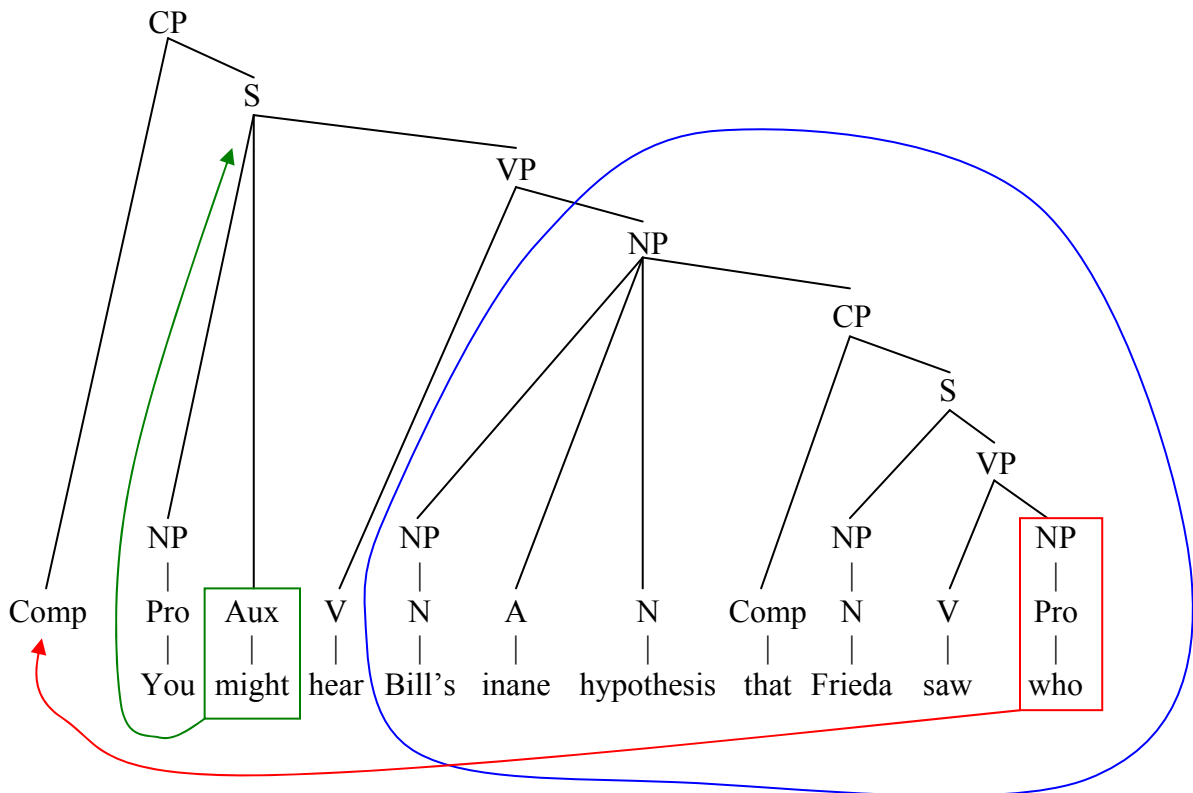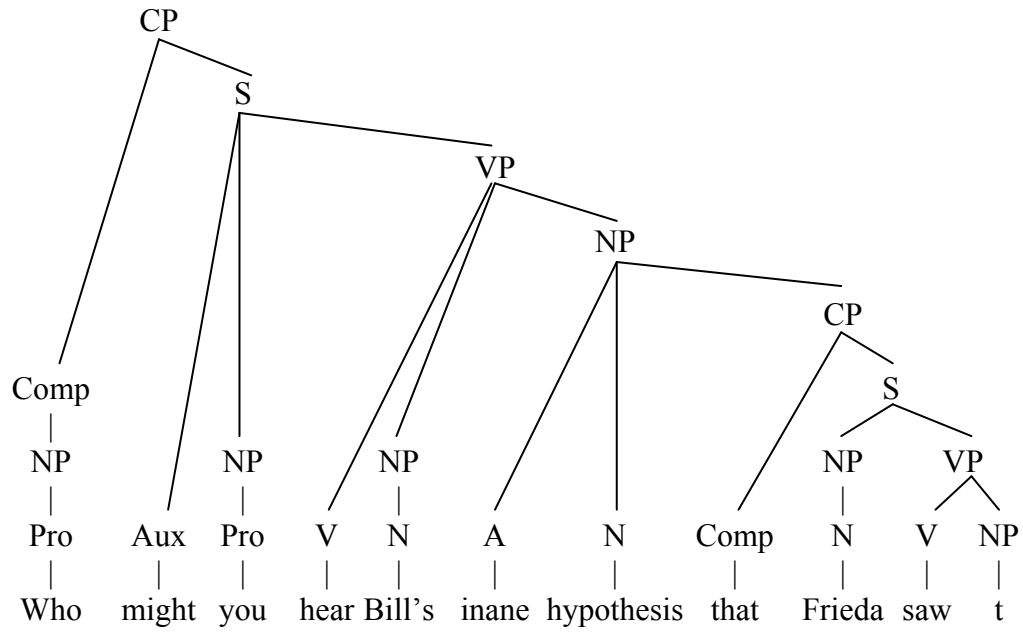
Study Exercise #36

Why is the sentence

Whose theory that Sam is crazy could you believe?

grammatical? (You have to imagine a scenario in which all sorts of people are presenting theories that Sam is crazy.)

Answer to Study Exercise #36

Deep structure, with Subject-Aux Inversion and Wh-Movement shown with arrows:
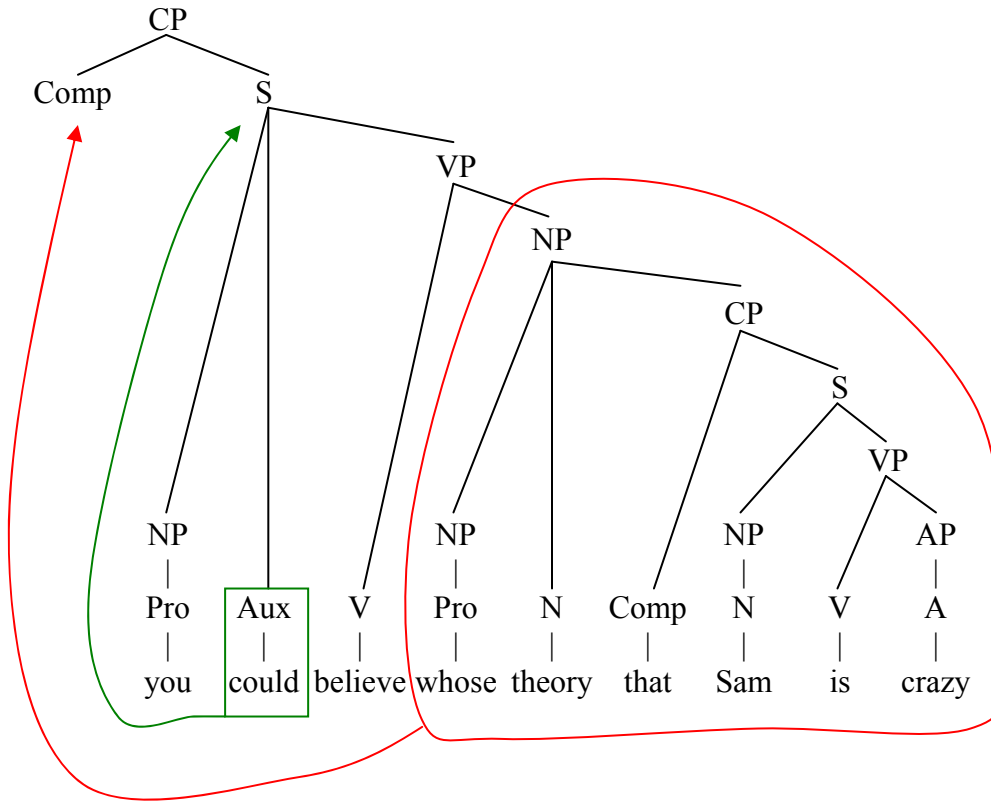
The point is that the *whole island* is extracted. Island constraints are violated when you extract from *within* an island.

13.3 The Complex NP Constraint and other syntactic transformations

As the following labeled sentences show, the Complex NP Constraint is obeyed by Topicalization and by It-Clefting:

Topicalization

*[Kate], I discounted [many rumors that they would elect ____]NP.

It-Clefting

*It was [Kate] that I discounted [many rumors that they would elect ____]NP.

13.4 The complex NP constraint is not universal

When it was noticed and first formalized by John R. Ross in the 1960's, it was thought that the Complex NP Constraint is a linguistic universal, just like the Coordinate Structure Constraint is. Shortly thereafter, however, Scandinavian linguists began studying the island constraints of their native languages, and noticed that neither Norwegian nor certain dialects of Swedish and Danish respect the constraint. The linguist Jens Allwood offers the following data from Swedish,[93] which he checked with a number of speakers; the complex NP is shown in brackets.

Simple sentence:

Herodes   levde i [hopp-et   om   att   Salome skulle   förföra den mannen.]NP
Herod   lived in hope-the of   that   Salome should   seduce   that man
'Herod lived in the hope that Salome should seduce that man.'

Wh- Movement out of Complex NP:

[Vem] levde Herodes i [hopp-et   om   att   ___   skulle   förföra   den   mannen]NP?
Who   lived Herod   in   hope-the of   that   should   seduce   that   man

[Vem] levde Herodes i [hopp-et   om   att   Salome skulle förföra   ___]NP?
Who   lived Herod   in   hope-the of   that Salome should seduce

Topicalization out of Complex NP:

[Salome] levde Herodes i [hopp-et   om   att   ___   skulle   förföra den mannen.]NP
Salome   lived Herod   in   hope-the of   that   should   seduce   that man

[Den   mannen] levde   Herodes i [hopp-et   om att   Salome skulle   förföra ___]NP.
That   man   lived   Herod   in hope-the of that Salome should   seduce

This is unusual; most languages that have these rules do respect complex NPs. Thus, here are some French data, very much like English:

*[Qui] as- tu proposé [l'idée que Marie aime ___]NP?

'Who have you suggested the-idea that Marie loves (gap)?

14. Why these islands?

To review, we have discussed three separate island constraints:

---

[93] The reason for the Biblical subject matter is not clear to me. You can make up example sentences about whatever you like, of course.

Coordinate Structure Constraint

Mark as ungrammatical any sentence in which a constituent has been extracted from inside a coordinate structure.

```
        *        X                      *         X
                 |                                 |
            X Conj   X                        X Conj X
```

Wh- Island Constraint

Mark as ungrammatical any sentence in which a constituent has been extracted from inside an S̄ whose Comp contains a wh- phrase.
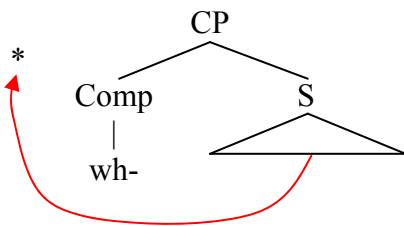
```
                    CP
        *
            Comp          S

            wh-
```

Complex NP Constraint

Mark as ungrammatical any sentence in which a constituent has been extracted from inside a complex NP.

```
    *            NP
        ... N ...  CP

              ... X ...
```
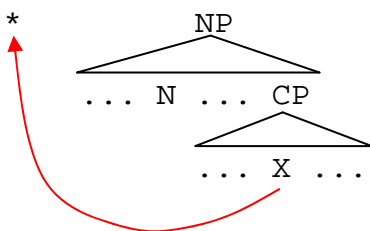
Of these, the Coordinate Structure Constraint seems to be a good candidate for being a linguistic universal; the other two are probably not universal but seem to be found in many languages.

The question that arises when one lines up the islands in a row like this is: "**Why these islands**?" That is, why should island-hood be found for just this particular configuration of syntactic structures? The three islands seem to have little in common with each other.

The view of most linguists who consider this question is that the islands as formulated above are a first-pass approximation. That is, it's a good idea to formulate the islands in this way, for the

sake of explicitness of analysis, but in the long term it seem desirable to seek more abstract principles to explain the data.

One approach that seems fruitful is to invert the problem: one specifies what places it is *legal* to extract from rather than what places it is illegal. You may encounter approaches of this type if you study syntax in future course work.

A final point is that the islands may be in some sense useful to the speakers. Psycholinguistic experimentation (including with brain-scanning devices) suggests there is a cognitive burden for the listener whenever the sentence heard involves a filler-gap constructions such as those created in the transformations described here. When a language has island constraints, they in effect tell the language user, "don't bother to look for gaps here."—perhaps this reduces the burden on speech perception, and thus reflects a principle of good "language design".

Chapter 7: Language acquisition

1. The relationship of linguistic theory to language acquisition

Linguistics exists in a kind of dual mode: at the level of language data, linguists are endlessly engaged in analysis, trying to develop better grammars as well as better general theories in which such grammars can be laid out. But behind all this activity are ponderings at a level which is less technical but more general, concerning how the strikingly elaborate grammars of human languages arise.

Let us assume (for purposes of argument) that the grammar we've been developing does in some way characterize the native speaker's knowledge. Our starting point here is that *the native speaker must learn the grammar, too*. Chidren do this in infancy and childhood, over the course of just a few years, usually without overt instruction, but instead simply by inhabiting a community where the language is spoken, listening intently, and trying to speak. Moreover, what the child learns is not the toy grammar we have been working with, but something much, much larger.

Language acquisition is an important area of linguistics and linguistic theory. There are three primary research methodologies. First, **observational study** is the longest-standing method: one arranges to be in a situation where one can hear little kids talking, and one records what they say, ideally with audio as well as transcription.[94] Much of the data from such study has been gathered into a large corpus, known as CHILDES, from which investigators can gather new and important generalizations.[95] Second, infants and children are the subjects in **experiments**, which gather their reactions to carefully-planned language material presented to them. In my own department at UCLA, an active infant and child laboratory carries out experiments with children brought into the lab by their parents. Third, research proceeds by **simulation**: linguists attempt to develop computer software that can learn the grammatical and phonological patterns of language on exposure to language data representative of what children hear; the grammars learned by the simulator can then be compared with evidence about what real people know about their language. Study of language acquisition by simulation is sometimes described as **learnability theory**.

What results are being obtained by this active research program. I think the most important are two.

First, **production lags perception**: children, and even infants, have considerable linguistic knowledge that can be detected only in their reactions to experimental stimuli, not in their own productions. The extreme case of this is phonological knowledge in infants, who evidently know the speech sounds and the principles of legal sound sequencing from the age of about six months. Going even further, even newborns can in some cases identify their mother's language from its characteristic patterns of syllable timing and pitch; presumably they can do this because such auditory properties are available to them even *in utero*.

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[94] A classical procedure, decades old, is for a linguist to keep a detailed diary on the linguistic productions of his or her own child. Alternatively, repeated visits are made to the same children in their home or daycare center.

[95] http://childes.psy.cmu.edu/

The other well-established result of the study of language acquisition is that **children are virtuosic**: they are prodigiously capable acquirers of language, and most noticeably, they outperform the efforts of linguists. Kids can exposed to a language for a few years become fluent native speakers, with extensive production abilities and nuanced, subtle judgments of well-formedness. Linguists, toiling away at analysis for many years, still struggle to obtain grammars that properly match what the native speaker knows. Moreover, to the extent that the linguists' theories are incorporated into machine-implemented systems that actually learn language, these systems cannot learn with anything like the speed or accuracy that children do. All of this causes linguists to believe that the ability to acquire language is an extraordinary aspect of human beings, well worth study.

The broad scientific debates surrounding grammar and language learning can be outlined as follows:

Outline:

- the quality of the evidence available to the child for learning
    - ➢ the "no negative evidence" issue

- the possibility of innate knowledge serving as an aid to learning
    - ➢ the alternative of powerful inductive mechanisms

- innate knowledge/abilities as a biological phenomenon
    - ➢ critical periods
    - ➢ genetic defects specific to language

- innate knowledge and linguistic universals

- linguistic abilities and human evolution

2. The quality of the evidence available to the child

To begin, it seems clear that however children learn language, conscious instruction (say, by parents) must play very little role. Not all parents instruct their children in language, and the parents who do are likely focusing on bits of normative grammar, quite peripheral to the language as a whole.

In fact, there's even less reason to consider overt instruction as a factor, because it appears that small children don't even pay much attention to it. Textbooks on language acquisition often include entertaining little dialogs between parents and toddlers showing the futility of overt instruction, of which the following is brief sampling:

C:	Nobody don't like me	C:	Want other one spoon, daddy.
A:	No, say 'nobody likes me'	D:	You mean, you want *the other spoon*
C:	Nobody don't like me	C:	Yes, I want the other one spoon, please, daddy.
A:	No, say 'nobody likes me'	D:	Can you say 'the other spoon'?
C:	Nobody don't like me	C:	Other...one...spoon
A:	No, say 'nobody likes me'	D:	Say 'other'

C: Nobody don't like me   C: Other.
A: No, say 'nobody likes me'   D: Spoon.
C: Nobody don't like me   C: Spoon.
A: No, say 'nobody likes me'   D: Other spoon.
C: Nobody don't like me   C: Other...spoon. Now give me other one spoon?
A: No, say 'nobody likes me'
C: Nobody don't like me
A: No, say 'nobody likes me'
C: Nobody don't like me
A: No, say 'nobody likes me'
C: Nobody don't like me
A: Now listen carefully: 'nobody likes me'
C: Oh, nobody doesn't likes me.[96]

These examples also make a subsidiary point: at any given point in the child's acquisition period, she has a relatively stable, internalized, wrong grammar, which she tends to stick to until it evolves in the natural way to the next, more accurate stage.

Leaving aside the case of overt instruction, we might also ask if children are somehow given a special linguistic diet by their parent, which makes acquisition possible. Such a diet might perhaps consist of a simplified version of the language, sometimes (more or less jokingly) called Motherese. Reasons to be skeptical of the effectiveness of Motherese are the apparent existence of children who learn their native language without it; and the fact that Motherese is often ungrammatical, a pattern that could hardly help acquisition in the long run.[97]

Scholars also differ on whether the input to the child is in general grammatical: Noam Chomsky[98] has repeatedly insisted that it is not, as in quotes like the following:

"Thus, it is clear that the language each person acquires is a rich and complex construction hopelessly underdetermined by the fragmentary evidence available." (*Reflections on Language*, 1975, p. 10)

"Knowledge arises on the basis of very scattered and inadequate data and ... there are uniformities in what is learned that are in no way uniquely determined by the data itself.." (*Cartesian Linguistics,* 1966, p. 65)

Various experts in child language development have disagreed with Chomsky's claim. It seems worth remembering that any one error in the learning environment (for example, if a speaker someone gets tangled up and inadvertently produces an island violation) could be very

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[96] From: McNeill, D. (1966). Developmental psycholinguistics. In Smith, F., and Miller, G. A. (eds.),*The Genesis of Language*, MIT Press, Cambridge, Mass.

[97] I make no claims here on whether or not it is *desirable* to speak Motherese to one's children.

[98] Chomsky invented most of the content of the syntax unit of this text in some extremely influential work from the 1950s to the 1970s. Devices attributable to him include phrase structure rules, subcategorization, transformations, morphosyntactic representations, and an early version of island constraints.

dangerous to the task of getting the grammar right, so even a modestly error-ful ambient environment might still suffice to make Chomsky's point.

3. Cases where "negative evidence" would be required for learning

One particularly intriguing aspect of language learning is this: *how do we learn that sentences are ungrammatical*? As noted above, actual correction of error is rare and ineffective, and for the more interesting cases like learning not to violate islands, it seems extremely unlikely that there would be sufficient overt correction for a child to learn the pattern.

4. Innate knowledge

For some linguists, the no-negative evidence problem provides indirect support for the hypothesis of **innate knowledge**. If some grammatical knowledge is simply not accessible to direct learning from the data, the only reasonable explanation for how we come by this knowledge as children is that we bring the knowledge to the task with us. In other words, our genome, physically embodied in our DNA, contains grammatical information, information crucial to acquisition.

It may seem counterintuitive to suppose that knowledge could be innate; some people get used to thinking that the genes control only the form of the body, and not of the mind. But examples of innate knowledge are easy to find in the animal kingdom. For example, some species of birds have a song that does not vary at all across individuals, and which even birds raised apart from their species will sing. The ability to sing these songs surely would count as innate knowledge. The stunning ability of human newborns to mimic tongue protrusion might likewise be taken as a clear case of innate knowledge.[99]

Chomsky is well known for his strong views on the innateness question for language. Here is a sampling, from his *Language and Mind* (1968):

> To repeat: Suppose that we assign to the mind, as an innate property, the general theory of language that we have called "universal grammar." This theory encompasses the principles that I discussed in the preceding lecture and many others of the same sort, and it specifies a certain subsystem of rules that provides a skeletal structure for any language and a variety of conditions, formal and substantive, that any further elaboration of the grammar must meet. The theory of universal grammar, then, provides a schema to which any particular grammar must conform. Suppose, furthermore, that we can make this schema sufficiently restrictive so that very few possible grammars conforming to the schema will be consistent with the meager and degenerate data actually available to the language learner. His task, then, is to search among the

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[99] Ponder briefly the tacit mental processing involved: "That pink patch of light falling on my retinas represents a *tongue*. I also have a tongue. If I use these particular muscles I can do this too with my tongue." All of this is unremarkable in a being who has had practice, but very striking in an individual who has just emerged from the darkness of the womb. For imitation in newborns see Meltzoff, A.N., & Moore, M.K. (1977). Imitation of facial and manual gestures by human neonates. *Science*, 198, 75–78 [currently posted at http://ilabs.washington.edu/meltzoff/pdf/77Meltzoff_Moore_Science.pdf].

possible grammars and select one that is not definitely rejected by the data available to him. What faces the language learner, under these assumptions, is not the impossible task of inventing a highly abstract and intricately structured theory on the basis of degenerate data, but rather the much more manageable task of determining whether these data belong to one or another of a fairly restricted set of potential languages.

5. Inductivism

Chomsky's view is near one pole of an intellectual continuum at whose other extreme are scholars with a strongly inductivist point of view. In this alternative, what makes the child capable of the feat of language acquisition is her possession of formidable techniques of inductive learning—that is, grasping the pattern through intensive processing of the learning data available.

Bruce Derwing of the University of Alberta wrote:[100]

> An alternative model of language acquisition ought to be developed on the assumption that the human organism is initially completely *un*-informed both as to the essential nature of language and as to the best way to learn a language. My initial assumption is that no other 'special mechanisms' or 'secret abilities' are required for learning *language* than for learning anything else. In short, I shall assume that language acquisition can be fully accounted for in terms of such known (i.e. empirically established) capacities as the ability of the human organism to discriminate among and generalize from the sense-data to which he is exposed and most importantly (since this capacity seems to be species-specific), to extract regularity—or induce a latent structure—from his experience.

Observe that Derwing is *not* opposed to innate abilities, but emphasizes that they are abilities to learn (not pre-formed knowledge); and he wants these abilities to not be specifically linguistic.

6. The learning of ill-formedness: two viewpoints

6.1 Learning well-formedness using innate knowledge

The most obvious cases here are straightforward linguistic universals. People wouldn't need to learn (somehow) that Coordinate Structure Constraint violations are ungrammatical if the Coordinate Structure Constraint (or, one might hope, something from which the Coordinate Structure Constraint follows as a consequence) is innate. This would also be the reason why the Coordinate Structure Constraint is universal.

More subtly, we can imagine how innate knowledge could permit English speakers to know that violations of the Complex NP Constraint are ungrammatical, while speakers of Swedish and Norwegian know that they are acceptable in their own languages. The idea is that the Complex NP Constraint (or again, something more abstract from which it follows) is innate, but in a form that would permit "data override": if you actually hear data that tell you the constraint is violable in your language, you override your innate knowledge. This would be the case for Swedish and

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[100] *Transformational Grammar as a Theory of Language Acquisition* (1973). Cambridge: Cambridge University Press, pp. 200-201.

Norwegian children, who presumably hear a number of sentences violating this constraint during their childhoods. Children in English-speaking environments never hear the data that would justify an override, so they never push aside the innate pattern.

6.2   *Learning ill-formedness inductively without negative evidence*

Although the learning of ill-formedness without negative evidence has been sometimes presented as an insuperable difficulty to inductive approaches, in fact inductivism is not entirely helpless in such cases. One strategy commonly proposed is to collect a lot of data, then compute some form of this statistic: **observed/expected** — that is, the number of observed instances of a structure, divided by some kind of estimate of how many instances one *should* observe, on the basis of other data.

For Complex NP Constraint violations, the observed/expected strategy might be something like this (I'm quoting the hypothetical unconscious inner monologue of the language-learning child):

- "Thus far in my experience I have heard 4,947 **complex NPs**, that is to say, in 10% of all sentences.
- "I have also noticed 6,823 **gaps**, created by rules such as Wh- Movement and Topicalization," in 30% of all sentences.
- "Thus, by multiplying, I estimate that 3% of the ambient sentences should have occurred with a gap inside a complex NP. This would be about 600 sentences."
- "But in fact, not a single gap has yet occurred inside a complex NP."
- "I therefore infer there is something wrong about extracting constituents from inside complex NPs".

The math exists that can make such inferences in a rigorous way, and is studied by statisticians.

Is this scenario a fantasy? It has in fact been applied to simpler data, in phonology, with fairly good results. Moreover, there is evidence that people can keep track of such statistics in syntax: psycholinguistic studies of how people understand sentences indicate that people's guesses about where in the tree a new word should go are guided by the *statistics of subcategorization*: their first guesses are those that match the most frequent subcategorization frame of the last syntactic head they heard. Thus (to use an example from earlier), the guess for the structure of *Fred ran up a big...* will depend on the relative frequency in real life with which *run* is followed by a particle (thus *ran up a big bill*) vs. a prepositional phrase (thus *ran up a big hill*).[101]

The apparent ability of people to count the statistics of subcategorization frames is particularly relevant because these frames have been put forth as a negative evidence problem.[102] If a child learns a wrong subcategorization, nothing in the ambient data will tell her it is wrong. Yet in fact,

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[101] For a general review of this and related literature, see
http://lcnl.wisc.edu/people/marks/pubs/SeidenbergMacDonald.1999.CogSci.pdf

[102] For instance, by C. L. Baker (1979) in "Syntactic Theory and the Projection Problem," *Linguistic Inquiry* 10.4.

children rather frequently make subcategorization errors—and ultimately, of course, recover from them. Here are a couple of examples:

"I filled the salt into the bear."[103]
"She came it over there"   (Meaning: "She made it come over there", a causative)

The first sentence indicates a wrong subcategorization for *fill* (probably acquired by wrongly generalizing from *put* and other verbs), which almost certainly was corrected prior to adulthood—mostly likely by gradually noticing that no occurrences of *fill* uttered by qualified individuals used this frame; the observed number of [___ NP PP] cases (probably zero) was smaller than the child's expected value, and ultimately led her to abandon this frame. The same reasoning would hold for the second example.

In general, I would judge that inductivism has made a modest comeback in linguistics in recent years, primarily due to experimental findings suggesting that people are very good at inductive learning.

Inductivism nevertheless faces a huge and still largely unanswered challenge. A statistic like *observed/expected* requires you to have, in effect, a set of "bins" into which you sort your linguistic experience, so as to be able to compute these values. A complex NP is a nontrivially complicated structure to describe—might there be a large variety of equally complex structures that also have to have their statistics monitored. Even for subcategorization, there is a danger of irrelevant bins: one hardly wants to waste counting how many sentences with an even number of words a verb has occurred in, and similarly for other utterly pointless contexts. Inductivism must either rely on innate knowledge to know what bins experience is sorted into, or find some way, not yet established, to get them "for free".

6.3 Universals

Lastly, a purely inductivist approach to language offers no account of true linguistic universals, if such exist—in inductivism, a language violating the Coordinate Structure Constraint would be learnable.[104] Innatist approaches offer a quick and cheap explanation of universals; they're true because languages are spoken by people, who being biologically arranged the way they are, have no choice but to obey them.

7. Innateness and biology

Turning, then, to the issue of the biology of human language, it's important to note that the view that people are biologically equipped for language in a special way unique to our species is not entirely tied to the idea of innate linguistic knowledge. In particular, we could be highly

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[103] Bowerman, M. (1982). Evaluating competing linguistic models with language acquisition data: Implications of developmental errors with causative verbs. *Quaderni di Semantica*, 3, 5-66.

[104] There is of course a temptation to do an experiment: have a team of skilled and charismatic research assistants spend a great deal of time in a day care center uttering Coordinate Structure Constraint violations, and see if the children who attend it develop a "universal-violating" grammar. It's not clear what the Human Subjects Protection Committee would think of this one...

adapted to *learning* and *use* of language, but not possess any innate knowledge of the *content* of language per se. At this level, the view the people are specialized for language is rather less controversial, though again it is hardly agreed upon universally.

A common way to make a case in this area is to compare language with other abilities (of various species) that plainly are part of their biological endowment.

7.1 Irrelevance of deliberate training

Achievement of fluency in language does not seem to depend on training (compare, for instance, playing the piano, or studying math). Most children become fluent speakers on their own, on schedule, by their own more or less automatic efforts. This is similar to the process of learning to walk, likewise documented to occur spontaneously, follows a standard time course, and (by experiment) has been shown not to be particularly aided by instruction.

7.2 Critical period

Language appears to involve a **critical period**, that is, a span of time after which complete acquisition of the skill becomes difficult or impossible. The critical period is widely documented for language; we see it (anecdotally) in families of immigrants, where the youngest members usually become the best speakers of the new language, despite equal exposure for all.

Vision in cats is apparently a similar ability: kittens who have one eye temporarily closed when young fail to "wire up" their neural circuitry for that eye, and do not make up the deficit later. Experimentation (cortical probes) indicates that the circuitry does not grow in. "Accidental experiments" on humans (surgery on congenital cataracts, misguidedly delayed to lessen risk) show that same is probably true for us.[105]

Some forms of birdsong reflect a critical period; young birds reared away from their species fail to acquire the song upon being returned to their original habitat.[106]

There's clearly a range of opinion, some of it impassioned, on whether such experiments on kittens and birds should be done. A much greater consensus exists that they should not be performed on young humans. However, cases of lunatic or criminal behavior by parents have occasionally created such experiments. "Genie," studied in the 1970's by my colleague Susan Curtiss,[107] was forced by a psychopathic father to spend the first thirteen years of her life strapped into a baby chair, with little human contact and no linguistic input. When she was rescued and released into a more normal environment, her linguistic development was slow and difficult. Although she acquired a fair amount of vocabulary, she was unable to acquire the syntactic rules of English. When Genie was last studied, around age 20, she still was essentially not a speaker of English. Prof. Curtiss contends that she was unable to acquire language fully because she began the task after the end of the critical period.

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[105] For details on this work see http://neuro.med.harvard.edu/site/dh/b50.htm (David Hubel).

[106] See http://www.neuro.duke.edu/faculty/mooney/.

[107] *Genie: A Psycholinguistic Study of a Modern-Day "Wild Child"* (1977) Academic Press.

The psychologist Steven Pinker has conjectured that critical periods occur when the members of the species learn the skill when young; the neural apparatus for learning is programmed to atrophy at the end of the critical period, to avoid metabolic waste.

7.3 *Genetic defects of language*

It is by now fairly well established that the syndrome called Specific Language Impairment, which is marked by inferior ability to use language (but normal intelligence), has at least some genetic component; indeed, investigators have located families in which multiple members suffer from the syndrome, and at least one specific gene has been located that is implicated in Specific Language Impairment. The relevance of all this is called into question, however, by some scholars, who note the possibility that the impairment may involve some fairly "low-level" defect of phonetic process that could be the cause of the higher-level language difficulties.

8. Language and evolution

Certainly, if it is true that humans are biologically specialized for language it would be reasonable to attribute this to natural selection, the source of all adaptive specializations in species. Steven Pinker and Paul Bloom (1990)[108] offer reasons why an innate ability for language would have conferred a selectional advantage on our distant ancestors and thus shaped their evolution.

Pinker and Bloom endorse in passing a theory due to the phonetician Philip Lieberman that our vocal tracts (mouth, throat, larynx) were evolutionarily shaped to permit speech. Lieberman's idea is that in evolving a long, arched vocal tract, we slightly increased our risk of choking to death while swallowing (the food and air paths cross in our elongated pharynxes). The evolutionary payoff, Lieberman claims, was highly intelligible speech. His theory remains controversial among paleontologists.[109]

9. Conclusion

I hope to have shown the study grammar does tie into broader issues. The link arises from grammar's scope, intricacy, and difficulty, leading to the hypothesis that children learn it with the aid of innate mechanisms. This innateness hypothesis collides with the rival point of view that language can be learned with highly virtuosic inductive mechanisms (which themselves may or may not be innate, or specifically linguistic). Innate mechanisms of any sort assume that language is a biological specialization of humans, a claim supported by the existence of a critical period, specific language impairment, and other evidence. Lastly, such mechanisms have led scholars to try to speculate in as informed a way as they can about the evolution of language.

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[108] From the journal *Behavioral and Brain Sciences*; on line at http://www.bbsonline.org/documents/a/00/00/04/99/.

[109] P. Lieberman and E. S. Crelin (1971) "On the speech of Neanderthal man," *Linguistic Inquiry* 2:203-22.

Chapter 8: Review of Morphology and Syntax

1. Summary: grammar fragment

This is as far as we're going to get concerning the syntactic analysis of English. It may be useful at this point to summarize the rules and constraints as we developed them.

Our grammar has:

- an overall **architecture** (see p. 158), providing for the following:

- a set of **phrase structure rules** (final version given above in (129))

- a **lexicon**, with words bearing subcategorizations, and a principle of lexical insertion

- a set of **word formation rules** (Chapter 2) that can be used to expand the inventory of words in the lexicon

- A set of **transformations**:
  - ➢ Tag Question Formation
  - ➢ Subject/Aux Inversion
  - ➢ Wh-Movement
  - ➢ Topicalization
  - ➢ It-Clefting

- Further transformations that form **morphosyntactic representations**:
  - ➢ Genitive Case Marking
  - ➢ Verbal Agreement

- A set of three **island constraints**
  - ➢ Coordinate Structure Constraint
  - ➢ Complex NP Constraint
  - ➢ Wh- Island Constraint

- A postsyntactic module of **inflectional morphology**, including rules of
  - ➢ Spell-Out (for contractions)
  - ➢ Genitive Inflection (adding - *'s*)

This grammar suffices to cover a fragment of English. As mentioned earlier, a full grammar of English would be vast—and not all the data have even been gathered yet.

The rest of this chapter consists of study exercises; these hopefully will be helpful if your teacher puts a midterm exam in the middle of the course. Answers will be found at the end of the chapter. These exercises cover everything up to, but not including, the unbounded transformations and island constraints.

2. Morphology: Areas and affiliated skills

- **Word formation**:

  - ➢ Writing word formation rules, which specify the base, what change in meaning and (perhaps) part of speech is involved.
  - ➢ Constructing iterated derivations, generally "inside out".

- **Inflectional morphology**

  - ➢ Finding morphemes and arranging them in position classes
  - ➢ Writing inflectional rules, specifying the relevant features of the morphosyntactic representation
  - ➢ Ordering the rules correctly to obtain the right affix order

- The **phonological form** of inflection and word formation

  - ➢ What change in the string of sounds is used to realize the word formation or inflectional process?

_____

Study Exercise #37: Persian verbal inflection

Positive present indicative

mixaram	'I buy'	mixarim	'we buy'
mixari	'you-sing. buy'	mixarid	'you-plur. buy'
mixarad	'he/she buys'	mixarand	'they buy'

Negative present indicative

nemixaram	'I do not buy'	nemixarim	'we do not buy'
nemixari	'you do not buy'	nemixarid	'you-plur. do not buy'
nemixarad	'he/she does not buy'	nemixarand	'they do not buy'

Positive past indicative

xaridam	'I bought'	xaridim	'we bought'
xaridi	'you-sing. bought'	xaridid	'you-plur. bought'
xarid	'he/she bought'	xaridand	'they bought'

Negative past indicative

naxaridam	'I did not buy'	naxaridim	'we did not buy'
naxaridi	'you-sing. did not buy'	naxaridid	'you-plur. did not buy'
naxarid	'he/she did not buy'	naxaridand	'they did not buy'

Positive subjunctive

bexaram	'that I buy'	bexarim	'that we buy'
bexari	'that you-sing. buy'	bexarid	'that you-plur. buy'
bexarad	'that he/she buys'	bexarand	'that they buy'

Negative subjunctive

naxaram	'that I not buy'	naxarim	'that we not buy'
naxari	'that you-sing. not buy'	naxarid	'that you-plur. not buy'
naxarad	'that he/she not buy'	naxarand	'that they not buy'

a. Find and gloss the morphemes
b. Arrange the morphemes into five position classes.
c. Make a set of inflectional rules to derive all these forms. You may assume these features:
    [Polarity: positive, negative]
    [Mood:indicative, subjunctive]
    [Tense: past, present]
    [Person: 1, 2, 3]
    [Number: Singular, Plural]
d. Show that your rules work by deriving all six third singular forms.
e. Which orderings of the rules are needed?

Answer to Study Exercise #37, Persian Verbal Inflection

a. Morphemes:

ne-, na-   negative
mi-   present
be-   imperative
xar   'buy'
-id   past
-am   first person singular
-i   second person singular
-ad, -∅   third person singular
-im   first person plural
-id   second person plural
-and   third person plural

b. There are five slots.

Negative	Misc.	Stem	Tense	Agreement
ne-	mi-	xar	-id	-am
na-	be-			-i
				-ad/-∅
				-im
				-id
				-and

c. Rules, in order

Miscellaneous Rule

Prefix   be-   when   [Mood:Subjunctive, Polarity:Positive]
          mi-   when   [Mood:Indicative, Tense:Present]

Negative Rule

Prefix   ne-   when   [Polarity:Negative, Tense:Present]
          na-   all other [Polarity:Negative]

Tense Rule
Suffix   -id   when   [Tense:Past]

Agreement Rule
Suffix   -am   when   [Person: 1, Number:Singular]
          -i   when   [Person: 2, Number:Singular]
          -∅   when   [Person: 3, Number:Singular, Tense:Past]
          -ad   all other [Person: 3, Number:Singular]
          -im   when   [Person: 1, Number:Plural]
          -id   when   [Person: 2, Number:Plural]

-and   when   [Person: 3, Number:Plural]

d. Deriving "(s)he buys":

xar	[① Tense:Present, ②Polarity:Positive, ③Mood:Indicative, ④Person:3, ⑤Number:Singular]
mixar	Misc.: ③, ①
—	Negative rule
—	Tense Rule
mixarad	Agreement Rule (①, ④, ⑤)

Deriving "(s)he does not buy":

xar	[① Tense:Present, ②Polarity:Negative, ③Mood:Indicative, ④Person:3, ⑤Number:Singular]
mixar	Misc. Rule (③, ①)
nemixar	Negative rule (①, ②)
—	Tense Rule
nemixarad	Agreement Rule (①, ④, ⑤)

Deriving "(s)he bought":

xar	[① Tense:Past, ②Polarity:Positive, ③Mood:Indicative, ④Person:3, ⑤Number:Singular]
—	Misc. Rule
—	Negative Rule
xarid	Tense Rule (①)
—	Agreement Rule

Deriving "(s)he did not not buy":

xar	[① Tense:Past, ②Polarity:Negative, ③Mood:Indicative, ④Person:3, ⑤Number:Singular]
—	Misc. Rule
naxar	Negative Rule (①, ②)
naxarid	Tense Rule (①)
—	Agreement Rule

Deriving "that (s)he buy":

xar	[① Polarity:Positive, ②Mood:Subjunctive, ③Person:3, ④Number:Singular]
bexar	Misc. Rule (①, ②)
—	Negative Rule
—	Tense Rule
bexarad	Agreement Rule

Deriving "that (s)he not buy":

xar	[① Polarity:Negative, ②Mood:Subjunctive, ③Person:3, ④Number:Singular]
—	Misc. Rule
naxar	Negative Rule (①)
—	Tense Rule
bexarad	Agreement Rule (③, ④)

e. Ordering:

   The prefix rules must apply in the order shown, else would get *mi-ne- rather than the correct form ne-mi-.

   The suffix rules must apply in the order shown, else we would get (for first singular forms) *-am-id, rather than the correct -id-am.

_____

Study Exercise #38: English word formation with *-ness*

   full   fullness
   squeamish   squeamishness
   lurid   luridness
   profound   profoundness

   Write a word formation rule in the format of Chapter 2.

Answer to Study Exercise #38, English Word Formation

$[X]_{Adj} \rightarrow [[X]_{Adj}$ ness $]_{Noun}$

Meaning: "the quality of being Adjective"

_____

Study Exercise #39: Compounding in English

Use this rule, taken from Chapter 2:

English Compound Formation (word formation rule)

$[X_1]_{Noun} + [X_2]_{Noun} \rightarrow [[X]_{Noun} [X]_{Noun}]_{Noun}$
Meaning: "an X_2 that has something to do with X_1."

to derive

a. *tigerbird*
b. *law degree requirements* (watch for inflection)
c. *eggplant plant*

Answer to Study Exercise #39, Compounding

a. *tigerbird:*

Given the existence of [tiger]_{Noun} and [bird]_{Noun}, we obtain [[tiger]_{Noun} [bird] _{Noun}]_{Noun}, which means "a bird having something to do with tigers"

b. *law degree requirements:*

Step 1: Given the existence of [law]_{Noun} and [degree]_{Noun}, we obtain
[[law]_{Noun} [degree] _{Noun}]_{Noun}, which means "a degree having something to do with the law", in this case "degree awarded for the study of law"

Step 2: Given the existence of [[law]_{Noun} [degree] _{Noun}]_{Noun} and [requirement]_{Noun}, we obtain [[[[law]_{Noun} [degree] _{Noun}]_{Noun}]_{Noun} [requirement] _{Noun}]_{Noun}, which means "a requirement have to do with a law degree", in this case "requirements needed to obtain a law degree"

Step 3: a rule of inflection morphology gives us the plural *law degree requirements.*

c. *eggplant plant*

Step 1: Given the existence of [egg]_{Noun} and [plant]_{Noun}, we obtain
[[egg]_{Noun} [plant] _{Noun}]_{Noun}, which means "a plant having something to do with eggs." In this case, the "having something to do with" is, "shaped like", so we get the familiar vegetable.

Step 2: Given the existence of [[egg]_{Noun} [plant] _{Noun}]_{Noun} and [plant]_{Noun}, we obtain [[[egg]_{Noun} [plant] _{Noun}]_{Noun} [plant]_{Noun}]_{Noun} which means "a plant having something to do with eggplants." In this case, the "having something to do with" is, premably, "suited for the manufacture of"; i.e. a hypothetical future factory capable of manufacturing eggplants.

Study Exercise #40: Hungarian word formation

Phonetic symbols: [ɔ] = "aw", with lip rounding; [ɲ] is rather like "ny"; [ː] marks a long vowel, [ˈ] goes before the stressed syllable; [ø] is like German "ö" or French "eu".

ˈaːll	'stand'	ˈaːllvaːɲ	'stand, scaffolding'
ˈigɔzol	'justify'	ˈigɔzolvaːɲ	'certificate'
kiɔd	'publish'	ˈkiɔdvaːɲ	'publication'
ˈmutɔt	'show'	ˈmutɔtvaːɲ	'specimen, spectacle'

with a different vowel; ignore the vowel issue for now.

køt	'tie'	køtveːɲ	'bond, security'
keːr	'ask for'	kérveːɲ	'questionnaire'

Write a rule of word formation. The hardest part is specifying the meaning.

Answer to Study Exercise #40, Hungarian Word Formation

[X]ᵥₑᵣᵦ → [[X]ᵥₑᵣᵦ vaːɲ]ₙₒᵤₙ

Meaning: "the result or instrument of Verbing"
-veːɲ is due to phonology, a rule of Vowel Harmony

Study Exercise #41: English word formation

a. Write a rule of word formation that can derive the italicized items.

a merry *chase*
a fifty-foot *drop*
The canoeists found that between Racquette Lake and Forked Lake was not a difficult *carry*.
He reached the water fountain and took a good long *drink*.

b. Write a rule of word formation that can derive the items in the right column.

kitchen   *kitchenette*
pipe   *pipette*[110]
rose   *rosette*
statue   *statuette*

---

[110] This example works just fine in the spoken domain (*pipe* = [paɪp], *pipette* = [paɪpɛt]), but in the written domain we have to assume a spelling rule. It's pretty general in English that final letter *e* is dropped before a vowel-initial suffix, as in *ride ~ riding*, *dispense ~ dispensation*, and so on. Prior to the application of this spelling rule, *pipette* is *pipe+ette*.

Answer to Study Exercise #41, English Word Formation

a. [X]_{Verb} → [[X]_{Verb}]_{Noun}

Meaning: "an instance of Verbing"

b. [X]_{Noun} → [[X ette]_{Noun}]_{Noun}

Meaning: "a little Noun or thing having to do with Noun"

Study Exercise #42: Luiseño Inflection(S. California)

Write morphological rules to cover inflection. You will have to make up your own morphosyntactic representations.

Hint: think about whether a noun is something you could ever lose, and make up a feature to describe this.

ʔuˈmaːkinaki	'your car'	ʔuˈmaːtʃa	'your back'
nuˈmaːkinaki	'my car'	nuˈmaːtʃa	'my back'
ʔuˈpaːnki	'your bread'	ʔuˈkaːmi	'your son'
puˈpaːnki	'his bread'	puˈkaːmi	'his son'
nuxarˈdiːnki	'my garden'	nuˈnaʔ	'my father'
puxarˈdiːnki	'his garden'	ʔuˈnaʔ	'your father'
nuˈnoːtki	'my boss'		
ʔuṣˈŋaːki	'your wife'[111]		

---

[111] To these may be added the somewhat startling *nuˈpeʃli* 'my dish', *puˈpeʃli* 'her dish'; grammar has an arbitrary side…

Answer to Study Exercise #42, Luiseño

The data illustrate the concept of **inalienability**, an inflectional category in many languages. A thing is inalienably possessed if you could never truly be rid of it: your relatives, the parts of the body.

Two rules are needed, which could apply in either order:

Person-Number Marking

X → nu X   where morphsyntactic representation contains [Number:Sing, Pers:1]
X → ʔu X   where morphsyntactic representation contains [Number:Sing, Pers:2]
X → pu X   where morphsyntactic representation contains [Number:Sing, Pers:3]

Inalienability Marking

X → X ki   where morphosyntactic representation contains [Alienable:True]

_____

3. Study Exercise #43: Applying Word Formation Rules in Order

Find two meanings for *overfillable* and provide derivations for both.

Answer to Study Exercise #43, Applying Rules of Word Formation in Order

fill   root
fillable   [X]$_{Verb}$ → [[X]$_{Verb}$ able]$_{Adj}$ Meaning: 'able to be Verbed'
overfillable   [X]$_{Adj}$ → [over [X]$_{Adj}$]$_{Adj}$ Meaning: 'excessively A'

'too fillable'; said perhaps of a conveniently wide-brimmed whiskey flask belonging to a heavy drinker. "Alas for Smith, the flask proved overfillable, and he filled it again and again."

compare: *dreamable*, *drinkable*; *overeager*, *overproud*

fill   root
overfill   [X]$_{Verb}$ → [over [X]$_{Verb}$]$_{Verb}$ Meaning: 'Verb too much'
overfillable   [X]$_{Verb}$ → [[X]$_{Verb}$ able]$_{Adj}$ Meaning: 'able to be Verbed'

'liable to be overfilled'; said perhaps of a car engine that admits a dangerous excess of motor oil because the dipstick gives an inaccurate reading: "my car engine is just way too overfillable"

compare: *overeat*, *overdress*; (same examples for -*able*)

---

4. **Study Exercise #44: Chamorro Infixation**

Formalize this rule of word formation using the symbols V, C, and numeral subscripts. State in words what your rule does. [ʔ] is a "glottal stop", a kind of consonant. It can be identified as the little silence created by closing the vocal cords, heard in the middle of "uh-oh".

liʔiʔ   'to see'   l5iniʔiʔ   '(the) thing seen'
hatsa   'to lift'   hinatsa   '(the) thing lifted'
saŋan   'to tell'   sinaŋan   '(the) thing told'
hasu   'to think'   hinasu   'thought'
faisin   'to ask'   finaisin   'question'

Answer to Study Exercise #44, Chamorro Infixation

Assumed to be word formation.

[C X]$_{Verb}$ → [[C in X]$_{Verb}$]$_{Noun}$ Meaning: "thing that is Verbed"
  1 2   1   2

In other words, "count off the first consonant, and place *-in-* right after it."

Study Exercise #45: Yucatec Reduplication

Symbols:

t͡ʃ as in *chur**ch***

t͡s like *Betsy* but is just one sound, not two
k' is k with extra oral pressure ("ejective"), and similarly for other sounds.
j is IPA for y
ʔ is glottal stop, heard in the middle of *uh-oh*.

sak	'white'	sasak	'very white'
t͡ʃit͡ʃ	'hard'	t͡ʃit͡ʃit͡ʃ	'very hard'
t͡ʃak	'red'	t͡ʃat͡ʃak	'very red'
k'as	'bad'	k'ak'as	'very bad'
nat͡s'	'near'	nanat͡s'	'very near'
haj	'thin'	hahaj	'very thin'
nat͡ʃ	'far'	nanat͡ʃ	'very far'
sis	'cool'	sisis	'very cool'
suʔut͡s'	'sour'	suʔusuʔut͡s'	'very sour'
jaʔab	'many'	jaʔajaʔab	'very many'

Answer to Study Exercise #45, Yucatec Reduplication

Assumed to be word formation.

[X C]$_{Adj}$ → [[X X C]$_{Adj}$]$_{Adj}$ Meaning: "very Adjective"
  1 2   1 1 2

in other words: "copy all but the last consonant, and put the copy before the original."

Study Exercise #46: Obligatory Expression

In

My cat jumped.

specify two cases of obligatory expression (inflectional system of English forces you to communicate particular information)

Answer to Study Exercise #46, Obligatory Expression

Cat is singular—the sentence means specifically one cat. This is because English nouns must appear with either [Number:Singular] or [Number:Plural] in their morphosyntactic representations.

Jumped is past tense; tense must be marked in the morphosyntactic representation of the main verb of a sentence.

Study Exercise #47: Organization of the grammar: morphology

In the view of some linguists, the following is not only an impossible word of English, but violates a fundamental principle of grammar. Explain.

*personsology   'the study of collections of more than one person'

Answer on next page.

Study Exercise #48: Normative grammar

Briefly describe a matched-guise experiment.

Answer to Study Exercise #47, Organization of the Grammar: Morphology

In *personsology*, a suffix for word formation, *-ology*, has been added "outside" of (hence, "after") an inflectional suffix. If word formation precedes lexical insertion and inflection follows it, this should not be possible

Answer to Study Exercise #48, Normative Grammar

The core of a matched guise experiment is to have a bilingual or bidialectal person say essentially the same thing in both of the language varieties she speaks, and then have experimental subjects rate both voices for various traits—honesty, intelligence, friendliness, etc.—without knowing that the "two" speakers are actually one. The idea is to get a controlled evaluation of what people think about the varieties as such.

5. Syntax: Some skills

- Parsing sentences, particularly knowing where to attach modifiers.
- Using phrase structures to check if your structure is "compliant".
- Establishing the phrase structure rules needed for new languages.
  - ➤ Method: parse the sentences first, based on meaning, then make a short, clean set of rules using ( ) and ( )*.
- Applying various transformations, given in the text.
- Determining the deep structure, given the surface structure, so you can give a whole derivation.
- Show how the various island constraints rule out sentences.
- Demonstrate that a movement transformation applied unboundedly.
- Demonstrate that a transformation obeys a particular island constraint.

Study Exercise #49: Syntax: parsing

English phrase structure rules:

S $\rightarrow$ NP (Aux) VP

NP $\rightarrow$ $\left(\begin{Bmatrix} \text{Art} \\ \text{NP} \end{Bmatrix}\right)$ (AP)* N (PP)*(CP)

NP $\rightarrow$ Pronoun

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

VP $\rightarrow$ V AP

PP $\rightarrow$ P NP

$\bar{\text{S}}$ $\rightarrow$ (Comp) S

NP $\rightarrow$ NP (Conj NP)*

VP $\rightarrow$ VP (Conj VP)*

PP $\rightarrow$ PP (Conj PP)*

S $\rightarrow$ S (Conj S)*

CP $\rightarrow$ $\bar{\text{S}}$ (Conj CP)*

V $\rightarrow$ V (Conj V)*

Parse:

a. His brother and his wife's book's excessive length meant that it would cost a lot.
b. They awarded the key to the city (explicate both meanings)

Answer to Study Exercise #49, Syntax: Parsing

a. Note that since the inflectional suffix *-'s* is added by rules of morphology, it is not placed in the deep structure tree. See below for how it is added.
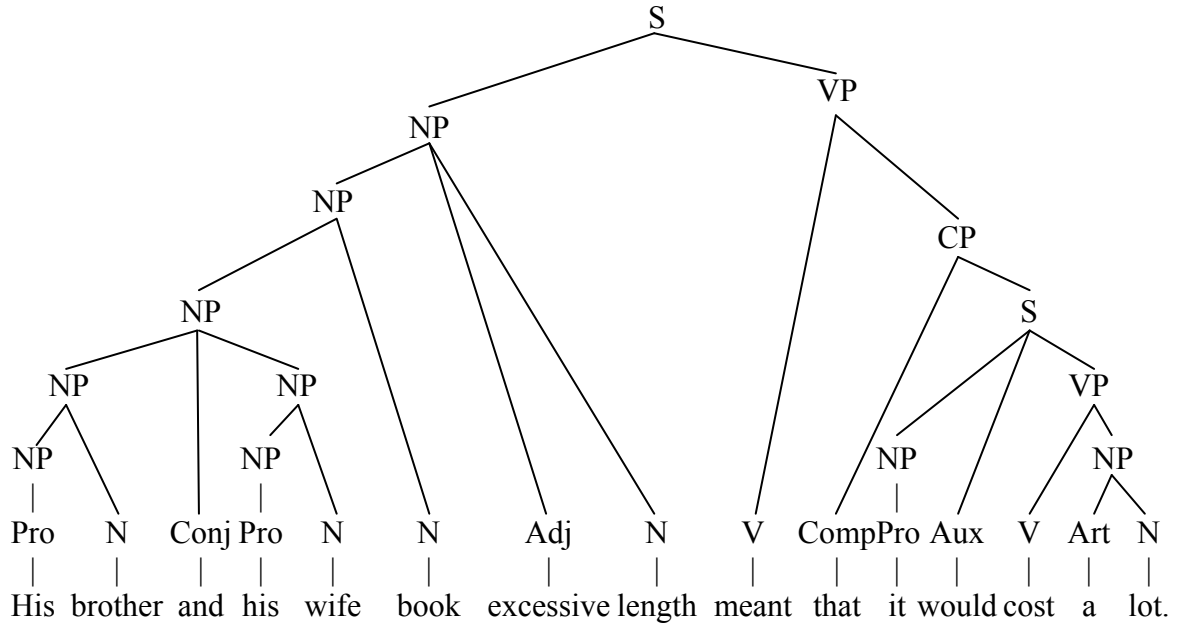
For the -'s, see a later exercise in this section.

b.
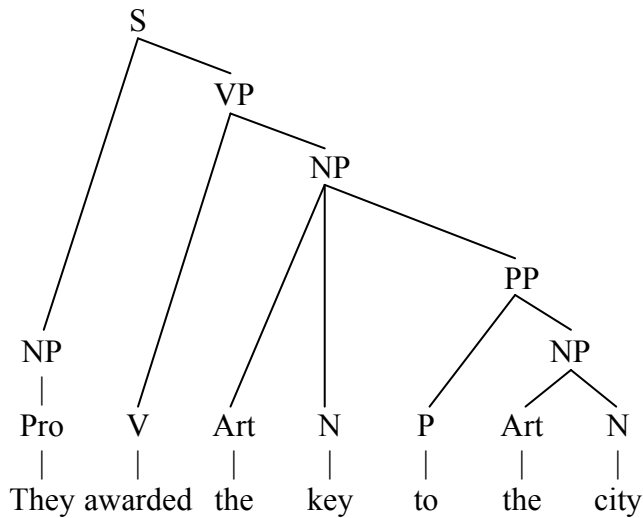
This is the meaning, "They awarded the key to the city (to someone, as an honor)." *To the city* specifies what kind of key.

```
                            S
                           / \
                          /   VP
                         /   /|\
                        /   / | \
                       /   /  |  \
                      /   /   |   PP
                     /   /    |  / \
                    /   /     | /   \
                   /   /      |/     NP
                  NP  /      NP     / \
                  |  /      / \    /   \
                 Pro V    Art  N  P   Art   N
                  |  |     |   |  |    |    |
                They awarded the key to  the  city
```
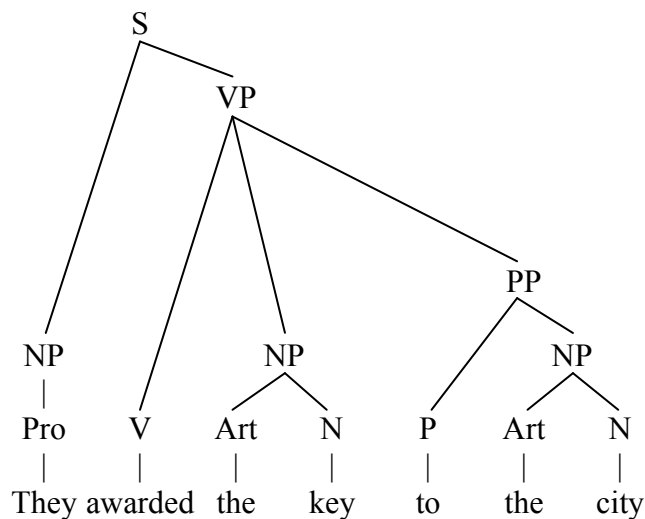
This is the meaning, "The city was award the key (perhaps an important historical artifact for the municipal museum." *To the city* specifies what kind of act of awarding.

Study Exercise #50: Constituency Testing with It Clefting

A. As noted earlier, It-Clefting can be used to show what is an NP or PP, since it "targets" these phrases; that is, it is a potential constituency test. Use this test to justify the constituency of the two meanings of the sentence (b) in Study Exercise #49.

B. Use the It-Clefting constituency test to determine if the underlined sequences of words are constituents.

    a. I put <u>the key under the mat</u>.
    b. I own <u>the key under the mat</u>.

Answer to Study Exercise #50, Syntax: Constituency Testing

Part A. In the first reading, *the key to the city* is held to be an NP; that is a constituent. It-Clefting can only apply to constituents. When we cleft *the key to the city*:

It was [the key to the city]_{NP} that they awarded ___ .
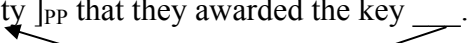
we only get the reading where *to the city* specifies which key.

In the second reading, *the key* and *to the city* are separate constituents, and they can each be It-Clefted on their own:

It was [the key]_{NP} that they awarded ___ to the city.

It was [to the city]_{PP} that they awarded the key ___ .

However, in each case, Clefting *removes the ambiguity*. It can only affect constituents; so it reveals the constituent structure of the basic sentence for each of the two meanings.

Part B.

a. I put <u>the key under the mat</u>.

*It was the key under the mat I put.

So, *the key under the mat* is not a constituent. (It's actually an NP followed by a separate PP.)

b. I own <u>the key under the mat</u>.

It is the key under the mat that I own.

So, *the key under the mat* is a constituent. (*under the mat* is part of this NP, modifying *key*)

Study Exercise #51: Case Marking

Apply the case marking rule below to the structure you gave for sentence (a) in Study Exercise #49 above.

English Genitive Case Marking

In the configuration shown:

```
           NP₁
          /    \
      NP₂        ...
```
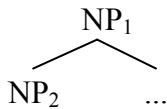
assign the feature [Case:Genitive] to the morphosyntactic representation of the rightmost word in NP₂.

You may assume that when the sentence is turned over to the component of inflectional morphology, the following morphological rule applies:

Genitive Realization

Suffix - *'s* when the morphosyntactic representation contains [Case:Genitive].

Answer to Study Exercise #51, Syntax: Case Marking

I'll show just the relevant NP. Items referred to in the rule are shown in boldface. We are looking for:

```
        NP₁
       /  \
     NP₂   ...
```
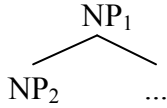
and are putting the feature [Case:Genitive] on the rightmost word of NP₂. Here is one application:

```
                                    NP₁
                            NP₂
                        NP
                  NP          NP
                NP          NP
                |           |
               Pro    N   Conj Pro    N      N       Adj      N
                |     |    |    |      |      |        |       |
               His brother and  his  wife   book  excessive length
                                             [Case:Gen]
```
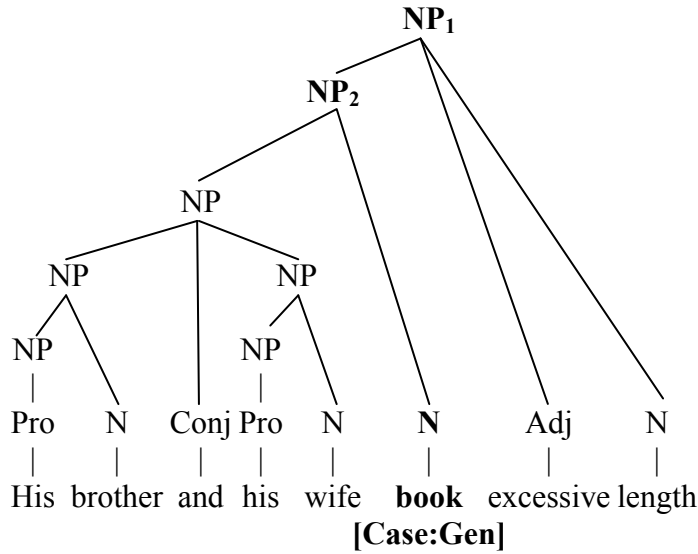
Here is the other application:

```
                                    NP
                            NP₁
                     NP₂
                 NP          NP
                NP          NP
                |           |
               Pro    N   Conj Pro    N      N      Adj    N
                |     |    |    |      |      |       |     |
               His brother and  his  wife   book excessive length
                              [Case:Gen][Case:Gen]
```
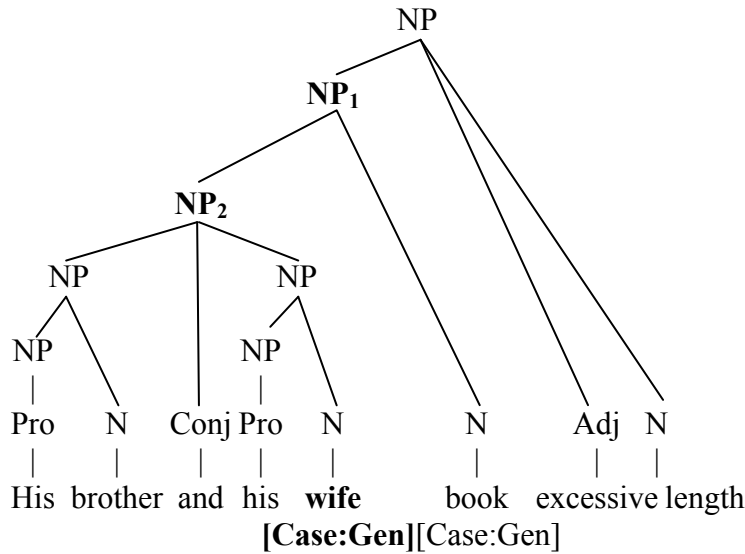
These are realized later in the morphology as *wife's* and *book's*.

Study Exercise #52: Subcategorization

    I.

    Provide and justify subcategorization frames for:

    a. opinion
    b. transform (as a verb)
    c. expire

    II.

    a. Explain why the grammar in this book would not generate these sentences:

    *We took.
    *We own.

    b. Suppose for the moment that we had a grammar that *did* generate these sentences. Would this be a case of overgeneration or ungeneration?

Answer to Study Exercise #52, Subcategorization

I.

a. opinion

[___ (CP)] and [___ (PP)]
Bill's opinion
Bill's opinion of Fred
Bill's opinion that Fred will win.

b. transform (as a verb)
[___ NP (PP)] and [___ PP]
*Fred transformed.
Fred transformed the field.
Fred transformed the apple into a pear.
Fred transformed into a dwarf.

c. expire

[___]

Time expired.
*Time expired the men.
*Time expired to (or: of, above) the men.

II.

a. *We took* is bad because *take* subcategorizes for an obligatory NP object. Its frame is:

[___ NP]

The grammar won't generate *We took* because *take* cannot be inserted into the relevant tree, which is:

```
            S
          /   \
        NP     VP
        |      |
       Pro     V
        |      |
        we    ___
```
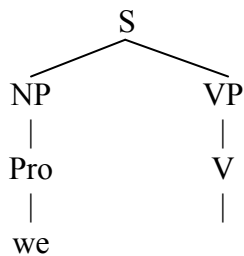
The explanation for *We own* is identical.

If the grammar did generate *We took*, *We own*, it would be overgeneration: outputting examples that are ungrammatical.

Study Exercise #53: Syntax: Writing your own phrase structure rules

The following data are from a problem set book by Jeannette Witucki. It's a pretty good book (sadly, never formally published), but you should remember that Witucki isn't necessarily teaching exactly the same syntactic theory as me, and not all the loose ends will necessarily get tied up here.

The language here is Sango, a creole[112] language spoken in the Central African Republic. The word-by-word glosses are by me, guessing as best as I could from the sentence glosses, which are Witucki's.

1.   mbi   tɛ   mbeni   yãma
        I   eat   some   meat
        'I eat some meat'

2.   mbi   kɛ   tɛ   yãma   la   so
        I   prog.   eat   meat   day   this
        'I am eating meat today'

3.   mbi   mu   na   mɔ   mersi   mingi
        I   give   to   you   thanks many
        'I give you many thanks'

4.   lo   mu   na   lo   ngu
        he   give   to   him   water
        'He gives him water'

5.   lo   kɛ   mu   na   mɔ   nginza
        he   prog.   give   to   you   money
        'He is giving you money'

6.   i   mu   mbeni   atɛmɛ   ka
        we   give   some   stones there
        'We take some stones there'

7.   mbi   mu   na   mɛrɛngɛ ti   lo   nginza
        I   give   to   child   of   him   money
        'I gave money to a child of his.'

---

[112] A creole language arises when a simple, spur-of-the-moment contact language arising among speakers of distinct languages (here, French and Ngbandi) is learned by children and elaborated (via Universal Grammar, some think) into a full-fledged, fully-expressive language with native speakers.

8.
mɔ	zia	ngu	na	wa
you	put	water	to	fire

'You put water on the fire'

9.
mɔ	zia	mbeni	yãma	na	sese
you	put	some	meat	to	ground

'You put some meat on the ground'

10.
ala	mu	na	lo	ere	so
they	give	to	him	name	this

'They gave this name to him.

11.
ala	zia	yãma	so	na	sese
they	put	meat	this	to	ground

'They put this meat on the ground'

12.
lo	zia	ala	na	kanga
he	put	them	to	jail

'He put them in jail'

13.
mbi	zia	mbeni	atɛmɛ	da
I	put	some	stone	here

'I put some stones here'

14.
mbi	zia	ala	da	la	so
I	put	them	here	day	this

'I put them here today'

15.
i	faa	na	yãma
we	kill	to	meat

'We kill animals'

16.
i	na	mɔ	faa	na	yãma
we	to	you	kill	to	meat

'you and I kill animals'

17.
i	na	ala	faa	na	yãma
we	to	them	kill	to	meat

'They and I kill animals'

18.
i	na	lo	faa	kɔndɔ
we	to	him	kill	chicken

'He and I kill chickens'

19.   i   faa   kɔndɔ   mingi
        we   kill   chicken   many
        'We kill many chickens'

20.   ala   faa   woga   mingi   ti   tɛ
        they   kill   antelope   many   of   eating?
        'They kill many antelope to eat'

21.   mbi   faa   kɔndɔ   ka   na   keke
        I   kill   chicken   there   to   tree
        'I killed a chicken there in the tree'

22.   mɔ   wara   mbi   ka   la   so
        you   find   I   there   day   this
        You found me there today'

23.   mbi   wara   kɔli   ti   mbi
        I   find   man   of   I
        'I found my husband'

24.   mbi   wara   ita   ti   mbi   ti   wale
        I   find   sibling   of   I   of   woman
        'I found my sister'

25.   mbi   wara   ita   ti   mbi   ti   kɔli
        I   find   sibling   of   I   of   man
        'I found my brother'

Answer to Study Exercise #53, Sango Phrase Structure Rules

Hoping for a slightly cleaner answer I made a couple of perhaps dubious assumptions:

- *la so* 'today' is a fixed expression, i.e. a compound, as in English. I am classifying this as an Adverb.
- I am treating *kɛ* as an Aux.
- I am treating the prenominal expression *mbeni* 'some' as an Adjective, letting postnominal *so* and *mingi* be in the position for Articles.

The analytic strategy is:

- Provide conjecture trees for each sentence.
- Write down "sketch" phrase structure rules, that is, exactly what is needed to generate the proposed tree.
- At the end, collate, generalize and simplify the rules using ( ) and ( )*.

1.	mbi	tɛ	mbeni	yãma
	I	eat	some	meat
	Pro	V	A	N
	'I eat some meat'
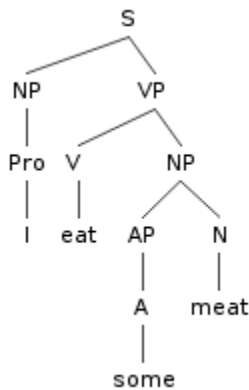
Rules needed:
S → NP VP
NP → Pro
VP → V NP
NP → AP N
AP → A
Out on a limb: "some" as Adjective, since it looks like in general, the Articles follow the noun.

2. mbi   kɛ   tɛ   yãma   la   so
    I   prog.   eat   meat   day   this
    Pro   Aux   V   N   Adv.............
    'I am eating meat today'
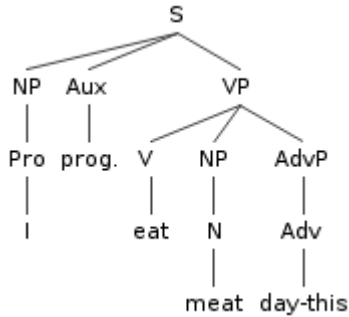
S → NP Aux VP
NP → Pro   (lots of these, I won't repeat this one)
VP → V NP AdvP
AdvP → Adv
NP → N

3. mbi   mu   na   mɔ   mersi   mingi
    I   give   to   you   thanks   many
    Pro   V   P   Pro   N   Art
    'I give you many thanks'
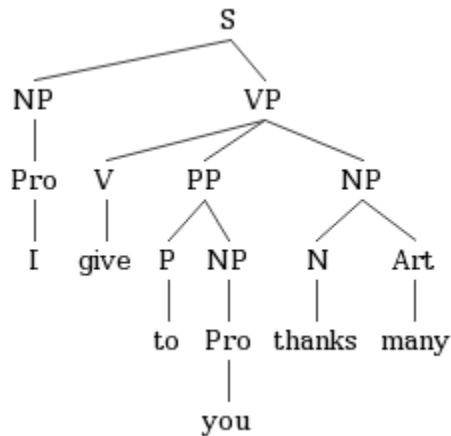
V → V PP NP
PP → P NP
NP → N Art

4. lo   mu   na   lo   ngu
    he   give   to   him   water
    Pro   V   P   Pro   N
    'He gives him water'

```
              S
           ___|___
          /       \
        NP         VP
        |        __|____
       Pro    V    PP    NP
        |    |    / \     |
       he  give  P  NP    N
                 |   |    |
                to  Pro  water
                     |
                    him
```
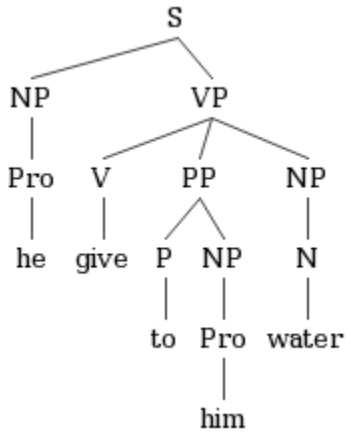
VP → V PP NP
PP → P NP   (many of these, won't repeat)
NP → N   (many of these, won't repeat)

5. lo   kɛ   mu   na   mɔ   nginza
    he   prog.   give   to   you   money
    Pro   Aux   V   P   Pro   N
    'He is giving you money'

```
                    S
            _____|____
           /    |        \
         NP    Aux        VP
          |     |       ___|____
        Pro   prog.   V    PP    NP
          |     |     |   / \     |
         he   prog. give  P  NP   N
                        |   |    |
                       to  Pro  money
                            |
                           you
```
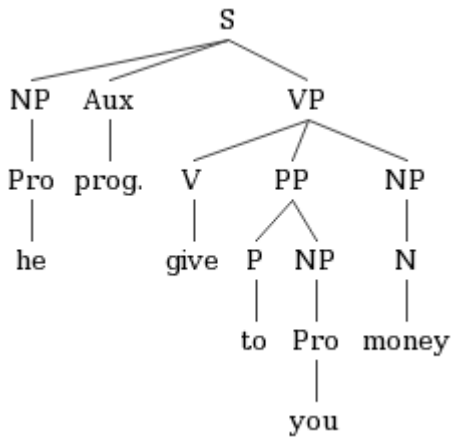
S → NP Aux VP   (many of these, won't repeat)
VP → V PP NP

6. i   mu   mbeni   atɛmɛ   ka
    we   give   some   stones   there
    Pro   V   Adj   N   Adv
    'We take some stones there'

```
                    S
          ┌─────────┴──────┐
         NP                VP
          |        ┌───────┼────────┐
         Pro   V         NP         AdvP
          |    |      ┌───┴───┐      |
         we  give    AP      N      Adv
                      |       |       |
                      A    stones  there
                      |
                    some
```
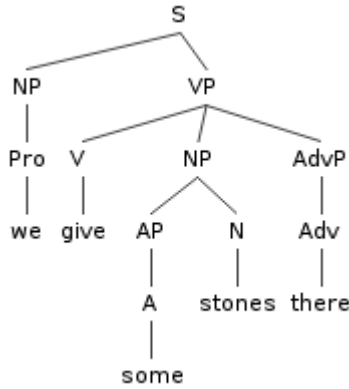
V → V NP AdvP
AdvP → Adv   (won't repeat)

7. mbi   mu   na   mɛrɛngɛ   ti   lo   nginza
    I   give   to   child   of   him   money
    Pro   V   P   N   P   Pro   N
    'I gave money to a child of his.'

```
                        S
            ┌───────────┴────────┐
           NP                    VP
            |        ┌───────┬────┴────────┐
           Pro   V         PP             NP
            |    |      ┌───┴───┐          |
            I  give    P       NP          N
                       |    ┌───┴───┐       |
                      to   N       PP    money
                            |     ┌─┴─┐
                          child   P  NP
                                  |   |
                                  of Pro
                                      |
                                     him
```
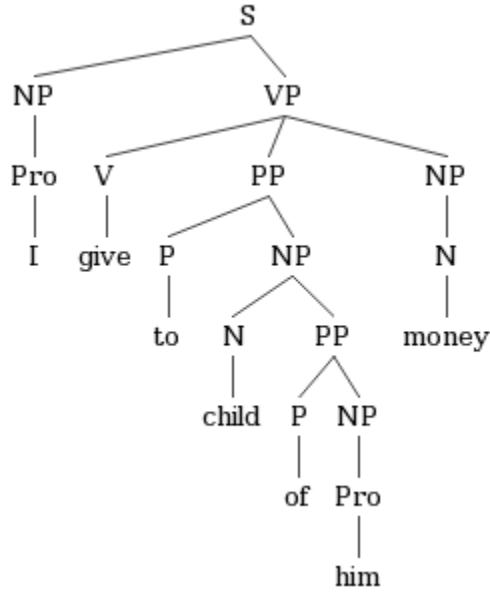
VP → V PP NP
NP → N PP

8.   mɔ   zia   ngu   na   wa
        you   put   water   to   fire
        Pro   V   N   P   N
        'You put water on the fire'
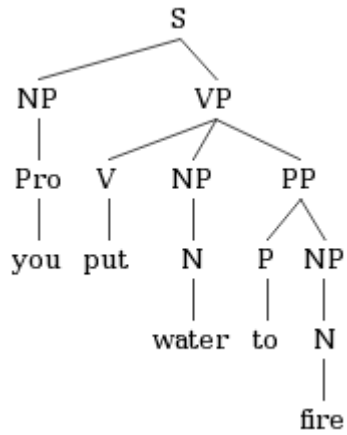
        VP → V NP PP

9.   mɔ   zia   mbeni   yãma   na   sese
        you   put   some   meat   to   ground
        Pro   V   Adj   N   P   N
        'You put some meat on the ground'
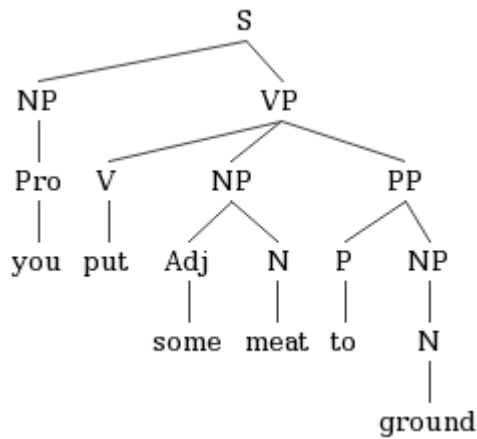
        VP → V NP PP

10.   ala   mu   na   lo   ere   so
      they   give   to   him   name   this
      Pro   V   P   Pro   N   Art
      'They gave this name to him.
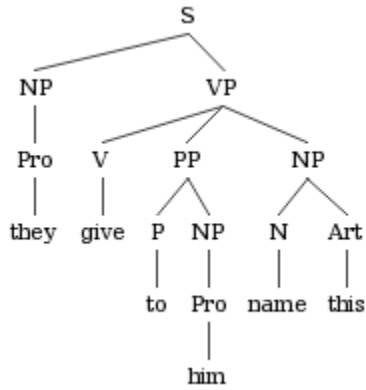
V → V PP NP
NP → N Art

11.   ala   zia   yãma   so   na   sese
      they   put   meat   this   to   ground
      Pro   V   N   Art   P   N
      'They put this meat on the ground'
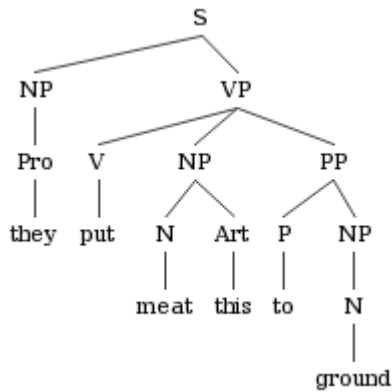
VP → V NP PP
NP → N Art   (won't repeat this one)

12.   lo   zia   ala   na   kanga
      he   put   them   to   jail
      Pro   V   Pro   P   N
      'He put them in jail'
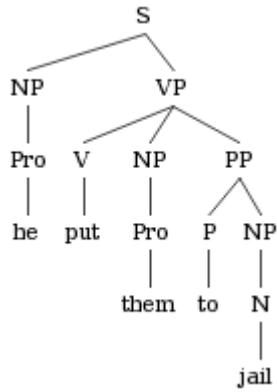
      VP → V NP PP

13.   mbi   zia   mbeni   atɛmɛ   da
      I   put   some   stone   here
      Pro   V   Adj   N   Adv
      'I put some stones here'
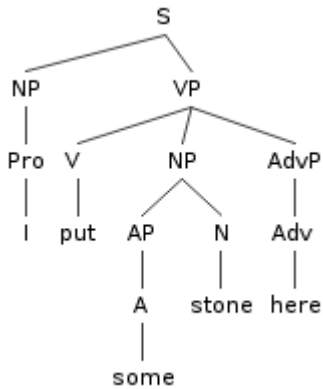
      VP → V NP AdvP

14.   mbi   zia   ala   da   la   so
      I   put   them   here   today........
      Pro   V   Pro   Adv   Adv
      'I put them here today'
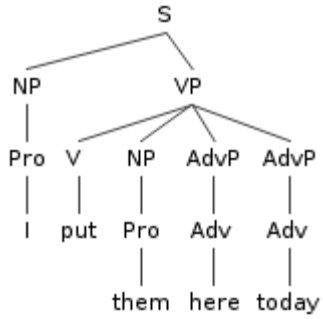
VP → V NP AdvP AdvP

15. i   faa   na   yãma
     we   kill   to   meat
     Pro   V   P   N
     'We kill animals'
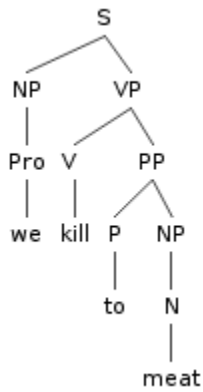
VP → V PP

16. i   na   mɔ   faa   na   yãma
     we   to   you   kill   to   meat
     Pro   P   Pro   V   P   N
     'you and I kill animals'
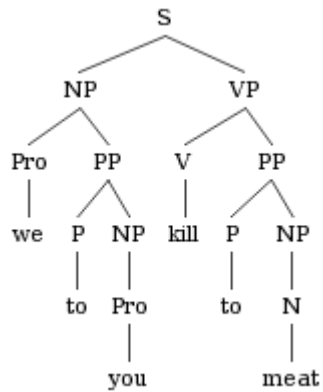
NP → Pro PP
VP → V PP

Note unusual construction, with a PP modifying a Pronoun within NP; not possible in English.

17.
i	na	ala	faa	na	yãma
we	to	them	kill	to	meat
Pro	P	Pro	V	P	N

'They and I kill animals'
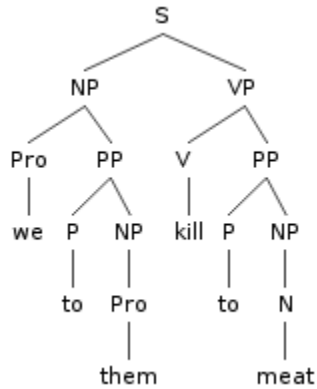
Nothing new in PS rules.

18.
i	na	lo	faa	kɔndɔ
we	to	him	kill	chicken
Pro	P	Pro	V	N

'He and I kill chickens'
Ditto.

19.
i	faa	kɔndɔ	mingi
Pro	V	N	Art

'We kill many chickens'
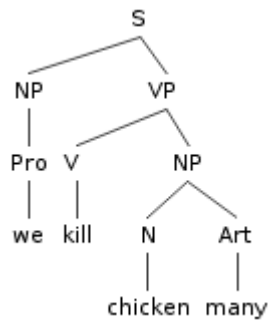
No new rules.

20.   ala   faa   woga   mingi   ti   tε
        they   kill   antelope many   of   eating?
        Pro   V   N   Art   P   N
        'They kill many antelope to eat'
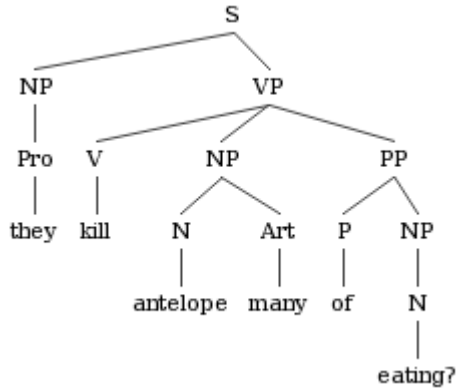
        VP → V NP PP

21.   mbi   faa   kɔndɔ   ka   na   keke
        I   kill   chicken   there   to   tree
        Pro   V   N   Adv   P   N
        'I killed a chicken there in the tree'
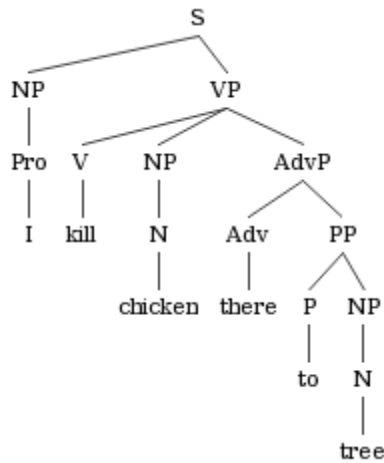
        I suggest that the PP *ne keke* is modifying the Adverb *ka*. Thus we need to put our Adverbs inside Adverb Phrases (adjusting the previous rules that used bare Adverbs), and set up an Adverb Phrase rule.

        VP → V NP AdvP
        AdvP → Adv PP

22.   mɔ   wara   mbi   ka   la   so
      you   find   I   there   today.........
      Pro   V   Pro   Adv   Adv
      'You found me there today'
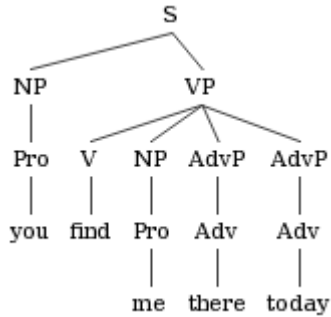
      A fairly clear case of two Adverbs.
      VP → V NP AdvP AdvP

23.   mbi   wara   kɔli   ti   mbi
      I   find   man   of   I
      Pro   V   N   P   Pro
      'I found my husband'
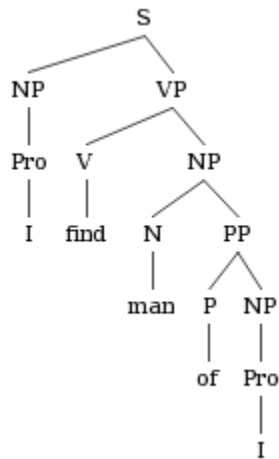
      NP → N PP

24.	mbi	wara	ita	ti	mbi	ti	wale
	I	find	sibling	of	I	of	woman
	Pro	V	N	P	Pro	P	N
	'I found my sister'
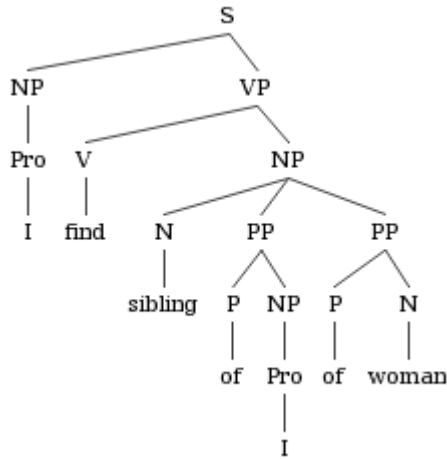
	NP → Pro PP PP
	I assume that each PP is independently a modifier of *ita* 'sibling':

25.	mbi	wara	ita	ti	mbi	ti	kɔli
	I	find	sibling	of	I	of	man
	Pro	V	N	P	Pro	P	N
	'I found my brother'
	Just like #24.

    This completes the gathering of the "sketch" phrase structure rules. We first collate them, removing duplicates, like this:

	S → NP Aux VP
	S → NP VP

	NP → AP N
	NP → N
	NP → N Art
	NP → N PP
	NP → Pro
	NP → Pro PP
	NP → Pro PP PP

	VP → V NP
	VP → V NP AdvP
	VP → V NP AdvP AdvP
	VP → V NP PP
	VP → V PP

VP → V PP NP

AdvP → Adv
AdvP → Adv PP

AP → A

then we can use the abbreviatory notations, and a little guess work, to produce a more general grammar:

S → NP (Aux) VP

NP → (AP)* $\begin{Bmatrix} N \\ Pro \end{Bmatrix}$ (PP)* (Art)

PP → P NP
VP → V (PP)(NP)(PP)(AdvP)*
AdvP → Adv (PP)

The most interesting of these is the VP rule. There are evidently VP's with both NP PP and PP NP order. My guess would be that this is determined by subcategorization; that is

Subcategorizes for [___ NP PP]:   zia 'put'
Subcategorizes for [___ PP NP]:   mu 'give'

Study Exercise #54: Recursiveness in Sango

Find a recursive loop in the phrase structure rules you just developed for Sango in Study Exercise #53. If there is none, so state.

Answer to Study Exercise #54, Recursiveness

The one loop appears to be a two-rule case:

$$NP \rightarrow (Adj)* \begin{Bmatrix} N \\ Pro \end{Bmatrix} (\textbf{PP})* (Art)$$

$$PP \rightarrow P \ \textbf{NP}$$
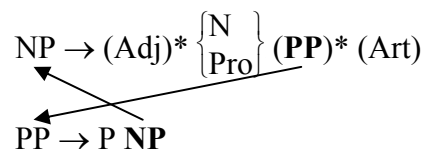
It's virtually certain that Sango has subordinate clauses, which would produce at least one further loop, as in English.

Study Exercise #55: Case marking in Pseudo-English

Write rules to mark case in this pseudo-English. You should write both syntactic rules of case marking, to put the right morphosyntactic features in the right places, and rules of inflectional morphology, to actually add the suffixes.

You will find it helpful first to parse the sentences. Other than the case marking, the language is just like real English.

    a. Johnwa gave Maryni a booko.
    b. The king of Englandwa sold the queenni a book of poemso.
    c. The kingwa sent the princeni of Wales a lettero.
    d. The key to the doorwa is of great importance.
    e. Fredwa thinks that the seller of fishwa read the papero.
    f. Wewa told the daughterni of Mary a story about miceo.
    g. Iwa sang a song about birdso to Alice.
    h. Alicewa made the claim that shewa was leavingo.

Answer to Study Exercise #55, Case marking in Pseudo-English

Syntactic rules of case marking

Mark the rightmost word of the subject NP (daughter of S) as [Case:Nominative].
Mark the rightmost word of the last object NP (last NP daughter of VP) as
    [Case:Accusative].
Mark the head of the first NP, when there are two of them in VP, as [Case:Dative].

Rules of inflectional morphology

Suffix -wa when [Case:Nominative]
Suffix -o when [Case:Accusative]
Suffix -ni when [Case:Dative]

Note: the nominative and the accusative here (but not the dative) are very roughly as in Japanese.

_____

For further reading

A widely used textbook covering much of the material treated here in greater depth is Liliane Haegeman (1994) *Introduction to Government and Binding Theory*. Oxford: Blackwell.

Much of the material discussed here originally derives from what is probably Noam Chomsky's most admired book, *Aspects of the Theory of Syntax* (Cambridge: MIT Press, 1965). The work was hugely influential, not just for the ideas it put forth for analyzing syntactic systems, but also for its more general discussion of the goals of linguistic theory.

Chapter 9:   Semantics

1. Goals of semantics

Semantics is the branch of linguistics that studies meaning, particularly meaning as it is conveyed by language. We can start out by asking what meaning is.

Meaning is a characteristic of symbolic systems; language is by far the most elaborate and powerful symbolic system that has ever been found. Our sentences are complex symbols, physically realized in speech or writing, which bear meanings and thus express our thoughts.

Clearly, there is more to thought than the language that expresses it. Thought can exist in the absence of language, since many animals can behave in a sophisticated and rational fashion without having anything like human language.[113] It also seems clear that we experience thought in ways that are very direct and not linguistic. There is no need for thought to occur in a linear sequence, as our words must; and moreover that our visual thoughts are not particularly expressible in language.

The development of a theory of thought is at present an active but speculative activity, involving psychologists, philosophers, cognitive scientists, and scholars in the field of artificial intelligence. One vindication for a proposed theory of thought would be if it could be embodied in a system that could think and reason like a person. This remains a distant goal.

Our focus in semantics is not quite as grand; we just want to know how language expresses thought. The problem faced by semanticists is to study the ways in which language embodies thought, without a well-developed theory of thought to go by. This problem has not stymied research, however, because there are plenty of ways to conduct careful research that don't require a full theory of thought to make progress. For instance, one strategy that has been followed (it originates in the field of philosophy) is to develop formal systems that determine the **truth conditions** of sentences (properties of the world that must hold for sentences to be true), often in a small, artificially-constructed world. This kind of approach requires a fair amount of development and will not be taught here; instead, in the interest of a unified text I want to cover aspects of semantics that interact most closely with syntax.

We will cover three aspects of linguistic meaning: **predicate-argument structure**, **anaphora**, and **operators and scope**.

2. Predicate-argument structure

A **predicate-argument structure** is a simple semantic representation that limits itself to depicting "who is doing what to whom." For example, in a sentence like

---

[113] A book on this topic I have enjoyed, written from a sober but exploratory viewpoint, is *Animal Minds*, by Donald Griffin (University of Chicago Press, 1992). This continues to be an active area of research as scientist document the ability of various animals to plan, to use tools, and to infer the mental states of other beings.

John cooked the egg.

an act of cooking is described. We could characterize this act with the following predicate-argument structure.

COOK (($_{Cooker}$ John), ($_{Cook-ee}$ the egg))

In this structure, COOK is a "predicate", which has "arguments", in this case filling the slot of Cooker and Cook-ee. The labels for the argument slots are arbitrary, and in fact I will sometimes be choosing slightly silly ones, simply because they are short and clear.[114] Argument slots are sometimes designated with the term **thematic roles**.

Predicate-argument structure contains both more and less information than a syntactic tree.

Predicate-argument structure contains *more* information than syntactic structure because it identifies the argument slots for each participant in the action. Syntactic structure instead places the participants (designated by NPs) in syntactic roles, such as **subject** (NP daughter of S) or **object** (NP daughter of VP)—and, as we will see, there is only a loose connection between thematic roles and syntactic roles.

Predicate-argument structure contains *less* information than syntactic structure for various reasons. Most notably, predicate-argument structure is not meant to convey linear order; COOK "has" the two arguments given, but there is nothing in the thought being expressed that requires this order. The order that appears on the page is selected purely for convenience.

Linear order is a property of language, not of thought. Different languages have idiosyncratic orders, including all six logically possible orders for simple two-NP sentences like *John cooked the egg*. Here are all six, with examples of each.

SVO   English, Spanish, Swahili, Mandarin
SOV   Japanese, Korean, Turkish, Persian
VSO   Tagalog, Biblical Hebrew, Irish
VOS   Fijian
OSV   Xavante (Brazil)
OVS   Hixkaryana (Brazil)[115]

2.1 Rough correlations between syntax and predicate-argument structure

Linguists have long noticed that aspects of meaning, as we might express them in a predicate-argument structure, show a *loose correlation* with syntactic structure. Here are some common generalizations.

---

[114] More ambitious theories try to *generalize* over slots, with widely-applicable terms. For instance, Agent is used for any slot occupied by an entity that controls the action, Theme is used for objects in motion, and so on. The details needed for this kind of generalization are not agreed upon by all linguists.

[115] The last three orders, with object before subject, are rare.

Many predicate-argument structures involve some sort of **actor**; an entity that is in control and performs the action. Most often, the actor is expressed syntactically as the **subject** (NP daughter of S). This is true, for instance, in the following sentences.

(162)   *The norm: subject as actor*

Alice sang.
Susan built the transmission.
Fred and Bill opened the package.

Many predicate-argument structures involve some sort of **patient** or "undergoer" of the action. These are most often expressed as **direct objects** of the verb (in English, NP daughter of VP.[116] So, this would hold true of *the transmission* or *the package* in the sentences just given.

Verbs of giving or sending often have a **recipient** or **beneficiary**. These are often expressed as an object (daughter of VP[117]), or as the object of a preposition, as below:

(163)   *The norm: recipient/beneficiary as object or PP object*

Alice sent Fred a dozen red roses.
Alice sent a dozen red roses to Fred.
Bill baked Sheila some cookies.
Bill baked some cookies for Sheila.

These are only loose correlations. The verb *undergo* is striking in that its subject is usually the patient of the action.

(164)   *Exception: subject as patient*

John underwent surgery.

The verb *experienced* is unusual because its subject is the mental experiencer of the event; normally experiencers are expressed in prepositional phrases.

(165)   *Norm: experiencer as PP object*

The world seemed sad to Sam.

(166)   *Exception: experiencer as subject*

Sam experienced sorrow.

---

[116] Second daughter, when there are two.

[117] First daughter, when there are two.

There are many other exceptional cases.

2.2 Variation in how syntax manifests predicate-argument structure

Aside from peculiar verbs like *undergo* or *experience*, there are general and systematic patterns in how the syntax of languages expresses predicate-argument structure. The grammar of particular languages often provide multiple possibilities for how a predicate-argument structure is realized syntactically. These patterns hold good for many or even all of the verbs of the language.

2.2.1 Passives

A well-known example of this kind is the **passive** construction, found in many languages:

(167) *An active sentence and its corresponding passive*

      a.   The doctor examined John.
      b.   John was examined by the doctor.

The first of these sentences is said to be in the "active voice" and the second in the "passive voice." For both sentences, the predicate-argument structure is something like this:

(168) *Predicate-argument structure for both (153)a and (153)b*

      EXAMINE (($_{Examiner}$ Doctor), ($_{Examinee}$ John))

The active voice for *examine* is probably more frequent; it makes the subject the agent of examining, and the object into the thing examined. I suspect that this is the most common form of expression for this verb. In the passive voice, the thing examined is expressed as the subject, and the agent of examining is expressed (if it is expressed at all) as the object of the preposition *by* within the VP.[118] In the passive, the agent can also be simply suppressed; that is, omitted:

(169) *A passive sentence with suppressed agent*

      John was examined.

We might plausibly give such a sentence a predicate-argument structure with a null argument, something like this:

(170) *Predicate-argument structure for (169)*

      EXAMINE (($_{Examiner}$ $\varnothing$), ($_{Examinee}$ John))

The null would be interpreted as meaning that *someone* did the examining but the sentence does not specify what.

---

[118] There is one other syntactic difference: passive sentences contain *be* as an Auxiliary, and the verb is inflected in its Past Participle form.

Why might languages offer more than one way to connect up the thematic roles with the grammatical positions? One view is that these variations are related to **discourse structure**: when we converse or tell a story, we are not producing sentences in isolation; rather, each sentence builds on a body of information that already exists and adds a new bit of information. Quite often, at least in English, the subject NP embodies the pre-existing information, and the VP is what adds something new. Thus, *The doctor examined John* is most naturally used where one is already talking about the doctor, and *John was examined by the doctor* is most naturally used when one is already talking about John. Thus, the passive construction permits the speaker to organize information in a dialogue or narrative in a coherent way that builds on older information, by making the old information the subject.

The use of passive to avoid the expression of certain arguments is, in English, confined to the omission of the *by*-phrase. German goes beyond English in allowing what is normally the *subject* to go unexpressed, when the when the verb is intransitive:

Es wurde getanzt.
It was   danced
'There was dancing, people danced.'

DANCE (($_{Dancer}$ $\varnothing$))

This construction is often called an **impersonal passive**.

2.2.2 Dative constructions

Here is another instance in which the same predicate argument structure has more than one syntactic expression. It occurs with verbs of giving. Here is an example:
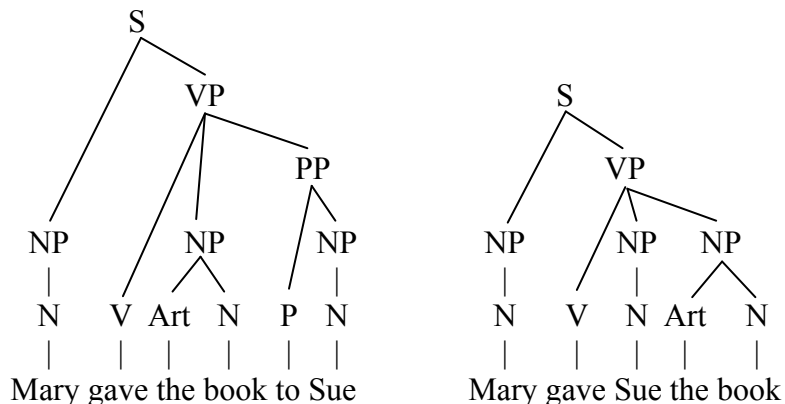
The first tree illustrates the NP PP construction, in which the item given is the NP object and the recipient is in the PP. The second tree illustrates the NP NP construction, in which the recipient is the first NP and the item given is the second NP. Both have the same predicate-argument structure:

GIVE (($_{Giver}$ Mary), ($_{Gift}$ book), ($_{Recipient}$ Sue))

As with passive, the variation may be related to the form of a discourse: the first sentence would be more natural when one is already talking about *the book*, the second would more natural when one is already talking about *Sue*. As in passive constructions, the new information comes later in the sentence.

2.3 Propositions as filling argument slots

The following sentence has a predicate-argument structure in which one of the participants is a Proposition — depicting an event.

> *Mary had John cook the egg.*
> CAUSE ((Causer Mary), (Proposition COOK ((Cooker John), (Cook-ee the egg))))[119]

To treat such a case, we need a kind of nested structure, similar to the multi-clause structure of syntax. In this sentence, Mary, the agent, caused the state of events described in Proposition to come into being.

Here is another sentence whose predicate-argument structure involves a proposition, here, the content of Mary's thoughts:

> Mary thinks that Bill jumped.
> THINK ((Thinker Mary), (Proposition JUMP ((Jumper Bill))))

2.4   Cases of mismatch between syntax and predicate-argument structure I: weather it *and* pleonastic it

Consider the following sentence, shown with a proposed predicate-argument structure.

> It rained.
> RAIN

What is special about such a case is that there are no arguments—*raining* is a thing that just happens (nobody rains!).[120] The *it* we get in syntactic structure is meaningless, and is evidently present simply to satisfy the grammatical requirement (S $\rightarrow$ NP VP) that sentences must have subjects. Such semantically empty elements are a mismatch between syntax and predicate-argument structure. They illustrate that syntax involves demands of "pure form" that have nothing to do with expression.

The *it* that occurs as the subject of *rain, snow*, etc. is sometimes called "weather *it*".

---

[119] In this and some later predicate-argument structures, I've used color to make sure that brackets match up correctly. For correct bracket structure: every argument is surrounded by parentheses, and every list of arguments is surrounded by parenthesis (even if there is just one argument).

[120] Observe that this is different from *John was examined* and *Es wurde getanzt*, discussed above. Someone really did examine John, and someone really did dance (we're just not saying who). But no one rains.

Here is another such case:

It seems that Mary gave the book to Sue.
SEEM(($_{Proposition}$ GIVE(($_{Giver}$ Mary), ($_{Gift}$ book), ($_{Recipient}$ Sue))))

Here again we have a semantically empty *it*, present to give the main clause a subject. This *it* is sometimes called **pleonastic** it.[121]

A related construction gives the main clause a subject by taking the logical subject of the embedded clause and expressing it "in the wrong position":

Mary seems to have given the book to Sue.
SEEM (($_{Proposition}$ GIVE(($_{Giver}$ Mary), ($_{Gift}$ book), ($_{Recipient}$ Sue))))

In this grammatical construction, often called "Subject Raising", the NP *Mary* occurs in a syntactic location that is intuitively "higher" than its location in predicate-argument structure.

Study Exercise #56

Give predicate-argument structures for the following sentences. Be brave about labeling the argument slots; this is a somewhat arbitrary business.

  a. John appears to have been given a book by Sue.
  b. It seems to have rained.
  c. It seems that it rained.
  d. It is felt that Bill rants.

---

[121] "Pleonastic" comes from the Greek for "superfluous"; the *it* is felt to be somehow unnecessary (though it's necessary for the sentence to be grammatical.)

Answer to Study Exercise #56

a. John appears to have been given a book by Sue.

   APPEAR ((_{Proposition} GIVE((_{Giver} Sue), (_{Gift} book), (_{Recipient} John))))

b. It seems to have rained.

   SEEM ((_{Proposition} RAIN))

c. It seems that it rained.

   SEEM ((_{Proposition} RAIN))

d. It is felt that Bill rants.

   FEEL ((_{Experiencer} ∅), (_{Proposition} RANT((_{Ranter} Bill)))

2.5 Cases of mismatch between syntax and predicate-argument structure II: causative verbs

Another important way in which predicate-argument structure mismatches syntax arises in languages that have so-called **causative** verbs. Here, a prefix or suffix appears on the verb (attached, perhaps, by a word formation rule), and the whole construction takes on a kind of "biclausal" character, seen in the suggested predicate-argument structure for each sentence.

(171) *Causative structures in Turkish*

a. *Simple sentence with predicate-argument structure*

   müdür   mektub-u   imzala-dı
   director   letter-ACC   sign-PAST
   'The director signed the letter'

   SIGN ((_{Signer} director), (_{Signee} letter))

b. *Causative sentence based on (a), with predicate-argument structure*

   dişçi   mektub-u   müdür-**e**   imzala-t-tı
   dentist   letter-ACC   director-**DAT** sign-CAUS-PAST
   'The dentist made the director sign the letter'

   CAUSE ((_{Causer} dentist), (_{Event} SIGN ((_{Signer} director) (_{Signee} letter)))

Syntactically, there is really just one clause, since there is only one verb present, and it assigns case to the NPs in the usual way for a Turkish clause (Accusative for the first object, Dative for the

second). You can see that in the formation of causatives, the number of NPs allowed in the clause goes up by one; the additional syntactic slot is needed to express the agent of causation.

Study Exercise #57

Provide plausible predicate-argument structures for the following two sentences of Turkish:

müdür	Hasan-a	mektub-u	göster-di		
director	Hasan-DAT	letter-ACC	show-PAST		

'The director showed the letter to Hasan'

dişçi	Hasan-a	mektub-u	müdür	tarafından	göster-t-ti
dentist	Hasan-DAT	letter-ACC	director	by	show-CAUS-PAST

'The dentist made the director show the letter to Hasan'

How is this construction similar to the English passive?

Answer to Study Exercise #57

First sentence:

SHOW((_{Show-er} director), (_{Shown} letter), (_{Witness} Hasan))

(or some other reasonable labels for the argument slots)

Second sentence:

CAUSE ((_{Causer} dentist), (_{Event} SHOW((_{Show-er} director), (_{Shown} letter), (_{Witness} Hasan))

The parallel to English that I had in mind was the use of the postposition *tarafından*, which means (roughly) 'by'. In English passives, we provide no simple slot for the agent of the action (there is no object position, and the subject position is taken up by the recipient of the action), so an added *by*-phrase is used to express the subject. In Turkish causatives like the one in this exercise, the slots provided by Nominative, Accusative, and Dative case are all "used up", as it were, so the language opts for the equivalent of the English *by*-phrase to express the fourth argument.

2.6 Predicate-argument structure in linguistic theory

There are two possibilities for integrating predicate-argument structure into linguistic theory. One possibility is to find a set of rules that inputs syntactic trees and derives the predicate-argument structure from them. Another approach that has been taken is to let the predicate-argument structure be the starting point of the derivation—embodying the message the speaker wishes to communicate—and let the grammar find an appropriate tree structure or structures for communicating this message. We will not pursue this question here.

Study Exercise #58: The predicate-argument structure of *As*-phrases

The particle *as* has interesting syntactic and semantic behavior, in which the phrase structure again mismatches the semantics. Some sample sentences:

1. We consider him as being eccentric.
2. They regard him as praiseworthy.
3. We judge it as unfortunate that he visited Mary.
4. We regard him as appearing to be sick.

We could accommodate *as* phrases with the following phrase structure rules:

VP → V (NP) *As*P (CP)

$$\text{AsP} \rightarrow as \begin{Bmatrix} \text{NP} \\ \text{PP} \\ \text{VP} \end{Bmatrix}$$

Furthermore, we must add rules of inflectional morphology that would ensure that the VP that is part of an *as*-phrase, the verb is marked to be a present participle (V-*ing*). Only a few verbs such as *regard* and *consider* subcategorize for *as*-phrases.

What is interesting semantically is that as-phrases express propositions without including any CP. For example, in the first sentence above, *we* are not doing anything to *him*; rather, we are holding a belief about him, that is, we are the mental experiencers of a proposition involving him. This idea could be expressed with the predicate-argument structure below:

CONSIDER ((_{Experiencer} we) (_{Proposition} ECCENTRIC ((_{Characterized} he)))

The proposition is, essentially, "he is eccentric", without any verb or CP encoding this proposition.

Assign predicate-argument structures to sentences #1-3 above. Note that the *it* in #2 is pleonastic.

Answers to Study Exercise #58

1. REGARD ((Experiencer they) (Proposition PRAISEWORTHY ((Characterized he))))
2. JUDGE ((Experiencer we) (Proposition UNFORTUNATE ((Proposition VISIT ((Visitor he), (Visitee Mary))))))
3. REGARD ((Experiencer we) (Proposition APPEAR ((Proposition SICK ((IllPerson he))))))

ANAPHORA

3. Defining anaphora

All languages have pronouns. For example, these are the pronouns of English in their various forms (this is an amplified version of chart (105) above).

(172) *English pronouns (more complete version)*

Nominative

I   we
you   you
he/she/it   they

Objective

me   us
you   you
him/her/it them

Genitive

my   our
your   your
his/her/its their

Predicative Genitive[122]

mine   ours
yours   yours
his/hers/— theirs

---

[122] Used after *be*, as in *It is mine*. There is no 3rd pers. singular inanimate form; for example, you can't say **That fuel pump is its*, referring to a particular car. This is known as a "paradigm gap" and is widely found in more heavily inflected languages.

Reflexive

myself	ourselves
yourself	yourselves
himself/herself/itself	themselves[123]

Pronouns are like nouns, but they get their reference from context—either the linguistic context, or the situational context of speech. As already noted, the English pronouns are distinguished by morphosyntactic features of Number, Case, and Person, and in the third person, for gender. Their meanings are determined entirely by these features.

There are also pro-forms for other parts of speech. The phrases *do it* and *do so* are pro-forms for Verb Phrases:

(173) Do it *and* do so *as VP pro-forms*

a. I wanted to [teach Linguistics 865]$_{VP}$ but was too busy with other courses to [do so]$_{VP}$.
b. I had to [teach Linguistics 497]$_{VP}$ because no one else would [do it]$_{VP}$.

Thus is a somewhat archaic proform for Adverb Phrases:

He did it thus.

The term **anaphora** refers, in linguistics, to the process whereby a pro-form gets its reference from the meaning of another phrase; thus in:

Bill thinks he's a genius.

we say that *he* makes anaphoric reference to *Bill*; likewise, above *do so* makes anaphoric reference to *teach Linguistics 865*.

4. The Pronominalization Hypothesis and why it fails

A tempting analytical option for pronouns, assuming that we need transformations anyway, is to suppose that pronouns are the result of applying a "Pronominalization" transformation.

Consider a sentence like **Error! Reference source not found.**.

(174) *Alice told Sue that she was a genius.*

Here, the pronoun *she* can refer either to *Alice* or to *Sue*. The sentence is therefore ambiguous. The Pronominalization theory would say that when *she* means *Alice*, then the deep structure would be as in **Error! Reference source not found.**:

---

[123] It would also be sensible to include here the *wh-* pronouns: Nominative *who,* objective *who* (normative English *whom*), Genitive *whose,* Predicative Genitive *whose,* missing the Reflexive.

(175) Alice told Sue that Alice was a genius.

(You should assume an appropriate tree structure for **Error! Reference source not found.**; I have not bothered to put this in). Analogously, when *she* means *Sue*, then the deep structure is as in **Error! Reference source not found.**:

(176) Alice told Sue that Sue was a genius.

According to the Pronominalization Hypothesis, there is a Pronominalization transformation that converts the second instance of two identical noun phrases into the appropriate pronoun:

(177) **Pronominalization (hypothetical rule)**

When two NP occur in sequence, replace the second one with a pronoun whose morphosyntactic representation bears matched values for the features [Number], [Animacy], and [Gender].

It is easy to see that Pronominalization will convert the two deep structures **Error! Reference source not found.** and **Error! Reference source not found.**
into the same surface structure, namely:

Alice told Sue that she was a genius

Assuming that the meaning of pronouns is determined by consulting their deep structure form, the Pronominalization Hypothesis therefore succeeds in accounting for the ambiguity of sentence **Error! Reference source not found.**, and indeed for sentences in general that are ambiguous because of pronoun reference.

Although the Pronominalization Hypothesis initially may seem reasonable (and indeed enjoyed a brief vogue among linguists in the early 1960's), in fact it suffers from several problems.

First, there are sentences in which the deep structure that the Pronominalization Hypothesis provides doesn't mean what we want it to. If all pronouns are derived from full noun phrases, then the deep structure of

Everyone thinks he is a genius

would be

Everyone thinks everyone is a genius.

But this deep structure clearly means something quite different from the surface structure. The problem here evidently lies in the **quantifier** word *everyone*; we will return to quantifiers later on in section 11 of this chapter.

A second problem with the Pronominalization Hypothesis is that there are pronouns that it can't derive, because the essential sequence of two identical NPs, as referred to in the

Pronominalization rule (177), is not present. Specifically, there are instances in which one uses a pronoun in the total absence of any other NP. The following example was invented by the linguist Howard Lasnik. Imagine a cocktail party at which a man arrives, a stranger to all, who starts drinking heavily and getting into heated, unpleasant discussions with all he encounters. After an hour of unpleasantness, he storms out of the room, slamming the door behind him. At this point one could, without knowing the man's name, say:

(178) *Well, he's left.*

Indeed, in this particular example it would be fine to say this sentence without even knowing the name of the man that *he* refers to. The point is that if *some* pronouns are interpreted as referring to a salient person in the context (that is, the pragmatic, real-life context), then we should consider the possibility that even the *she* in *Alice thinks she's a genius* is similarly interpreted—*Alice* is a plausible person for *she* to refer to, since, after all, we're talking about her.

A final problem with the Pronominalization Hypothesis is that, curiously enough, it appears to lead us to infinite deep structures.[124] Here is an example:

> *The girl who deserves it will get the prize she wants.*

This sentence contains two pronouns, *it* and *she*. According to the Pronominalization Hypothesis, we can get the deep structure by replacing these pronouns with copies of the full NPs to which they refer. Doing this yields:

> *The girl who deserves* [*the prize she wants*] *will get the prize* [*the girl who deserves it*] *wants.*

But this sentence also contains pronouns! Thus, to arrive at the true deep structure we will have to substitute for these as well:

> *The girl who deserves* [*the prize* [*the girl who deserves it*] *wants*] *will get the prize* [*the girl who deserves* [*the prize she wants*]] *wants.*

And we are still not done, so:

> *The girl who deserves* [*the prize* [*the girl who deserves* [*the prize she wants*]] *wants*] *will get the prize* [*the girl who deserves* [*the prize* [*the girl who deserves it*] *wants*]] *wants.*

No matter how long we keep going, we are still going to have uninterpreted pronouns in our representation, so it's clear that this process is never going to yield an interpreted representation. The upshot is that deriving pronouns from full-NP deep structures does not seem promising as an account of their semantics.

---

[124] The problem was noticed in the 1960's by the linguists Emmon Bach and Stanley Peters, and is sometimes called the Bach-Peters paradox.

5. Interpretive rules for pronouns

Given what we've just seen, one might think that the right way to handle the meaning of pronouns would be just to let them be pronouns; that is, nouns whose meaning is determined by referring to a salient (highly noticeable) entity in the context (either linguistic context, or real-life context), which matches the requirements of number (*she* vs. *they*), gender (*she* vs. *he*), and animacy (*she* vs. *it*). In this approach, interpreting pronouns is relegated largely to the domain of thought, not language—pretty much every sentence would be interpreted the way we interpret the sentence *Well, he's left* given above.

This is an appealingly simple theory, but it likewise cannot work. Research on the possibilities of how pronouns refer has shown that there is indeed a heavy *linguistic* contribution to their interpretation.

Consider the following very simple sentence:

John likes him.

Fluent speakers of English will assert pretty firmly that *him* cannot refer to *John*, even though there is no logical reason why it could not. Similar sentences are:

He likes John.
He likes John's brother.
He thinks John is a genius.

The reason why *he* cannot refer to *John* in these sentences turns out, as we'll see shortly, to be linguistic; that is, grammatical. Curiously, there seem to be linguistic rules that tell you what certain pronouns *cannot* refer to. In what follows, we will work out the basics of these rules, and find that they depend on syntax.

Our rules will not change the syntactic structure or words of sentences in any way; they simply specify possible (or impossible) meanings. Thus, they are called **interpretive rules**.

We have already covered, informally, an interpretive rule for English, the Each Other Reference rule, rule (24) from Chapter 1. Here, we will cover further rules, with a more ambitious formalization of them.

6. Formal preliminaries

6.1 Subscripts and coreference

In what follows, we will use a standard notation for designating what pronouns refer to, namely, subscripting. When I write this:

(179) *Bill$_i$ thinks he$_i$ is a genius.*

I will mean: the reading of this sentence in which *he* is understood as referring to *Bill.* This is denoted by the use of identical letters as subscripts.

When I write this:

(180) *Bill$_i$ thinks he$_j$ is a genius.*

the nonidentical subscripts should be taken to mean that *he*, in this reading, refers to someone other than Bill.

It will important later on to suppose that the indices are attached to the NP node, not further down (like the Pronoun or Noun node). Thus the tree for (179) is as follows:

```
                    S
          ┌─────────┴─────────┐
        NP_i                  VP
         │          ┌─────────┴─────────┐
         N          V                   CP
         │          │                   │
        Bill      thinks                 S
                             ┌───────────┴───────────┐
                           NP_i                      VP
                            │             ┌───────────┴───────────┐
                           Pro            V                       NP
                            │             │              ┌────────┴────────┐
                            he            is            Art                N
                                                         │                 │
                                                         a               genius
```
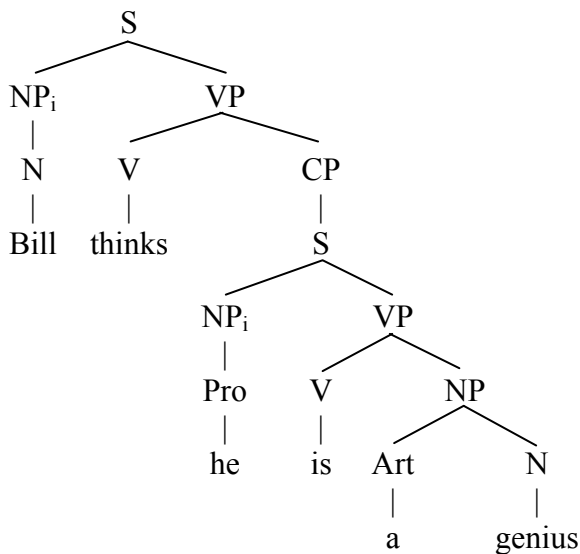
Terminology: in (179), *Bill* and *he* are said to be **coreferent**, meaning that they refer to the same thing. In (180), *Bill* and *he* are not coreferent. Also, in the first sentence, *Bill* is taken to be the **antecedent** for *he,* which means that it supplies the information about what *he* refers to.

We will also make use of a three-way distinction:

- **Reflexive pronouns** are members of the set {*myself, yourself, ourselves,* ...}
- **Regular pronouns** are members of the set {*I, me, you, he, them,* ... }
- **Full noun phrases** are Noun Phrases that are neither reflexive pronouns or regular pronouns; such as *Sue, the president, my brother,* etc.

Lastly, a technical definition:

(181) *Definition: c-command*

In a syntactic tree, constituent A **c-commands** constituent B if the mother of A dominates B.

In other words, A c-commands B if there is a path that

> ➢ starts at A
> ➢ moves up one node from A to A's mother node
> ➢ travels exclusively downward through the tree and arrives at B.

Thus in the following example:

S
VP
CP
S
VP
NP
N
V Comp Pro V Art N
Bill thinks that he is a genius
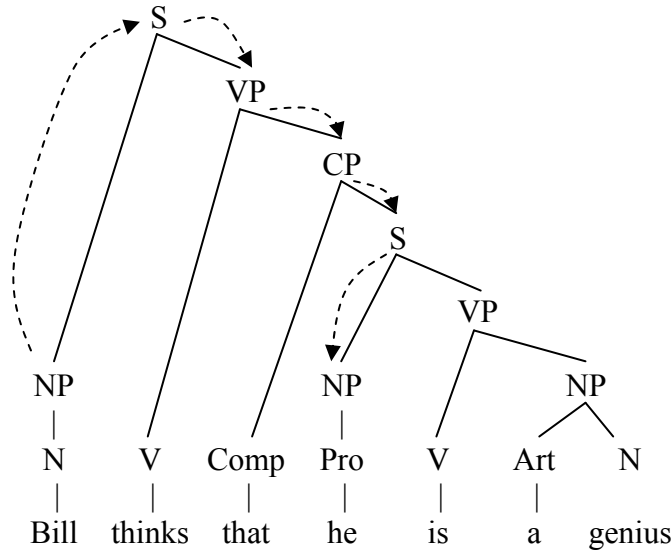
the NP *Bill* c-commands the pronoun *he* because you can go upward by one from the NP Bill, arrive at S, then move downward through VP, CP, S, and thence to the NP *he*. See dotted arrows.

In the same example, the NP *he* does not c-command the NP *Bill* because once you've gone uphill once from *he*, you can't get to *Bill* by going just downhill:

S
VP
CP
S
VP
NP
N
V Comp Pro V Art N
Bill thinks that he is a genius
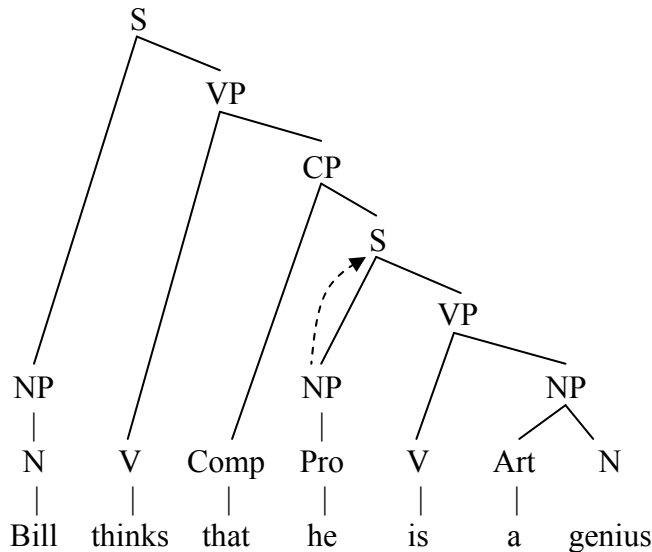
He does c-command *genius*, however.

In general, we will speak of c-command only for NPs. In drawing these little arrows, you want to start with the NP node, or you'll have problems.

The term c-command apparently means "constituent-command". It emerges from a period of syntactic research that tried out a number of similar definitions, of which c-command appears, at least for now, to be the simplest and most effective. We'll see the relevance of c-command to pronouns shortly.

6.2 Clausemates

Following up on the discussion in Chapter 1, we will also make use of the term *clausemates*, defined as follows.

(182) *Definition:* **clausemates**

Constituents X and Y are **clausemates** if every S node that dominates X also dominates Y, and vice versa.

Clausemates are often said to be **in the same clause**, which means the same thing.

In the following sentence:
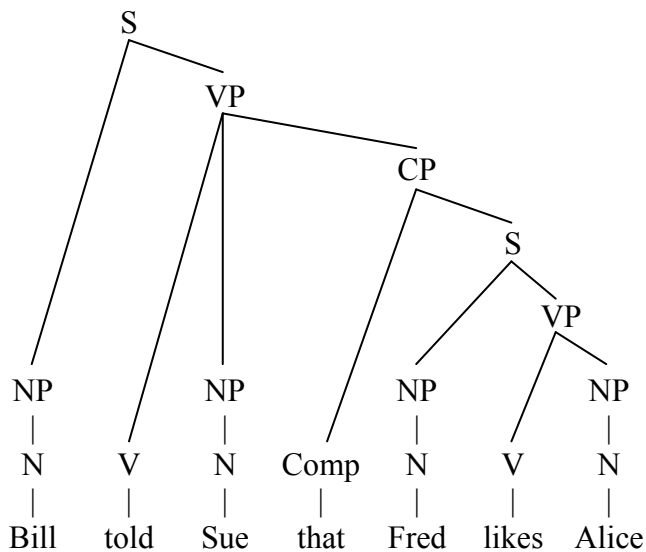
the clausemate pairs are: *Bill-Sue, Fred-Alice*. Non-clausemates: *Bill-Alice, Bill-Fred, Sue-Alice, Sue-Fred*.

A quick informal way to show clausemates is to bracket the sentences into domains of clausematehood, like this:

```
                    S
                         VP
                              CP
                                   S
                                        VP
       NP        NP        NP        NP
       |      |   |     |    |     |    |
       N      V   N   Comp  N     V    N
       |      |   |     |    |     |    |
      Bill  told Sue  that Fred likes Alice
```
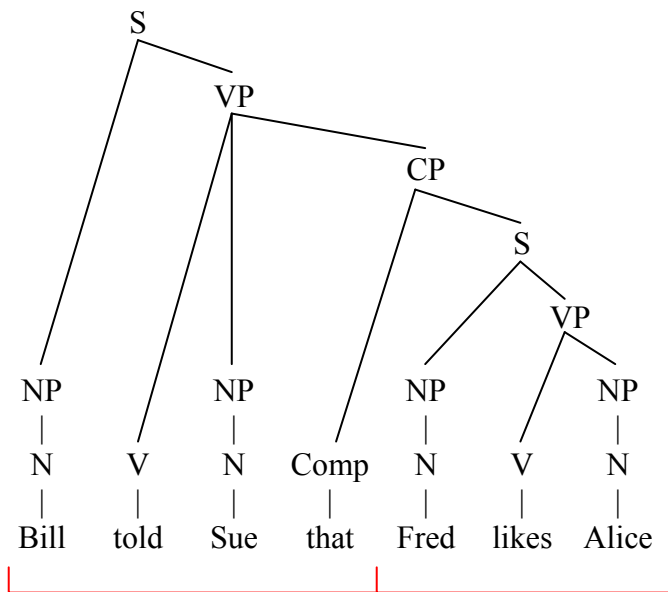
Within brackets, any two NP are clausemates.

Study Exercise #59: **Clausemates**

Mary assumes that Fred will tell Sam that Alice saw Tom.

    Parse the sentence, and draw the informal brackets to show the clausemate domains. Then consider every pair of NP (there are ten pairs) and specify whether they are clausemates. Answer on next page.

Answer to Study Exercise #59
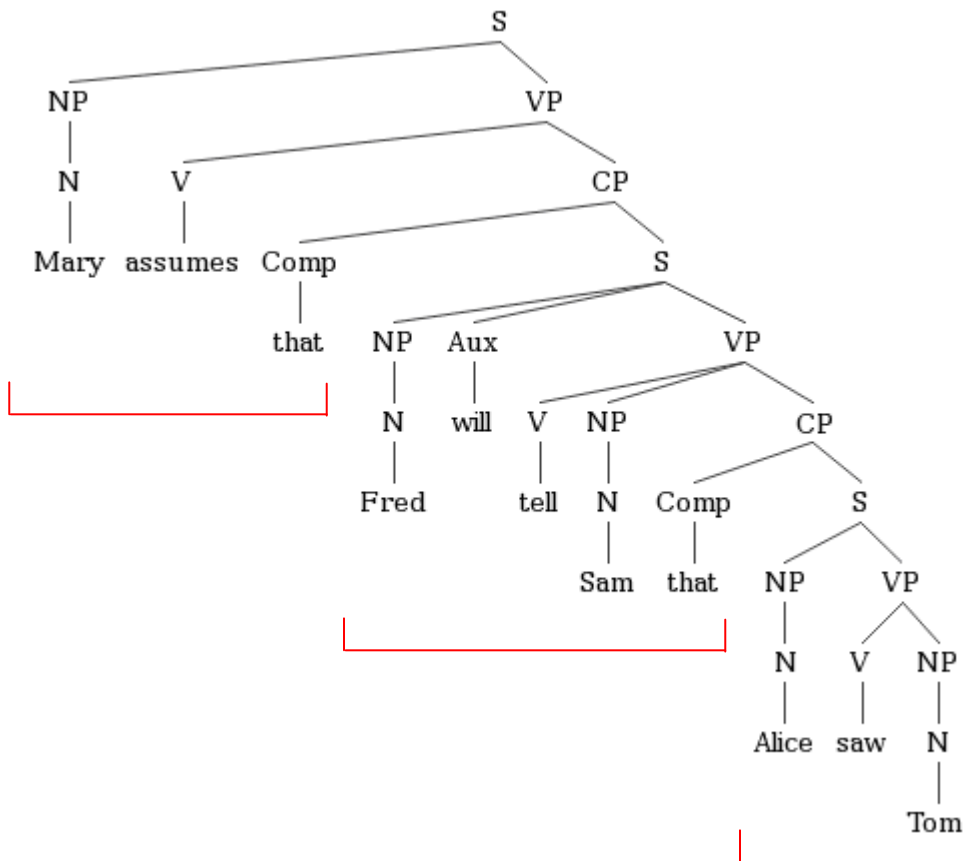
Pairwise:

Mary-Fred: no
Mary-Sam: no
Mary-Alice: no
Mary-Tom: no
Fred-Sam: yes
Fred-Alice: no
Fred-Tom: no
Sam-Alice: no
Sam-Tom: no
Alice-Tom: yes

7. An interpretive analysis for reflexive pronouns

Using the approach just described, we can write the following rule of interpretation for reflexives:

(183) **Reflexive Interpretation**

A reflexive pronoun must be coreferent with an NP that

(a) is its clausemate; and
(b) c-commands it.

Here are examples, labeled for how the rule works. As you read these examples, I suggest you draw the tree, consult the definitions of c-command and clausemate, and check the rule is working correctly.

*Himself sings.

Here, there's no NP for *himself* to be coreferent with, so it receives no interpretation. The standard assumption, which we will follow, is that a sentence with an uninterpretable pronoun is ungrammatical.

Next consider:

Mary$_i$ congratulated herself$_i$.
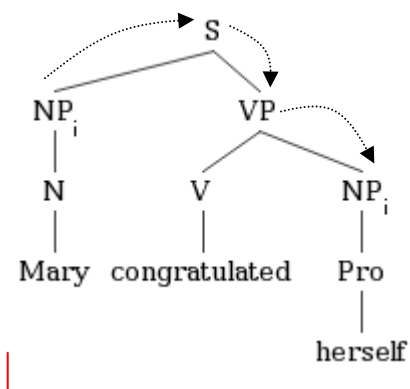
This one is fine; the NP *Mary* c-commands the NP *herself* and, since there is just one clause, the two are clausemates. The correct indexation (note: on the NPs, not lower down) is shown in the tree above.

Next consider:

*[Mary$_i$'s brother] congratulated herself$_i$.
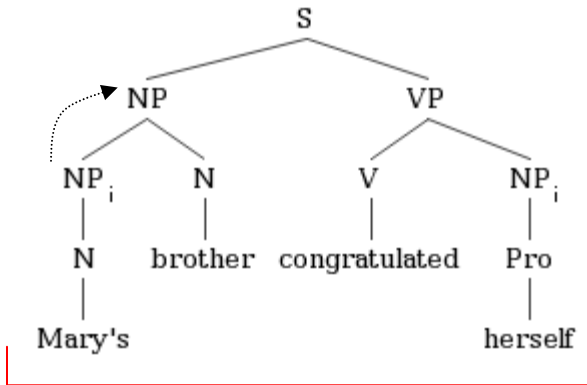
Here, *Mary* is a clausemate of *herself*, but doesn't c-command it—the mother of *Mary* is the higher NP *Mary's brother*; so *Mary* is not "high enough" in the tree to c-command *herself*.

Next consider:

*[Mary's brother]$_i$ congratulated herself$_i$.
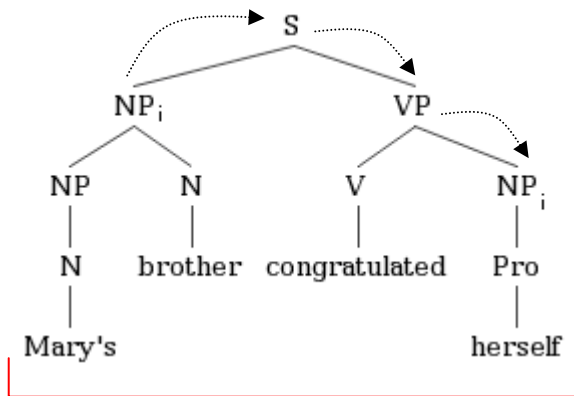
Same tree, but different indices. Here, the NP *Mary's brother* does c-command the NP *herself*, and is a clausemate. The problem here is not with Reflexive Interpretation, but rather with the morphosyntactic representation: brothers are always male, and *herself* is [Gender:feminine]), so the sentence is still ungrammatical. Let us record this feature-matching principle for future reference:

(184) **Feature-matching in pronouns**

A pronoun must bear a morphosyntactic representation that matches its referent in the features [Gender], [Number], and [Person].

Now consider:

(185) [Mary's brother]$_i$ congratulated himself$_i$.
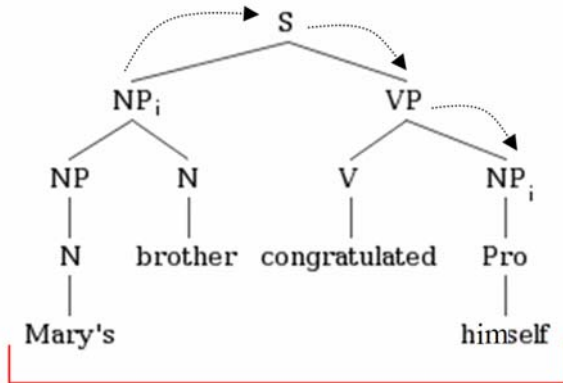
This one matches all requirements (gender match, c-command, clausemate condition), and is fine.

The next case to consider is:

(186) Mary$_i$ said that Tom congratulated herself$_i$.
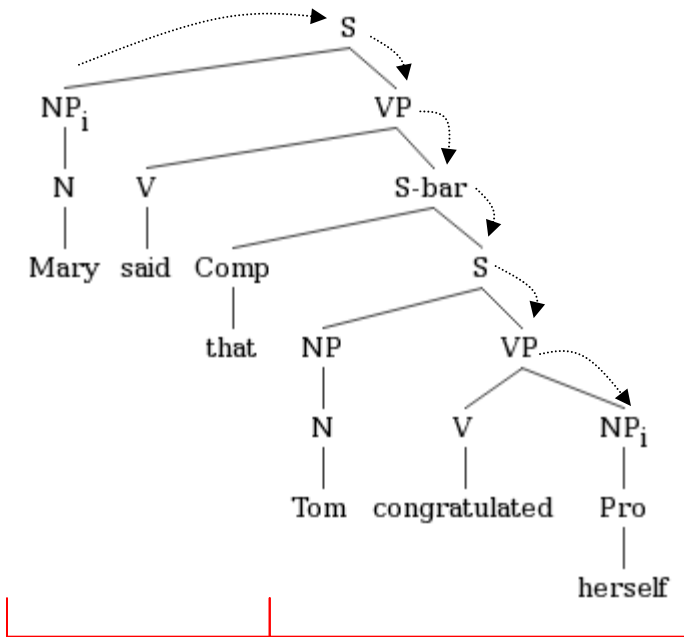
Bad: *Mary* is not the clausemate of *herself* (*herself* is in the lower S, *Mary* is not).

We can try a different indexation for the same sentence:

(187) Mary said that Tom$_i$ congratulated herself$_i$.
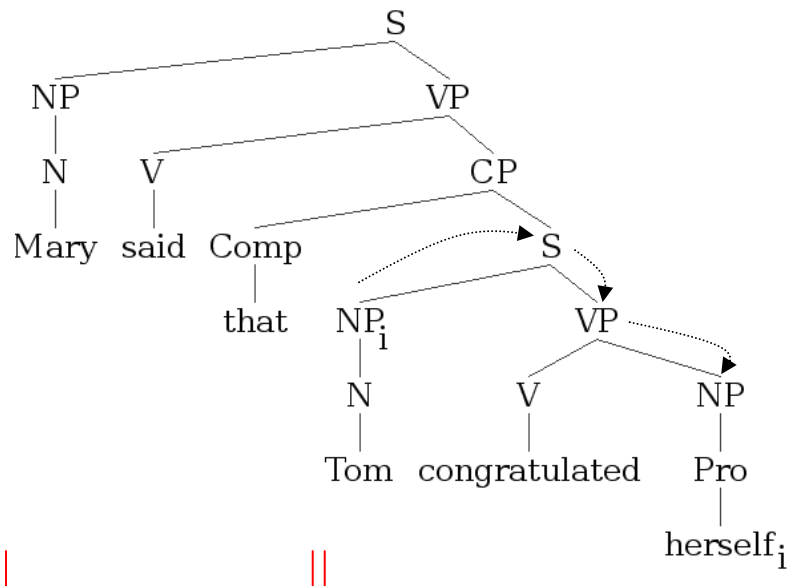
Bad: *Tom* is a c-command clausemate but because it is a name for males there is a featural mismatch with the pronoun, following (167).

Study Exercise #60

The fact that Mary$_i$ lost the race surprised herself$_i$.

This one is bad; you give the explanation. Answer on next page.

Answer to Study Exercise #60
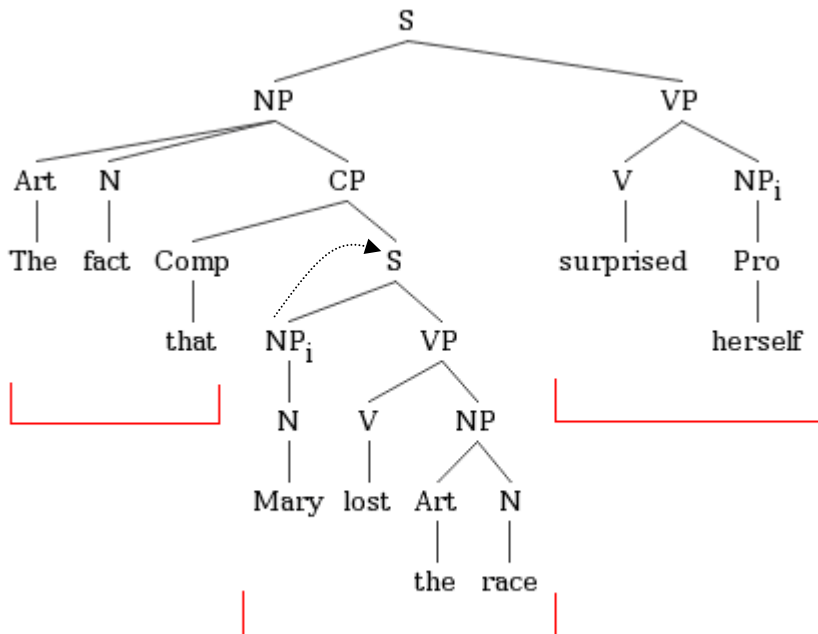
This one is bad because *Mary* doesn't c-command *herself*. Specifically, the mother of *Mary* is *Mary lost the race*, which doesn't dominate *herself*.

7.1 Each other

The phrase *each other* is a **reciprocal** pronoun, not a reflexive. For reasons of meaning, it requires a plural antecedent, but as far as the conditions on its reference it works essentially like a reflexive and is normally analyzed using the same sort of rule. Thus:

[John and Mary]$_i$ like [each other]$_i$.   Ok.
*[Each other]$_i$ like [John and Mary]$_i$.   Bad: c-command condition violated
*[John and Mary]$_i$ think I like [each other]$_i$.   Bad: clausemate condition violated

For further relevant data see Chapter 1.

8. An interpretive analysis for regular pronouns

The regular pronouns (like *she*, *him*, *us*, *our*, etc.) are used quite differently from reflexives. For one thing, they can be used without any linguistic Noun Phrase to refer to at all—as in the "Well, he's left" example given earlier in (178) above.

The key to these pronouns, in the view of many linguists, is that you specify not what they *can* refer to*,* but rather what they *cannot* refer to. Here is a version of the rule commonly proposed:

(188) **Regular Pronoun Interpretation**[125]

A regular pronoun cannot be coreferent with a c-commanding clausemate.

Some examples follow.

8.1 *Pronouns alone*

He$_i$ left.

This is fine: there is no NP in the sentence that *he* is required to be non-coreferent with, and the sentence is freely usable whenever there's an obvious enough male entity available for *he* to refer to. This could be someone mentioned in a previous sentence, or someone noticed in the physical surroundings, as discussed earlier for sentence (178).

8.2 *No c-command, coreference ok*

[Mary$_i$'s brother] congratulated her$_i$.
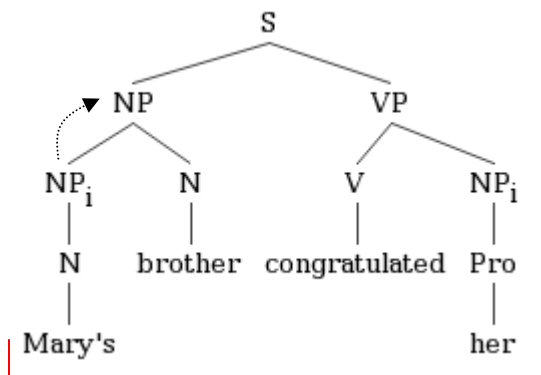
This is fine, because *Mary* doesn't c-command *her*.

8.3 *No coreference — always ok*

[Mary$_i$'s brother] congratulated her$_j$.

---

[125] In the linguistics literature this rule is often called "Principle B." The rules for reflexives and reciprocals are subsumed together under "Principle A". In this introductory text I have opted for descriptive rule names instead.

The subscript *j* means that the *her* refers to a female person other than *Mary*. This is fine, too—Regular Pronoun Interpretation doesn't actually *require* that pronouns be coreferent with any other NP in the sentence. Thus, this sentence could appear in a context like this:

> *Alice sang incredibly well, enough to convince her sternest critics. In fact, even Mary's brother congratulated her.*

I think it's pretty clear that in this sentence it would be possible for *her* to refer to *Alice.*

8.4 C-commanding clausemate: coreference impossible
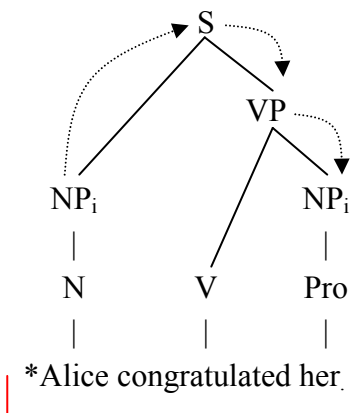
This one is no good: *Alice* is the clausemate of *her*, and also c-commands *her*, so it can't be coreferent. However, with distinct reference, the following reading is ok:

Alice$_i$ congratulated her$_j$.

8.5 C-command but not clausemate: coreference ok
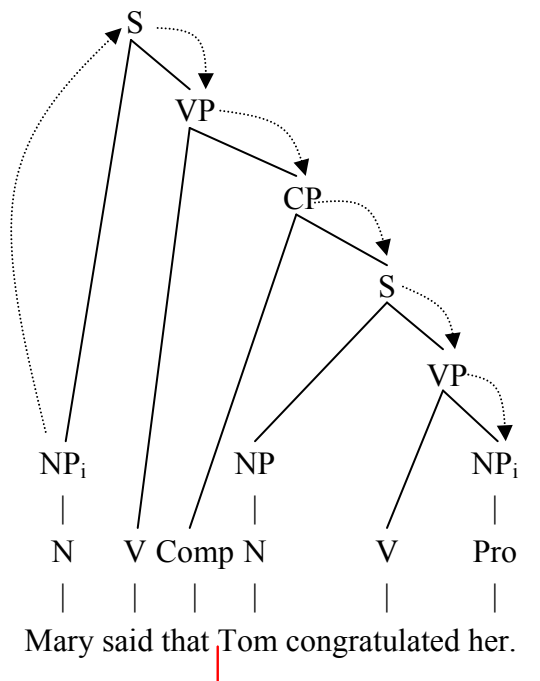
This one is fine: *Mary* does c-command *her*, but it is not the clausemate of *her*, so
Regular Pronoun Interpretation doesn't rule out this reading.

8.6 C-command but not clausemate: non-coreference ok

Mary$_i$ said that Tom congratulated her$_j$.

This is likewise fine, *her$_j$* refers to some female person mentioned earlier or physically present.

8.7 *No c-command, not clausemate: coreference ok*

The fact that Mary$_i$ lost the race surprised her$_i$.
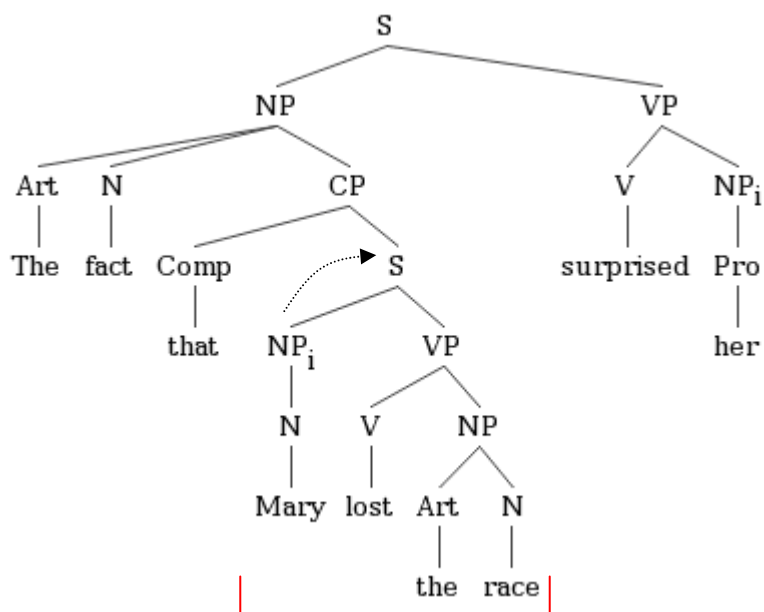
Ok, *Mary* is neither a clausemate of *her*, nor does *her* c-command *Mary*, so the coreference is allowed.

8.8 *Backwards coreference*

An intriguing prediction of the analysis is that you could, in principle, get sentences in which the pronoun actually comes before the full NP with which it is coreferent. These do in fact arise, though because of additional factors they won't be found in all places you would expect them. Here is an example:

The fact that she_i lost the race surprised Mary_i.
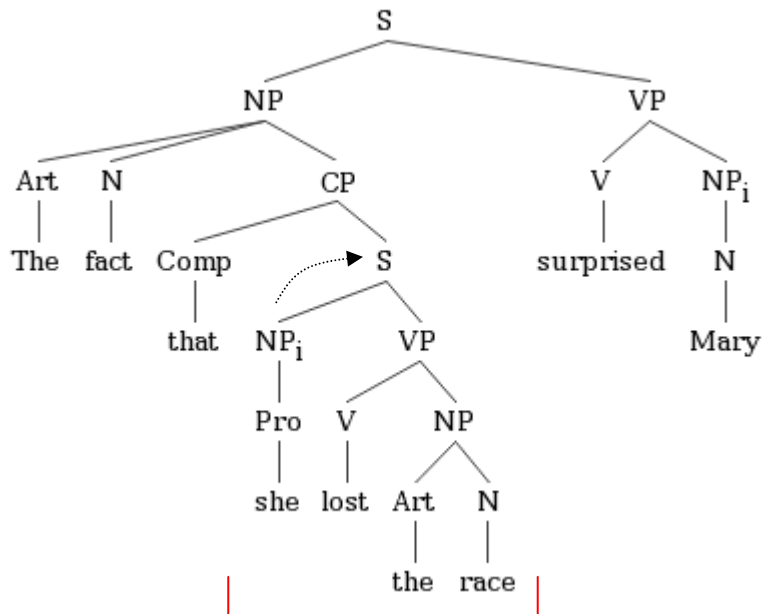
This sounds best only under particular conditions of emphasis and intonation. In particular, you can't utter *Mary* with a full phrasal stress, as if the name were being introduced to the conversation for the first time — if *Mary* were new information, you wouldn't have been referring to her with a pronoun! The sentence sounds ok if you say:

The fact that she_i lost the race SURPRISED Mary_i.

Of course, since Regular Pronoun Interpretation only forbids coreference, the following reading is also acceptable:

The fact that she_j lost the race surprised Mary_i.

9. An interpretive analysis for full noun phrases

One wouldn't think that there need to be any rules for the meaning of full noun phrases, but these are in fact needed. Consider a sentence like:

*He_i thinks Bill_i is a genius.

The coreference shown is impossible, even though nothing we've said so far rules it out. The rule commonly used is this one:

(189) **Full Noun Phrase Interpretation**[126]

A full noun phrase cannot be coreferent with a c-commanding Noun Phrase.

This rules out *He_i thinks that $Bill_i$ is a genius* because *he* c-commands *Bill* and *Bill* is a full NP.
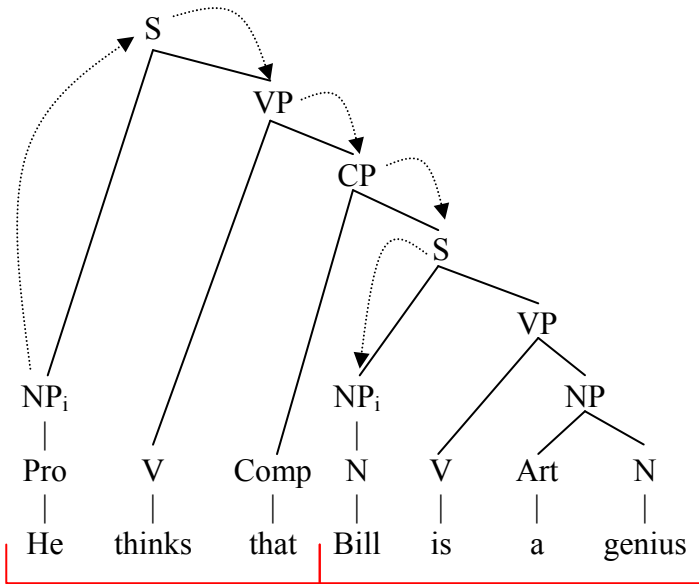
Indeed, the same rule predicts that in

Bill thinks that Bill is a genius.
Bill saw Bill.

we must interpret the two *Bill*'s as being different people; that is, these sentences must be interpreted:

$Bill_i$ thinks $Bill_j$ is a genius.
$Bill_i$ saw $Bill_j$.

If neither copy of *Bill* c-commands the other, then coreference becomes more or less ok:

[well, at least] $Bill_i$'s mother likes $Bill_i$.

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[126] In the linguistics literature this rule is often called "Principle C."
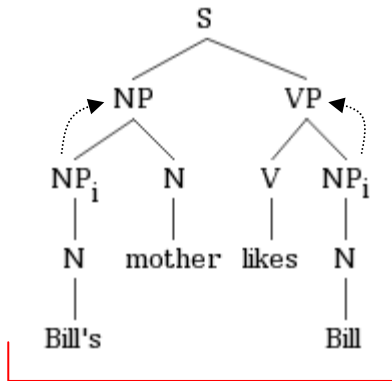
Study Exercise #61: in the following, why can the two *Bill*'s be the same person? Show the relevant structure.

The idea that Bill might have the lowest score bothers Bill.

Answer to Study Exercise #61
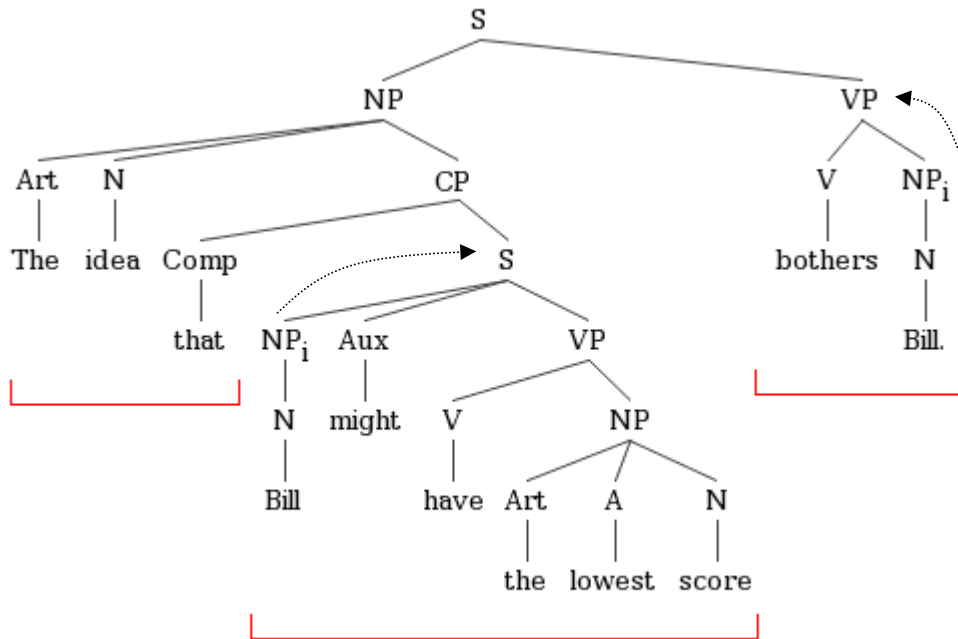
This is ok because neither instance of *Bill* c-commands the other. The mother of the first *Bill* is S, which doesn't dominate the second *Bill*; and the mother of the second *Bill* is VP, which doesn't dominate the first *Bill*.

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10. Summary

We've now done a particular corner of English semantics, setting out rules of semantic interpretation for anaphoric elements. Dividing all NPs into the categories of Reflexive Pronouns (with their close relative Reciprocal Pronouns), Regular Pronouns, and Full NPs, we developed three rules, one of which requires coreference in certain contexts, the other two of which forbid it:

Reflexive Interpretation (183)

A reflexive pronoun must be coreferent with an NP that (a) is its clausemate; and (b) c-commands it.

Regular Pronoun Interpretation (188)

A regular pronoun cannot be coreferent with a c-commanding clausemate.

Full Noun Phrase Interpretation (189)

A full noun phrase cannot be coreferent with a c-commanding Noun Phrase.

OPERATORS AND SCOPE

11. Operators and scope in formal logic

The idea of operators and scope was incorporated into linguistics from the field of symbolic logic, a branch of philosophy.[127] Logicians express (certain aspects of) meaning with formulas like the following.

For all x

P is true of x

$\forall x(P(x))$
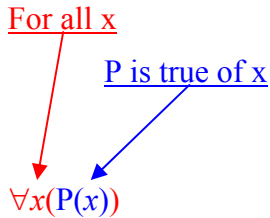
The meaning of the formula is, "for all x, P is true of x". If we were applying this formula to a real-life situation, we might image a universe that consists of the students in Linguistics 20, and P represents "has the flu". The formula could then be interpreted as "Every student in Linguistics 20 has the flu." In the formula, $\forall x$ is an **operator**, x is a **variable**, and P is a **predicate** (just like we saw with predicate-argument structure).

To see the concept of **scope**, let us compare two formulae that are more complex. Here is the first one.

I.   For all x
        P is true of x
                    implies that
                        Q is true

$\forall x(P(x)) \ \rightarrow \ Q$
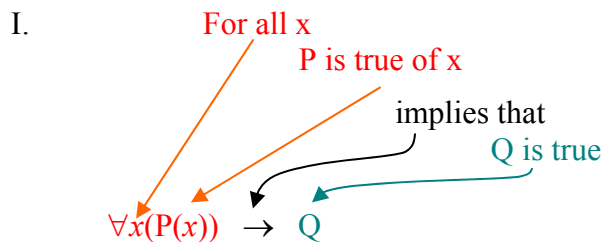
Pursuing our real-life interpretation, we might suppose that Q means "the professor postpones the exam". The symbol $\rightarrow$ means "if … then". The interpretation would then be "If every one of the students in Linguistics 20 has the flu, then the professor will postpone the exam."

Now consider a similar formula, with a different location for the right parenthesis.

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[127] At UCLA you can study the basics of this field in Philosophy 31; indeed almost every university has an introductory logic course.

II.
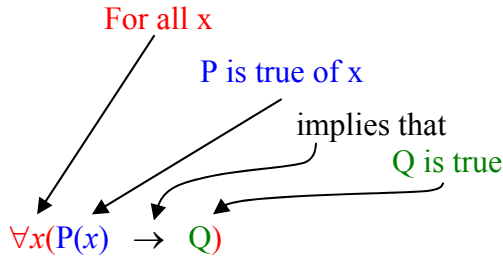
With the parenthesis relocated, "for all" now covers the entire rest of the formula, rather than just P(x). Thus, in the real-life interpretation of the formula, this would be "For every student, if that student has the flu, then the professor will postpone the exam." — this would imply that the professor will postpone the exam even if there is just one case of the flu in the class.

One can speak here of an operator having **scope**. In the first formula, the scope of the operator $\forall x$ is just P(x) (informally, "x has the flu") whereas in the second formula the scope of the operator $\forall x$ is P(x) → Q (informally, "if x has the flu, the professor will postpone the exam").

The operator $\forall x$ is of a particular kind, called a **quantifier**. It means "all" (symbol: inverted A). The other quantifier most often used in elementary logic is $\exists x$, which means "at least one x" (inverted E, "exists").

In logic, these concepts are employed in the study of the principles of valid reasoning. For example, the formula $\sim\forall x$(P(x)) → $\exists y$($\sim$P(y)) (which means "If it's not so that P is true of all x, then there must be a y of which P is not true") represents a case of valid reasoning. It is true irrespective of how we interpret the elements it contains. Over the centuries, logicians have provided mathematical proofs for a vast number of such formulae, thus providing a more solid basis for reasoning.

12. Operators and scope in language: some examples

In linguistics, the focus is less on proofs of validity, and more on using logic to provide a precise and interpretable characterization of meaning. In fact, linguistic meaning is much richer than what can be expressed with the logic taught in beginning courses, and finding a rich enough formal system to characterize human language continues to be a research challenge for logicians and linguists alike.

We can start by seeing that the logical notions of quantifier, scope, and variable are expressed fairly directly in English (or indeed in any other language). Here is an example:

Every boy sang.

Here, we have the following:

Every boy	a kind of (restricted) universal quantifier ($\forall x$, x a boy)
x sang	a predicate

Putting these together, we get something like (190):

(190) ($\forall x$, x a boy) (x sang)

If you want to read (190) aloud, you might say "For all x, such that x is a boy, x sang."

Generally, linguists, just like logicians, put operators at the left of the domain over which they have scope; this is a matter of convenience and is an arbitrary convention. So, for instance, a sentence like:

Jane taught every student.

would be expressed as:

($\forall x$, x a student) (Jane taught x)

In principle, we could integrate such expressions with the predicate-argument structure developed earlier in this chapter. Under this approach, the meaning would appear like this:

($\forall x$, x a student) (TEACH (($_\text{Teacher}$ Jane) ($_\text{Teachee}$ x)))

For brevity (and to avoid unwanted complications), in what follows I will skip this step and simply place the quantifiers and variables into ordinary syntactic structure.

12.1 Pronouns as variables

So far, we have treated pronouns as NPs that refer to things. When a pronoun is coindexed with another NP (*Bill$_i$ thinks he$_i$ is tall*) it is meant to refer to the same real-world thing as that NP. When a pronoun has its own distinct index (*Well, he$_i$ left*), it is meant to refer to some real-world thing assumed to be identifiable by the real-world context.

However, not all pronouns refer to things. The other use of pronouns is as *the linguistic manifestation of logical variables*. This can happen when there is a logical operator, such as a quantifier, elsewhere in the sentence. Consider the following sentence.

Every boy thinks that he is smarter than average.

There is a boring reading:

[*Every boy*]$_i$ *thinks that* [*he*]$_j$ *is smarter than average.*

where *he* is someone else, like, say, Fred. We focus here on the interesting reading:

[*Every boy*]$_i$ *thinks that* [*he*]$_i$ *is smarter than average.*

This sentence would hold true in a world in which Fred thinks Fred is smarter than average, Bill thinks Bill is smarter than average, and so on. In this reading, the pronoun *he* does not *refer* to

anyone. The more sensible interpretation is that *he* act as a logical variable, and indeed we have two instances of the same variables under the scope of a single quantifier.

Every boy	is the quantifier ($\forall x$, x a boy)
he	is a bound variable (x)
x thinks x is smarter than average	is a complex predicate, with two variables

Putting these together, we get the structure in (191):

(191)($\forall x$, x a boy) (x thinks x is smarter than average)

In sum, the pronoun *he* is not referential but rather is the linguistic means for expressing the second instance of the variable. (The first variable simply occurs in the syntactic location of the NP containing the quantifier; see rules below for how this can be derived).

Let us return briefly to the "boring" reading mentioned above: the pronoun *he* does not *have to* act as a bound variable, but can also be an ordinary pronoun, which can refer to some male person who happens to be under discussion, such as Fred. Thus, the boring reading could be represented as in (192):

(192) ($\forall x$, x a boy) (x thinks he_i is smarter than average)

where *he_i* is a pronoun referring to someone in the environment, in the ordinary way.

Some terminology: we say that in the first reading, *he* acts as a variable that is **bound** by the quantifier. In sum, the pronouns of a language play at least two roles: they either simply refer to other entities, or they act as bound variables.

What is the mechanism whereby pronouns get interpreted as bound variables? As a rough approximation, we can make use of the discussion of pronoun reference from earlier in this chapter. There, we studied rules that assign indices to pronouns and their antecedents, to express ordinary coreference and non-coreference. The extension of this idea in the present context is this: if a pronoun gets coindexed with a *quantified* NP, then the relationship is then semantically interpreted not as coreference, but as an operator-variable relationship. Thus, for instance, the rules of anaphoric interpretation permits the following coindexation for the NPs in the sentence we are working with (*he* is not the clausemate of *every boy*, so Regular Pronoun Interpretation ((188)) is satisfied; and *he* does not c-command *every boy*, so Full Noun Phrase Interpretation ((189)) is satisfied).[128]

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[128] The tree below is not compliant with our phrase structure rules. The change needed is pretty straightforward: AP → (Adv) A **(PP)**. All comparative adjectives ("X-er") can take a PP with *than*.
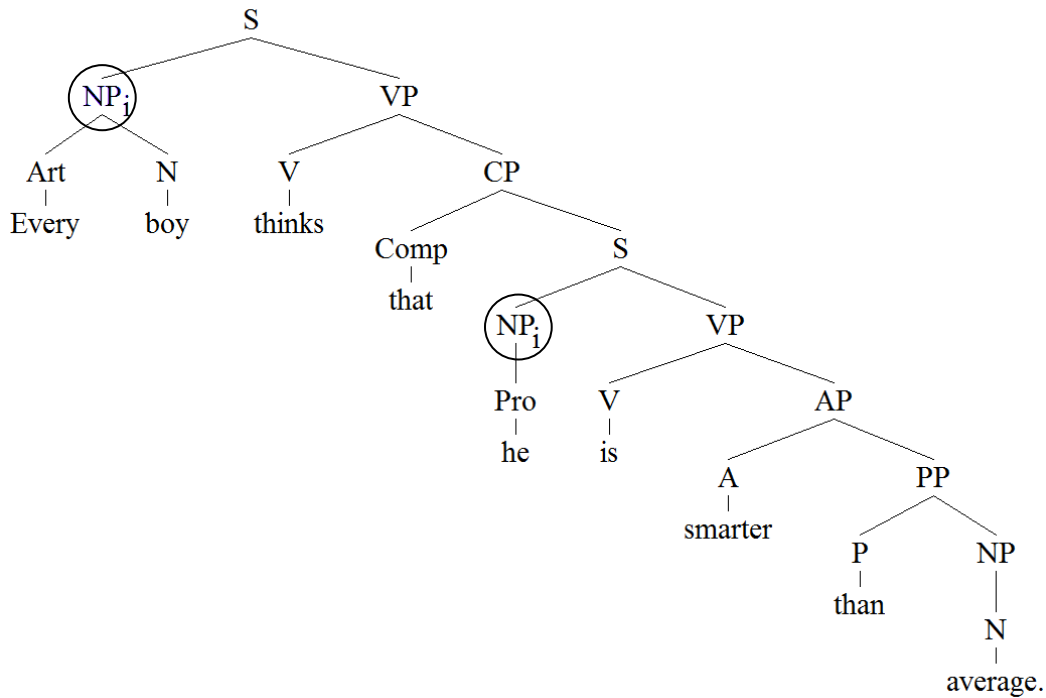
Because *every boy* is a quantified NP, this must be further translated to

$(\forall x, x$ a boy$)$ $(x$ thinks x is smarter than average$)$

More specifically, when a quantified NP is logically interpreted as an operator-variable combination, any pronouns coindexed with it must be assigned the same variable. The following match-up illustrates this:

[Every boy]$_i$ thinks that [he]$_i$ is smarter than average.

$(\forall x, x$ a boy$)$ $(x$ thinks x is smarter than average$)$
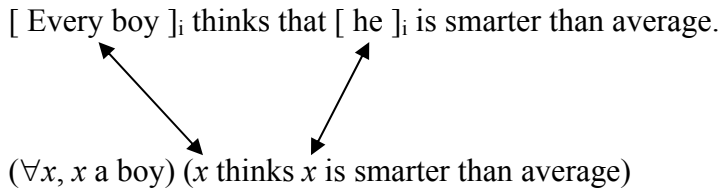
13. Logical form

It is time now to integrate the discussion into a general approach to semantics. Note that the following is just one (well represented) viewpoint among many.

The core idea is that the rules of the semantics create from syntactic representation[129] a separate representation of the sentence's meaning (or, in cases of ambiguity, more than one representation). Such a semantic representation is often called the **logical form** of a sentence.

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[129] Most likely, from surface structure. The traces left by movement rules generally make it possible to cover the effects of deep structure on meaning; they serve as a "memory" for the location of phrases at the deep structure level.

Logical form is meant to be specifically linguistic in character; it only represents the contribution of language to meaning and is certainly not the "language of thought", if such a thing exists — our thoughts involve all sorts of non-linguistic inferences and associations, in addition to language.

Here are some of the steps that would be needed to construct a logical form from a syntactic structure. As some (probably early) stage we would establish the possible references of pronouns and reflexives through the assignment of indices, using the rules of Reflexive Interpretation, Regular Pronoun Interpretation, and Full Noun Phrase Interpretation, given earlier in this chapter. Another step would be to convert quantified NPs into operator-variable pairs, to indicate scope, as described in the previous section; at this stage coindexed pronouns must be converted to variables under the scope of the same quantifier. Yet another step would be to establish precisely "who is doing what to whom" by replacing the syntactic tree with an appropriate predicate-argument structure.

Here are a couple of examples of how all this might work. In

Every boy thinks he is smart

the rule of Regular Pronoun Interpretation would (as one of its options) coindex *every boy* and *he*, thus:

[Every boy]$_i$ thinks [he]$_i$ is smart

Next, the quantified NP *every boy* would be converted to an operator-variable combination. Since *he* is coindexed with *every boy*, it is a assigned the same variable *x*:

($\forall x$, *x* a boy) (*x* thinks *x* is smart)

Then the whole expression could be converted to a predicate-argument structure, yielding a logical form:

$\forall (x, x \text{ a boy})((\text{THINK}((_{\text{Thinker}} x), (_{\text{Proposition}} \text{SMART}((_{\text{Assessee}} x)))))$

For the sentence *Mary seems to like every boy*, the same processes would yield:

$\text{SEEM} ((_{\text{Proposition}} \forall (x, x \text{ a boy})(\text{LIKE} ((_{\text{Liker}} \text{Mary}) (_{\text{Lik-ee}} x))))))$

This is, of course, only an outline scheme. In the pages below, I'll discuss briefly the rules for converting quantified NPs into operator-variable pairs, which will flesh out the scheme a bit. However, we will henceforth skip the step of creating predicate-argument structure from syntax.

14. Sentences with two operators

The strongest justification for the type of analysis to follow comes from sentences that have two logical operators. In such sentences, the two operators often interact with each other, yielding different meanings. For example, speaking of an archery tournament, we could say sentence (193):

(193) *A sentence ambiguous because of two interacting quantifiers*

　　Two arrows hit every target.

This sentence is ambiguous, in the following way. Suppose that the archers are so impoverished that between them they could bring a total of only five arrows to the tournament. Thus, each arrow has to be used repeatedly. Suppose further that the archers used a total of five targets. Here is one reading: two of the arrows (perhaps the straightest ones) were used so successfully that during the course of the tournament they penetrated every one of the five targets.

(194) *"Two arrows hit every target": Scenario I*
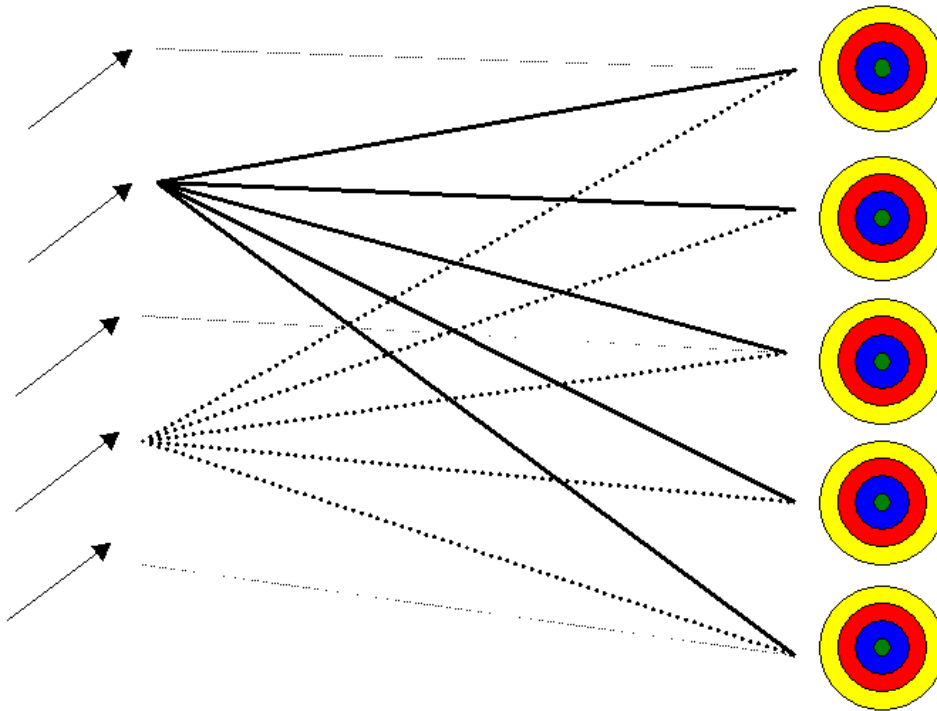
　　In the other reading, we would find that inspecting the targets at the end of the tournament, each has at least two holes in it.[130]

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[130] I'm saying "at least" because this seems to be the default interpretation of numerals like *two*; we could get a different interpretation by saying *exactly two*.

(195) *"Two arrows hit every target": Scenario II*
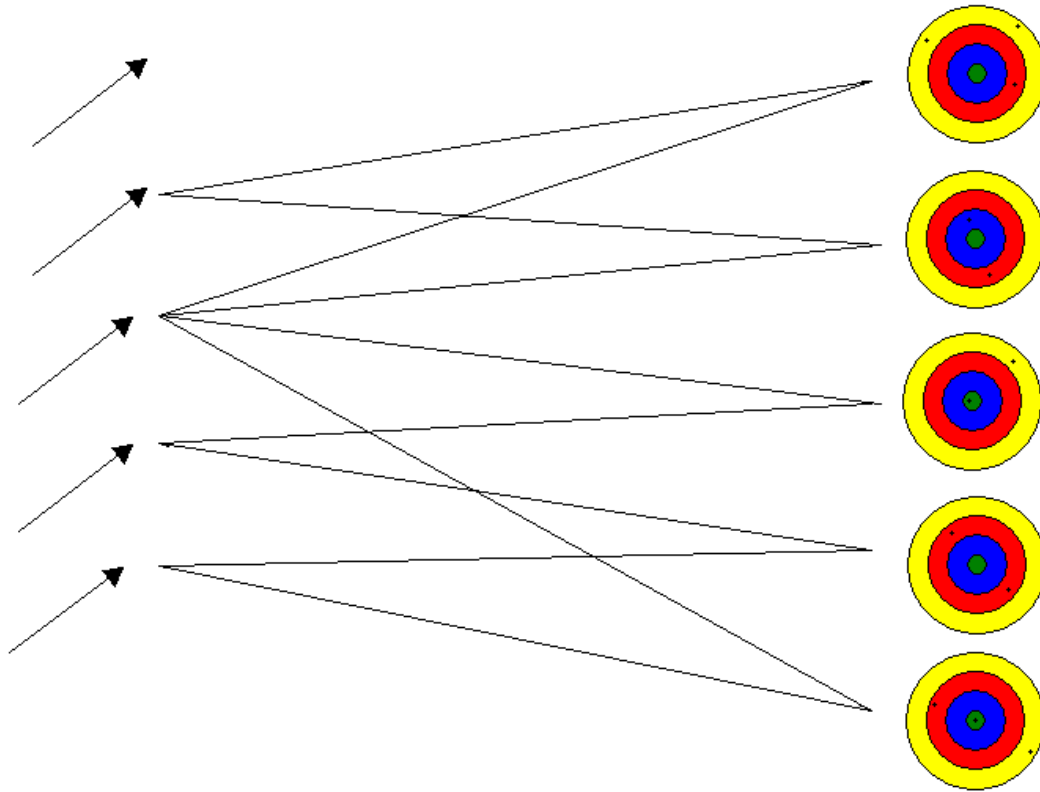
A nice challenge to one's ability to write very clearly is the task of expressing, in a single sentence, just *one* of the two meanings of a a double-quantifier sentence. For example, the two readings of *Two arrows hit every target* can be summarized as follows:

(196) *'There were two arrows such that they hit every target.'*

      True of Scenario I; diagram (194)

(197) *'For every target, it is the case that two arrows hit it.'*

      True of Scenario II; diagram (195)

Two common phrases that can often help in producing an unambiguous paraphrase are *such that* and *it is the case that* — both of them have the effect of canceling out an unwanted scope reading, so the paraphrase becomes unambiguous. Paraphrase (196) above uses *such that*, and paraphrase (197) uses *it is the case that.*

The ambiguity we have just seen is within the capacity of the system we are developing. To handle it, we use two operators. The word *every* is a real-language version of the universal quantifier $\forall x$. *Two* is not an operator that is normally taught in introductory logic, but I think it is

intuitively clear that it is an operator of some kind. Thus, by putting the operators in the right structural locations, we can characterize the ambiguity.

(198) *Representing the two scopes for "Two arrows hit every target"*

a. *Scenario I*

(For two *x*, *x* an arrow) ((for every *y*, *y* a target) (*x* hit *y*))
'There were two arrows such that they hit every target.'

b. *Scenario II*

(For every *y*, *y* a target) ((for two *x*, *x* an arrow) (*x* hit *y*))
'For every target, it is the case that two arrows hit it.'

This is an example of a **scope ambiguity**. In (198)a, the scope of the operator (For two *x*, *x* an arrow) is ((for every *y*, *y* a target) (*x* hit *y*)). In (198)b, the scope of the operator (For every *y*, *y* a target) is ((for two *x*, *x* an arrow) (*x* hit *y*)).

Another way of saying that same thing is that in (198)a, (For two *x*, *x* an arrow) **takes scope over** (for every *y*, *y* a target), because (for every *y*, *y* a target) is inside the scope of (For two *x*, *x* an arrow). In (198)b, (for every *y*, *y* a target) takes scope over (For two *x*, *x* an arrow).

14.1 The local "universe of discourse"

As you can see above, in language operators often consist of two parts, one the quantifying expression itself (*two*, *every*), and the other an expression of the set of entities (*arrows*, *targets*) being quantified over. The latter set is grounded in the local "universe of discourse"—when I say *every target*, I mean, "every target in the set of targets relevant to the conversation we are having"; hence, in the present context, every target that was present at the archery tournament. Clearly, speakers interpret quantifiers making use of their real-world knowledge, which permits them to infer the set of relevant targets (or whatever) from the context.

15. Operator scope in multiclause sentences

Operators can have scope not just over other operators, but over particular clauses in a sentence that has more than one clause. These cases are of special interest for us because they can be used to show the close relationship of operator scope with syntactic structure.

Here is an example. The sentence at hand is:

(199)   *Sue shouted* [*for us to give water to each runner*]

We need briefly to cover the syntax here. In one commonly-adopted analysis, *for us to give water to each runner* is a CP, *for* is a *Comp*, *us* is the NP subject of *for us to give water to each runner* and *to* is a particular sort of Aux used only in verbal infinitives. *Shout* is a verb that subcategorizes

for this particular kind of CP (often called an "infinitival clause", since *to give* is the infinitive form of *give*) Here is the proposed parse:
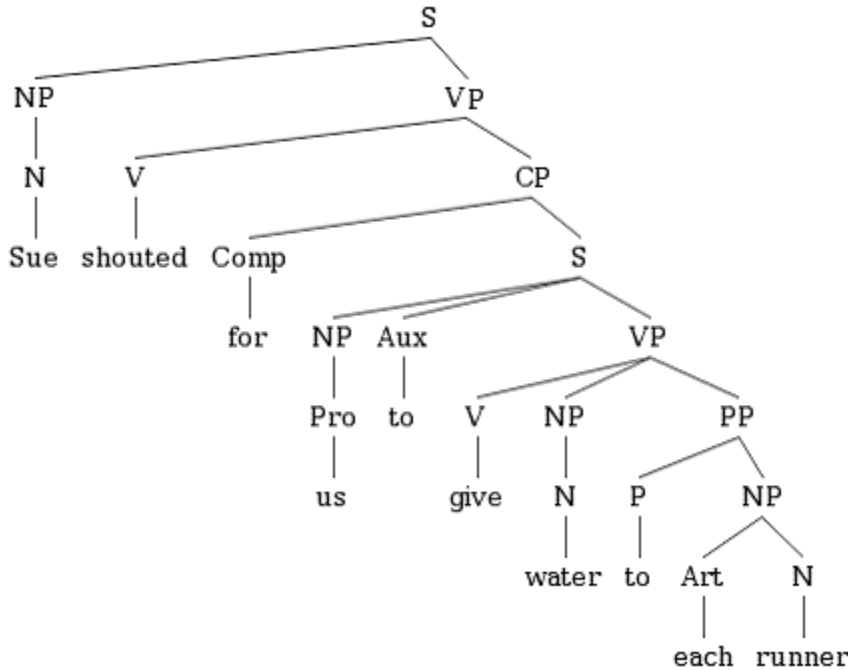
Now, let us consider the meanings at hand. The easy reading here, which I will call Narrow Scope, is the one where Sue shouts just once, at the beginning of a marathon,

Hey! Give water to each runner!

In this reading, the scope of *each* is the embedded clause that reports what Sue shouted. Here is a possible logical structure for this reading:

(200) *Narrow scope reading of "Sue shouted for us to give water to each runner"*

Sue shouted ((for each *x*, *x* a runner) (for us to give water to *x*))

For the other reading, imagine it's a bit late in the day in a marathon, and the stragglers are coming by the water station at Mile 23, spaced about two minutes apart. Whenever this happens, Sue shouts:

(Happens many times:) *Hey! Give water to that runner!*

Call this the Wide Scope reading. It could be represented like this:

(201) *Wide scope reading of "Sue shouted for us to give water to each runner"*

(For each *x*, *x* a runner) (Sue shouted (for us to give water to *x*))

In other words, for each passing runner, there was a "shouting event", in which Sue directed the workers to give that runner some water.

Here is an effort to provide single-sentence paraphrases of the two readings.

Narrow-scope reading:

The message expressed by Sue's shouting was such that for each runner, we should give water to that person.

Wide-scope reading:

For each runner, Sue emitted a shout to the effect that we should give water to that runner.

The general point of this example is that we can have a sentence that has just one variable, but is ambiguous. This is because the sentence has two clauses, and thus two locations for the operator to go.

Study Exercise #62

Provide paraphrases for both the wide and narrow scope readings of these sentences, which are ambiguous in the same way as (199). Also, provide logical notation similar to the ones just given.

a. I signed an order for each soldier to be given a medal.
b. I announced that progress has been made on every front.

Answer to Study Exercise #62

a. Wide scope:　　　　"For each soldier, I signed an order that that solder be given a medal."

　Narrow scope:　　　"I signed an order, whose content was that each soldier should be given a medal."

b. Wide scope:　　　　"For every front, I announced that progress was being made on that front."

　Narrow scope:　　　"I made announcement, whose content was the progress was being made on every front."

---

16. Creating operator-variable pairs from quantifiers in logical form

We can now consider what rules could be used to derive the logical form of quantified sentences. We know, up front, that the rules need to have some flexibility, because of sentences like (199) *Sue shouted for us to give water to each runner*, where a single syntactic structure yields two different interpretations for quantification.

We first need a rule that translates quantified NPs into operators.

(202) **Quantifier Translation**

　　Replace

　　[every N]$_{NP}$　　with　　[for every x, x an N]$_{NP}$
　　[some N]$_{NP}$　　with　　[for some x, x an N]$_{NP}$

　　and similarly for other quantified expressions. If the variable *x* is already in use, use *y* instead; etc.

The other rule we need is more dramatic: it lets us pick the clause over which the operator will have scope, moves it there, and creates a variable in the location that the moved NP left behind.

(203) **Quantifier Raising**

　　Left-adjoin a quantified NP to S, leaving behind a variable in its original location.

This rule has an undefined concept in it, **adjunction**, which is defined as follows:

(204) **Left-Adjunction**

Given a constituent A, containing a B, and (optionally) C, the mother of A:

Form a new constituent, which is:

 ➤ has the same node label as A
 ➤ has as its daughter nodes a copy of B, followed by A
 ➤ if A was the daughter of C, the new constituent becomes the daughter of C

Here are two simple cases of left adjunction.
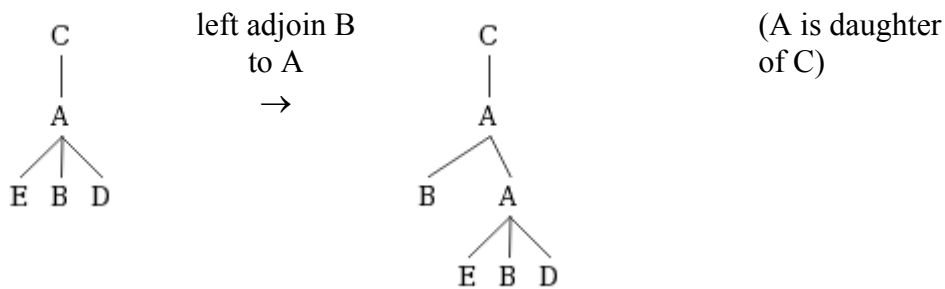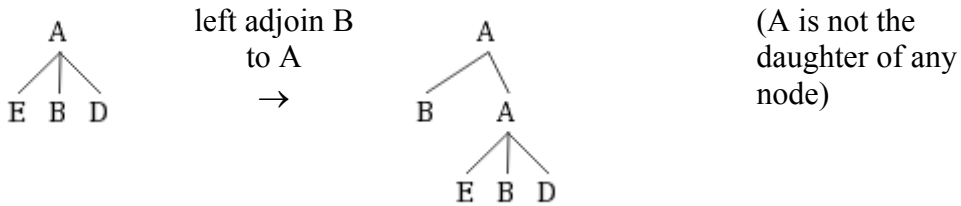
The purpose of left adjunction is simply to provide a slot in which the logical operator can reside.

17. Deriving distinct meanings with Quantifier Raising

Let us return to (199) *Sue shouted for us to give water to each runner*, whose surface structure is repeated below.
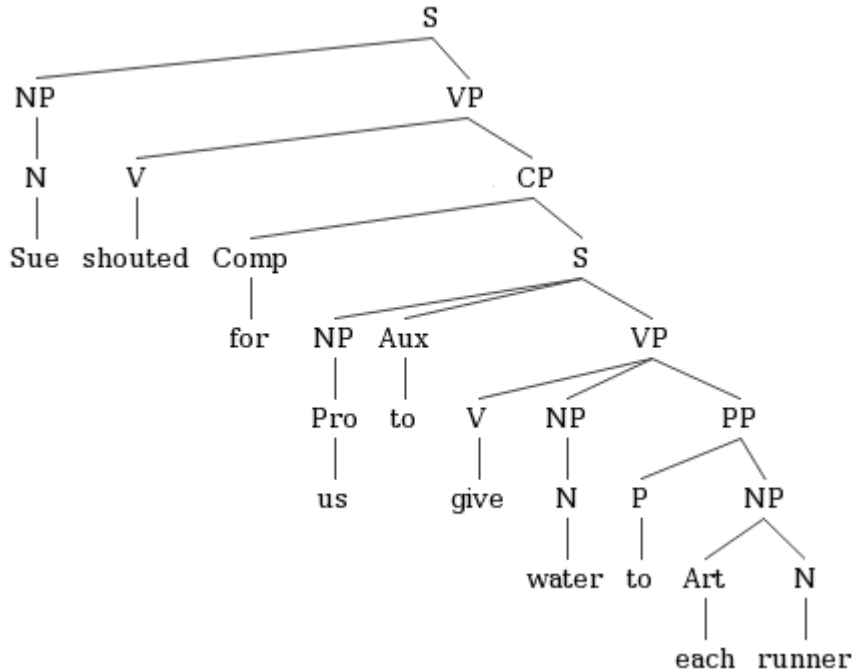
First applying Quantifier Translation to *each runner*, we get the following. A triangle is used to avoid worrying about the inner details of the quantifiers.
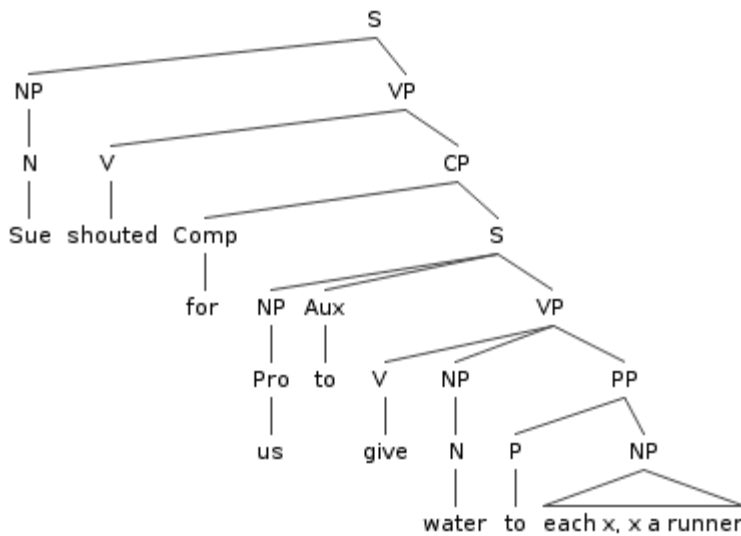
Next, we note that the clue to the multiple meanings is that the sentence has two clauses, hence two S nodes that the Quantifier Raising can adjoin *each runner* to. If we pick the lower S, adjunction will look like this:
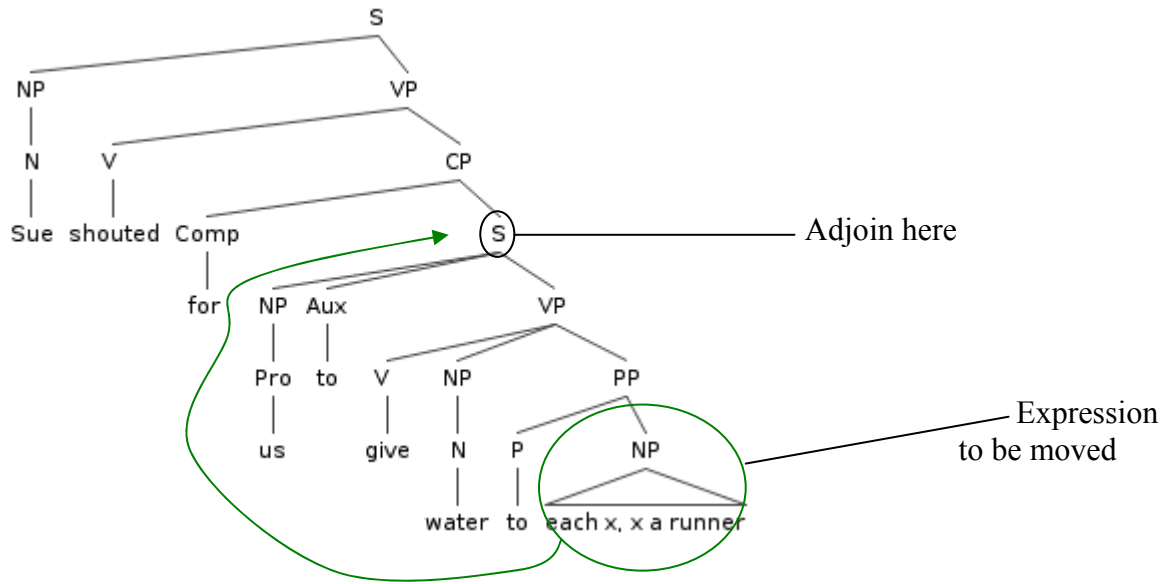
Inserting the new S node, and rearranging the tree in the way required, we get the following:
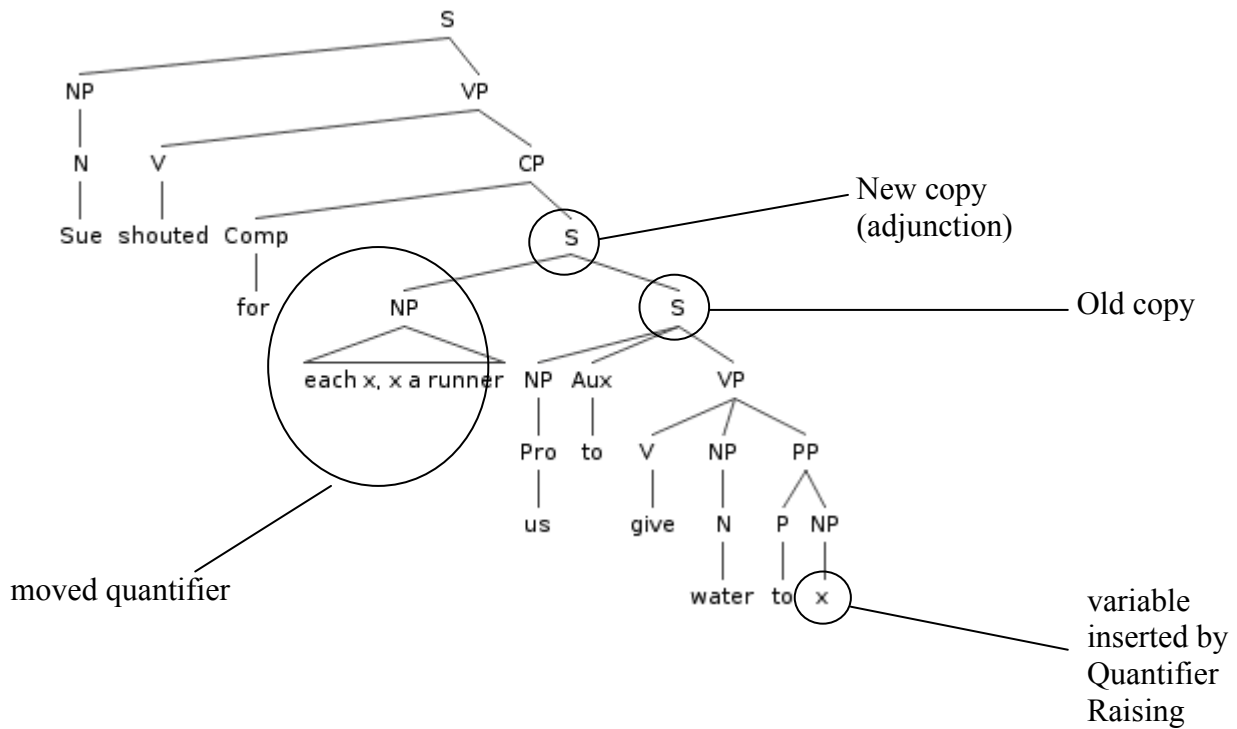
Note the variable: it is the logical place marker formerly occupied by *each runner*, and it is bound (shown by the shared index *x*) by the raised operator *each runner*. This yields a logical form for one of the meanings, that is, a single act of shouting, telling us to attend to all of the runners. This is the Narrow-scope reading given above.

If we pick the upper clause, we will end up deriving the Wide-scope reading. The stage of adjunction will look like this:

Adjoin to this node

Quantifier to be adjoined
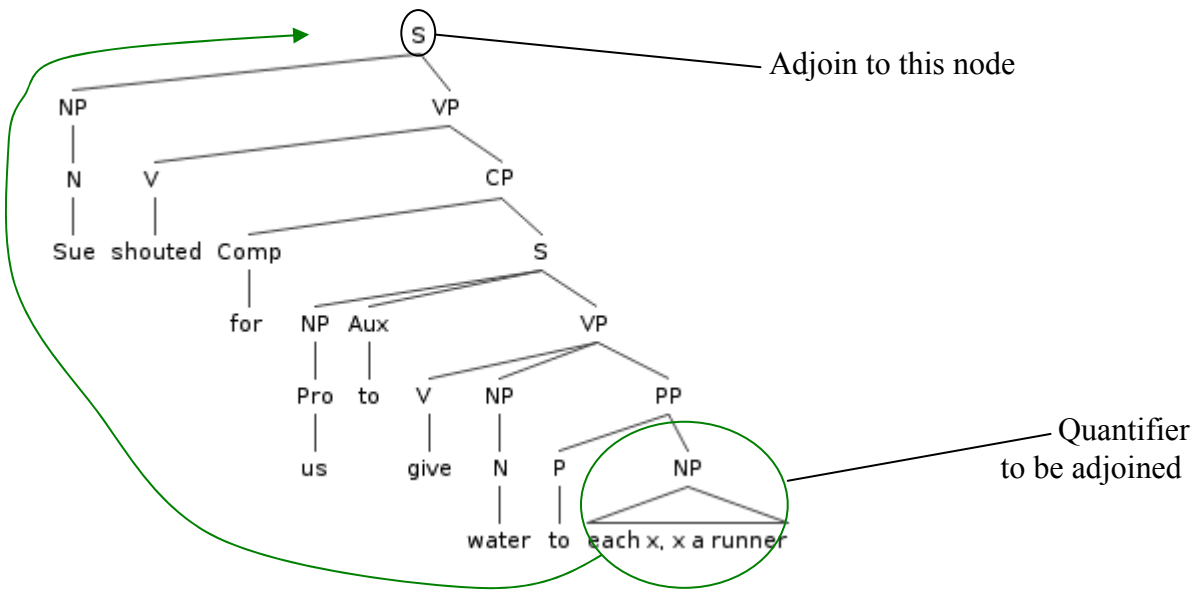
Study Exercise #63

Show the final output of the derivation.

Answer to Study Exercise #62
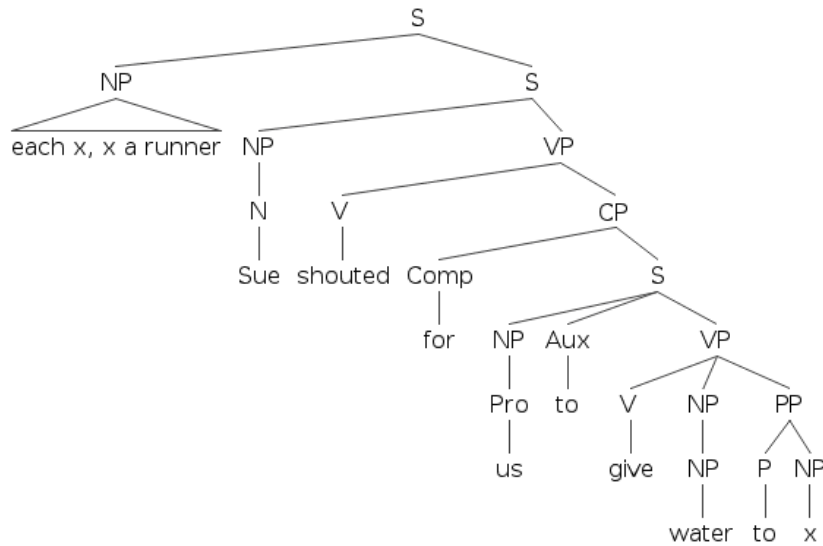
This is the Wide-scope reading.

_____

18. Logical form in sentences with two quantifiers

Let us now return to the topic of section 14 of this chapter, namely sentences that include two quantifiers. This time, we will actually provide the derivations (using Quantifier Raising) that apply to the syntactic representation to create the alternative readings at the level of Logical Form.

Suppose we start with a simplified version of our arrow-target sentence:

Many arrows hit every target.

This sentence is ambiguous, and could mean either "Many were the arrows that hit every target"; or "For every target, many arrows hit it." The syntactic surface structure (as well as deep structure) would be as shown below; *many* and *every* are both Articles syntactically.
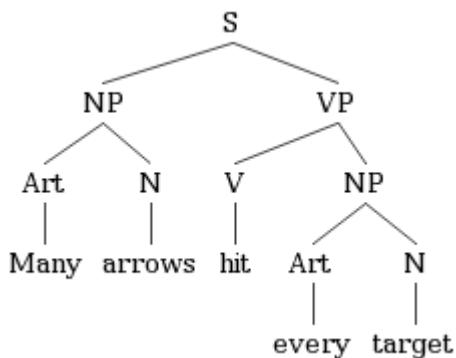
We first translate the NP with quantifiers into appropriate operators, with the rule of Quantifier Translation (173). Note that it is crucial to use *different* variables (here, *x* and *y*) for the different noun phrases (it's with bound pronouns that we use the *same* variable).

```
                    S
          ┌─────────┴─────────┐
         NP                   VP
     ┌────┴────┐          ┌────┴────┐
 many x, x an arrow       V         NP
                          |     ┌────┴────┐
                         hit  every y, y a target
```
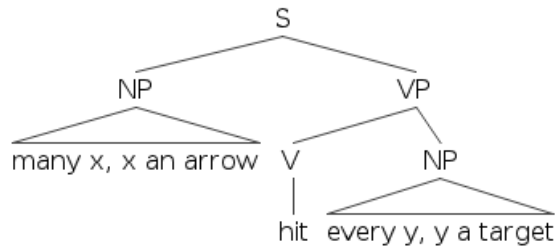
Although the order in which we perform the operations turns out not to matter here, we can arbitrarily chose first to left-adjoin *many x, x an arrow* to the sentence, as follows:

```
                    S
          ┌─────────┴─────────┐
         NP                   VP
     ┌────┴────┐          ┌────┴────┐
 (many x, x an arrow)     V         NP
                          |     ┌────┴────┐
                         hit  every y, y a target
```
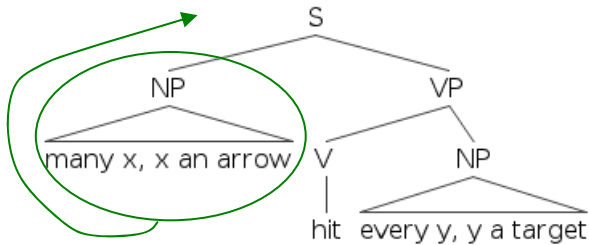
The result has a new S node, copying the original one, and the moved quantifier is the sister of the original S:

```
                       S
           ┌───────────┴───────────┐
          NP                        S
      ┌────┴────┐              ┌─────┴─────┐
 many x, x an arrow           NP           VP
                              |        ┌────┴────┐
                              x        V         NP
                                       |     ┌────┴────┐
                                      hit  every y, y a target
```
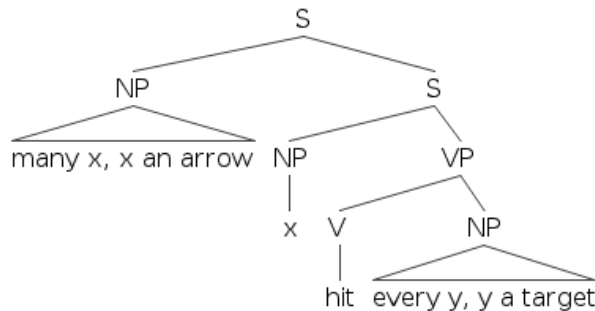
In the next step, we need to apply the same rule of Quantifier Raising again, this time to *every y, y a target*, which likewise is a quantified NP. Assuming (again arbitrarily) that it left-adjoins to the highest available S node, the application would look like this:
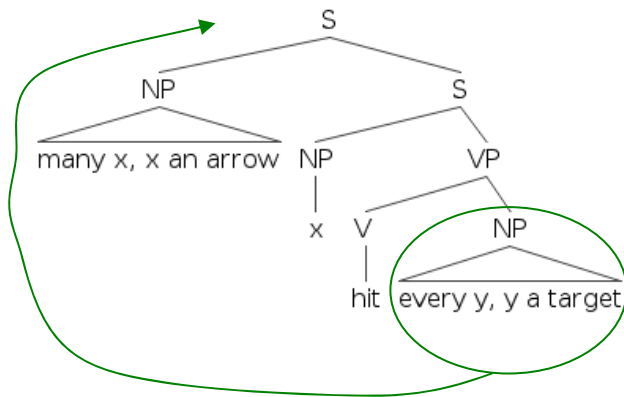
Here is the result:
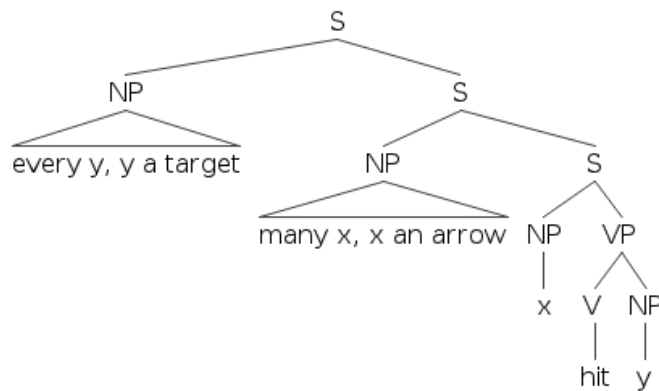
Note that a second variable, *y*, now appears in the clause. This is the reading we wanted: "For every target, many were the arrows that hit it". In this reading, *every* has scope over *many*, and this can be seen directly in the structure of the logical form.

Study Exercise #64

Derive the other reading.

Answer to Study Exercise #64

Syntactic structure:

```
                    S
         _____/    _____
       NP                      VP
     /    \                  /    \
   Art     N              V         NP
    |      |              |        /   \
  Many  arrows          hit     Art      N
                                 |       |
                              every   target
```
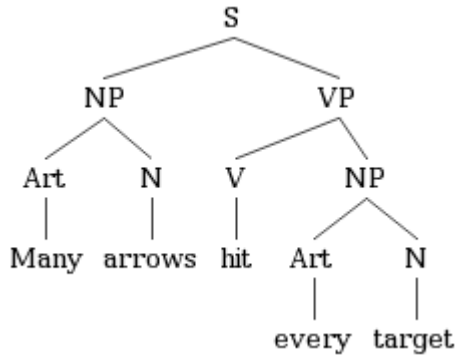
Output of Quantifier Translation. I also show an arrow that indicates the application of Quantifier Raising to the quantified expression *every y, y a target*.

```
                    S
          _____/    _____
        NP                     VP
      /    \                 /    \
  many x, x arrows  V                NP
                    |            /        \
                   hit    every y, y a target
```
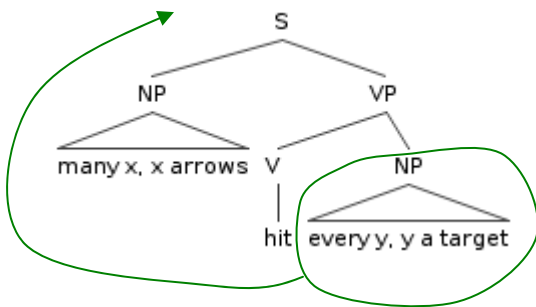
The structure that results is given below.

```
                      S
          _____/     _____
        NP                          S
      /    \                    ___/   \___
  every y, y a target         NP           VP
                            /    \        /  \
                    many x, x arrows   V     NP
                                       |      |
                                      hit     y
```
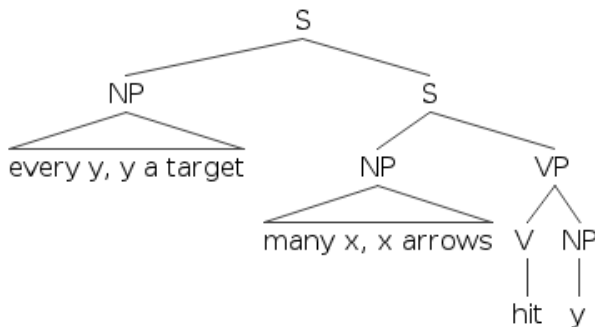
Next, we apply Quantifier Raising to *many x, x arrows*. This is shown with the arrow below:

S
NP   S
every y, y a target   NP   VP
many x, x arrows   V   NP
hit   y
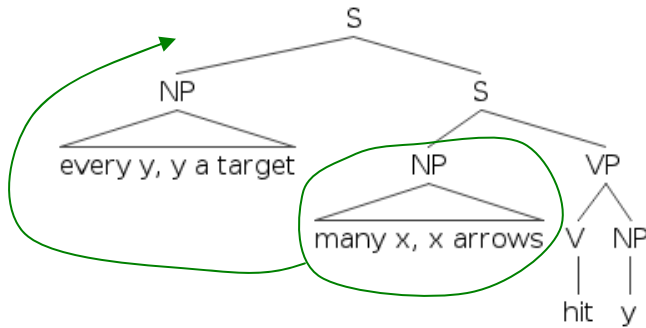
The final structure that results is shown below:

S
NP   S
many x, x arrows   NP   S
every y, y a target NP   VP
x   V   NP
hit   y
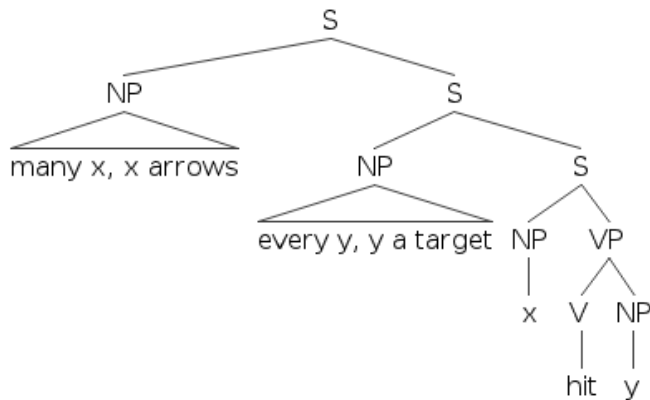
As the diagram shows, in this reading *Many* has scope over *every*. Hence, the meaning is something like "Many were the arrows that hit every target."

---

19. Wh-phrases are operators

Chapter 5, section 6 of this text discussed the fact that Wh- questions can differ in the scope of the Wh- phrase, giving the following example:

> [*What song*] *can Sue imagine that Bill sang* ___?
> *Sue can imagine* [*what song*] *Bill sang* ___

We can now express this idea more precisely by giving these sentences logical forms similar to the quantifier sentences above. The key idea is that wh- phrases are logical operators, which are requests for the listener to fill in the missing information that the variable stands for. Thus we might have the following two logical forms:

a. Wide scope of *what song*
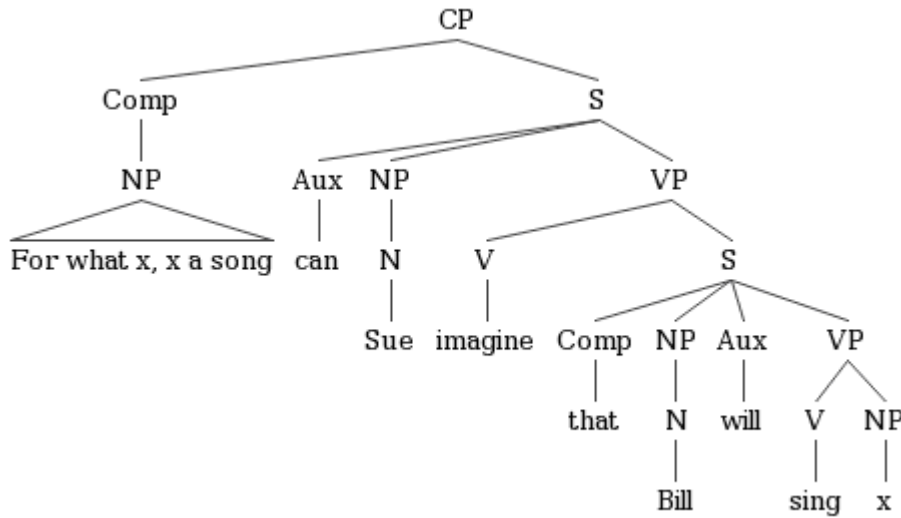
b. Narrow scope of *what song*
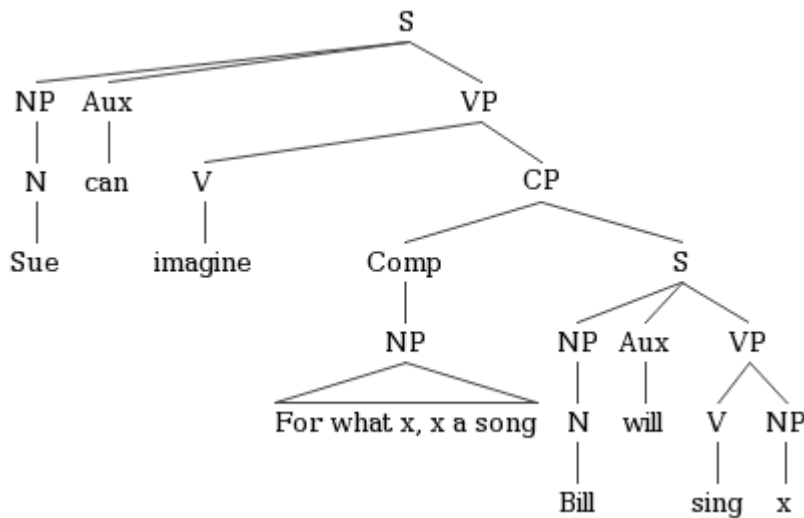
You can see that the syntactic transformation of Wh- Movement is a kind of observable, syntactic analogue of Quantifier Raising, and has the function of placing the wh- phrase where it bears its logical scope. The landing site for Wh-Movement is different (Comp vs. adjoined to S), but this is a relatively superficial difference.

In languages where Wh- phrases syntactically remain *in situ*, things will work differently. Here, Quantifier Raising must apply to wh- phrases, so that their scope will be correctly expressed in logical form. Here is an example from Mandarin Chinese, an in-situ language:

(205) *A sentence of Mandarin with ambiguous scope*

   a. IPA transcription

[ₛ tʂáŋsán   tsʰái [ₛ lìsɯ̂ ɕìhwán ʂěi   ]
    Zhangsan   guess   Lisi   like   who

   b. Pinyin Romanization with integers for tone number

      1   1   1   3   4   3   1   2
      Zhangsan   cai   Li   si   xi-huan shui

This sentence is ambiguous. It can mean "Who does Zhangsan guess that Lisi likes?" This meaning involves raising the Wh- phrase to adjoin to the highest S in logical form, a wide-scope reading. The sentence can also mean "Zhangsan guessed who Lisi likes", a narrow-scope reading. This meaning involves raising the Wh- phrase only to the lower S in logical form.[131] Here are derivations demonstrating the two meanings.[132]

a. Surface syntactic structure

---
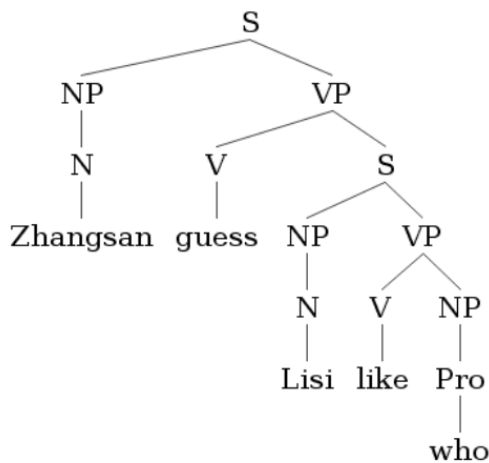
[131] Thanks to UCLA graduate students Kristine Yu and Grace Kuo for constructing this example for me.

[132] Mandarin apparently has no complementizers for embedded clauses, so I am omitting the CP node.

b. Quantifier translation of wh-phrase
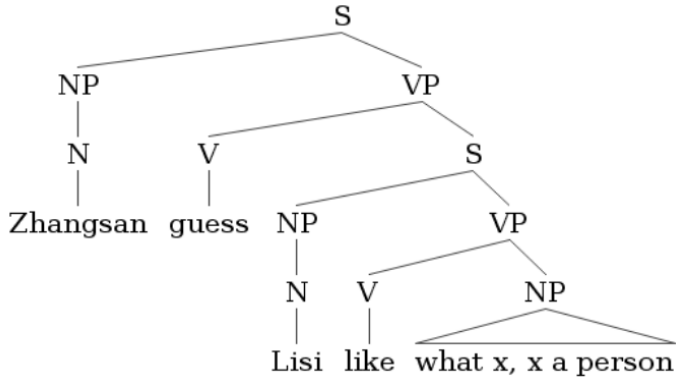
c. Quantifier Raising to lower S (narrow-scope reading):
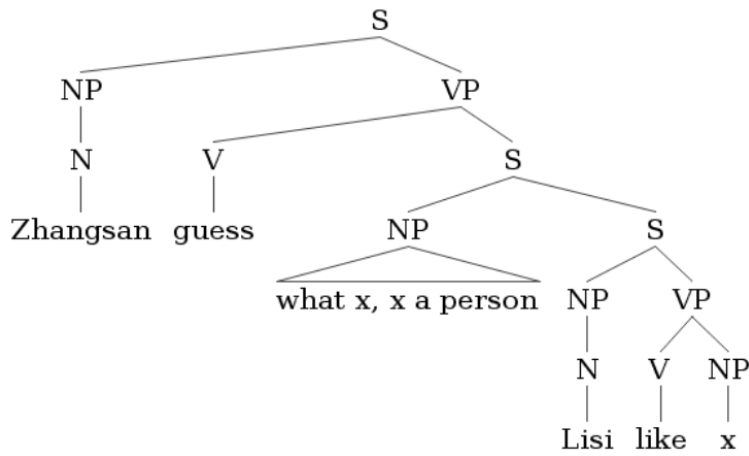
d. OR Quantifier Raising to higher S (broad-scope reading):
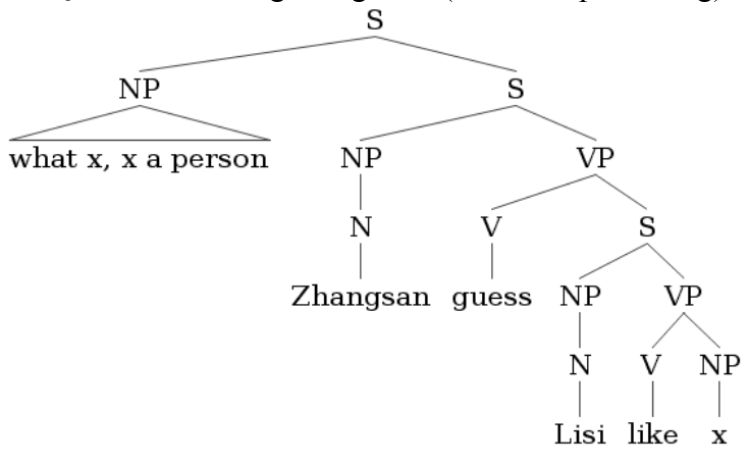
20. Summary of operators, variables, and scope

- Constructions with operators and variables are among the most intricate of semantic phenomena. A basic analysis of them is possible using the rules of Quantifier Translation and Quantifier Raising. These rules apply during the creation of logical form, a hypothesized linguistic level that explicitly characterize linguistic aspects of meaning.

- Scope differences can be of various kinds: a single operator can be raised to different levels (as in *Sue shouted for us to give water to each runner*), or there can be two operators that vary in their scope relative to each other (as in *At least two arrows hit every target.*).

- Pronouns coindexed with quantifier NPs often turn into additional variables in logical form (as in *Every boy thinks that he is smarter than average*)

- The constructions created in logical form by Quantifier Raising are abstract and not directly observable. Yet they are mimicked by observable constructions in language: Wh- phrases are a sort of quantifier, which in languages like English really do move to the appropriate scope location in surface structure.

Chapter 10: Phonetics

This point in the text marks a discontinuity in the subject matter. Language is a system relating sound and meaning, and the previous chapter ended with the relatively subtle aspects of meaning involved in quantifiers. We turn now to the other extreme: physical sounds, created by the speech organs and apprehended by the ear. Later, we will see that phonetics is the primary working material of phonology, a field that in turn relates to morphology and to syntax, and hence ultimately to semantics. Thus, linguistics is like an arch, primarily abstract but anchored at either end in observable aspects of the world. Semantics relates language structure to situations in the real world; phonetics relates language structure to the physical events in the vocal tract and the atmosphere on which we depend to communicate.

1. Phonetic description

The first task of a linguist trying to study a new language is to be able to hear its sounds correctly and take down utterances in accurate and reliable fashion. It's a familiar experience for everyone to have heard a foreign language as a babbling stream of sound—it seems to go by very fast, and is hard to imitate and remember. Often, a language will include crucial distinctions between sounds that escape the linguist entirely in the period of initial efforts. Therefore, it's a fundamental skill of linguists to be able to listen to other languages with a trained ear and to take down what is said accurately in a phonetic transcription. Transcription is taught to beginning linguists all over the world.[133]

Here is an example of phonetic transcription:

[ˈðɪs ɪz ə fəˈnɛɾɪk tɹænˈskɹɪpʃən əv ən ˈɪŋglɪʃ ˈsɛntn̩s pɹəˈnaʊnst ɪn maɪ ˈoʊn ˈdaɪələkt]
(This is a phonetic transcription of an English sentence pronounced in my own dialect.)

In fieldwork, the task of transcribing a new language usually begins with slow and modest steps: listening to one single, perhaps short, word at a time, and only gradually building up to the point of being able to provide an accurate transcription for any utterance. It also helps to focus on very short utterances when you are learning to transcribe.

2. The International Phonetic Alphabet

The standard form of phonetic transcription is the **International Phonetic Alphabet**, a large symbol set promulgated by a scholarly society called the International Phonetic Association. Both the alphabet and the association may be abbreviated "IPA". The IPA is the form of transcription that will be covered in this text. The Association offers much information, either free or inexpensive, on its Alphabet and how to use it:

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[133] At UCLA we offer both Linguistics 102 and Linguistics 103 for this purpose.

- Their printed guide, *Handbook of the International Phonetic Association : A Guide to the Use of the International Phonetic Alphabet* (Cambridge University Press, and probably, your university library)
- The IPA website: https://www.internationalphoneticassociation.org/
- The IPA phonetic chart, which, despite the continuing discovery of new sounds, still fits on just one page. Below, I've split it up for greater legibility.

(206) **The IPA chart**

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2015)

CONSONANTS (PULMONIC)   © 2015 IPA

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k ɡ	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	N		
Trill	ʙ			r					R		
Tap or Flap		ⱱ		ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

Symbols to the right in a cell are voiced, to the left are voiceless. Shaded areas denote articulations judged impossible.

Clicks	Voiced implosives	Ejectives	
⊙ Bilabial	ɓ Bilabial	ʼ	Examples:
ǀ Dental	ɗ Dental/alveolar	pʼ	Bilabial
ǃ (Post)alveolar	ʄ Palatal	tʼ	Dental/alveolar
ǂ Palatoalveolar	ɠ Velar	kʼ	Velar
ǁ Alveolar lateral	ʛ Uvular	sʼ	Alveolar fricative

VOWELS
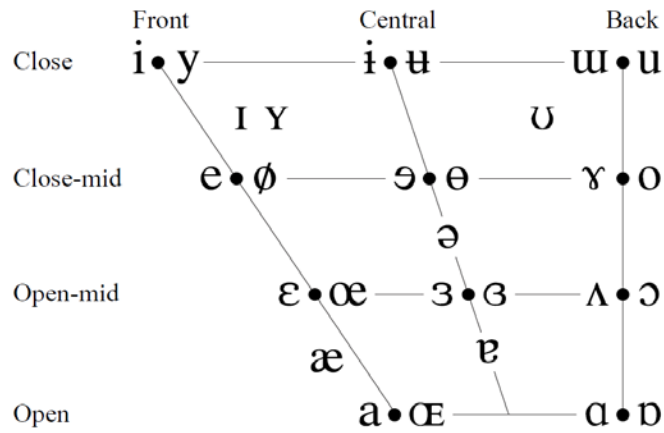
Where symbols appear in pairs, the one
to the right represents a rounded vowel.

OTHER SYMBOLS

ʍ	Voiceless labial-velar fricative	ɕ ʑ	Alveolo-palatal fricatives
w	Voiced labial-velar approximant	ɭ	Voiced alveolar lateral flap
ɥ	Voiced labial-palatal approximant	ɧ	Simultaneous ʃ and x
ʜ	Voiceless epiglottal fricative		
ʢ	Voiced epiglottal fricative		
ʡ	Epiglottal plosive		

Affricates and double articulations
can be represented by two symbols
joined by a tie bar if necessary.

k͡p t͜s

DIACRITICS Some diacritics may be placed above a symbol with a descender, e.g. ŋ̊

̥ Voiceless	n̥ d̥	̈ Breathy voiced	b̤ a̤	̪ Dental	t̪ d̪
̬ Voiced	s̬ t̬	̰ Creaky voiced	b̰ a̰	̺ Apical	t̺ d̺
ʰ Aspirated	tʰ dʰ	̼ Linguolabial	t̼ d̼	̻ Laminal	t̻ d̻
̹ More rounded	ɔ̹	ʷ Labialized	tʷ dʷ	̃ Nasalized	ẽ
̜ Less rounded	ɔ̜	ʲ Palatalized	tʲ dʲ	ⁿ Nasal release	dⁿ
̟ Advanced	u̟	ˠ Velarized	tˠ dˠ	ˡ Lateral release	dˡ
̠ Retracted	e̠	ˤ Pharyngealized	tˤ dˤ	̚ No audible release	d̚
̈ Centralized	ë	~ Velarized or pharyngealized	ɫ		
̽ Mid-centralized	e̽	̝ Raised	e̝ (ɹ̝ = voiced alveolar fricative)		
̩ Syllabic	n̩	̞ Lowered	e̞ (β̞ = voiced bilabial approximant)		
̯ Non-syllabic	e̯	̘ Advanced Tongue Root	e̘		
˞ Rhoticity	ɚ a˞	̙ Retracted Tongue Root	e̙		

SUPRASEGMENTALS

ˈ Primary stress
ˌ Secondary stress ˌfoʊnəˈtɪʃən
ː Long eː
ˑ Half-long eˑ
̆ Extra-short ĕ
| Minor (foot) group
‖ Major (intonation) group
. Syllable break ɹi.ækt
‿ Linking (absence of a break)

TONES AND WORD ACCENTS

LEVEL
é̋ or ˥ Extra high
é ˦ High
ē ˧ Mid
è ˨ Low
è̏ ˩ Extra low
↓ Downstep
↑ Upstep

CONTOUR
ě or ˄ Rising
ê ˅ Falling
e᷄ ˧˥ High rising
e᷅ ˩˧ Low rising
e᷈ Rising-falling
↗ Global rise
↘ Global fall

It would not be reasonable to teach the entire IPA chart in an introductory linguistics course, but I've included it to show what is needed to cover (most of) the world's languages.[134] Given the very brief time available, the only language that we will cover will be American English. This is

[134] The IPA is revised and improved from time to time, but still needs work. For instance, it still lacks symbols for the sounds commonly Romanized as *pp*, *tt*, and *kk* in Korean.

actually a rather complex language phonetically, and once you have it down, it makes transcribing the others easier.

3. Vowel and consonant charts for English

The following are charts, based on the IPA chart, giving just the vowels and consonants of English. Below each symbol is a **keyword** of English meant to identify and illustrate the sound.

(207) **IPA symbols for the sounds of English**

a. Consonants

		Bilabial	Labio-dental	Dental	Alveolar	Palato-alveolar	Palatal	Velar	Glottal
Stops	voiceless	/p/ pin			/t/ tin			/k/ kin	
	voiced	/b/ bin			/d/ din			/g/ gill	
Affricates	voiceless					/tʃ/ chin			
	voiced					/dʒ/ gin			
Fricatives	voiceless		/f/ fin	/θ/ thin	/s/ sin	/ʃ/ shin			/h/ hymn
	voiced		/v/ vim	/ð/ this	/z/ zip	/ʒ/ vision			
Nasals		/m/ mitt			/n/ nip			/ŋ/ sing	
Approximants	lateral				/l/ Lynn				
	central	/w/ win				/ɹ/ rim	/j/ ying		

b. Vowels and diphthongs

	Front Unrounded	Central Unrounded	Back Unrounded	Back Rounded	Diphthongs
Upper high	/i/ beat			/u/ boot	/aɪ/, /aʊ/, /ɔɪ/ bite, bout, Coit
Lower high	/ɪ/ bit			/ʊ/ foot	
Upper mid	/eɪ/ bait	/ə/ abbot		/oʊ/ boat	Rhotacized upper mid central unrounded /ɚ/ Bert
Lower mid	/ɛ/ bet		/ʌ/ but		
Low	/æ/ bat		/ɑ/ father		

If you want to hear these words pronounced (by me) visit
http://www.linguistics.ucla.edu/people/hayes/103/charts/english/chartsforEnglishbroadtranscription.htm

Here is a quick identification of the sounds; later, we will go into phonetic theory and discuss the way the sounds are produced in the human vocal tract.

Most consonant symbols have their expected values (that is, expected on the basis of English spelling), with the following exceptions:

(208) *Key for English consonants in IPA*

- [ʃ]   is the "sh" sound, heard in *she*.
- [ʒ]   is the "zh" sound, heard in the middle of *vision*.
- [tʃ] is the "ch" sound, heard at the beginning and end of *church*. If you listen carefully, you'll hear that the choice of "t" + "ʃ" is a sensible one here.[135]
- [dʒ] is the "j" sound, heard at the beginning and end of *judge*. It, too, is "compositional", made up of [d] plus [ʒ]
- [ŋ]   is the "ng" sound, heard at the end of *sing*.
- [ɹ]   is the "r" sound of English. (We can't use [r], because in IPA [r] is a tongue-tip trill.)
- [j]   is the "y" sound (the IPA symbol is based on how the "y" sound is spelled in German, Dutch, Polish, and many other languages)

Vowels only seldom match their English spelling (which is quite variable in any event), and indeed there some potentially confusing cases: letter *i* in English often spells what in IPA is [aɪ] ([baɪt] *bite*), whereas the IPA sound [i] represents a sound fairly close to what English often spells as *ee* (as in [bi] *bee*). Similarly, IPA [u] is what English often spells as *oo* ([mun] *moon*), whereas letter *u* is often [ju] in IPA ([mjut] *mute*). If you have studied a foreign language that uses the Roman alphabet, it is likely to be a better match to IPA.[136]

In addition, the Roman alphabet has very few vowel letters, so novel symbols needed to be used for the IPA. The ones used for English are given below.

---

[135] Though in close detail, you can notice that the [tʃ] in *gray chip* is not really the same as the [t] + [ʃ] in *great ship*. If you want to show that a single sound is meant, you can link up the [t] and the [ʃ] with a ligature: [t͡ʃ].

[136] How did this come to be? The original phonetic values of the Roman letters come from Latin, and most European languages preserve, roughly, these old phonetic values. English underwent massive phonetic changes in the decades around 1500 that greatly altered the phonetic values of its letters. When the IPA was set up in the late 19th century, the founders (who were mostly British, French, and German) opted for the "consensus" values found in most European languages. This proved sensible, because as usage of the Roman alphabet expanded to other world languages, most of these also adopted something like the consensus values.

(209) *Non-Roman symbols for English vowels in IPA*

- [ɪ] is easy for native speakers but can be very hard for second language speakers; it is close to [i] but not as long, and with the tongue pressing less firmly against the roof of the mouth. Try listening to pairs such as *peat, pit* (ˈpit, ˈpɪt]).
- [ʊ] is to [u] as [ɪ] is to [i]. Try listening to pairs such as *kook, cook* [ˈkuk, ˈkʊk].
- [ʌ] is similar to [ə] ("schwa") but is longer with a lower jaw position. In addition, [ʌ] mostly occurs in stressed syllables; [ə] is always in a stressless syllable (in English). Listen to *mundane* vs. *contain* [mʌnˈdeɪn kənˈteɪn]
- [ɚ] ("rhotacized schwa" is much like [ɹ], only it acts as a vowel rather than consonant. Compare *furry* [ˈfɚi] with *free* [ˈfɹi]

The remaining vowels are **diphthongs**, which means a vowel that changes during its time course. IPA transcribes diphthongs by providing two symbols; one for the start, the other for the end. Try pronouncing these diphthongs very slowly, and hearing the starting or ending points—is your [aɪ] like Spanish [a] plus English [ɪ]?[137] Depending on your dialect, you may also be able to hear the diphthongal character of [eɪ] and [oʊ] —saying these diphthongs instead of their simple monophthongal versions [e] and [o] is a common source of an accent when English speakers learn languages that have [e, o].

4. Stress

Most of the information in a phonetic transcription will consist of symbols standing for individual speech sounds. However, in a language like English, it is also important to transcribe **stress**, which roughly speaking, is the amount of articulatory effort or loudness found on a syllable. Stress must be included because you can have different words that are phonetically distinguished only by their stress pattern, as in the examples given below. These illustrate the IPA diacritic for stress: [ˈ], placed just *before* the stressed syllable:

differ	[ˈdɪfɚ]	
defer	[dɪˈfɚ]	
permit	[pɚˈmɪt]	verb: 'to allow'
permit	[ˈpɚmɪt]	noun: 'a kind of document giving permission'[138]

---

[137] If not: the probable cause is that the diphthongs vary greatly across different speaking rates and styles. [aɪ] is a "medium" pronunciation; "fast" would be [ae], and "slow and careful" would be [ai]. Probably, when you listen carefully to yourself, your speech is slow and careful. Another possibility (rather unlikely if you are a UCLA student), is that your own dialect doesn't have an [aɪ], using (for example) the sound [aː] instead.

[138] The example works for the majority of Americans, though there are many who say [pɚˈmɪt] for both.

5. Transcription technique

There are various methods you can use to become a skilled phonetic transcriber.

5.1 The keyword method

A very useful method is the **keyword method**, which I will illustrate with an example. Suppose you have trouble hearing the distinction between [i] and [ɪ], but you are trying to transcribe the word *mitt*. The correct transcription happens to be [mɪt]. You already know, having examined chart (207) above, that the English word *beat* has [i] and the word *bit* has [ɪ]. These can serve as keywords for the [i]/[ɪ] distinction. The dialogue below illustrates the method.

Linguist:	"Please say the next word on our list."
Native speaker:	"[mɪt]"
Linguist (can't hear it, but is coping):	"Please say the word spelled *b - i - t*."
Native speaker:	"[bɪt]"
Linguist:	Please say *b - e - a - t*.
Native speaker:	"[bit]"
Linguist:	"Now say the word we are working on."
Native speaker:	"[mɪt]"
Linguist:	"Now say all three words in a row."
Native speaker:	"[bɪt] … [bit] … [mɪt]"

The idea should be plain: it's easier for your ear to compare a new word to known words than it is to transcribe "out of the blue". This holds not just for the more delicate distinctions of English but for all difficult distinctions, in any language.

When I do English phonetic dictations in class, I sometimes encourage students to raise their hand and ask me to pronounce keywords. If you want to use keywords in doing a homework, you can find them (with sound files) at this web address:

http://www.linguistics.ucla.edu/people/hayes/103/charts/english/chartsforEnglishbroadtranscription.htm

5.2 Other general hints

When you're transcribing a language that you know, and which has a spelling system, it's important not to be influenced by the spelling of a word. In my experience teaching English transcription, this is by far the most common source of errors.

It's also sometimes a good idea to listen to a word more than once. You can do this indefinitely with a recording; with a live speaker you have to size up how patient they are.

Lip reading can be very useful, particularly for the difference between [θ] and [f] (*thin* vs. *fin*), and for vowels that have lip rounding.

5.3 Hints specific to English

Inflectional endings like -*ed* and -*s* are spelled in a constant way, but are pronounced differently in different environments. For example, *latched* = [lætʃt], not *[lætʃd]; *blades* = [bleɪdz], not *[bleɪds].

The letter *s* is often ambiguous between [s] and [z]: compare *goose* [gus] with *lose* [luz].

The sequence *ng* in spelling can spell either one sound or two (for most dialects). For example, *finger* is [ˈfɪŋgɚ] (two sounds), but *singer* is [ˈsɪŋɚ] (one sound). In the less-widely-spoken dialect, spelled *ng* is [ŋg] in the middle of a word (*finger* [ˈfɪŋgɚ], *singer* [ˈsɪŋgɚ]) and [ŋ] otherwise. For what we should think about this dialect, see Chapter 3.

It is difficult to hear schwa; often people transcribe a full vowel that corresponds to the spelling. For example: *tenacious* = [təˈneɪʃəs], not *[tɛˈneɪʃəs]; *connection* = [kəˈnɛkʃən], not *[koʊˈnɛkʃən]; *childless* = [ˈtʃaɪldləs], not *[ˈtʃaɪldlɛs]. Schwas can be spotted because they tend to be very short and rather "indistinct" in their quality.

As noted above, the letter *u* often represents a sequence of [j]+[u]: *use* = [ˈjuz]; *fugue* = [ˈfjug]; *spectacular* = [spɛkˈtækjulɚ] or [spɛkˈtækjəlɚ].

The letter *x* can represent [ks] (*Texas* = [ˈtɛksəs]) or [gz] (*exact* = [əgˈzækt]).

The sequence *th* can represent either [θ] (*ether* = [ˈiθɚ]) or [ð] (*brother* = [ˈbrʌðɚ]).

A note on my own teaching practice: where I have provided more than one way of transcribing the same sound, either way is acceptable. I do not require that you memorize the symbols; phonetic charts are provided for exams.

Study Exercise #65

Visit the following web page. It has a list of English words. When you click on a word, it will launch a sound file in .wav format, which (if your Web browser is set up properly), should play on your computer. (I recommend you use headphones in a quiet place.)

- http://www.linguistics.ucla.edu/people/hayes/20/sounds/English/.

Answers below.

Answer to Study Exercise #64

1.   [ˈpɪn]
2.   [ˈtɪn]
3.   [ˈkɪn]
4.   [ˈbɪn]
5.   [ˈdɪn]
6.   [ˈgɪl]
7.   [ˈtʃɪn]
8.   [ˈdʒɪn]
9.   [ˈfɪn]
10.   [ˈθɪn]
11.   [ˈsɪn]
12.   [ˈʃɪn]
13.   [ˈhɪm]
14.   [ˈvɪm]
15.   [ˈðɪs]
16.   [ˈzɪp]
17.   [ˈvɪʒən]
18.   [ˈdæd]
19.   [ˈmɪt]
20.   [ˈnɪp]
21.   [ˈsɪŋ] (many speakers say [siŋ] instead)
22.   [ˈlɪn]
23.   [ˈwɪn]
24.   [ˈɹɪm]
25.   [ˈjɪŋ]   (many speakers say [jiŋ] instead)
26.   [ˈbut]
27.   [ˈbʊk]
28.   [ˈboʊt]
29.   [ˈbit]
30.   [ˈkɑt]
31.   [ˈbit]
32.   [ˈbut]
33.   [ˈkɑt]
34.   [ˈbæt]

35. [ˈbɪt]
36. [ˈfʊt]
37. [ˈbeɪt]
38. [ˈæbət]
39. [ˈboʊt]
40. [ˈbɛt]
41. [ˈbʌt]
42. [ˈbɔt]
43. [ˈbæt]
44. [ˈfɑðɚ]
45. [ˈbaɪt]
46. [ˈbaʊt]
47. [ˈkɔɪt]
48. [ˈbɚt]
49. [ˈdɪfɚ]
50. [dɪˈfɚ]
51. [pɚˈmɪt]
52. [ˈpɚmɪt]   (some speakers have final stress for this word)
53. [ˈpɑp]
54. [ˈtɑt]
55. [ˈkɪk]
56. [ˈbɑb]
57. [ˈdæd]
58. [ˈgæg]
59. [ˈfaɪf]
60. [ˈθɪn]
61. [ˈsɪs]
62. [ˈʃu]
63. [ˈhi]
64. [ˈvæt]
65. [ˈðau]
66. [ˈzu]
67. [ˈeɪʒə]
68. [ˈtʃɚtʃ]
69. [ˈdʒʌdʒ]

70.   [ˈmɑm]

71.   [ˈnʌn]

72.   [ˈjʌŋ]

73.   [ˈyuθ]

74.   [ˈwɪtʃ]

75.   [ˈtɔɪ]

76.   [ˈdʒunəpɚ]

77.   [ˈwɪʃ]

78.   [ˈpɚʒən]

79.   [ˈθætʃɚ]

80.   [ˈjɑt]

81.   [ˈkwɛstʃən]

82.   [ˈtɛnθ]

83.   [ˈʌðɚ]

84.   [ˈʃælou]

85.   [ˈbɛltʃ]

86.   [ˈmjuzɪk]

87.   [ˈlætʃt]

88.   [ˈbleɪdz]

89.   [ˈfɪŋgɚ]   (some speakers have [ˈfɪŋgɚ])

90.   [ˈsɪŋɚ]   (some speakers have [ˈsɪŋgɚ])

91.   [ˈjuz]

92.   [ˈfjug]

93.   [spɛkˈtækjulɚ]

94.   [spɛkˈtækjələ]

95.   [ˈtɛksəs]

96.   [ɪgˈzækt]

97.   [ˈiθɚ]

98.   [ˈbɹʌðɚ]

99.   [ˈfit]

100.   [ˈfɪt]

101.   [ˈfɪət]

102.   [ˈluk]

103.   [ˈlʊk]

104.   [ˈlʊək]

105. [ˈðaɪ]
106. [ˈθaɪ]
107. [ˈɹʌɪɾɚ]
108. [ˈɹaɪɾɚ]
109. [ˈkɔt]
110. [ˈkɑt]
111. [ˈʔʌʔoʊ]
112. (misnumbered, no word here)
113. (misnumbered, no word here)
114. [ˈɹɔɹ]
115. [ˈdeɪɾə]
116. [ˈθɪn]
117. [ˈðɛn]   (some speakers have [ðɪn])
118. [ˈʃu]
119. [ˈvɪʃən]
120. [ˈtʃɚtʃ]
121. [ˈdʒʌdʒ]
122. [ˈjɪɹ]   (some speakers have [ˈjiɹ])
123. [ˈlɔ]   (some speakers have [ˈlɑ] for this word)
124. [ˈlɑ]
125. [ˈkɔt]   (some speakers have [ˈkɑt] for this word]
126. [ˈkɑt]
127. [ˈpɔli]   (some speakers have [ˈpɑli] for this word)
128. [ˈpɑli]
129. [ˈbɔɪ]
130. [təˈmeɪɾoʊ]
131. [əˈmɛɹəkə]   (some speakers have [əˈmɛɹɪkə] for this word)
132. [kəˈnɛɹəkət]
133. [ˈbɚd]
134. [ˈɹaɪd]
135. [ˈbɔɪ]
136. [ˈhaʊ]
137. [ˈtɪkəl]
138. [ˈbʌtn̩]

6. Other places to practice

If you want to get practice in learning the symbols, you might try reading passages of transcription; I have posted a couple of them at

* http://www.linguistics.ucla.edu/people/hayes/103/PracticeReadingTranscription.pdf
* http://www.linguistics.ucla.edu/people/hayes/103/PracticeReadingTranscriptionII.pdf

Some further practice can be obtained from an exercise I've posted for another course:

* http://www.linguistics.ucla.edu/people/hayes/103/EnglishTranscriptionPractice/

7. Some toughies from English

The hardest factor in phonetic transcription is that we tend to hear best the phonetic distinctions of languages we speak. In fact, it's typically the distinctions heard in infancy and toddlerhood that are the most noticeable — experiments have shown that the neural circuitry for vowel detection, for example, is already being "tuned" to the ambient language by the age of six months.

Thus, if there are English distinctions that you didn't acquire early on, you may find them tough. I only apologize a little bit for this: linguistics training necessarily involves practice in hearing such distinctions, even if it's hard!

To make the course a bit fairer I will render some "exotic" cases from American dialects, which I hope will be hard for everybody!

Here are cases of distinctions that may be difficult. They are posted at the same Web page mentioned above.

feet	[fit]	
fit	[fɪt]	Clues: [ɪ] shorter than [i]. Spoken slowly, [ɪ] becomes [ɪə].
Luke	[luke]	
look	[lʊk]	Clues: [ʊ] shorter than [u]. Spoken slowly, [ʊ] becomes [ʊə].
thy	[ðaɪ]	
die	[daɪ]	Clue: sit up close and lip-read. [ð] when pronounced carefully usually has some tongue protrusion.
writer	[ɹʌɪɾɚ]	
rider	[ɹaɪɾɚ]	Clue: [aɪ] has more jaw lowering.

caught   [kɔt]

cot   [kɑt]   Clue: [ɑ] has a fish-like lip-rounding gesture.


THE PRODUCTION OF SOUNDS IN THE VOCAL TRACT

The human vocal tract can produce thousands of audibly distinct sounds. Of these, only a subset are actually used in human languages. Of this subset, some sounds are much more common than others. For example, almost every language has a [t]-like sound, while very few languages have a bilabial trill. Any one language uses only a fairly small inventory of speech sounds.

8. Vocal tract anatomy

To understand how sounds are made, one needs to have an idea of the location and shape of the articulatory organs. Here is a diagram; a so-called "mid-sagittal" section:

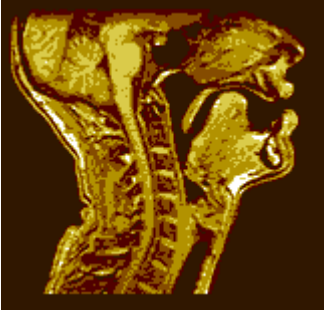(210) *Diagram: Midsaggital section of the vocal tract*
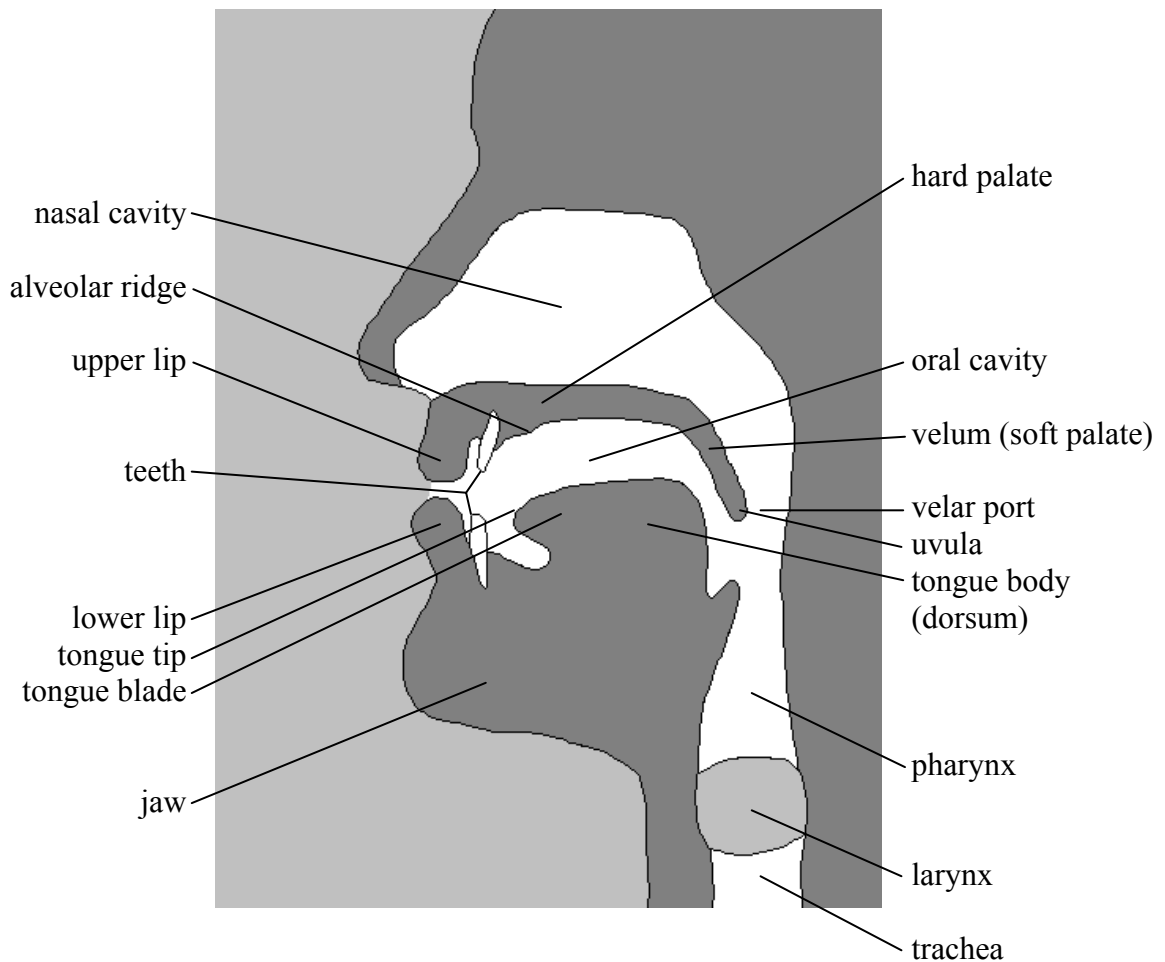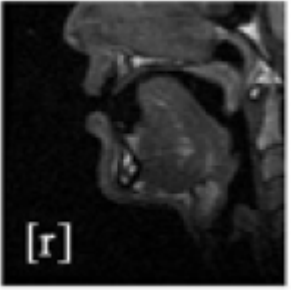
The above is a schematic diagram; the hypothetical speaker is saying something like [Ʌ̃] (nasalized "uh").

The information for images has traditionally been obtained by dissection of cadavers, or later, from X-rays. More recently, magnetic resonance imaging makes possible the safe examination of living subjects, with images like the following:

(211) *MRI images of the vocal tract (midsaggital section)*

	American English [l]
	American English [ɹ]
	A evidently nasalized [ɪ̃], showing more of the head and neck[139]

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[139] First two images: from www.linguistics.ubc.ca/isrl/Gick_Whalen_Kang(SPS5); research from Haskins Laboratories, New Haven, CT. Last image: http://web.mit.edu/albright/www/; the Web page image of Prof. Adam Albright, Massachusetts Institute of Technology.

8.1 The parts of the vocal tract

The three major regions of the vocal tract are the **nasal cavity**, the **oral cavity** (less pretentiously, the mouth), and the **pharynx**, which is located behind the tongue but above the larynx.

The most crucial organ of speech is the **tongue**. Bear in mind that just looking in a mirror gives you a poor idea of the shape of the human tongue, because you can only see the tongue's forward extension. In reality, the tongue is more of a lump; when at rest it is fairly round in shape except for visible flange up front. The round main section is quite mobile and flexible, and can move in all directions. Terminology for parts of the tongue are as follows: the **tip** (or **apex**), the **blade** (= the forward flange), and the **body** (the main rounded part).

We will now cover the roof of the mouth, going from front to back. The **lips** and **teeth** need no comment other than that they are both important for speech. The next important landmark, going backward, is the **alveolar ridge**. Most people can feel this ridge by placing the tongue a little further back in the mouth than the upper inside edge of the front teeth. The alveolar ridge forms a useful "boundary line" on the upper surface of the mouth.

The expanse behind the alveolar ridge is called the **palate**. The palate is divided into a hard, bony section in front called the **hard palate** and a soft fleshy section in back called the **soft palate** or **velum** (Latin for "sail"). The velum is mobile. If you know how to produce nasalized vowels (as in French), you can see it moving by looking in a mirror, placing your tongue as low as possible, and alternating between saying nasalized and normal vowels. The main function of the velum in speech is to control nasality. Most often, the velum is raised up to block of the nasal passage. When it is lowered, air may pass out the nose and we get a nasal sound.

The little hanging object at the tip of the velum, made famous by screaming cartoon characters, is called the **uvula**. It is used in consonant production in many languages (for example, French, Persian, and Arabic), but not in English.

The **pharynx** is the space behind the tongue, invisible to us unless we use a mirror. This space can be made smaller by retracting the tongue body down into it.

8.2 The larynx

At the bottom of the pharynx is the **larynx**, or voice box. This is a highly complex structure of cartilage, muscle, and ligaments. The crucial elements of the larynx are the **vocal cords**.[140] These are not really cords, but flaps that come in from both sides. The vocal cords can close off the flow of air to varying degrees. The gap between the vocal cords is called the **glottis.**

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[140] Not: chords.

(212) *The larynx*

Larynx with vocal cords in position to vibrate:

glottis (narrow slit suitable for vibration)
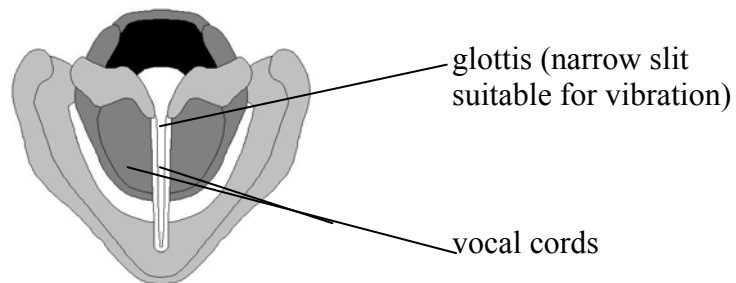
vocal cords

Open larynx (vocal cords spread):

glottis (wide open)
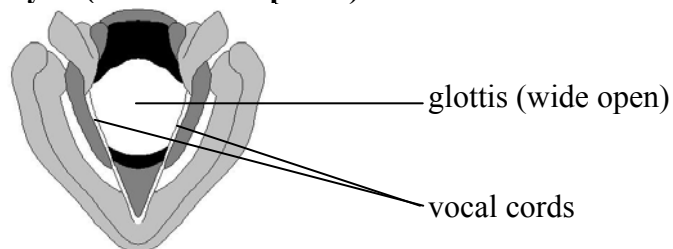
vocal cords

There are basically four things that the vocal cords can do. (1) If they are spread far apart, we get normal breathing. (2) If they are brought tightly together, the airflow is blocked. If the blockage is then quickly released, we get what is called a **glottal stop**, IPA symbol [ʔ]. This is the sound that begins each syllable of the expression "uh-oh" [ˈʔʌʔoʊ]. (3) If the vocal cords are brought close but not touching, we get an [h]. (4) If the vocal cords are just barely touching, they vibrate, producing what is called **voicing**. Voicing accompanies most vowels and many consonants (except when we whisper), and is the most important source of sound in speech.

Numerous speech organs are actively controlled by the speaker in the production of speech. In normal speech, the following organs are active: the lips, the tongue blade, the tongue body, the velum, the jaw, the larynx (up and down), and the vocal cords. X-ray movies of speech show that these speech organs move extremely rapidly and with great precision.[141] Speaking is one of the most complex physical feats people can perform, yet we do it without even thinking about it.

9. Describing consonant articulation

To describe a consonant, one normally describes three things:

Place of articulation. All consonants involve a constriction somewhere in the vocal tract. To specify a consonant one must state where this constriction is made; this is the place of articulation.

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[141] For a moving image of the vocal tract, consult http://www.speech.kth.se/~olov/Bilder/MRIs_2D.gif.

Manner of articulation. This indicates the kind of constriction that is made—roughly, how narrow it is, and the acoustic result.

Voicing— whether the vocal cords are vibrating during the production of a consonant. A good way to detect voicing is to put your hand firmly on top of your head when you say a word. If you do this while you say "za", you will feel buzzing all the way through. If you do this for "sa", you will feel buzzing only after the [s] is over. So [z] is a voiced sound and [s] is voiceless.

9.1 Manner of articulation

We will cover six manners of articulation.

(a) In a **stop**, the airflow is momentarily blocked off completely (i.e. "stopped"), then released. The stops of English are

	[p]	[t]	[k]
(*Keywords:*)	*pop*	*tot*	*kick*
	[b]	[d]	[g]
	Bob	*Dad*	*gag*

Note that I have arranged the six stops in rows and columns, going by place of articulation and voicing.

(b) In a **fricative**, one forms a narrow constriction at the place of articulation. The air passing through the constriction makes a hissing noise. English has nine fricatives:

[f]	[θ]	[s]	[ʃ]	[h]
fife	*thin*	*Sis*	*shoe*	*he*
[v]	[ð]	[z]	[ʒ]	
vat	*thou*	*zoo*	*Asia*	

(c) An **affricate** is a rapid sequence of a stop and a fricative made at roughly the same place of articulation with a single gesture. Affricates can usually be considered a subclass of the stops. English has two affricates, [tʃ] (as in *church*) and [dʒ] (as in *judge*).

(d) In a **nasal** consonant, the velum is lowered, allowing air to escape out the nose. The great majority of nasals have a complete blockage within the mouth at the same time. The places of articulation for nasals are usually the same as those for stops. The nasal consonants of English are [m] (*Mom*), [n] (*none*), and [ŋ], which is the last sound of *young*.

(e) In an **approximant**, the vocal tract is relatively open, so that air flows freely and there is no frication noise. Approximants are normally divided into **lateral** and **central**. In a lateral

approximant, the air flows around the sides of the tongue; [l] is a lateral. In a central approximant, air flows through a central channel. English has three central approximants:

- [j] occurs in words like *youth*
- [w] occurs in words like *witch*[142]
- [ɹ] occurs in words like *roar*

Approximants are often divided up in a different way: **liquids** are the "r" and "l" sounds; in English [l] and [ɹ]. **Glides** (also called "semivowels") are central approximants like [j] and [w] that are closely similar to vowels (see below).

(f) In a **tap**, the tongue tip brushes very briefly against the roof of the mouth—too short a closure to count as a stop. The tap of English is found in words like *data* (North American dialects only), and is symbolized [ɾ]. The tap is generally voiced.

9.2 Place of Articulation

By combining information about place of articulation with information about manner, we can arrive at complete descriptions of English consonants. I will cover the places of articulation going from the front to the back of the mouth. In reading the following refer to the midsaggital section diagram in (210) above (p. 368).

(a) **Bilabial** sounds are made by touching the upper and lower lips together. English has a voiceless bilabial stop [p], a voiced bilabial stop [b], and a (voiced) bilabial nasal [m].

Note the standard form for describing a consonant: the format is VOICING-PLACE-MANNER. In the case of nasals and approximants, which are almost always voiced, it is permissible to specify only place and manner.

(b) **Labio-dental** sounds are made by touching the lower lip to the upper teeth. English has a voiceless labio-dental fricative, [f], and a voiced one, [v]. Labio-dental stops and nasals are rare, though English speakers make them if they try to say [p], [b], or [m] while smiling.

(c) **Dental** sounds are made by touching the tongue to the upper teeth. This can be done in a number of ways. If the tongue is stuck out beyond the teeth, the sound is called an **interdental**, though we will not worry about such fine distinctions. English has a voiceless interdental fricative [θ] (as in *thin*), and a voiced one [ð] (as in *then*).

(d) **Alveolar** sounds are made by touching the tip or blade of the tongue to a location just forward of the alveolar ridge. English has several alveolar consonants. There is a voiceless alveolar stop [t], a voiced alveolar stop [d], voiceless and voiced alveolar fricatives [s] and [z], an alveolar

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[142] A small number of American English speakers have an additional central approximant, [ʍ], which is a voiceless version of [w]. It occurs in words spelled with *wh*, like *which*.

nasal [n], and an alveolar lateral liquid [l]. All these phonetic symbols correspond to English spelling.

(e) **Palato-alveolar** sounds are made by touching the blade of the tongue to a location just behind the alveolar ridge. English has a voiceless palato-alveolar fricative [ʃ] (as in *shoe*), a voiced palato-alveolar fricative [ʒ] (as in *vision*), a voiceless palato-alveolar affricate [tʃ], (as in *church*), and voiced palato-alveolar affricate [dʒ] (as in *judge*).

(f) **Palatal** sounds are made by moving the body of the tongue forward toward the hard palate. English has just one palatal sound, the palatal glide [j], as in *year*.

(f) **Velar** sounds are made by touching the body of the tongue to the velum. English has three velar sounds: a voiceless velar stop [k] (as in *cat* or *king*), a voiced velar stop [g] (as in *goat*), and a velar nasal [ŋ] (as in *sing*). Note that in this case English uses a sequence of two letters to spell what is phonetically a single sound.

(g) **Glottal** sounds are made by moving the vocal cords close to one another. English has a voiceless glottal fricative [h].

9.3 Interpreting the consonant chart

The consonant chart for English, given above in (207) (p. 357) can now be better understood, as it arranges the consonants of English place, manner, and voicing. The arrangement of the chart is traditional: the columns depict place, going from front to back in the vocal tract, and the rows depict manner, going roughly in increasing sonority (loudness). Take a look at the chart again, examining its rows and columns, to see how these group together sounds of similar phonetic properties.

Study Exercise #66: Pronouncing the "gaps"

    Look at this copy of the English consonant chart. It has eight digits in it, located in cells that
are blank for English but not for languages in general. Try to pronounce each of the gaps. The
answer key identifies the gaps in IPA and gives languages that have them.

		Bilabial	Labio-dental	Dental	Alveolar	Palato-alveolar	Palatal	Velar	Glottal
Stops	voiceless	/p/ pin		**1**	/t/ tin			/k/ kin	
	voiced	/b/ bin		**2**	/d/ din			/g/ gill	
Affricates	voiceless				**3**	/tʃ/ chin			
	voiced				**4**	/dʒ/ gin			
Fricatives	voiceless	**5**	/f/ fin	/θ/ thin	/s/ sin	/ʃ/ shin		**7**	/h/ hymn
	voiced	**6**	/v/ vim	/ð/ this	/z/ zip	/ʒ/ vision		**8**	
Nasals		/m/ mitt			/n/ nip			/ŋ/ sing	
Approximants	lateral				/l/ Lynn				
	central	/w/ win					/ɹ/ rim	/j/ ying	

Answer to Study Exercise #65

Sound files of me pronouncing these sounds can be listened to at
www.linguistics.ucla.edu/people/hayes/103/Charts/CChartWithSounds/CChart.pdf.

1.   This is a voiceless dental stop, made by putting the tongue tip in the location for [θ] and "squeezing" the constriction enough to yield a stop articulation. The IPA symbol uses a diacritic, a little subscript platform for the *t*: [t̪]. [t̪] is the normal pronunciation in Spanish and French for the sounds that are spelled with letter *t* in these languages.

2.   This is a voiced dental stop; as [t̪] is to [t], so is [d̪] to [d].

3 and 4: The alveolar voiceless and voiced affricates can be pronounced by putting together a [t] and an [s] (for voiceless) and a [d] and a [z] (for voiced) and saying them rapidly as a single sound: [ts], [dz] (or, for sticklers, [t͡s] and [d͡z]). [ts] is the sound spelled with letter *z* in German. [dz] occurs for some English speakers as a variant (allophone; see below) of the basic [z] sound after [n], in words like *lens* (IPA [lɛnd͡z]).

5 and 6: If you make a fricative instead of a stop at the bilabial location, you will get [ɸ] (voiceless) and [β] (voiced). Both occur in Ewe (Ghana); listen at to real versions at www.phonetics.ucla.edu/course/chapter7/ewe/ewe.html.

7 and 8: If you make a fricative instead of a stop at the velar location, you will get [x] (voiceless) and [ɣ] (voiced). [x] occurs in German, where is spelled *ch*, as in *Bach* [bax]. [ɣ] occurs in Spanish as the *g* sound when between vowels, as in *lago* ['laɣo] 'lake'.

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10. Describing vowels

Vowels differ from consonants in that they do not have real "places of articulation", that is to say, points of major constriction in the vocal tract. Rather, the vocal tract as a whole acts as a resonating chamber. By modifying the shape of this chamber using movements of the tongue, jaw, and lips, one imparts different sound qualities to the basic noise made by the vocal cords.

An analogy can be made with brass instruments. The vocal cords by themselves make a rather ugly buzz, just like the mouthpiece of a trumpet does when played by itself. The buzz is given its more pleasant characteristic quality by being passed through a resonating chamber (for example, a trumpet or a vocal tract). The quality of the sound is determined by the shape of the chamber; thus vowels of English are similar to notes played by the same trumpet with different mutes placed inside.

There are three basic modifications that one can make to the shape of the vocal tract. Vowels are described by specifying the amount of each modification used.

10.1 Rounding

One obvious modification one can make to the shape of the vocal tract is to round the lips, thus narrowing the passage at the exit. This happens, for example, in the vowels of *boot* [u], *book* [ʊ], and *boat* [oʊ]. These are called *rounded* or simply *round* vowels. Other vowels, such as the [i] of *beet* or the [ɑ] of *cot*, are called *unrounded*. (Warning: you may speak a dialect of English that has little lip rounding. The really rounded vowels are found more easily in other languages.)

10.2 Height

Another modification one can make to the shape of the vocal tract is to make passage through the mouth wider or narrower. Widening is accomplished by opening the jaw and/or lowering the body of the tongue towards the bottom of the mouth. Narrowing is accomplished by raising the jaw and raising the body of the tongue.

The terminology for describing these changes is based on the height of the tongue body (without regard to whether this is due to jaw movement or tongue movement). Vowels are classified as **high**, **mid**, or **low**, depending on tongue body position. In effect, high vowels have a narrow passage for the air to pass through, and low vowels have a wide passage.

Examples of high vowels in English are [i], the vowel of *beat*, and [u], the vowel of *boot*. Example of low vowels are [ɑ], the vowel of *cot*, and [æ], the vowel of *bat*. You can feel the oral passage widening and narrowing if you pronounce a sequence of vowels that alternates between high and low, such as [i æ i æ i æ].

10.3 Backness

The third primary way of changing the vocal tract shape is to place the body of the tongue towards the front part of the mouth or towards the back. Vowels so made are called **front** and **back** vowels.[143] For example, [i] (*beat)* is a high front vowel, and [u] (*boot*) is a high back vowel (which is also rounded). You can feel the tongue moving forwards and backwards if you pronounce the sequence [i u i u i u i u].

10.4 Vowel chart

We now have three "dimensions" for classifying vowels, each based on a particular modification of the vocal tract shape: rounding, height, and backness. The three dimensions allow us to describe vowels clearly, and also to organize them in a chart:

Note that this chart is an abstraction, since in physical reality the vowels do not line up vertically in tongue body position. In particular, the high front vowels are considerably more

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[143] A more refined classification recognizes **central** vowels; neither front nor back. Here it will suffice to have just two degrees of backness.

forward than the high back vowels, owing to the space available for tongue movement. Because of this, the chart should be interpreted as saying "relatively more front" or "relatively more high" rather than specifying actual physical tongue positions.

	Front	Back		Diphthongs
	Unrounded	Unrounded	Rounded	
Upper tense Lower nontense	/i/ b<u>ea</u>t /ɪ/ b<u>i</u>t		/u/ b<u>oo</u>t /ʊ/ f<u>oo</u>t	/aɪ/, /aʊ/, /ɔɪ/ b<u>i</u>te, b<u>ou</u>t, C<u>oi</u>t
Upper tense Lower nontense	/eɪ/ b<u>ai</u>t /ɛ/ b<u>e</u>t	/ə/ abb<u>o</u>t /ʌ/ but	/oʊ/ b<u>oa</u>t /ɔ/ b<u>ou</u>ght	Rhotacized upper mid back unrounded: /ɚ/ B<u>er</u>t
Low	/æ/ b<u>a</u>t	/ɑ/ f<u>a</u>ther		

Vowels are usually identified with formula HEIGHT-BACKNESS-ROUNDNESS. For example, [u] is an "upper high back rounded vowel."

10.5 Dialect variation

English dialects differ most noticeably in their vowel systems. Here are differences you may find in your speech:

(1) I included the lower mid back rounded vowel [ɔ] on the chart, but probably about half of Americans don't have this vowel in their speech—there is an ongoing change in American English that is wiping out this vowel. Speakers of the newer, [ɔ]-less dialect use [ɑ] in the words that speakers of the older dialect say with [ɔ]; thus:

Old dialect   **New dialect**[144]

law   [ˈlɔ]   la   [lɑ]   law, la   [ˈlɑ]
caught [ˈkɔt]   cot   [ˈkɑt]   caught, cot   [ˈkɑt]
Pauley [ˈpɔli]   Polly   [ˈpɑli]   Pauley, Polly   [ˈpɑli]

Speakers who don't have an [ɔ] as a separate sound do usually have it as part of diphthong, as in [ɔɪ] *boy*.

(2) Many Americans have a high central rounded vowel, IPA [ʉ], instead of [u].

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[144] These labels should be interpreted with caution: some speakers of the "old" dialect are three years old, some speakers of the "new" dialect are 100. Language change happens fairly slowly.

10.6 Schwa ([ə]): a reduced vowel

English has a so-called "reduced vowel", which appears in the underlined position in the following words:

t<u>o</u>mato	[təˈmeɪɾoʊ]
<u>A</u>mer<u>i</u>ca	[əˈmeɹəkə]
C<u>o</u>nnect<u>i</u>c<u>u</u>t	[kəˈnɛɾəkət]

 This vowel varies in its quality and is quite short, so it is hard to transcribe. We will simplify things by always transcribing the reduced vowel as [ə] (the vowel called "schwa"). In transcribing, if you hear a very short, indistinct "blurry" vowel, transcribe it as schwa.

10.7 The rhotacized vowel [ɚ]

[ɚ], the vowel of *bird*, is rather like the schwa, except that the tongue blade is curved upward in the manner of an [ɹ] (see images above). This upward curvature is called **rhotacization**; thus [ɚ] is classified as a rhotacized upper mid central unrounded vowel. It is often called a "rhotacized schwa," which fits its visual form.

10.8 Glide-vowel connections

As a "semivowel", a glide is a consonant that is articulated in the same manner as a vowel. Glides can be described from the viewpoint of vowels as well as consonants. Thus, [j] is considered a central palatal approximant; but from the viewpoint of semivowels it is the partner of [i]—since its position is upper high and front. Likewise, [w] is the partner (articulated in the same place as) [u], and the alveolar central approximant [ɹ] also has the vowel partner [ɚ].

10.9 Diphthongs

A *diphthong* (note the spelling) is a vowel (that is, a single sound) during which the articulator are in motion. A common way to represent diphthongs in IPA is to give a sequence of vowel symbols, one representing the starting point and the other the ending point. English has numerous diphthongs. The three most obvious ones are [aɪ], which appears in *ride*; [ɔɪ], which appears in *boy*; and [aw], which appears in *how*. The diphthong [aʊ] is pronounced [æʊ] by many speakers. Less obvious diphthongs (because the articulators don't move as far) are [eɪ], as in *bay*, and [oʊ], as in *so*.

10.10 Syllabic consonants

 English also has what are called "syllabic consonants". These are sounds that are articulated like consonants, but form the nucleus of a syllable as if they were vowels. Syllabic consonants are transcribed by putting a [ˌ] underneath the symbol for the appropriate consonant. The following transcriptions illustrate this:

tickle   [ˈtɪkl̩]
button   [ˈbʌtn̩]

It's possible to think of the rhotacized schwa, [ɚ], in a different way: as [ɹ̩]. These quite different symbols depict essentially the same sound from different points of view. [ɹ̩] is the consonant [ɹ], rendered syllabic, whereas [ɚ] is a schwa vowel [ə] with added tongue retroflextion.

FEATURES

11. Features

We will shortly shift from phonetics to phonology, which studies the legal arrangements of speech sounds (essentially, phonological grammaticality) as well as the changes of sounds as they appear in context. This involves writing rules and constraints, and to do this, it will be essential to have a system of features, just as we did for inflectional morphology. The features of phonology are phonetic in nature. For example, in informal terms, the features of [d] are that it is a stop, that it is alveolar, that it is voiceless, and further, that it is *not* round and *not* nasal.

When we have specified enough features for a particular sound, then we have complete and explicit description, properly distinguishing it from any other sound. This makes it possible to write explicit rules and constraints.

In phonology, features are generally given a more compact notation than what we used for morphological features: a plus sign, placed *before* the feature name, means that a segment has the relevant property; minus means that it lacks it. Thus [i] is said to be [+high, +tense, –round, –nasal, –back]. If you wanted to, you could read this as [High:Plus, Tense:Plus, Round:Minus, Nasal:Minus, Back:Minus], but in practice no one actually expresses phonological features in this way.

As with morphological features, phonological features normally have brackets placed around the feature names. But more often than not, the features are arranged in a column rather than a list:

$$\begin{bmatrix} +\text{high} \\ +\text{tense} \\ -\text{round} \\ -\text{nasal} \\ -\text{back} \end{bmatrix}$$

This makes it easier to string them together and express whole morphemes and words, should be be necessary, in features. The notation given above is often called a **feature matrix**.

12. A feature set

In this text we will use the following features for phonology; each should be assumed to take the values plus or minus:

(213) *A simple phonological feature set*

[syllabic]	[high]	[stop]	[bilabial]
[voiced]	[low]	[affricate]	[labiodental]
[nasal]	[front]	[fricative]	[dental]
	[back]	[liquid]	[alveolar]
	[round]	[glide]	[palato-alveolar]
	[tense]		[palatal]
		[aspirated]	[velar]
	[stressed]	[lateral]	[glottal]

Here is some discussion of the individual features:

[syllabic] distinguishes vowels (and syllabic consonants like [l̩] and [n̩]; see §10.10 above) from consonants; the vowels are [+syllabic], the consonants [−syllabic].

[tense] is a feature of vowels, corresponding to what is sometimes taught in school as "long". The vowels [ɪ], [ɛ], [æ] [ʌ], [ʊ] are [−tense]; the others are [+tense]. The lower high, lower mid, and low vowels are [−tense], the others [+tense]. The distinction may seem arbitrary, but is useful for phonology—consider, for instance, that it is precisely the [−tense] vowels that may not occur before another vowel, or at the end of a word.

To distinguish the three basic vowel height categories (high, mid, and low), we only need two features, not three: high vowels are [+high, −low]; low vowels are [−high, +low]; and mid vowels are [−high, −low]. (A vowel that was [+high, +low] would be a articulatory impossibility; you can't put the tongue in both high and low positions at once.)

Other than the above, the features are simply restatements of the traditional phonetic terminology already covered above.

For this course I'd like you to understand the meaning of the features but not memorize them; exams will include feature charts where needed.

13. Feature charts

Here are the features we'll be using, with the sounds of English defined according to the features.

Notes:

- [aspirated]: for stops, this means "accompanied by a little puff of breath on release." In English, initial [ptk] are aspirated: *pin* [pʰɪn], *tin* [tʰɪn], *kin* [kʰɪn].
- [stressed]: This is treated as a feature of vowels; vowels can be either stressed or stressless. The value is not given in the chart, but (for example) when you see stressless [i] (as in [ˈhæpi] *happy*) you should assume [−stress] and when you see stressed [i] (as in [ˈdivə] *diva*) you should assume [+stress]. The exceptions are: assume that schwa ([ə]) is always [−stress] and caret ([ʌ]) is always [+stress].
- When a blank appears in the chart, it means that the feature is not essential to the production of the sound. For example, there are no values under [p] for [high], [low], [back], [round], or [tense]. The actual position of the tongue and lips for [p] will vary depending on the context.
- The major diphthongs [aɪ aʊ ɔɪ] would be treated as two-vowel sequences, so they don't appear in the chart. [eɪ] and [oʊ] are close enough to [e] and [o] that we can ignore that difference here.

(214) *Feature charts for English sounds*

a. Consonants

| | [syllabic] | Manner of articulation features | | | | | Laryngeal features | | [nasal] | Features mostly for vowels | | | | | | Place of articulation features | | | | | | | | |
		[stop]	[affricate]	[fricative]	[liquid]	[glide]	[voiced]	[aspirated]		[high]	[low]	[back]	[round]	[tense]	[stressed]	[bilabial]	[labiodental]	[dental]	[alveolar]	[palato-alveolar]	[palatal]	[velar]	[glottal]	[lateral]
p	–	+	–	–	–	–	–		–				–			+	–	–	–	–	–	–	–	–
t	–	+	–	–	–	–	–		–				–			–	–	–	+	–	–	–	–	–
k	–	+	–	–	–	–	–		–				–			–	–	–	–	–	–	+	–	–
b	–	+	–	–	–	–	+		–				–			+	–	–	–	–	–	–	–	–
d	–	+	–	–	–	–	+		–				–			–	–	–	+	–	–	–	–	–
g	–	+	–	–	–	–	+		–				–			–	–	–	–	–	–	+	–	–
tʃ	–	–	+	–	–	–	–		–				–			–	–	–	–	+	–	–	–	–
dʒ	–	–	+	–	–	–	+		–				–			–	–	–	–	+	–	–	–	–
f	–	–	–	+	–	–	–		–				–			–	+	–	–	–	–	–	–	–
θ	–	–	–	+	–	–	–		–				–			–	–	+	–	–	–	–	–	–
s	–	–	–	+	–	–	–		–				–			–	–	–	+	–	–	–	–	–
ʃ	–	–	–	+	–	–	–		–				–			–	–	–	–	+	–	–	–	–
h	–	–	–	+	–	–	–		–				–			–	–	–	–	–	–	–	+	–
v	–	–	–	+	–	–	+		–				–			–	+	–	–	–	–	–	–	–
ð	–	–	–	+	–	–	+		–				–			–	–	+	–	–	–	–	–	–
z	–	–	–	+	–	–	+		–				–			–	–	–	+	–	–	–	–	–
ʒ	–	–	–	+	–	–	+		–				–			–	–	–	–	+	–	–	–	–
m	–	–	–	–	–	–	+		+				–			+	–	–	–	–	–	–	–	–
n	–	–	–	–	–	–	+		+				–			–	–	–	+	–	–	–	–	–
ŋ	–	–	–	–	–	–	+		+				–			–	–	–	–	–	–	+	–	–
l	–	–	–	–	+	–	+		–				–			–	–	–	+	–	–	–	–	+
ɹ	–	–	–	–	+	–	+		–				–			–	–	–	–	+	–	–	–	–
j	–	–	–	–	–	+	+		–				–			–	–	–	–	–	+	–	–	–
w	–	–	–	–	–	+	+		–				+			–	–	–	–	–	–	–	–	–

b. **Vowels**

		Manner of articulation features					Laryngeal features			Features mostly for vowels						Place of articulation features								
	[syllabic]	[stop]	[affricate]	[fricative]	[liquid]	[glide]	[voiced]	[aspirated]	[nasal]	[high]	[low]	[back]	[round]	[tense]	[stressed]	[bilabial]	[labiodental]	[dental]	[alveolar]	[palato–alveolar]	[palatal]	[velar]	[glottal]	[lateral]
i	+	−	−	−	−	−	+		−	+	−	−	−	+		−	−	−	−	−	−	−	−	−
ɪ	+	−	−	−	−	−	+		−	+	−	−	−	−		−	−	−	−	−	−	−	−	−
eɪ	+	−	−	−	−	−	+		−	−	−	−	−	+		−	−	−	−	−	−	−	−	−
ɛ	+	−	−	−	−	−	+		−	−	−	−	−	−		−	−	−	−	−	−	−	−	−
æ	+	−	−	−	−	−	+		−	−	+	−	−	−		−	−	−	−	−	−	−	−	−
u	+	−	−	−	−	−	+		−	+	−	+	+	+		−	−	−	−	−	−	−	−	−
ʊ	+	−	−	−	−	−	+		−	+	−	+	+	−		−	−	−	−	−	−	−	−	−
oʊ	+	−	−	−	−	−	+		−	−	−	+	+	+		−	−	−	−	−	−	−	−	−
ɔ	+	−	−	−	−	−	+		−	−	−	+	+	+		−	−	−	−	−	−	−	−	−
ʌ	+	−	−	−	−	−	+		−	−	−	+	−	−	+	−	−	−	−	−	−	−	−	−
ə	+	−	−	−	−	−	+		−	−	−	+	−	−	−	−	−	−	−	−	−	−	−	−
ɚ	+	−	−	−	−	−	+		−	−	−	+	−	+		−	−	−	−	−	+	−	−	−
ɑ	+	−	−	−	−	−	+		−	−	+	+	−	+		−	−	−	−	−	−	−	−	−

13.1 Description of sounds using their features

As already noted, the features allow us to describe a segment phonetically in the compact notation of a feature matrix. For example, a more complete feature matrix for the vowel [i] would be as follows:

$$
\begin{bmatrix}
\text{+syllabic} \\
\text{–back} \\
\text{+high} \\
\text{–low} \\
\text{+tense} \\
\text{–round} \\
\text{–nasal}
\end{bmatrix}
$$

A less detailed matrix, important later on when we turn to phonology, would specify [i] as a vowel of English, giving only the features necessary to distinguish it from all the other English sounds. In these terms, [i] is

$$\begin{bmatrix} -\text{back} \\ +\text{high} \\ +\text{tense} \end{bmatrix}$$

You can find such reduced feature matrix by examining the full matrix and taking away features one by one where they are not needed to distinguish the sound from any other sound in the same language. In the above example, [−low] is not needed, since no high vowel can be low. [−round] is not needed, since English no vowel can be both front and rounded vowels. [−nasal] is not needed, since nasality is not a distinctive property of English vowels.

Study Exercise #67

Using the features above, describe the sounds [tʃ] and [n] in the same way that [i] was described, that is, enough to distinguish them from other sounds of English.

Answer to Study Exercise #66

I believe the shortest possible descriptions are as follows.

[tʃ]: $\begin{bmatrix} -\text{voiced} \\ +\text{affricate} \end{bmatrix}$

[-voiced] is needed to distinguish [tʃ] from [dʒ]. [+affricate] is obviously needed since there are many other voiced sounds in English (but only two affricates).

[n]: $\begin{bmatrix} +\text{nasal} \\ +\text{alveolar} \end{bmatrix}$

[+nasal] is needed since [t, d, s, z] are also [+alveolar]. [+alveolar] is needed because [m, ŋ] are also [+nasal].

Feature notation also allows us to refer to whole classes of segments at a time. This is similar to the use of features in inflectional morphology, where they permit use to refer to classes of inflected forms. For example, the expression [+voiced, +alveolar] would pick out the segments [d,z,n,ɹ,ɾ,l] if we were dealing with English. Similarly, the expression [+syllabic, +high] picks out the vowels [i,ɪ,u,ʊ] from the set of all English vowels. The expression [+syllabic] uses one feature to pick out the vowels.

This is the same use we made of features in inflectional rules. For example, [Tense:past] might designate a whole set of possible morphosyntactic representations, which might differ from each other, for example, in person and number. Any representation that is designated by the expression [Tense:past], whatever its features for person and number, would be eligible for attachment of (for example) the past tense suffix.

13.2 The role of features in language: preview of phonology

Often, when we put morphemes together into words (Chapter 2) or put words together into sentences (Chapters 4-6), the resulting sequences get pronounced in a way that is not the "sum of their parts". Rather, there are phonological changes that adjust the basic sequences in some way.

Here is a simple example. The distinguished UCLA linguist Russell Schuh was known to his colleagues as "Russ Schuh". Prof. Schuh once told me that he had become used to hearing his name pronounced as [ɹʌʃʃu], as if he were "Rush Schuh". The crucial data are:[145]

Russ   [ɹʌ**s**]
Schuh   [ʃu]
Russ Schuh   [ɹʌʃʃu]

---
[145] I will leave off the stress marks for simplicity.

Similarly English speakers say *miss* [mɪs], *Sheila* [ʃilə], but *miss Sheila* [mɪʃʃilə]; *nice* [naɪs], *shadow* [ʃædoʊ], but [naɪʃʃædoʊ], and so on. The substitution is to replace [s] by [ʃ] when another [ʃ] follows, resulting in phonetic double [ʃʃ].[146]

[z] is similar to [s] (its voiced partner) and it undergoes a parallel process, becoming [ʒ], the voiced partner of [ʃ].

use   [juz]
Schuh's book   [ʃuz bʊk]
use Schuh's book [juʒ ʃuz bʊk]

We can think of [ʃ] as the "trigger" of this process; it causes the [s] to become [ʃ] and the [z] to become [ʒ]. With this in mind, we might ask if [ʒ], the voiced partner of [ʃ], can likewise act as a trigger for the change. This is hard to check, since words in English cannot begin with [ʒ]. But pushing things a bit, we can try some Russian loanwords:

Russ   [ɹʌs]
Zhirinovsky   [ʒɪrənɔfski]
Russ Zhirinovsky   [ɹʌʃ ʒɪrənɔfski]

use   [juz]
Zhivago's book   [ʒɪvɑgoʊz bʊk]
use Zhivago's book   [juʒ ʒɪvɑgoʊz bʊk]

So it looks like [ʒ] is indeed a possible trigger. Summing up, we want a rule like this:

Alveolar Fricative Palatalization[147]

$$\begin{Bmatrix} s \\ z \end{Bmatrix} \rightarrow \begin{Bmatrix} ʃ \\ ʒ \end{Bmatrix} \text{ when } \begin{Bmatrix} ʃ \\ ʒ \end{Bmatrix} \text{ immediately follows.}$$

We have two **sets** of sounds here, {s, z} and {ʃ, ʒ}. These sets are hardly arbitrary; they have a basis in the phonetic properties of these sounds. Thus, the phonological features become relevant.

The set {s, z} consists of all and only the alveolar fricatives. The notation here:

$$\begin{bmatrix} +\text{fricative} \\ +\text{alveolar} \end{bmatrix}$$

means "all and only the sounds (of the language under study) that are [+fricative] and [+alveolar]".

---

[146] If you wonder what a *single* [ʃ] sounds like, try the sentence *Rush oodles of food to the meeting room.* It begins [ɹʌʃ u...], with a single [ʃ], which is simply the final [ʃ] of *rush*.

[147] "Palatalization" is a common name for any rule that shifts sounds into the (roughly) palatal region.

Moreover, it is sensible to let rules alter the value of individual features. We can do this for Alveolar Fricative Palatalization as follows:

Alveolar Fricative Palatalization (restated with features)

$$\begin{bmatrix} +\text{fricative} \\ +\text{alveolar} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{alveolar} \\ +\text{palato-alveolar} \end{bmatrix} \text{ when } \begin{bmatrix} +\text{fricative} \\ +\text{palato-alveolar} \end{bmatrix} \text{ immediately follows.}$$

The general conception here is that phonological rules do not apply to arbitrary lists of sounds, but to groups of sounds defined setting the values of some group of phonetic features (often called **natural classes**). Moreover, the change in a rule is usually not some wholesale change of sounds, but an adjustment in some small number of the features.

The key idea for formulating rules is that *any feature not mentioned in a rule stays the same*. So, for instance, if we start out with [s], which is [−voice], and apply Alveolar Fricative Palatalization, we end up with [ʃ], which is likewise [−voice]. If we start out with [z], which is [+voice], and apply the rule, we end up with [ʒ], which is likewise [+voice]. This is what permits us to describe symmetrical changes such as that of Alveolar Fricative Palatalization.

For now, what is important as an analytic skill is to be able to use the features to identify natural classes of sounds, and to execute parallel changes when they occur in a rule.

Study Exercise #68

If you wanted to characterize the following set of sounds in English:

a. [u,i] b. [i,ɪ,eɪ,ɛ,æ] c. [v, ð, z, ʒ]   d. [w, u, ʊ, oʊ, ɔ] e. [m, n, ŋ]
f. [l]   g. [p, t, k, tʃ, f, θ, s, ʃ, h] h. [θ, ð]

what features would you use? Try to use the minimum needed. Use the feature charts given in (214) on p. 383 above.

Answer to Study Exercise #67

a. [u,i] $\begin{bmatrix} +\text{high} \\ +\text{tense} \end{bmatrix}$

b. [i, ɪ, eɪ, ɛ, æ]   [−back]

c. [v, ð, z, ʒ] $\begin{bmatrix} +\text{voiced} \\ +\text{fricative} \end{bmatrix}$

d. [w, u, ʊ, oʊ, ɔ]   [+round]

e. [m, n, ŋ]   [+nasal]

f. [l]   [+lateral]

g. [p, t, k, tʃ, f, θ, s, ʃ, h]   [−voice]

h. [θ, ð]   [+dental]

Study Exercise #69

Indicate the minimum number of features needed to single out the following sets of sounds from the other sounds of English. Use the feature charts given in (185) on p. 383 above.

a.   [d, n, z, l]
b.   [l]
c.   [w]
d.   [h]
e.   [æ,ɑ]
f.   [eɪ, ɛ, oʊ, ɔ, ʌ, ə, ɚ]
g.   [ɛ,ʌ,æ,ə]
h.   [ɛ,ʌ,ə]
i.   [æ, ɪ, ʊ, eɪ, ɛ, oʊ, ɔ, ɚ, ɑ, i, u, b, d, g, dʒ, v, ð, z, ʒ, m, n, ŋ, l, ɹ, j, w]
j.   [f,θ,s,ʃ,h]

Answers to Study Exercise #68

a.   [+voice, +alveolar]
b.   [+lateral]
c.   [−syllabic,+round]
d.   [+glottal]
e.   [+low]
f.   [−high,−low]
g.   [−tense,−high]
h.   [−tense,−high,−low]
i.   [+voice]
j.   [−voice,+fricative]

_____

Study Exercise #70

Formulate these imaginary rules using the feature charts given in (214) on p. 383 above. Assume that the inventory of sounds is as in English. Use as few features as you can.

a.   t, d become tʃ, dʒ before j, w.
b.   i, ɪ become u, ʊ after w.
c.   tʃ, dʒ become ʃ, ʒ after a vowel

Answers to Study Exercise #69

a. $\begin{bmatrix} +\text{stop} \\ +\text{alveolar} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{affricate} \\ -\text{stop} \\ +\text{palato-alveolar} \\ -\text{alveolar} \end{bmatrix}$ before [+glide]

b. $[+\text{high}] \rightarrow \begin{bmatrix} +\text{back} \\ +\text{round} \end{bmatrix}$ after $\begin{bmatrix} +\text{glide} \\ +\text{round} \end{bmatrix}$ [148]

c. $[+\text{affricate}] \rightarrow \begin{bmatrix} +\text{fricative} \\ -\text{affricate} \end{bmatrix}$ after [+syllabic]

For further reading

A fine introductory textbook in phonetics was written by the late Peter Ladefoged of UCLA, his *A Course in Phonetics.* Current editions are now extremely expensive, but used copies of earlier editions are widely available. Ladefoged prepared a website, still posted at UCLA, that relates to his text and can be used for studying phonetics: www.phonetics.ucla.edu/course/contents.html.

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[148] Instead of $\begin{bmatrix} +\text{glide} \\ +\text{round} \end{bmatrix}$ you could use $\begin{bmatrix} -\text{syllabic} \\ +\text{round} \end{bmatrix}$.

Chapter 11: Phonology I — Phonemic Analysis

1. Phonology

Phonetics studies speech sounds as physical events; whereas phonology studies the (mostly unconscious) rules that govern the use of sounds in language. That is, phonology studies the "grammar of sound."

2. What is the content of phonology?

Phonologists study, more or less, four aspects of the grammar of sound.

First, they study how sounds **change in context**. The rule of Alveolar Fricative Palatalization given in the previous chapter describes how the basic sounds [s] and [z] vary when they occur just before a [ʃ] or [ʒ]. This changing of sounds by context is often called **alternation** and is discussed further below.

Second, phonologists study the principle of **legal sequencing of speech sounds** — essentially, phonological grammaticality. To give on example, it is "phonologically legal" for English words to begin [bl] (and plenty of them do: *blend*, *blood*, *black*, *bliss*, and so on). But it is phonologically impossible for English words to begin with *[bn]: a word like *bnick* [bnɪk] is judged by English speakers to be aberrant; and English speakers often have great trouble even in saying it (they tend to "repair" the bad sequence by putting in a schwa: [bənɪk]). The study of legal sound sequencing is often called **phonotactics** and, at the level of theory, is usually done by means of setting up a system of constraints, which use the phonological features just like the rules do.

Third, phonologists study how the realization in sounds is **related to other components of the grammar**. Here is a simple example. In the variety of American English I speak, the word *bonus* (similarly *onus*, *phonograph*, *persona*), the sequence [oʊ n ə] has a nasalized [õʊ̃] and a very short [n] (in IPA it would be transcribed [ɾ̃]). But in *slowness* or *lowness* the [oʊ] is not nasalized, and the [n] is an ordinary regular-length [n]. Here is the full comparison:

bonus	[ˈbõʊ̃ɾ̃əs]	*slowness*	[ˈsloʊnəs]
onus	[ˈõʊ̃ɾ̃əs]	*lowness*	[ˈloʊnəs]
phonograph	[ˈfõʊ̃ɾ̃əgɹæf]		
persona	[pɚˈsõʊ̃ɾ̃ə]		

These differences evidently have to do with the fact that *slowness* and *lowness* are derived by a word-formation rule, namely the **-ness Rule** seen in (56) in Chapter 2 ([X]$_{Adj}$ $\rightarrow$ [[X]$_{Adj}$ ness]$_{Noun}$). Quite often, the syntactic or morphological source of an utterance will have some kind of effect on its phonology.

Lastly, phonologists are interested in the **contextual variation** observed for most speech sounds. They attempt to discover this variation and analyse it in the usual manner of linguistics with a set of formalize rules and representations. This is the topic we turn to next.

3. Phonemes and allophones

3.1 The Phonemic Principle

The most basic principle of phonology is the following:

(215) **Phonemic Principle**

Every language has a limited set of phonemes (= basic speech sounds); and every word in the language consists solely of phonemes of that language.

The phonemes of one dialect of English, arranged in feature-based charts, are as follows:

(216)   *The phonemic inventory of one English dialect*

Consonants

		[+bilabial]	[+labio- dental]	[+dental]	[+alveolar]	[+palato- alveolar]	[+palatal]	[+velar]	[+glottal]
[+stop]	[−voice]	/p/ pin			/t/ tin			/k/ kin	
	[+voice]	/b/ bin			/d/ din			/g/ gift	
[+affricate]	[−voice]					/tʃ/ chin			
	[+voice]					/dʒ/ gin			
[+fricative]	[−voice]		/f/ fin	/θ/ thin	/s/ sin	/ʃ/ shin			/h/ hill
	[+voice]		/v/ van	/ð/ this	/z/ zip	/ʒ/ vision			
[+nasal]	[+voice]	/m/ mitt			/n/ nip			/ŋ/ sing	
[+liquid]	[+voice]				/l/[149] Lynn				
						/ɹ/ rip			
[+glide]	[+voice]	/w/ [150] win					/j/ yet		

---

[149] /l/ is also distinct from /ɹ/ in being [+lateral]; air moves around sides of tongue.

[150] "bilabial" is an approximation for /w/; the feature chart from last time uses the vowel features [+round, +high, +back].

Vowels

		$\begin{bmatrix}-\text{back}\\-\text{round}\end{bmatrix}$	$\begin{bmatrix}+\text{back}\\-\text{round}\end{bmatrix}$	$\begin{bmatrix}+\text{back}\\+\text{round}\end{bmatrix}$
$\begin{bmatrix}+\text{high}\\-\text{low}\end{bmatrix}$	[+tense]	/i/ beat		/u/ boot
	[−tense]	/ɪ/ bit		/ʊ/ foot
$\begin{bmatrix}-\text{high}\\-\text{low}\end{bmatrix}$	[+tense]	/eɪ/ bait	/ə/ abb*o*t	/oʊ/ boat
	[−tense]	/ɛ/ bet	/ʌ/ but	/ɔ/[151] bought
$\begin{bmatrix}-\text{high}\\+\text{low}\end{bmatrix}$	[+tense]		/ɑ/ father	
	[−tense]	/æ/ bat		

Can't fit on chart: rhotacized schwa /ɚ/[152]

Three diphthongs: /aɪ/, /aʊ/, /ɔɪ/[153]

All the words of English (in the relevant dialect) are made up of *these sounds and no others*. Thus you can recognize that [ˈblɪk] ("blick") could be English and that [ˈqʼøɸʏ] could not, even if you have never heard either word before. In phonological analysis, we set up a phoneme inventory that is large enough to encompass the target language — but no larger.

Languages vary a great deal in the number of phonemes they have. The record low is believed to be held by Rotokas (South Pacific), with 11, and the record high is believed to be held by !Xoo (Namibia), with 160. English has somewhere around 40, the number varying according to dialect. The average across languages is about 30.

To see the point of the phonemic principle, you have to imagine a language that did not obey it. In such a language: every word would have its own unique phonetic content, and would not be decomposable into a sequence of units. (Such a system might be rather like the vocal communication systems of certain animal species, consisting of a fixed inventory of calls.)

---

[151] Dialectal; many speakers use /ɑ/ in all of the words that (for speakers who have this vowel) have /ɔ/.

[152] Treated as bearing a consonant feature, [+palato-alveolar] (tongue blade is up, unlike in any other vowel).

[153] Features for diphthongs: one approach is to treat them as vowel sequences, assigning features to each vowel.

There is a clear advantage for a language in having a phonemic design. As noted earlier, speech articulation is highly complex, with many articulators moving very rapidly. It would be difficult to learn to pronounce all the thousands of words of a language if each one were a unique phonetic sequence. Presumably it is easier to proceed phonemically; that is, to learn only a limited number of sounds and form all words by stringing these sounds together.

The sign languages of the deaf could, in principle, be suggested as a counterexample to the Phonemic Principle. However, research on sign language suggests that even this form of language can be analyzed into gestural "phonemes", even though these phonemes are quite different from the phonemes of spoken language.[154]

3.2 *Allophones, phonemes, and rules*

A second principle, which will be the basis of much of the analyses to follow, is the Allophonic Principle:

(217) **Allophonic Principle**

Phonemes vary; and the variation is rule-governed.

A **allophone** is a variant of phoneme.

Consider an example. We consider two variants of the phoneme /ɹ/—a distinction that typically is not transcribed, but seems to be widely found.[155] One variant is simply the plain alveolar central approximant [ɹ], already discussed. However, many instances of this phoneme are pronounced as [ɹʷ],with simultaneous lip rounding. The superscript [ʷ] is the IPA symbol for simultaneous rounding, which is also called **labialization**.

Inspecting my own speech (and checking with other speakers), I transcribed the following data:

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[154] And more generally, such research has found morphemes, words, phrases, sentences, grammar, intonation, etc. in sign languages; it's a serious area of linguistics with a large research program.

[155] Reference: Daniel Jones (1918) *An outline of English phonetics*. For a study with physical measurement, see Delattre, Pierre C., and Donald C. Freeman. 1968. "A Dialect Study of American r's by X-ray Motion Picture." *Linguistics* 44: 29–68.

real	[ˈɹʷil]	*par*	[ˈpɑɹ]
write	[ˈɹʷaɪt]	*core*	[ˈkoɹ]
rope	[ˈɹʷoʊp]	*ear*	[ˈiɹ]
reveal	[ɹʷəˈvil]	*part*	[ˈpɑrt]
arrange	[əˈɹʷeɪndʒ]	*bear*	[ˈbɛɹ]
apparition	[æpəˈɹʷɪʃən]	*lure*	[ˈluɹ]
carry	[ˈkeɹʷi]	*forming*	[ˈfoɹmɪŋ]
era	[ˈeɹʷə]	*tornado*	[toɹˈneɪɾoʊ]
Erie	[ˈiɹʷi]		

Plainly, some words have [ɹʷ] and some have [ɹ], but the data are not haphazard. Looking at the examples, it should be apparent that

[ɹʷ]   occurs only before a vowel

[ɹ]   occurs elsewhere; that is, before a consonant or pause

This is an essentially *mechanical* difference: it's a genuine detail of English pronunciation, and if you don't respect it you will sound like you are likely to sound a bit accented in your English. But the difference between [ɹʷ] and [ɹ] has no *communicative* value, the way the difference between [t] and [p] has. ([t] vs. [p] is "communicative" because *tin* and *pin* are not the same word; because *mat* and *map* are not the same word, and so one — you could not say the same thing for [ɹʷ] [ɹ].)

The idea, then, is that at some abstract level, [ɹʷ] and [ɹ] belong to the *same category*—they are predictable variants of the same fundamental sound. A diagram suggesting this idea is:

/ɹ/   phonemic level

[ɹ]   [ɹʷ]   phonetic (= allophonic) level
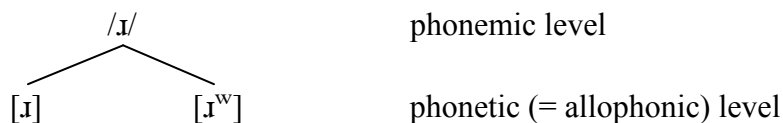
This fundamental sound designated as /ɹ/ is a **phoneme** of English. Phonemes are normally placed in slant brackets to distinguish them from ordinary phonetic transcription. The sounds [ɹ] and [ɹʷ] are said to be the **allophones** of /ɹ/.

One justification for this move is as follows. If we were trying to form the minimal number of sounds with which we could specify the pronunciation of any English word, it would be pointless to include both [ɹʷ] and [ɹ] in this list of sounds. The distinction between the two is redundant (predictable)—thus it is far more sensible to include just /ɹ/ in our list of sounds, and let the distinction between [ɹʷ] and [ɹ] be *derived by rule*.

The point at hand has nothing to do, incidentally, with the spelling of these sounds (always letter *r*)—the argument would hold just as true for illiterate or preliterate speakers, as it is based solely on phonetic observations. Many unwritten languages have been subjected to phonemic analysis. Moreover, where the spelling is inconsistent (*beat* vs. *beet*), the phonemes are the same, in this example /i/.

4. Treating phonemes with rules and derivations

There is a fairly standard analysis of phonemes and allophones which will be covered here. It involves setting up appropriate representations and rules, just as we have been doing for the rest of grammar.

The key idea is to derive all allophones from underlying phonemes, using phonological rules. We set up a phonemic level of representation, as a kind of useful abstraction, and then employ a sequence of rules to derive the actually pronounced forms. As we saw at the end of the previous chapter, the phonological rules have the capacity to change the values of the features; later on we will see that they can insert or delete sounds and perform other operations as well.

To do this carefully, let us suppose that every morpheme has a **phonemic representation**, defined as follows:

(218)   *Defn.: Phonemic representation*

The **phonemic representation** of a morpheme is the string of phonemes from which it is formed.

For example, the phonemic representation of *real* (phonetically ['ɹʷil]) is /'ɹil/. The phonemic representation of *par* (phonetically ['pɑɹ]) is /'pɑɹ/.

From the phonemic representation, we can derive a **phonetic representation**, which is a linguistic characterization of the actual pronunciation of a word. In the case we are considering, there is just one phonological rule, which can be stated as follows:

(219) **/ɹ/ Rounding**

ɹ → [+round] / ___ [+syllabic]

Here is a verbal translation of the notation.

→	means "becomes", or in the present context, "changes its features to"
/	means "in the environment, in the context"
/ ___ X	means "before X"

and similarly:

/ X ___	means "after X"

/ X ___ Y   means "between X and Y"

With this notation, the rule of /ɹ/ Rounding can be read

(220) **/ɹ/ Rounding (expressed as prose)**

"If the sound ɹ occurs in the environment before a [+syllabic] sound, change its features so that it is [+round]."

Given a phonemic form and one or more rules, we can apply the rules in a derivation, which derives the allophones from the phonemes. Here is a derivation for the word *real*.

/ɹil/	underlying representation
ɹ^w	/ɹ/ Rounding
[ɹ^wil]	surface representation

The inputs and outputs to the derivation are traditionally called the "underlying" and "surface" representations. The underlying representation could be thought of as an abstract, idealized version of the pronunciation, embodying only the essential aspects, and the surface representation is what one obtains after filling in all the detail through the application of rules.

The process of applying a rule to a form can be examined in detail: /ɹ/ Rounding matches up to /ɹil/ as follows:

/   ɹ   i   l   /

ɹ → [+round] / ___ [+syllabic]

That is, the position where /ɹ/ occurs is immediately followed in the form /ɹil/ by the phoneme /i/, which, being a vowel, is [+syllabic]. When we change the feature values of /ɹ/ so that its former value of [−round] is altered to [+round], that is the formal way of indicating that the plain /ɹ/ has been converted to a labialized [ɹ^w].

The word *par* has a quite trivial derivation, since /ɹ/ Rounding cannot apply to it (there is no following [+syllabic] sound). The non-effect of inapplicable rules is shown in a phonological derivation with a long dash:

/pɑɹ/	underlying representation
—	/ɹ/ Rounding
[pɑɹ]	surface representation

Such cases *should* be shown, because it is assumed for phonology that all words are submitted to all rules, like objects passing down an assembly line. In this respect, phonology is like inflectional morphology, discussed in Chapter 2. It is not like word formation, where rules apply freely, and optionally, whenever they can.

The allophone [ɹ] is what is often called an **elsewhere allophone**. This term can only be defined if you have a rule-based analysis. The elsewhere allophone of a phoneme is the one that has not undergone any rules. Verbally, it is often best described with the word "elsewhere": for the phoneme /ɹ/, you get [ɹʷ] before a vowel and [ɹ] elsewhere. The elsewhere allophone is an allophone like all the others; it just happens to be the one that doesn't need any rules to derive it.

The analysis just given makes an important claim: although English has two [ɹ]-like sounds at the phonetic level, there is a more abstract analytical level at which it has just one, namely the phoneme /ɹ/: we don't need both [ɹ] and [ɹʷ] to characterize the pronunciation of English words; having /ɹ/ plus the rule of /ɹ/ Rounding suffices.

5.   Practical uses of phonemic analysis

Here are practical uses of phonemes.

First, linguists sometime write **reference grammars**, intended to be a thorough account of the structure of a language, covering phonetics, phonology, morphology, syntax, and semantics. Often the first few pages of a reference grammar give the examples in full IPA transcription, setting forth a phonemic analysis with its phoneme inventory. Once this is done, all future examples can be given in phonemic transcription. It is assumed that the reader can apply the allophone rules to any such transcription to get the desired pronunciation. This eliminates unnecessary detail from the transcriptions and makes them easier to read.[156] You can easily imagine how un-useful (indeed, annoying) it would be if a reference grammar of English always specified the difference between [ɹ] and [ɹʷ].[157]

Dictionaries usually use a phonemic transcription in their specifications of pronunciation. This avoids redundancy and clutter. There is often a further advantage: speakers of different dialects of the dictionary's language often have the same phonemes but different systems of allophones. Such speakers can make use of the same phonemic transcription but render it (probably, without even thinking about it) in their own accent.

Second, phonemic analysis is important in **alphabet design**. A sensible alphabet will have a symbolization for all and only the phonemes of a language. This makes is possible for the spelling to specify, in principle, all aspects of the pronunciation of a word, without including any additional

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[156] Indeed, most reference grammars go one step further and produce a **practical orthography**; a spelling system that follows the phonemic principle but uses only Roman letters.

[157] This sounds like I am making a joke, but old 19th century reference grammars can be found in libraries that do exactly this.

redundant information. Alphabet design is a continuing activity worldwide as ever more languages are provided with writing systems.

6. Phonemes, allophones, and well-formedness

Usually, if you say a word with the "wrong" allophone for one of the phonemes, it sounds funny. I find this to be true with the words above: if I say

real	*[ˈɹil]
write	*[ˈɹaɪt]
rope	*[ˈɹoʊp]

leaving out the labialization, it doesn't right (intuitively: "not enough like an r", "a lazy r"); and likewise if I say

par	*[ˈpɑɹʷ]
core	*[ˈkɔɹʷ]
ear	*[ˈiɹʷ]

it sounds quite peculiar indeed (intuitively: "adding a *w* where it doesn't belong").

A phonemic analysis is a partial theory of what is "sayable" in a language. For a word to sound right, it must be composed of phonemes from the language, to which all the rules of the language have been applied. *[ˈɹil] is ungrammatical because the speaker has neglected to apply /ɹ/ Rounding where it should be applied; *[ˈpɑɹʷ] is ungrammatical because (one might say) /ɹ/ Rounding has been applied in the wrong context.[158]

7. Features and natural classes

The rule of /ɹ/ Rounding in (190) has just one segment in its input. But many rules apply to more than one segment. This is where phonological features, covered in the last chapter, come in. The scheme is: (a) on the left side of the arrow, we set up a group of features to single out the class of sounds that undergo the rule; (b) on the right side of the arrow, we specify all and only the features that change their value. The result is a kind of parallel shift of whole classes of sounds.

The relevant term here is **natural class**, already discussed at the end of the previous chapter. We can define the concept more carefully here.

(221) **Defn.: Natural class**

A **natural class** is the complete set of speech sounds from a particular language characterized by a set of one or more features.

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[158] "Sayability" in phonology also involves legal phoneme orders (phonotactics), mentioned above.

Here are examples of allophonic rules of English that apply to natural classes.

(222) **Aspiration**

$$\begin{bmatrix} +\text{stop} \\ -\text{voice} \end{bmatrix} \rightarrow [+\text{aspirated}] \; / \; [_{\text{word}} \underline{}$$

"Voiceless stops become aspirated word-initially."

Derivations:

pit	*spit*	*top*	*stop*	*kick*	*Scot*	
/pɪt/	/spɪt/	/tɑp/	/stɑp/	/kɪk/	/skɑt/	underlying representation
pʰ	—	tʰ	—	kʰ	—	Aspiration
[pʰɪt]	[spɪt]	[tʰɑp]	[stɑp]	[kʰɪk]	[skɑt]	surface representation

Note the parallel shift, /p t k/ → [pʰ tʰ kʰ]. As noted earlier, the assumption made in the theory is that *only the features specified in the rule* are changed in the form. Thus /p/ starts out [+bilabial] and [−voice], and ends up with these features because nothing has changed them (and similarly for all of the features of /p/, see features chart (185) on p. 383.

(223) **Vowel Nasalization**

[+syllabic] → [+nasal] / _____ [+nasal]

"A vowel becomes nasalized when it precedes a nasal sound."

Derivations:

bun	*bud*	*doom*	*do*	*sing*	*sit*	
/bʌn/	/bʌd/	/dum/	/du/	/sɪŋ/	/sɪt/	underlying representation
ʌ̃	—	ũ	—	ɪ̃	—	Vowel Nasalization
[bʌ̃n]	[bʌd]	[dũm]	[du]	[sɪ̃ŋ]	[sɪt]	surface representation

Examples are given here for three vowels only, but all the others would work the same.

Study Exercise #71

Demonstrate that Vowel Nasalization can apply to /ɚ/, using a close pair similar to *bun / bud*. Include a derivation in the same format as above.

Answer to Study Exercise #70

The case I could find are *burn/bird, turn/turd, kern/curd, CERN/surd, Hearn/herd, stern/stirred, spurn/spurred, kernel/curdle,* and (in some dialects) *earn/erred.* If you don't insist on near-identity, there are many more. Derivations for *burn/bird*:

burn	*bird*	
/bɚn/	/bɚd/	underlying representation
ɚ̃	—	Vowel Nasalization
[bɚ̃n]	[bɚd]	surface representation

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8. Formulating rules with features

In this textbook, the philosophy for use of features is: make the rule as terse as it can be while still deriving the correct output.

In practice, this often means: you can often get away with very few features on the *left* side of the arrow (also in the rule context, when there is one). These parts of the rule only need to single out a group of sounds from the set of sounds that the language already has. But, on the *right* side of the arrow, it is often necessary to specify quite a few features, since we want the rule to produce the intended sounds—precisely—in its outputs. As one of my students aptly put it, the style of rule writing advocated here is "sparse on the left side, verbose on the right side" of the arrow.

Example 1: suppose in English we want i u ɪ ʊ → ĩ ũ ĩ ʊ̃. The left side of the rule can be just [+high], because in the feature system we're using there are no [+high] consonants.[159] The right side of the rule need only mention [+nasal], since that is all that changes; hence, [+high] → [+nasal].

Example 2: suppose in English we want k g ŋ → p b m. The left side is [+velar]. The right side must specify $\begin{bmatrix} +\text{bilabial} \\ -\text{velar} \end{bmatrix}$. Why [−velar]? Because plenty of languages have sounds that are both [+velar] and [+bilabial]—they have two articulations at once. IPA renders these sounds (common in West Africa) as [k͡p g͡b ŋ͡m].[160] If we didn't change [+velar] to [−velar], we'd end up with one of the "labial-velar" sounds as the incorrect output.

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[159] A caution: you may elsewhere encounter feature systems in which certain consonants, such as [j w], are [+high].

[160] And if you are pondering a theory like "automatically change the other features so that you arrive at the closest sound in the phoneme inventory compatible with the change", then ponder the rule of /ɹ/ Rounding, (190) on p. 398. There is no /ɹʷ/ phoneme in English, and the closest phoneme compatible with adding [+round] to /ɹ/ is /w/. This works great for describing the phonology of little kids and Elmer Fudd ([ˈkweɪzi ˈwæbɪt]), but not ordinary adult English.

Example 3: suppose in English we want this:

p t k → m n ŋ

The left side of the arrow in the formalized rule has to have $\begin{bmatrix} +stop \\ -voice \end{bmatrix}$, since we don't want b d g to

undergo the rule. On the right side of the arrow we need to have $\begin{bmatrix} +nasal \\ -stop \\ +voice \end{bmatrix}$, since nasals are nasal,

and they aren't stops, and they are voiced (look at feature chart (185) on p. 383, to see that these are indeed exactly the three features that need to change).

Example 4: suppose in English we want ɪ ʊ → i u. Let's do the change first: this clearly has to be X → [+tense]. Now, what is the simplest characterization for X? The answer is evidently [+high]. For ɪ ʊ, this works straightforwardly. And for i u, the rule takes an input that is already [+tense] and mindlessly turns it into an output that is [+tense] — no harm done. Application that harmlessly makes no change is sometimes called **vacuous application**.

Study Exercise #72

Formulate these rules using feature chart (185) on p. 383. Assume that the inventory of sounds is as in English.

a.   t, d become tʃ, dʒ before j, w.[161]
b.   l becomes ɹ when another l comes before it, separated by a vowel.[162]
c.   tʃ, dʒ become ʃ, ʒ between vowels.[163]
d.   v, ð, z, ʒ become f, θ, s, ʃ at the end of a word.[164]
e.   ɪ, ɛ, æ are deleted at the end of a word.
f.   ɪ, ʊ become voiceless vowels (IPA [ɪ̥], [ʊ̥]) when they occur between {p t k tʃ f θ s ʃ h} and {p t k tʃ f θ s ʃ h}.[165]

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[161] This one is more or less real: *get you* [ˈgɛtʃju], *said you would go* [ˈsɛdʒjuwʊdˈgoʊ], *twin* [tʃwɪn], *dwell* [dʒwʒɛl]. A later rule normally deletes [j] after palato-alveolars, yielding [ˈgɛtʃu], [ˈsɛdʒuwʊdˈgoʊ].

[162] Based on Latin phonology. This is why we say *nav-al*, but *sol-ar* (words borrowed into English from Latin).

[163] More or less real, as a rule of the vernacular dialect of Italian spoken in Florence.

[164] This is close to being true of English, though it really happens only at the ends of phrases, and the devoicing is sometimes partial.

[165] Not unlike a phonological rule of Japanese.

g.   u, ʊ become i, ɪ everywhere[166]

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[166] A change that was once a phonological rule in Yiddish.

Answers to Study Exercise #71

a. $\begin{bmatrix} +\text{stop} \\ +\text{alveolar} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{affricate} \\ -\text{stop} \\ +\text{palato-alveolar} \\ -\text{alveolar} \end{bmatrix} / \underline{\quad} [+\text{glide}]$

b. $[+\text{lateral}] \rightarrow \begin{bmatrix} -\text{lateral} \\ +\text{palato-alveolar} \\ -\text{alveolar} \end{bmatrix} / [+\text{lateral}][+\text{syllabic}] \underline{\quad}$

c. $[+\text{affricate}] \rightarrow \begin{bmatrix} +\text{fricative} \\ -\text{affricate} \end{bmatrix} / [+\text{syllabic}] \underline{\quad} [+\text{syllabic}]$

d. $[+\text{fricative}] \rightarrow [-\text{voice}] / \underline{\quad}]_{\text{word}}$ Note the use of vacuous application (to [f, θ, s, ʃ]) to simplify the rule.

e. $\begin{bmatrix} +\text{syllabic} \\ -\text{back} \\ -\text{tense} \end{bmatrix} \rightarrow \varnothing / \underline{\quad}]_{\text{word}}$

f. $\begin{bmatrix} +\text{high} \\ -\text{tense} \end{bmatrix} \rightarrow [-\text{voice}] / [-\text{voice}] \underline{\quad} [-\text{voice}]$

g. $[+\text{high}] \rightarrow \begin{bmatrix} -\text{back} \\ -\text{round} \end{bmatrix}$ Note the use of vacuous application (to [u,ʊ]) to simplify the rule.

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9. Phonemic analysis

There is a fairly standard technique for starting with phonetic data, and determining from it the phonemes and allophonic rules of the phonology. The technique has two parts.

9.1 Location of minimal pairs

Remember what we said about phonemes earlier, as the "Phonemic Principle" ((215)): Every language has a limited set of phonemes (= basic speech sounds); and every word in the language consists solely of phonemes of that language. Now that we are including allophones in the system, we must consider this a little more abstractly: the limited set of phonemes is actually a set of *abstract* entities, from which the pronounced allophones are derived by rule. This leads us to a more sophisticated characterization of the phoneme.

(224) **Defn.: phoneme**

The inventory of **phonemes** for a language is the smallest set of abstract sounds from which all the (physically pronounced) sounds can be derived by rule.

So, for example, we set up /ɹ/ as the entity that underlies both surface [ɹ] and surface [ɹ^w], along with a rule to derive the latter allophone. An adequate full phoneme inventory for English would include enough phonemes to permit us to derive everything.

The definition in (224) immediately leads to one of the two principal techniques for figuring out a phonemic system. Here is the rationale. If I give you the following set of paired words:

pin	[pɪn]	*tin*	[tɪn]
pail	[peɪl]	*tail*	[teɪl]
append	[əˈpɛnd]	*attend*	[əˈtɛnd]
cap	[kæp]	*cat*	[kæt]
aspen	[ˈæspən]	*Aston*	[ˈæstən]

then I have firmly ruled out the possibility that [p] is an allophone of /t/ (or similarly that [t] is an allophone of /p/). The reason is that *there can be no environment* for the claimed rules that derive these allophones — no such environment could exist, given that they occur in exactly the same locations. These locations are:

[___ ɪn]
[___ eɪl]
[əˈ ___ ɛnd]
[kæ ___]
[ˈæs ___ ən]

It follows that pairs like *pin* and *tin* are extremely informative about the phonemic system. Such pairs are called **minimal pairs**.

(225) **Defn.: Minimal pair**

Two words form a **minimal pair** if they differ in just one sound, in the same location.

All the pairs given above are minimal pairs. *Pin* [pɪn] and *Tim* [tɪm] are not a minimal pair for /t/ and /p/ because they differ in more than one sound. *Spin* [spɪn] and *pins* [pɪnz] are not a minimal pair for /s/ and /z/ because the [s] and [z] occur in different locations.

Linguists tend to love minimal pairs; indeed long ago a linguist wrote "minimal pairs are the analyst's delight". They instantly clarify a distinction; in the present case they show that two sounds are separate phonemes. If you have a minimal pair, anywhere in linguistics,[167] then you know you have two structurally different things, and you know where the difference resides.

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[167] The minimal pair method is widely used in phonemicization, but in fact it is an important method of analysis throughout linguistics. Thus, we have already seen minimal pairs in morphology (Turkish *eli* 'hand-accusative' / *ele*

Even better than minimal pairs are minimal triplets, minimal quadruplets, minimal n-tuplets; the more the better. A set like *pin*, *tin*, *chin*, *kin*, *bin*, *gin*, *din*, *fin*, *thin*, *sin*, *shin*, *Zinn*, *Lynn*, *win* already establishes the phonemic status of a majority of English consonants.

9.2 Establishing complementary distribution

The other well-known method for figuring out a phonemic system is to locate pairs of sounds that are in **complementary** distribution, defined as follows.

(226)   Defn. **Complementary distribution**

Two sounds A and B are in **complementary distribution** if B never occurs in the environments where A occurs, and vice versa.

Complementary distribution is a pattern that strongly suggests membership in the same phoneme.[168] It implies that there is an important phonological genrealizaton present, which ought to be accounted for by our system of rules. Usually, when A is in complementary distribution with B, it is sensible either to derive surface [A] from underlying /B/ or derive surface [B] from underlying /A/.[169]

There is a simple procedure for detect complementary distribution, which usually (not always) works. The method has no official name, but I will call it the method of **local environments** here.

Let us look at two sounds of English. The regular [l] we have already defined, as a lateral approximant. The so-called **dark l** is transcribed [ɫ] (l with a tilde through it). It is made by pushing the tongue body upward and backward at the same time the tongue blade makes the appropriate movement for the l. I list below a bunch of words that have either the normal "light" [l] or dark [ɫ]. Here are some data.

Words with light [l]		Words with dark [ɫ]	
lay	[leɪ]	fall	[fɑɫ]
lose	[luz]	tell	[tɛɫ]
please	[pliz]	else	[ɛɫs]
allow	[əˈlaʊ]	filter	[fɪɫtɚ]
gremlin	[ˈgɹɛmlən]	milk	[ˈmɪɫk]

'hand-dative'), in syntax ("Fred stole/killed the chicken from Greeley"), and in semantics ("Alice congratulated her/herself"). Throughout, the method used is to compare utterances that have just one single difference, in order to learn the contribution made by that difference.

[168] There are exceptions (complementary distribution, but separate phonemes), which you would have to learn about in a more advanced treatment of phonology. See For Further Reading at the end of Chapter 12.

[169] The exception is when (for example) A is in complementary distribution with *both* B and C, but B and C belong to separate phonemes. We must then evaluate a number of difference analyses; one usually emerges as much simpler.

freely   [ˈfrili]   apple   [ˈæpəɫ]

In the method of local environments, you write down a dash, and before it whatever comes before the target sound, and after it whatever comes after the target sound. When the sound comes initially, we can use [to mark a "left word boundary" and when it comes finally we can use] to mark a right word boundary. So, the local environments for the data just given are as follows:

Words with light [l]		Words with dark [ɫ]	
lay	[___ eɪ]	fall	[ɑ ___]
lose	[___ u]	tell	[ɛ ___]
please	[p ___ i]	else	[ɛ ___ s]
allow	[ə ___ aʊ]	filter	[ɪ ___ tɚ˙]
gremlin	[m ___ ə]	milk	[ɪ ___ k]
freely	[i ___ i]	apple	[ə ___ ɫ]

Inspection of the local environments with usually yield a *simple* description of the distribution of at least one of the two sounds. Try looking at the data above and finding the simplest description, before you turn the page.

The simplest description is that light [l] comes before a vowel. (We can't use "after a vowel", since both sounds occur after vowels.)

Once you have a description, it's easy to set up the rules. Choose an underlying form compatible with using a simple rule to get the right answer. Here, we ought to choose /ɫ/, since we can apply a single rule of Lightening to get the [l] allophone. (Choosing /l/ is perhaps more intuitive, but would require two rules of Darkening, one applying before a consonant, one at the ends of words.)

The full analysis works as follows:

Phoneme: /ɫ/

Rule:

/l/ Lightening

ɫ → [−back] / ___ [+syllabic]

'/l/ becomes light when it precedes a vowel'

And here are representative derivations:

lay	please	freely	fall	else	
/ɫeɪ/	/pɫiz/	/fɹiɫi/	/fɑɫ/	/ɛɫs/	underlying representations
l	l	l	——	——	/l/ Lightening
[leɪ]	[pliz]	[fɹili]	[fɑɫ]	[ɛɫs]	surface representations

Summing up, the location of minimal pairs and the establishment of complementary distribution by local environments are the two usual methods for determing the system of phonemes in a language.

10. A bigger example: Yidiɲ

Phonemic analysis of English has a kind of trivial quality to it if you are an English speaker — we strongly sense our own phonemic system, and the rules are just adding the details. But this is an English-internal perspective. The surprises happen when you do the same basic procedure *on other languages*. The sounds are often organized in a way quite different from how English works. Often, sounds that are mere allophones in English turn out to be phonemes as they appear in other languages, and certain phonemic distinctions of English emerge as allophonic elsewhere. The important idea is to work out of each language's phonemic system in its own terms.

Here are the two principal errors that can arise during phonemicization. Sometimes linguists do not set up *enough* phonemes so that all words that have distinct pronunciations have distinct

phonemic content — there must be "no lost distinctions".[170] Second, linguists occasionally set up *too many* phonemes. This is the result of underanalysis: the linguist fails to notice that two sounds are in complementary distribution. In this kind of error, a generalization is missed, and we have a failure to note that the distributions of the allophones are predictable by rule.

Let us work out some phonemes in a more detailed example, using data from an Australian aboriginal language, Yidiɲ ([ɲ] is IPA for the palatal nasal, like Spanish "ñ"). Yidiɲ is probably no longer spoken, though there may be a few aborigines alive today who remember a few words. The fieldwork on Yidiɲ was done in the 1960's and 70's by Prof. Robert M. W. Dixon of the Australian National University, who also developed the phonemic analysis given. The data below are somewhat idealized, constructed from Dixon's lexicon following his description of the facts.

First, here are the non-English IPA symbols needed.

- [ɟ] is a voiced palatal stop —same place of articulation as [j], but full closure.
- [ɲ] is a palatal nasal, as noted above
- [ː] indicates that the preceding vowel is long
- [ɫ] is dark l, with the tongue body backed (in IPA terminology, **velarized**). We have already seen this sound as an allophone in English.
- [r] is a trilled r.
- [ɻ] is a retroflex central approximant, with tongue tip curled up and back.[171]

The following are consonant and vowel charts for Yidiɲ. These are not just a casual review— consulting the chart is actually a good procedure to follow when you are discovering the rule environments.

(227) *Phonetic charts: sounds of Yidiɲ*

a. Consonants

	Bilabial	Alveolar	Retroflex	Palatal	Velar
Stops (voiced)	b	d		ɟ	g
Nasals	m	n		ɲ	ŋ
Liquids nonlateral		r	ɻ		
Lateral		l			
Lateral velarized		ɫ			
Glides	w				j

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[170] The usual reason for a lost distinction is that the linguist can't hear it. Bringing more linguists onto the scene — especially, native speaker linguists — is often the remedy.

[171] Some English speakers use this kind of r, rather than the (more common) /ɹ/.

b. Vowels

	Front Unrounded	Back Unrounded	Back Rounded
High tense	i, iː		u, uː
High lax	ɪ, ɪː		ʊ, ʊː
Low		a, aː	

Here are the data we will work with.

(228)   *Data for Yidiɲ problem*

1. [ɟʊmbaːgɪ]   'tobacco'
2. [ŋawuːjʊ]   'salt-water turtle'
3. [guɬaːɻ]   'big-leafed fig tree'
4. [ŋuɲʊːr]   'initiated man'
5. [duguːbil]   'bark bag'
6. [muɲɟʊːɻ]   'plenty'
7. [wigilwigil]   'sweet'
8. [ɟambuːɬ]   'two'
9. [ɟʊɬŋuːɬ]   'waterfall'
10. [gabuːɬ]   'stick for carrying fish'
11. [wurguːɬ]   'pelican'
12. [babuːɟʊ]   (can't find gloss)
13. [guɬgɪ]   'sand, sugar'
14. [maguːɬ]   'a root vegetable'
15. [muɬɲaːrɪ]   'blanket'
16. [ŋumbuːbʊ]   'new-born baby'
17. [jʊjʊɻuŋguɬ]   'noise of snake sliding through grass'
18. [ɟʊgaːbal]   'house frame'
19. [ɟʊwaːr]   'wattle tree'
20. [ɟʊduːɬʊ]   'brown pigeon'
21. [duɬnbiːlaj]   'white cedar'
22. [ɟimuːr]   'large house'
23. [gunbuːɬ]   'billy-can'
24. [guɬaːn]   'walnut tree'

25. [ɲʊŋguːɬ]   'Torres Straits pigeon'
26. [mugaːɻʊ]   'fish net'
27. [wiɻʈuːɬ]   'shellfish species'
28. [wuɬmbuːɻ]   'leafy broom'
29. [ɹʊriːn]   'leech'
30. [ɲʊnduːba]   'you-nom. sing'
31. [gujʊ]   'tree vine species'
32. [wuɬmbuːɻ]   'leafy broom'
33. [ɟʊɬugunʊ]   'black myrtle tree'
34. [buɬuːɻ]   'storytime person'
35. [ŋuɻʈuːɬ]   'just now'
36. [guguːɬʊ]   'recitative mourning style used by men'
37. [wubuːɬ]   'lucky'
38. [dalŋudalŋʊ]   'sound of bell ringing'
39. [dalʊ]   'forehead'
40. [ɟʊmaːl]   'straight spear thrower'
41. [ɟilŋʊ]   'down'
42. [baŋgaːmʊ]   'English potato'
43. [muɬaːrɪ]   'initiated man'
44. [ganguːɬ]   'grey wallaby'
45. [guɟʊːn]   'wind'
46. [gaɟʊːɬ]   'dirty (e.g. water)'
47. [buɬguːɻ]   'swamp'
48. [ɹʊŋguːm]   'worm'
49. [ɟʊɻʈ]   'sharp, pointed'
50. [gawuːɬ]   'blue gum tree'
51. [bawʊː]   'backbone'
52. [gawʊː]   'tree species'
53. [galbɪː]   'catfish'
54. [diwɪː]   'small ground bee'

    In phonemicization, the overall strategy one follows is to consider pairs or small groups of sounds that are phonetically similar, under the hypothesis that they are allophones of the same phoneme. There is no reliable principle to be followed here other than general phonetic similarity; one must make guesses, some of which pay off in the discovery of allophonic relationships.

Usually in introductory textbooks, the author decides to send you in a direction that actually turns out to work when you try it, and that will be generally true here.

We can start in on Yidiɲ by considering the two sounds [l] and [ɫ], which are indeed phonetically similar (light vs. dark l). Following the method of 9.2 above, we collect local environments for these sounds by looking up each on in the data, and recording (a) the example number; (b) the preceding sound; (c) the following sound. Here is such a chart for [l]:

(229)   *Local environments for Yidiɲ* [l]

5.	i___]		38.	a___ŋ
7.	i___w		38.	a___ŋ
7.	i___]		39.	a___ʊ
18.	a___]		40.	aː___]
21.	iː___a		41.	i___ŋ

The first item on chart (229) was obtained by taking the l-containing form

    5. [duˈguːbil]

from (228) and replacing l with ___, as follows:

    5. [duˈguːbi___]

and then removing all the material not next to the l:

    5. [~~duˈguːb~~i___]

The resulting entry in (229), 5. i ___], means "an [l] occurred after [i] and at the end of a word." All the other entries in (229) were obtained the same way.

The same procedure yields this list for dark [ɫ]:

(230) *Local environments for Yidiɲ* [ɬ]

3.	u___a	20.	uː___ʊ	34.	u___u
8.	uː___]	21.	u___n	35.	uː___]
9.	ʊ___n	23.	uː___]	36.	uː___ʊ
10.	uː___]	24.	u___a	37.	uː___]
11.	uː___]	25.	uː___]	43.	u___aː
13.	u___g	27.	uː___]	44.	uː___]
14.	uː___]	28.	u___m	46.	ʊː___]
15.	u___ɲ	32.	u___m	47.	u___g
17.	u___]	33.	ʊ___u	50.	uː___]

These lists are then inspected for pattern. It's useful to look first at "right sides" alone, then at "left sides" alone, and remember the phonetic character of the sounds in involved. In the present case, the payoff comes from looking at the "left side" environments for [ɬ], which, shown alone, look like this:

(231) *Inspecting the local environments for Yidiɲ* [ɬ]: *left sides only*

3.	u___	20.	uː___	34.	u___
8.	uː___	21.	u___	35.	uː___
9.	ʊ___	23.	uː___	36.	uː___
10.	uː___	24.	u___	37.	uː___
11.	uː___	25.	uː___	43.	u___
13.	u___	27.	uː___	44.	uː___
14.	uː___	28.	u___	46.	ʊː___
15.	u___	32.	u___	47.	u___
17.	u___	33.	ʊ___	50.	uː___

which in turn reduces to the following four cases:

u ___, uː___, ʊ___, ʊː___

These four cases occupy a specific region of the vowel chart, repeated below:

	Front Unrounded	Back Unrounded	Back Rounded
High tense	i, iː		u, uː
High lax	ɪ		ʊ, ʊː
Low		a, aː	

This can be characterized very simply as the round vowels.[172] Thus, using our feature set, "in the environment, after a round vowel" is stated:

$$/ \begin{bmatrix} +\text{syllabic} \\ +\text{round} \end{bmatrix} \underline{\quad}$$

This is clearly a meaningful discovery; there are enough data that this pattern is very unlikely to be true by accident.

The next thing to check is: how does the distribution of the phonetically similar light [l] sound relate to this environment? Combing through the list of local environments (229), we find that there are *no* cases of light [l] in the environment $\begin{bmatrix} +\text{syllabic} \\ +\text{round} \end{bmatrix} \underline{\quad}$. Thus, we have established complementary distribution, a key part of the task of grouping sounds into phonemes. Assuming that the data are representative, this complementary distribution is something we need to explain. And there is actually good reason to think the data *are* representative, since they are numerous and were chosen more or less at random.

The phonemic analysis, therefore, would work like this. We set up the else allophone [l] as the phoneme /l/, and write the following rule:

(232) **/l/ Darkening (Yidiɲ)**

$$l \rightarrow [+\text{back}] / \begin{bmatrix} +\text{syllabic} \\ +\text{round} \end{bmatrix} \underline{\quad}$$

"Realize the /l/ phoneme as back (dark; velarized) when it follows a round vowel."

This rule can be illustrated with derivations of words chosen from the original data in (228). To make the illustration clear, we pick one form that is eligible for the rule and one that isn't:

(233) *Derivations to illustrate Yidiɲ /l/ Darkening*

10. /gaˈbuːl/	5.	/duˈguːbil/	underlying representation
ɫ		—	/l/ Darkening
[gaˈbuːɫ]		[duˈguːbil]	phonetic form

As before, the horizontal dash bears the meaning "rule is inapplicable."

---

[172] It's true that these four vowels are also [+back] and [+high]; we're going for a terse characterization here (see p. 403) and there's no point in using more features than necessary.

10.1 Why does the local-environment method work?

Collecting local environments is, of course, tedious, and in some cases it's not hard to solve phoneme problems at sight, rather than slogging through all this data processing by hand. However, collecting local environments can be a help when you are stuck.

The method works because the environments for phonological rules are usually local, meaning "confined to adjacent segments". Some rules have non-local environments—vowels sometimes influence vowels across intervening consonants; and consonants occasionally influence consonants across intervening vowels. Such cases require the linguist to examine a wider window.

11. Some minimal pairs in Yidiɲ

In many languages (for instance, Italian and Swahili), long vowels are allophones of the their short counterparts. This *might* be true of Yidiɲ — in principle — but the following minimal pair data show that we needn't pursue this hypothesis very far:

[malan]   'flat rock'
[malaːn]   'right hand'

[wuɻu]   'spear handle'
[wuɻuː]   'river' or 'snake species'[173]

[guɟil]   'smell-present tense'
[guɟiːl]   'smell-past tense'

Plainly, the long and short vowel pairs must be counted as separate phonemes.

12. More Yidiɲ allophones

The local-environment method for detection of allophones is applied below to [u], [ʊ], [uː], and [ʊː]; again the data we are working from are from (228).

---

[173] Two unrelated meanings, like English *bank*.

(234)   *Environments for [ʊ] in Yidiɲ*

1. ɟ___m	48. ɟ___ŋ	20. ɬ___]
9. ɟ___ɬ	49. ɟ___ɻ	26. ɻ___]
12 ɟ___]	30. ɲ___n	33. n___]
18. ɟ___g	2. j___]	36. ɬ___]
19. ɟ___w	17. j___j	38. ŋ___]
20. ɟ___d	17. j___ɻ	39. l___]
29. ɟ___r	31. j___]	41. g___]
33. ɟ___ɬ	16. b___]	42. m___]
40. ɟ___m		

(235)   *Environments for [u] in Yidiɲ*

11. w___r	26. m___g	36. g___g
13. g___ɬ	28. w___ɬ	37. w___b
15. m___ɬ	3. g___ɬ	38. ŋ___d
16. ŋ___m	31. g___j	4. ŋ___ˈɲ
17. ɻ___ŋ	32. w___ɬ	43. m___ɬ
17. g___ɬ	33. ɬ___g	45 g___ɟ
21. d___ɬ	33. g___n	47. b___ɬ
23. g___n	34. b___ɬ	5. d___g
24 g___ɬ	35. ŋ___ɻ	6. m___ɲ

   This one is a bit harder: you have to notice that there are *two* environments for [ʊ]: after a palatal consonant, and at the end of a word. The [u] cases occur in neither environment, so we have a more complex complementary distribution.

   We can set up a basic phoneme ("elsewhere") /u/, and write two rules, which happen to derive the same allophone. Both rules turn out to be generalizable when we look at further data, so these are preliminary versions.

(236)   **Yidiɲ Postpalatal Laxing (preliminary)**

$$u \rightarrow [-\text{tense}] \ / \begin{bmatrix} -\text{syllabic} \\ +\text{palatal} \end{bmatrix} \underline{\quad}$$

   "/u/ becomes lax when it follows a palatal consonant."

(237) **Yidiɲ Final Laxing (preliminary)**

u → [−tense] / ____]_{word}

"/u/ becomes lax at the end of a word."

Some derivations of three sample forms are as follows. Note that these forms have /l/'s as well, which redundantly illustrate /l/ Velarization.

1.	/ɟilŋgu/	9.	/ɟuɬnguːl/	4.	/buluːɻ/	underlying form
	—		ʊ		—	Postpalatal Laxing
	ʊ		—		—	Final Laxing
	—		ɬ		ɬ	/l/ Velarization
	[ɟilŋgʊ]		[ɟʊɬnguːɬ]		[buɬuːɻ]	phonetic form

(238) *Environments for* [ʊː] *in Yidiɲ*

4. ɲ___r
45 ɟ___n
46. ɟ___ɬ
6. ɟ___ɻ
51. w___]
52. w___]

(239) *Environments for* [uː] *in Yidiɲ*

10.	b___ɬ	25.	g___ɬ	37.	b___ɬ
11.	g___ɬ	27.	ɻ___ɬ	44.	g___ɬ
12	b___ɟ	28.	b___ɻ	47.	g___ɻ
14.	g___ɬ	30.	d___b	48.	g___m
16.	b___b	32.	b___ɻ	5.	g___b
2.	w___j	34.	ɬ___ɻ	50.	w___ɬ
20.	d___ɬ	35.	ɻ___ɬ	8.	b___ɬ
22.	m___r	36.	g___ɬ	9.	g___ɬ
23.	b___ɬ				

It should be clear that the situation is quite parallel to what we saw with short [u] and [ʊ]: the laxed vowel occurs finally and after a palatal consonant, whereas the tense vowel occurs elsewhere. There are fewer data here, but our confidence should be increased by the fact that we've seen the pattern before.

The analysis needs to be revised, not replaced, to handle these data: evidently the rules of Postpalatal Laxing and Final Laxing must apply to the *class* of vowels { u, uː }. This is another instance of phonological rules applying to natural classes (see section 7 of this chapter, above). We need, therefore, to be explicit about the vowel features we are using, and then use features to handle the data. Here are vowel features for Yidiɲ:

 i [+high, −low, −back, −round, +tense, −long]
 iː [+high, −low, −back, −round, +tense, +long]

 ɪ [+high, −low, −back, −round, −tense, −long]

 u [+high, −low, +back, +round, +tense, −long]
 uː [+high, −low, +back, +round, +tense, +long]

 ʊ [+high, −low, +back, +round, −tense, −long]
 ʊː [+high, −low, +back, +round, −tense, +long]

 a [−high, +low, +back, −round, −tense, −long]
 aː [−high, +low, +back, −round, −tense, +long]

With these features, we can we restate the rules as follows, capturing natural classes:

(240) **Yidiɲ Postpalatal Laxing (final version)**

$$\begin{bmatrix} +\text{syllabic} \\ +\text{round} \end{bmatrix} \rightarrow [-\text{tense}] \ / \begin{bmatrix} -\text{syllabic} \\ +\text{palatal} \end{bmatrix} \underline{\quad\quad}$$

 "Any rounded vowel becomes lax after a palatal consonant."

(241) **Yidiɲ Final Laxing (still preliminary)**

$$\begin{bmatrix} +\text{syllabic} \\ +\text{round} \end{bmatrix} \rightarrow [-\text{tense}] / \underline{\quad\quad} \ ]_{\text{word}}$$

 "Any rounded vowel becomes lax in final position."

 The designation $\begin{bmatrix} +\text{syllabic} \\ +\text{round} \end{bmatrix}$ suffices, in a language like Yidiɲ with a tiny vowel inventory, to designated all and only the vowels of the set { u, uː }. The idea behind the rule is that it changes only the feature [tense], with all other features remaining the same. As a result, /uː/ becomes [ʊː] and /u/ becomes [ʊ], each retaining their value of the feature [long]—as before, features not specified by the rule are assumed to remain unaltered.

 Note that in this kind of analysis, part of the goal is to achieve as much generality as you can. In principle, you could describe the language with zillions of little rules, each applying to one

sound in one environment. But aiming for more general rules gives a clearer picture of the overall pattern.

Study Exercise #73

Find three appropriate forms from the list above and illustrate the revised versions of these rules as they apply to long vowels. Use the derivations given in (233) above as your model.

Answer to Study Exercise #72

52. /bawuː/	6. /muɲɟuːɻ/	11. /wurguːl/	underlying representation
—	ʊ	—	Postpalatal Laxing
ʊː	—	—	Final Laxing
—	—	ɫ	/l/ Velarization
[bawʊː]	[muɲɟʊːɻ]	[wurguːɫ]	phonetic form

We are almost done sorting the data. Here is how the high front vowels [i] and [ɪ] are distributed.

(242)   *Environments for Yidiɲ [i] and [ɪ]*

[ɪ]:

1.   g___]
13. g___]
15. r___]
43. r___]
49. ɻ___]

[i]:

22. ɟ___m   7.   w___g
27. w___ɻ   7.   g___l
41. ɟ___l   7.   w___g
5.   b___l   7.   g___l

These data also suggest complementary distribution: all of the [ɪ]'s are final and no [i]'s are final. Knowledge of phonetics helps here: clearly, [ɪ] is the lax partner of [i] just as [ʊ] is the lax partner of [u], suggesting that our Final Laxing rule should be generalized even further, to include the front vowels. However, Postpalatal Laxing should *not* be generalized further, since as examples 22 and 41 show, we get [i], not [ɪ], after palatals.

If Final Laxing applies to long /uː/, to short /u/, and to short /i/, then it have better apply to long /iː/ as well. Data are few, but apparently conform to the prediction:

(243)   *Environments for Yidiɲ* [iː], [ɪː]

                [ɪː]   [iː]

        53.   b___]   21.   b___l
        54.   w___]   29.   r___n

Let us go out on a limb, assuming that collection of further data would continue to confirm the overall pattern. Thus we will complete the fully-generalized rule. We want it to apply, in final position, to { u, uː, i, iː }, but not [a, aː]. This can be done if we formulate it to affect only non-low vowels:

(244)   **Yidiɲ Final Laxing (final version)**

$$\begin{bmatrix} \text{+syllabic} \\ \text{–low} \end{bmatrix} \rightarrow [\text{–tense}] / \underline{\hspace{1cm}}]_{\text{word}}$$

        "Non-low vowels are made lax in word-final position."[174]

Study Exercise #74

Review the completed phonemic analysis of the Yidiɲ vowels and specify all the natural classes it uses that have more than one member. Describe each natural class according to (a) the rule that uses it; (b) a list of sounds in { }, (c) a description in IPA terminology.

---

[174] [+high] would work as well as [–low], since Yidiɲ has no mid vowels.

Answer to Study Exercise #73

Postpalatal Laxing is triggered by the natural class of palatal consonants, which in Yidiɲ is { ɟ, ɲ, j }. Postpalatal Laxing applies to the class of round vowels, which in Yidiɲ is { u, uː }. Final Laxing applies to the natural class of nonlow vowels, which in Yidiɲ is { i, iː, u, uː }.

---

13. The full Yidiɲ phoneme inventory

We've now succeeded in showing that several of the sounds of the Yidiɲ phonetic chart in (227) above are not independent phonemes, but merely allophones. These are placed in parentheses in the revised charts below:

(245)   *The sounds of Yidiɲ with allophones shown in parentheses*

a. Consonants

	Bilabial	Alveolar	Retroflex	Palatal	Velar
Stops (voiced)	b	d		ɟ	g
Nasals	m	n		ɲ	ŋ
Liquids nonlateral		r	ɻ		
Lateral		l			
Lateral velarized		(ɫ)			
Glides	w				j

b. Vowels

	Front Unrounded	Back Unrounded	Back Rounded
High tense	i, iː		u, uː
High lax	(ɪ), (ɪː)		(ʊ), (ʊː)
Low		a, aː	

This reduces the phoneme population to 19, a rather small inventory.

13.1 When to use features in writing rules

A fully explicit phonological analysis of a language would use no phonetic symbols. Only the features have theoretical status, and the phonetic symbols are meant only as convenient abbreviations for particular feature matrices.

On the other hand, one also wants to be able to describe phonologies in a way that is precise, but accessible to human inspection. My own feeling is that in semi-formal presentation, it is appropriate to use a mixed notation, using phonetic symbols where they lead to no harm, and features where they contribute insight. Here are ways in which rules benefit by writing them with features.

To capture a natural class. We've just seen several examples of this in Yidiɲ.

To capture an assimilation. We do this by showing that the assimilating segment adopts a feature value already possessed by one of its neighbors. For example, in English, /k, g, ŋ/ becomes fronted [ḵ, g̟, ŋ̟] before front vowels, as in *keel* [ˈḵil], *gale* [ˈg̟eɪl], or *dinghy* [ˈdɪŋ̟i]. This is an assimilation, which can be expressed by:

Velar Fronting

$$[+\text{velar}] \quad \rightarrow \quad [-\text{back}] \: / \: \underline{\quad} \begin{bmatrix} +\text{syllabic} \\ -\text{back} \end{bmatrix}$$

"A velar consonant becomes fronted before a front vowel."

To show that a change is minor; that is, of only one or two feature values. For example, if a rule changes (only) /p/ to [b], one would write p → [+voice] rather than p → b, to show that nothing other than [voice] is changing.

Otherwise use of plain symbols seems like a sensible way to make a rule easier to read, provided that it is understood that the "real" rule employs only feature matrices.

Chapter 12: Phonology II —Optional Rules, Phonology/Morphology Interaction

1. Optional rules

Phonological rules may be *optional*. When a phonological rule applies optionally, both the input and the output can be pronounced.

1.1 Preglottalization

Here is an example of an optional rule of English.

(246) **Preglottalization**

$$\begin{bmatrix} +\text{stop} \\ -\text{voiced} \end{bmatrix} \rightarrow [+\text{glottal}] \ / \ \underline{\quad} \ ]_{\text{word}} \quad \text{(optional)}$$

That is, a voiceless stop at the end of a word can optionally receive simultaneous glottal closure (thus, an alveolar stop stays alveolar, a velar stops stays velar, and a bilabial stops stays bilabial, but they receive a glottal closure in addition). Here are data:

cat: [ˈkæt] or [ˈkæˀt]
hat: [ˈhæt] or [ˈhæˀt]
cut: [ˈkʌt] or [ˈkʌˀt]

Additional data with other places of articulation are as follows:

cup: [ˈkʌp] or [ˈkʌˀp]
hack: [ˈhæk] or [ˈhæˀk]

1.2 Tapping

Another optional rule (of North American English[175]) is Tapping, which derives [ɾ] as an allophone of /t/.[176] The data look like this:

---

[175] Tapping is unusual outside North America. It occurs natively in some Irish speech and is apparently currently in the process of spreading into overseas dialects such as Australian. Non-tapping dialects often have Glottaling instead: *butter* [ˈbʌʔə], [ˈbʊʔə].

[176] And, as we'll see later on, of /d/.

Forms that can be tapped

butter	[ˈbʌɾɚ]
attic	[ˈæɾɪk]
heritability	[hɛɹəɾəˈbɪləɾi]
motto	[ˈmɑɾoʊ]

Forms that cannot be tapped

attain	[əˈteɪn]	(*[əˈɾeɪn])
Tommy	[ˈtɑmi]	(*[ˈɾɑmi])
cat	[ˈkæt][177]	(*[ˈkæɾ])
actor	[ˈæktɚ]	(*[ˈækɾɚ])
Atkins	[ˈætkɪnz]	(*[ˈæɾkɪnz])

Inspection of these and similar data indicate a very particular environment for Tapping, namely: between two vowels (or other syllabic sounds; diphthongs and syllabic consonants), of which the second must stressless:

(247)   **Tapping (preliminary version)**[178]

$$t \rightarrow \text{ɾ} \ / \ [\text{+syllabic}] \underline{\quad\quad} \begin{bmatrix} \text{+syllabic} \\ -\text{stress} \end{bmatrix} \quad \text{(optional)}$$

Now, different speakers will vary, but my impression is that most speakers of North American dialects can, in very slow and careful speech, "turn off" tapping and produce [t]'s in the relevant words:

butter	[ˈbʌɾɚ], [ˈbʌtɚ]
attic	[ˈæɾɪk], [ˈætɪk]
heritability	[hɛɹəɾəˈbɪləɾi], [hɛɹətəˈbɪləti]
motto	[ˈmɑɾoʊ], [ˈmɑtoʊ]

1.3   /æ/ Diphthongization

A third optional rule, which is found in the dialect of many but not all American English speakers, is a rule of /æ/ Diphthongization, which applies before nasals. Here are data:

---

[177] Or, optionally, [ˈkæʔt], not relevant here.

[178] To be generalized below.

No diphthongization:

cat	[ˈkæt]
pack	[ˈpæk]
lap	[ˈlæp]
lab	[ˈlæb]
pal	[ˈpæl]

Diphthongization:

can	[ˈkɛən]
man	[ˈmɛən]
Spanish	[ˈspɛənɪʃ]
dance	[ˈdɛəns]
spam	[ˈspɛəm]
tram	[ˈtɹɛəm]

Setting up the basic phoneme as /æ/, we can write the rule as follows:

(248) **/æ/ Diphthongization**

/æ/ → [ɛə] / ___ [+nasal]

The pronunciations given above in the second group of forms are in fact only one option; these words can also be pronounced [ˈkæn], [ˈmæn], [ˈspænɪʃ], [ˈdæns], [ˈtɹæm]. Thus /æ/ Diphthongization must be optional.

1.4 An obligatory rule

Not all phonological rules are optional. The rule of Initial Aspiration derives the little puff of breath (aspiration, IPA [ʰ]) heard on word-initial voiceless stops.

(249) **Initial Aspiration**

$$\begin{bmatrix} +\text{stop} \\ -\text{voiced} \end{bmatrix} \rightarrow [+\text{aspirated}] \; / \; [_{\text{word}} \underline{\quad}$$

Data:

pie	[ˈpʰaɪ]
tie	[ˈtʰaɪ]

cat	[ˈkʰæt]
police	[pʰəˈlis]
collect	[kʰəˈlɛkt]

but not

|	
spy	[ˈspaɪ]
sty	[ˈstaɪ]
scat	[ˈskæt]
upper	[ˈʌpɚ]
tickle	[ˈtɪkəl]

Aspiration is obligatory; it is grossly unnatural to say words like *cat* without the aspiration.

1.5 *Optional rules and derivations*

There is no standard way to write derivations for optional rules, but one way that shows the optionality in a nice clear way is what I will call a "branching derivation." The format gives arrows indicating the two possibilities for when an optional rule does or does not apply; for example:

(250)   *A branching derivation for* can

/kæn/		underlying form ("can")
—	kɛən	/æ Diphthongization/
[kæn]	[kɛən]	phonetic form
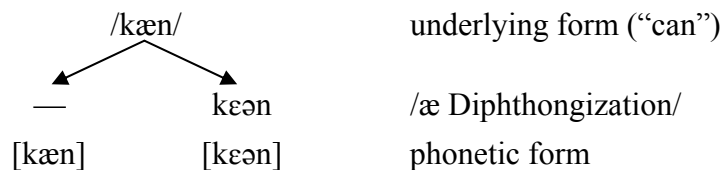
Where there are multiple applicable rules, the branches will multiply, producing a tree of greater size. Some commercial speech recognition devices use rules to generate alternate forms of the words to be recognized; their derivations can culminate in hundreds or thousands of branches.

1.6 *Optional rules and speaking style*

It seems that different optional rules tend to apply in differing speech styles. In most people's speech, Tapping is very close to obligatory, and "turning it off" (as in *pity* [ˈpɪti]) is appropriate only in the most formal of speaking styles. I find that /æ/ Diphthongization can be "turned off" in somewhat more casual contexts than Tapping can be; and Preglottalization can be turned off even in fairly relaxed contexts. On the other end of this continuum, there are rules that (for me at least), only get to apply in the most casual speech, for instance the rule that monophthongizes /aʊ/ to [æ] (try for instance: *Get out of here!* [gɛrˈæ̠rəhiɹ].)

Research by sociolinguists indicates that when we speak, we constantly regulate the application of a great number of optional phonological rules. Presumably, we do this for purposes of making the appropriate impression on the people with whom we are speaking: there are contexts that call for colloquial speech and contexts that call for formal speech. Most people command a range of styles,[179] and the ability to turn optional rules off or on is part of this command.

2. Optional rules and phonemic analysis

The existence of optional rules implies a slight change in how we determine the system of phonemes: we need to look not just for cases of complementary distribution (defined above in (202)) but also for cases of **free variation**. Free variation occurs whenever you have this situation: in some particular context, wherever X occurs, so can Y, and vice versa. Thus in the example above, in the context / ___ [+nasal], wherever [æ] can occur, so can [ɛə], and vice versa. Two sounds occurring in free variation are treated as allophones of a single phoneme.

The method of local environments can be adapted for free variation. The trick is to make separate columns for each variation pattern. Thus, for instance, if you were working on the data for /æ/ Diphthongization above, you would make a column headed "[æ] or [ɛə]", like this:
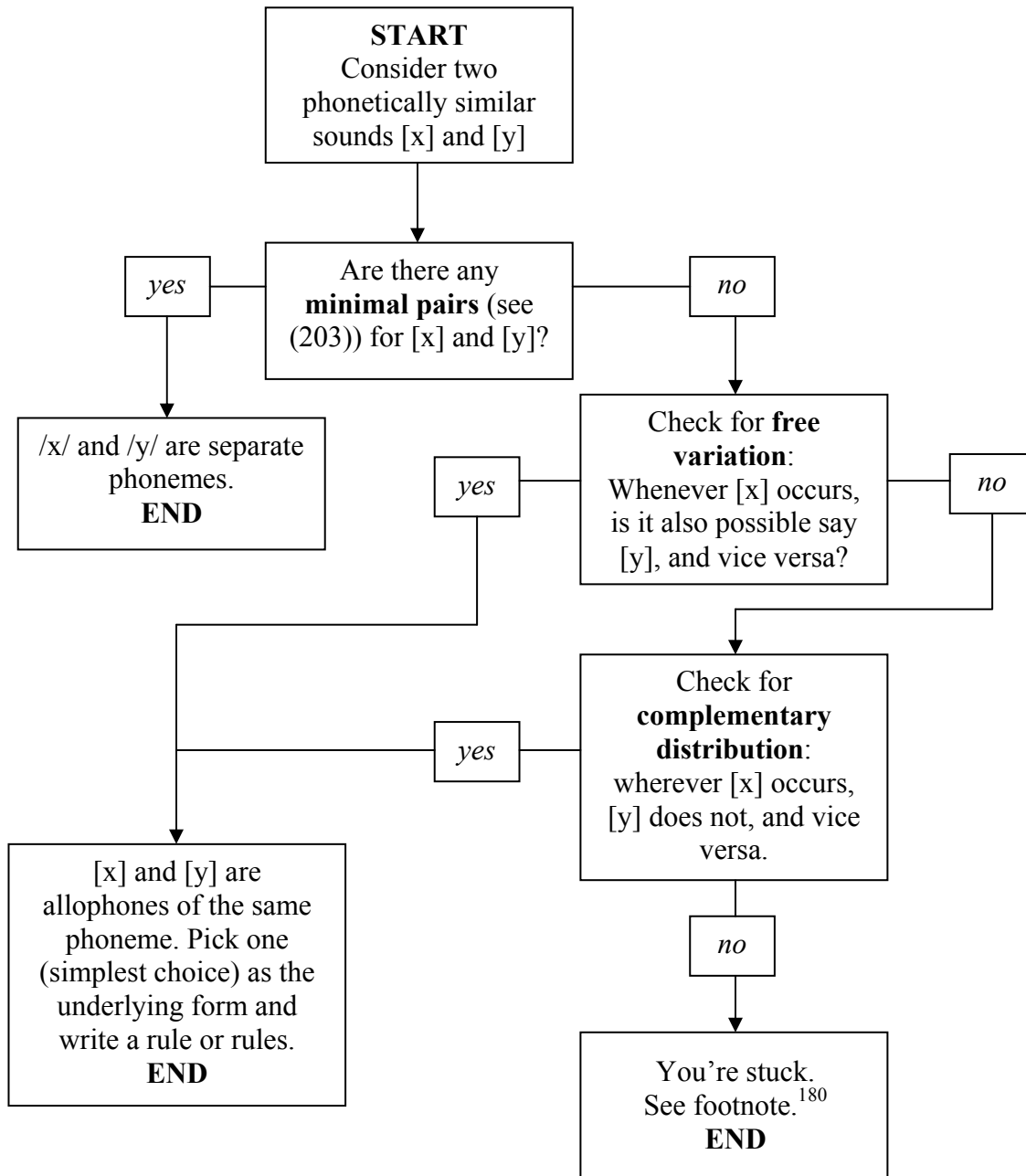
[æ] or [ɛə]   [æ] only

can   / k ___ n   *cat*   / k __ t

Sam   / s __ m   *lass*   / l __ s

etc.   etc.

Free variation makes phonemic analysis sufficiently complicated that it may be helpful to describe it as a "flow chart" of options, as in (221) below.

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[179] By this I mean even monolingual, monodialectal people. Obviously, the ability to speak more than one dialect or language increases the range of impressions that a speaker can create.

(251) *A flow chart for phonemic analysis*

```
                          ┌─────────────────────┐
                          │       START         │
                          │   Consider two      │
                          │ phonetically similar│
                          │  sounds [x] and [y] │
                          └─────────────────────┘
                                    │
                                    ▼
        ┌─────┐         ┌─────────────────────┐        ┌─────┐
        │ yes │─────────│    Are there any    │────────│ no  │
        └─────┘         │ minimal pairs (see  │        └─────┘
           │            │  (203)) for [x] and [y]?│        │
           ▼            └─────────────────────┘        ▼
  ┌──────────────────┐                        ┌─────────────────────┐
  │ /x/ and /y/ are  │        ┌─────┐         │   Check for free    │        ┌─────┐
  │    separate      │        │ yes │─────────│    variation:       │────────│ no  │
  │   phonemes.      │        └─────┘         │ Whenever [x] occurs,│        └─────┘
  │     END          │           │            │ is it also possible say│        │
  └──────────────────┘           │            │  [y], and vice versa?│        ▼
                                  │            └─────────────────────┘
                                  │                                    ┌─────────────────────┐
                                  │            ┌─────┐                 │     Check for       │
                                  │            │ yes │─────────────────│  complementary      │
                                  │            └─────┘                 │   distribution:     │
                                  ▼               │                    │ wherever [x] occurs,│
  ┌──────────────────┐           │               │                    │ [y] does not, and vice│
  │ [x] and [y] are  │◄──────────┘               │                    │      versa.         │
  │allophones of the same│                       │                    └─────────────────────┘
  │ phoneme. Pick one│                           │                            │
  │ (simplest choice) as the│                    │                      ┌─────┐
  │ underlying form and│                          │                      │ no  │
  │ write a rule or rules.│                        │                     └─────┘
  │     END          │                           │                            │
  └──────────────────┘                           │                            ▼
                                                               ┌─────────────────────┐
                                                               │   You're stuck.     │
                                                               │  See footnote.[180] │
                                                               │      END            │
                                                               └─────────────────────┘
```

---

[180] In such a case, [x] and [y] are normally separate phonemes, for which, by sheer bad luck, there happen to be no minimal pairs. This happens sometimes for rare phonemes such as English /ð/ and /ʒ/. The next step in such cases is to show that, *if* we treated [x] and [y] as allophones, we would not be able to write a phonological rule that could derive them, and so they must be separate phonemes.

Study Exercise #75

Data from English. The target sounds are [s] and [t͡s]. Are these one phoneme or two?

(a) Collect local environments.
(b) Give the appropriate underlying forms and rules.
(c) Give underlying representations and derivations for *dance*, *concert*, and *false*.

Hints:
- In your local environments, put the stress mark before the vowel; rather than before the syllable as IPA requires. For instance, for the [s] in [kənˈsid], write / n ___ ˈi.

Sorting local environments: make a list for "just [s]", a list for "[s] and [t͡s] in free variation, and for "just [t͡s]".

dance	[ˈdænt͡s]
Clarence	[ˈklɛɹənt͡s]
mince	[ˈmɪnt͡s]
hence	[ˈhɛnt͡s]
concert	[ˈkɑnsɚt], [ˈkɑnt͡sɚt],
cancer	[ˈkænsɚ], [ˈkænt͡sɚ]
cancel	[ˈkænsəl], [ˈkænt͡səl]
cancellation	[kænsəˈleɪʃen], [kænt͡səˈleɪʃen]
tonsil	[ˈtɑnsəl], [ˈtɑnt͡səl]
fancy	[ˈfænsi], [ˈfænt͡si]
insert	[ɪnˈsɚt]
concede	[kənˈsid]
coincide	[koʊɪnˈsaɪd]
soup	[ˈsup]
false	[ˈfɑls]
farce	[ˈfɑɹs]
miss	[ˈmɪs]
fussy	[ˈfʌsi]

3. Answer to Study Exercise #74

Local environments:

[t͡s] only

dance	/ n ___]
Clarence	/ n ___]
mince	/n ___]
hence	/ n ___]

Environments for either [s] or [t͡s] in free variation:

concert	/ n ___ ɚ
cancer	/ n ___ ɚ
cancel	/ n ___ ə
cancel	/ n ___ ə
tonsil	/ n ___ ə
fancy	/ n ___ i

Environments with only [s]:

insert	/ n ___ ˈɚ
concede	/ n ___ ˈi
coincide	/ n ___ ˈaɪ
soup	/ [___ ˈu
false	/ l ___]
farce	/ ɹ ___]
miss	/ ˈɪ ___]
fussy	/ ˈʌ ___ i

[s] and [t͡s] are sometimes in complementary distribution, sometimes in free variation.

[t͡s] only: word-finally after [n].
Free variation: between [n] and a stressless vowel.
 [s] only: elsewhere

We set up /s/ as the underlying form (it would be quite a mess to try to state all the environments for [s], but it works fine as the elsewhere allophone).

Rules:

Obligatory /s/ Affrication

$$s \rightarrow \begin{bmatrix} -\text{fricative} \\ +\text{affricate} \end{bmatrix} / n \underline{\quad}]_{\text{word}}$$

"An s becomes [t͡s] if it comes between [n] and the end of a word."

Optional /s/ Affrication

$$s \rightarrow \begin{bmatrix} -\text{fricative} \\ +\text{affricate} \end{bmatrix} / n \underline{\quad} \begin{bmatrix} +\text{syllabic} \\ -\text{stress} \end{bmatrix} \quad \text{(optional)}$$

"An s may become [t͡s] if it comes between [n] and a stressless vowel."

Derivations:

dance	*concert*		*false*	
/ˈdæns/	/ˈkɑnsɚt/		/fɑls/	underlying representations
t͡s	—		—	Obligatory /s/ Affrication
—	ˈkɑnt͡sɚt	—	—	Optional /s/ Affrication
[ˈdænt͡s]	[ˈkɑnt͡sɚt]	[kɑnsɚt]	[fɑls]	phonetic forms

PHONOLOGY AND MORPHOLOGY

4. Overview

Phonology is a part of grammar, the part dealing with speech sounds and their realization. Phonology does not operate in isolation, but is tied to other components of the grammar, notably morphology. In what follows we will examine some of the phenomena involving in this relationship; which was previewed above in §13.2 of Chapter 10.

5. Alternation

Let us start with a definition:

(252) **Defn.: alternation**

> **Alternation** is the appearance of a single morpheme in different phonetic forms in different contexts.

Alternation is found in all languages of the world. It normally results from an interaction of morphological and phonological rules. To show how alternation arises, we can consider an example, which requires some background material on the morphology and phonology of American English.

For morphology, we can very briefly review the format used here for word formation rules. In Chapter 2 we established a rule of word formation that we called the *-able* Rule; repeated below.

(253) *-able* **Rule** (repeated from (52))

$$[\text{X}]_{\text{Verb}} \quad \rightarrow \quad [[\text{X}]_{\text{Verb}} \text{əbəl}]_{\text{Adj}}$$ meaning: "able to be Verbed"

This derives, for instance, *lovable* and *wearable*.

In Study Exercise #7 (Chapter 2) we established another word formation rule, the *-ation* Rule:

(254) *-ation* **Rule**

$$[\text{X}]_{\text{Verb}} \quad \rightarrow \quad [[\text{X}]_{\text{Verb}} \text{ˈeɪʃən}]_{\text{Noun}}$$ meaning: "process of Verbing"

This derives, for instance, *accusation*, *improvisation*, and *indentation*.

We will also use some phonological rules that interact with the morphological rules just given. Of these, the following one is new:

(255) **Pre-Stress Aspiration**

$$\begin{bmatrix} +\text{stop} \\ -\text{voice} \end{bmatrix} \quad \rightarrow \quad [+\text{aspirated}] \, / \, [+\text{syllabic}] \underline{\quad\quad} \begin{bmatrix} +\text{syllabic} \\ +\text{stressed} \end{bmatrix}$$

This is part of family of rules assigning aspiration; see also Initial Aspiration in (219) above.[181] This one is needed to cover that cases of aspiration that occur other than at the beginning of the word. Here are examples:

appeal   [əˈpʰil]
attend   [əˈtʰɛnd]
account   [əˈkʰaʊnt]

---

[181] It's odd to need two aspiration rules (one initial, the other pre-stress). Various proposals have been made to unify them.

In these examples the voiceless stop is between two syllabic sounds (vowel, diphthong, or syllabic consonant), of which the second is stressed. Note further that when the second is *not* stressed, the aspiration is absent (or at least quite weak):

caper   [ˈkʰeɪpɚ]

tickle   [ˈtʰɪkəl][182]

The remaining phonological rules we'll need were justified in the pages above; they are repeated below for convenience:

Tapping (from (247))

$$t \rightarrow ɾ \: / \: [\text{+syllabic}] \_\_\_ \begin{bmatrix} \text{+syllabic} \\ \text{−stress} \end{bmatrix}$$

as in *butter* [ˈbʌɾɚ], *motto* [ˈmɑɾoʊ] , *vanity* [ˈvænəɾi], etc.

Preglottalization (from (246))

$$\begin{bmatrix} \text{+stop} \\ \text{−voiced} \end{bmatrix} \rightarrow \: [\text{+glottal}] \: / \: \_\_\_ \:]_\text{word} \quad (\text{optional})$$

as in *cat* [ˈkæʔt], *cap* [ˈkæʔp], *lack* [ˈlæʔk], etc.

Both of these rules are optional, but for simplicity we will assume here that they apply obligatorily. This simplifying assumption will not change the analysis in any crucial way.

6. Testing for the relative ordering of morphology and phonology

With all of these morphological and phonological rules in hand, we can now cover the crucial data:

note   *notable*   *notation*
[ˈnoʊʔt]   [ˈnoʊɾəbəl]   [noʊˈtʰeɪʃən]

quote   *quotable*   *quotation*
[ˈkwoʊʔt]   [ˈkwoʊɾəbl]   [kwoˈtʰeɪʃən]

The first three forms are, or are derived from, the stem *note* and the last three from *quote*; the relevant rules of word formation are the *-able* Rule and *-ation* Rule. If we "peel away" the affixes *-able* and *-ation*, then we can look at what is "left over"; that is, the various versions of the stems:

---

[182] We can't check /t/ here because it would undergo Tapping (247), which makes it not a stop at all and hence ineligible for aspiration.

note	*notable*	*notation*
[ˈnoʊʔt]	[ˈnoʊɾ~~əbəl~~]	[noʊˈtʰ~~eɪʃən~~]
quote	*quotable*	*quotation*
[ˈkwoʊʔt]	[ˈkwoʊɾ~~əbl̩~~]	[kwoˈtʰ~~eɪʃən~~]

or simply:

note	*notable*	*notation*
[ˈnoʊʔt]	[ˈnoʊɾ]	[noʊˈtʰ]
quote	*quotable*	*quotation*
[ˈkwoʊʔt]	[ˈkwoʊɾ]	[kwoˈtʰ]

These variant forms of the stems are called **allomorphs**. It can be seen that, following the definition given above of "alternation" ((252): "Alternation is the appearance of a single morpheme in different phonetic forms in different contexts."), both *note* and *quote* alternate.

Most, but not all alternation, has a simple explanation, stated in the theory given here as follows:

Morphological rules precede phonological rules.

More specifically, the morphological component of grammar is assumed to occupy a position before the phonological component. The scheme that results is this: morphological rules, by adding prefixes, suffixes, etc., change the environments in which the phonemes occur. Then, phonological rules sensitive to these environments apply differentially to different instances of the morpheme. This makes the morphemes show up differently in different contexts; that is to say, makes them alternate.

Here is a derivation showing how the scheme works for the words and rules given so far. It will be a "bicomponential" derivation, with first word formation then phonology.

As noted above in chapter 2, section 16, rules of word formation apply freely; they represent a choice made to derive a new word from an old one. Since this is essentially a form of optionality, we can again use the branching derivation formalism to show the various possible routes:

['noʊt]~Verb~   stem

[['noʊt]~Verb~ əbəl]~Adj~   *-able* Rule (253)

                    [[noʊt]~Verb~ eɪʃən]~Noun~   *-ation* Rule (254)

[['noʊt]~Verb~ əbəl]~Adj~ ['noʊt]~Verb~ [[$^{(ˌ)}$noʊt]~Verb~ 'eɪʃən]~Noun~   output of morphological
                                                        component
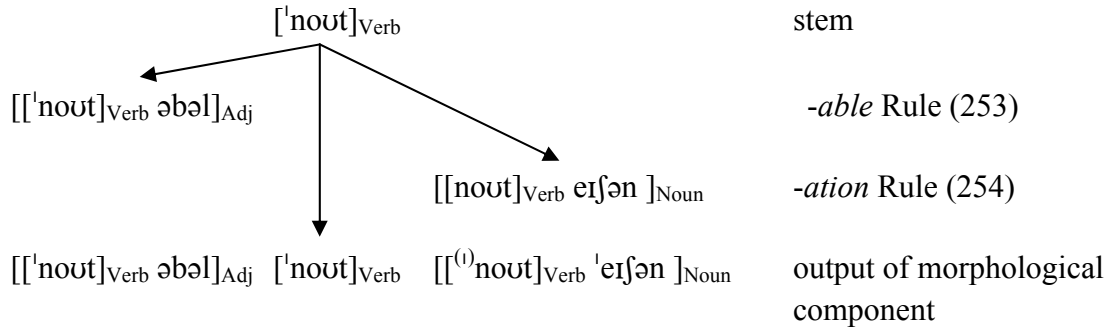
The resulting forms [['noʊt]~Verb~ əbəl]~Adj~, ['noʊt]~Verb~, and [[noʊt]~Verb~ 'eɪʃən]~Noun~ are submitted to the phonology, in order to convert the abstract schemata of phonemes to an overt, pronounceable string of sounds. There are reasons to think that the bracketed structure of the morphology is retained in the phonological component, but since this is not necessary here, and it is helpful to keep the representations maximally legible, I will discard the brackets. The phonological component thus starts with:

  'noʊtəbəl   'noʊt   noʊ'teɪʃən[183]

These forms are in fact the phonemic (also called **underlying**) representations for these word, and would normally be shown surrounded by / /. These representations are of course "underlying" for purposes of phonology, where they form the most abstract level of representations; they are actually output representations when considered from the viewpoint of morphology.

As before, the phonological derivation consists of applying the rules in order. In many cases, it is crucial to order the rules in a particular way (we will examine such cases later on), but here the order does not matter, and the order shown is arbitrary.

/'noʊtəbəl/	/'noʊt/	/noʊ'teɪʃən/	underlying representations
—	—	t^h	Pre-Stress Aspiration (255)
ɾ	—	—	Tapping (247)
—	^{ʔ}t	—	Preglottalization (246)
['noʊɾəbəl]	['noʊ^{ʔ}t]	[noʊ't^{h}eɪʃən]	phonetic representations

We have now produced an explanation for alternation: the *-able* Rule placed the /t/ of /noʊt/ in an environment where Tapping could apply to it; the *-ation* Rule placed the /t/ of /noʊt/ in an environment where Pre-Stress Aspiration could apply to it; and the lack of any morphological affixation left the /t/ in word-final position, where Preglottalization could apply to it. The end result is three allomorphs, [noʊɾ], [noʊ^{ʔ}t], and [noʊt^h].

---

[183] There is an additional change here, removing the stress on the stem before the stressed suffix *-ation*. This can be done by rule ([+syllabic] → [−stress] / ___ X [+stress]), but we'll not deal with this here.

This pattern is very general in languages: morphology changes environments, phonology "sees" these environments and accommodates the phonemes to them by assigning the appropriate allophone. The theoretical conclusion is that, at least in the normal case, morphology precedes phonology.[184]

7. Phonology so far

Here is a quick summary of what we have so far in phonology.

Phonemes: Every language can be analyzed as consisting phonologically of a smallish set of phonemes (usually a few dozen), which form the building blocks for the pronunciation of words. Phonemes are represented as feature matrices, and morphemes as sequences of feature matrices.

Allophones: The phonemes often vary according to their context; that is, they have allophones. Sometimes the appearance of particular allophones is obligatory; one must use a particular allophone in a certain context (and if you don't, the result is phonologically ungrammatical, and "sounds funny"). Sometime we instead get free variation: two or more allophones are possible in one particular context.

Theory: morphemes are assumed to have an underlying representation consisting of a string of phonemes. The underlying representation of a phoneme is its elsewhere allophone. Phonological rules apply to these underlying representations to create surface representations, which determine the observed pronunciations. Phonological rules make use of features, which are the phonologically relevant phonetic properties of sounds. They often apply to whole classes of phonemes (definable using the features), and they usually change just one or two feature values.

Analytic method: you can prove two sounds are *different* phonemes by presenting a minimal pair (this is: two sounds, identical environment, eliminating the possibility of a rule to predict the difference). You can prove two sounds are part of the *same* phoneme by collecting their environments in a sample of words, scanning these environments for the crucial generalization,[185] and formalizing what you find with rules. The same method works for free variation, if you collect each variation pattern as a separate batch of environments.

Alternation: morphology, which works with phonemic forms, puts morphemes in different locations. This makes the phonemes of these morphemes vulnerable to different phonological rules in different locations. As a result, the morphemes get different pronunciations in different contexts, which is what we call alternation.

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[184] It is certainly a consensus among linguists that at least some phonology follows morphology. Linguists have also experimented with theories in which some phonological rules are premorphological, some postmorphological; we won't try to cover such theories here in a first course.

[185] This is usually the hardest step. In office hours I have suggested to people that memorizing the phonetic symbols and feature chart might be helpful here; that is, while I won't give you test questions for doing this memorization, it probably would help you in finding environments and applying rules.

8. The ordering of syntax and phonology

If phonological rules in general apply after morphological rules, then it is worth asking if phonological rules are always ordered in a particular way with respect to syntactic rules. The way to test this is the same as before: we set up a situation in which the ability of the syntax to combine two words into a phrase would alter which phonological rules are able to apply.

Here is the background. Just as English has two aspiration rules, it also has two Tapping rules. To review, the original Tapping rule looked like this:

Tapping

t → ɾ / [+syllabic] ____ $\begin{bmatrix} +\text{syllabic} \\ -\text{stress} \end{bmatrix}$

utter [ˈʌɾɚ]   *batting* [ˈbæɾɪŋ]

It is crucial that the second vowel be [−stress], otherwise we get aspiration instead of Tapping. However, there is a particular situation in English where we get Tapping even when the second vowel *is* stressed; namely, when the second vowel is in a separate word.

Here are Tapping examples across word boundary, shown here with the brackets]w [

	Phonemic	**Phonetic**
at Ed	[æt]w [ˈɛd]	[æɾ]w [ˈɛd]
get Alice	[gɛt]w [ˈælɪs]w	[gɛɾ]w [ˈælɪs]w
not Adam	[nɑt]w [ˈædəm]w	[nɑɾ]w [ˈærəm]w

To handle these facts, we need to adopt an additional Tapping rule, which could be written like this:

(256) **Phrasal Tapping**

t → ɾ / [+syllabic] ____]w [+syllabic]

In words, this says "make /t/ a tap when it is immediately preceded by a vowel and immediately followed by a vowel which is in the next word."

Phrasal Tapping is the phonological rule that we will need to test out the ordering between syntactic and phonological rules. For syntax, we will use the following phrase structure rules taken from (129) above.

PP → P NP
NP → $\left(\begin{Bmatrix} \text{Art} \\ \text{NP} \end{Bmatrix} \right)$ (AP)* N (PP)*($\overline{\text{S}}$)
 (plus: lexical insertion)

Consider now the pronunciation of the PP *at Ed*. If the syntactic rules apply first, then we will derive the correct output as follows:

SYNTACTIC COMPONENT:

PP

$$PP \rightarrow P\ NP$$
$$NP \rightarrow \left(\begin{Bmatrix} Art \\ NP \end{Bmatrix} \right) (A)^* \ N \ (PP) \ (\overline{S})$$

PP
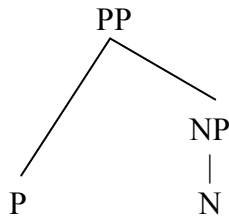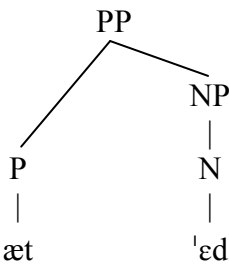
Lexical insertion

PHONOLOGICAL COMPONENT:

[æt]_{word} [ˈɛd]   (same as above, but tree omitted, and word boundaries made explicit)

[æɾ]_{word} [ˈɛd]   Phrasal Tapping (256)

[æɾˈɛd]   phonetic form

It is easy to see that, had we applied Phrasal Tapping before the syntactic rules joined *at* and *Ed* together, we would have derived the wrong result.

What about languages in general? Certainly it is very common for phonological rules to be sensitive to phrasal environments, so at the very least we can say that *some* phonological rules are postsyntactic. Linguists differ on the question of whether there exists in addition a class of presyntactic phonological rules.

9. Neutralization

A definition:

(257) **Defn.: neutralization**

Neutralization is the phonetically identical realization of distinct phonemic forms.

That is, two forms that differ phonemically undergo their phonological derivation, and emerge as identical.

The rule of Tapping is, at least in many dialects, a neutralization rule. The following data show that Tapping can apply to /d/ as well as to /t/ (plus sign is a notation for morpheme break):

Cases of Tapping with /t/			**Cases of Tapping with /d/**		
write	/ˈɹaɪt/	[ˈɹaɪʔt]	*ride*	/ˈɹaɪd/	[ˈɹaɪd]
writer	/ˈɹaɪt+ɚ/	[ˈɹaɪɾɚ]	*rider*	/ˈɹaɪd+ɚ/	[ˈɹaɪɾɚ]
white	/ˈwaɪt/	[ˈwaɪʔt]	*wide*	/ˈwaɪd/	[ˈwaɪd]
whiter	/ˈwaɪt+ɚ/	[ˈwaɪɾɚ]	*wider*	/ˈwaɪd+ɚ/	[ˈwaɪɾɚ]
pat	/ˈpæt/	[ˈpæʔt]	*pad*	/ˈpæd/	[ˈpæd]
patting	/ˈpætɪŋ/	[ˈpæɾɪŋ]	*padding*	/ˈpæd+ɪŋ/	[ˈpæɾɪŋ]

Reformalizing the rule with features, it now reads:

(258) *Tapping (revised)*

$$\begin{bmatrix} +\text{alveolar} \\ +\text{stop} \end{bmatrix} \rightarrow \text{ɾ} \ / \ [+\text{syllabic}] \ \underline{\quad} \ \begin{bmatrix} +\text{syllabic} \\ -\text{stress} \end{bmatrix}$$

"An alveolar stop when between two vowels of which the second is stressless is realized as a tap."

The neutralization inflicted by Tapping takes the form given in (259):

(259) *Neutralization diagram for Tapping*

/t/ ↘   ↙ /d/

[ɾ]
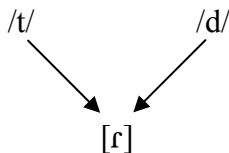
We have seen several sources of ambiguity in this text, arising from rules of morphology (*undoable*), syntax (*They saw the man with the telescope*) and semantics (*Many children rode on each ride*). Phonological neutralization is yet another source of ambiguity in language. In the dialect under description here, the listener hearing [ˈɹaɪɾɚ] must infer from context, or just guess, whether the speaker meant /ˈɹaɪtɚ/ *writer* or /ˈɹaɪtɚ/ *rider*. Usually, context suffices, but in my own experience the particular ambiguity *kitty*/*kiddie* really does seem to create confusion — many households have both kitties and kiddies in them!

The case of Tapping is somewhat unusual in that two phonemes are realized identically by converting them into an allophone that happens to be different from either of them. More typically, the neutralized output is identical to one or the other phoneme. Here is an instance; consider the following data:

We live in Pittsburgh	[ɪm pɪtsbɚg]
Wouldja hand me the phone book?	[foʊm bʊk]
I gotta make a phone call.	[foʊŋ kɔl]
It's all a con game.	[kɑŋ geɪm]

If one says these casually enough, the /n/'s at the end of *phone*, *in*, and *con* turn into either [m] or [ŋ]. The patterning is as follows:

n	→	m	/ ___ p
n	→	m	/ ___ b
n	→	ŋ	/ ___ k
n	→	ŋ	/ ___ g

Informally, we can write the rule as follows:

Nasal Place Assimilation

n → [same place] / ___ [−syllabic]

where "same place" is an inexplicit shorthand for changing all of the place features to match those of the following sound.

Nasal Place Assimilation is clearly a neutralizing rule; it neutralizes the difference between /n/ and /m/ in some cases, and between /n/ and /ŋ/ in others. For example, the following sentence is ambiguous:

"They were [sʌŋ glæsəz]"

The readings are the sensible "They were sunglasses", and the phonetically literal but nonsensical "They were sung glasses".[186]

(260) *Neutralization diagram for "sunglasses" and "sung glasses"*

/sʌn glæsəz/   /sʌŋ glæsəz/   phonemic forms

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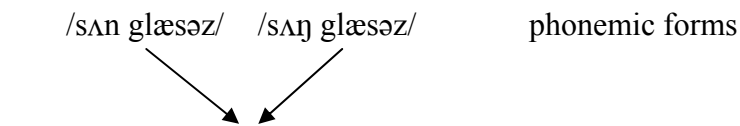
[186] Context: magical world in which singing by trained experts gives the lenses a bluish tint; speaking, in contrast, makes them slightly pinker.

[sʌŋ glæsəz]   phonetic forms

Study Exercise #76

Look at chapter 10, section 13.2. Justify this claim: "Alveolar Fricative Palatalization is neutralizing". Make reference to the definition of neutralization in (257) and provide a neutralization diagram analogous to (260).

Answer to Study Exercise #75

"Neutralization is the phonetically identical realization of distinct phonemic forms. *Russ Schuh* /ɹʌs ʃu/ and *rush Schuh* /ɹʌʃ ʃu/ are distinct phonemic forms (as shown by the distinct pronunciations of *Russ* [ɹʌs] and *rush* [ɹʌʃ]). They are realized identically when *Russ Schuh* undergoes Alveolar Fricative Palatalization and becomes [ɹʌʃ ʃu], just like *rush Schuh*. The neutralization diagram is:

/ɹʌs ʃu/   /ɹʌʃ ʃu/   phonemic forms

                [ɹʌʃ ʃu]   phonetic forms
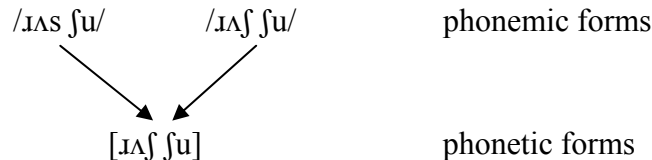
10. Rule ordering

The final topic to be covered in phonology is the ordering of phonological rules. We will find that there are cases in which it makes a difference just which order one applies the rules in, and that "ordering statements" must therefore form part of the phonologies of human languages.

To develop our argument for ordering, we will need two phonological rules of American English. Our first rule is based on the following data. IPA symbol: /˘/ is the diacritic meaning "extra short".

cat	[kæ̆t]	*cad*	[ˈkæd]
pot	[pɑ̆t]	*pod*	[ˈpɑd]
cop	[kɑ̆p]	*cob*	[ˈkɑb]
cup	[kʌ̆p]	*cub*	[ˈkʌb]
batch	[bæ̆tʃ]	*badge*	[ˈbædʒ]
pasta	[ˈpɑ̆stə]	*Mazda*	[ˈmɑzdə]
beat	[ˈbĭt]	*bead*	[ˈbid]
Bruce	[ˈbɹŭs]	*bruise*	[ˈbɹuz]

Normal-length and extra-short vowels in English are allophones of the same phoneme. There are no minimal pairs, and it is not hard to establish complementary distribution. In the data above, long vowels occurs before voiced consonants, and the short vowels occur before voiceless consonants.

To decide what is the basic variant of the vowel phonemes, one needs to know what occurs when neither a voiced consonant nor a voiceless consonant follows. Forms like *Pa* [pɑ], *bee* [bi], and *brew* [ˈbɹu] indicate that the longer versions of the vowels are the *elsewhere allophones* (as defined above; Chap. 11 section 4), and we should set them up as the underlying representations.

We also need a feature to write the rule with; for present purposes we can simply add the feature [short].

With these assumptions, then, the rule of Vowel Shortening would be as follows.

Vowel Shortening

[+syllabic] → [+short] / ___ [−voice]

"Realize a vowel as extra short before a voiceless sound."

Here are derivations:

Bruce	*bruise*	*brew*	
/ˈbɹus/	/ˈbɹuz/	/ˈbɹu/	phonemic forms
ŭ	—	—	Vowel Shortening
[ˈbɹŭs]	[ˈbɹuz]	[ˈbɹu]	phonetic forms

The other rule we will need is the familiar rule of Tapping (that is, word-internal Tapping). Thus far, we have improved the rule to the point that it looks like this:

Tapping

$$\begin{bmatrix} +\text{alveolar} \\ +\text{stop} \end{bmatrix} \rightarrow \text{ɾ} / [+\text{syllabic}] \underline{\quad} \begin{bmatrix} +\text{syllabic} \\ -\text{stress} \end{bmatrix}$$

Here, it will be useful to use a fully formalized version of the rule, using features instead of the symbol [ɾ]. We need to know, then, just what features must be changed in order to turn both /t/ and /d/ into [ɾ].

First of all, a tap is voiced, so that the rule should add [+voiced] on the right side of the arrow. This will correctly voice /t/, and it will do no harm for /d/. Tap also differs from the alveolar stops in manner of articulation, being a tap and not a stop. Thus, assuming [tap] is a feature, we have:

Tapping (again revised)

$$\begin{bmatrix} +\text{alveolar} \\ +\text{stop} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{voiced} \\ -\text{stop} \\ +\text{tap} \end{bmatrix} / [+\text{syllabic}] \underline{\quad} \begin{bmatrix} +\text{syllabic} \\ -\text{stress} \end{bmatrix}$$

With these two rules in hand, we can now see how they might interact. The crucial facts are:

- Tapping changes the voicing of a /t/;
- Vowel Shortening depends on the voicing of the following consonant.

Because of this, we will get different outputs depending on which order we apply the rules in.

Here are derivations of pertinent examples, using both orderings:

A. *Tapping precedes Vowel Shortening*

patting	*padding*	
/ˈpætɪŋ/	/ˈpædɪŋ/	Phonemic forms
ˈpæɾɪŋ	ˈpæɾɪŋ	Tapping
—	—	Vowel Shortening
[ˈpæɾɪŋ]	[ˈpæɾɪŋ]	Phonetic forms

B. *Vowel Shortening precedes Tapping*

patting	*padding*	
/ˈpætɪŋ/	/ˈpædɪŋ/	Phonemic forms
æ̆	—	Vowel Shortening
ɾ	ɾ	Tapping
[ˈpæ̆ɾɪŋ]	[ˈpæɾɪŋ]	Phonetic forms

The predictions that the derivations make are clear: if Tapping precedes Lengthening, then *patting* and *padding* should be pronounced identically — there should be neutralization. If Lengthening precedes Tapping, then *patting* and *padding* should be pronounced differently; that is, *padding* should have the longer vowel. The two words will be distinct (but in their vowels, not their taps). These observations should hold true not just for these two words, but for all the words in which both rules can apply (e.g. *latter-ladder*, *writer-rider*, *Patty-Paddy*, etc.).

What are the facts? There is actually no single outcome. Instead, different dialects of American English use different orderings. Speakers from Michigan, Illinois, and Wisconsin typically order Lengthening before Tapping; thus they pronounce pairs like *patting-padding* differently, with the length difference as shown above. Speakers from other areas tend to have the opposite ordering, and the pronounce such pairs identically.

Notice that this requires a small correction to something I said earlier: it actually *is* possible to tell *writer* and *rider* apart, provided both speaker and hearer speak a dialect in which Lengthening precedes Tapping. However, they will use the vowel length, not the voicing, to tell the difference. The neutralization is complete only for dialects that order Tapping before Lengthening.

The crucial point here is not the details of the two dialects, but the very fact that they differ. This implies that when one learns a language, and hence its phonology, part of what one learns is *ordering restrictions* that must be imposed on its phonological rules. Depending on what dialect of English you speak, you implicitly learned a particular ordering for two of the phonological rules.

10.1 Analyzing rule order

To establish the ordering of two rules A and B, the simplest procedure is simply to find a relevant form — a form where A and B are both applicable — and try both orders. Either you will find that only the order A-B produces the right output, only B-A produces the right output, or they both work (in which case the order doesn't matter). All that's really needed to do this test is to match up the rules with the forms with care, so you know that you've found exactly what the rule predicts.

A slightly less mechanical skill here is to explain what you've found in words. Here is an example description, for the example in the preceding section: "In the dialect where *patting* is [ˈpæ̆ɾɪŋ] and *padding* is [ˈpæɾɪŋ], Vowel Shortening must be applied before Tapping. The reason is that Vowel Shortening depends on the phonemic value of [voice] for the following consonant, before that value is neutralized to [+voice] by Tapping."

Here is a description of the ordering argument for the other dialect: "In the dialect where both *patting* and *padding* are both pronounced [ˈpæɾɪŋ], Tapping must be applied before Vowel Shortening. If we applied Tapping first, it would "see" the underlying /t/ of *patting* and wrongly shorten the vowel." Notice that this description is of the "counterfactual" type, which tells us what would go wrong if we ordered the rules incorrectly.

Study Exercise #77

This involves the case forms of nouns in Hungarian. Please ignore the vowel changes in suffixes, which are due to a phonological rule of Vowel Harmony.

Phonetic symbols:
[ɟ] is a voiced palatal stop.
[c] is a voiceless palatal stop.
[ɲ] is a voiced palatal nasal.
[ː] means that the preceding vowel is long.
[ø] mid front rounded, as in German *Goethe* or French *Chartr<u>eu</u>se.*
[y] high front rounded, as in German *F<u>ü</u>hrer* or French *tu* or Mandarin [nỹ] 'female'[187]

a. What stems alternate, and what are their allomorphs?
b. State a phonological rule that correctly derives the alternation, in both formalism and words. Give your rule a name.
c. Give underlying forms and derivations for pɔd, pɔdnɔk, and pɔttoːl.
d. Is your rule neutralizing? Explain your answer.

---

[187] Unchecked data taken from a textbook. If you are a native Mandarin speaker and can confirm, please contact me.

Hungarian Data

Nominative	Dative	Ablative[188]	Essive[189]	Allative[190]	Gloss
røgbi	røgbinɔk	røgbitøːl	røgbikeːnt	røgbihɛz	'rugby'
ipʃɛ	ipʃɛnɛk	ipʃɛtøːl	ipʃɛkeːnt	ipʃɛhɛz	'fellow'
kɔlɔp	kɔlɔpnɔk	kɔlɔptoːl	kɔlɔpkeːnt	kɔlɔphoz	'hat'
kuːt	kuːtnɔk	kuːttoːl	kuːtkeːnt	kuːthoz	'well'
juk	juknɔk	juktoːl	jukkeːnt	jukhoz	'hole'
sɛm	sɛmnɛk	sɛmtøːl	sɛmkeːnt	sɛmhɛz	'eye'
rɔb	rɔbnɔk	rɔptoːl	rɔpkeːnt	rɔphoz	'prisoner'
ʒɛb	ʒɛbnɛk	ʒɛptøːl	ʒɛpkeːnt	ʒɛphɛz	'pocket'
kaːd	kaːdnɔk	kaːttoːl	kaːtkeːnt	kaːthoz	'bathtub'
pɔd	pɔdnɔk	pɔttoːl	pɔtkeːnt	pɔthoz	'bench'
aːɟ	aːɟnɔk	aːctoːl	aːckeːnt	aːchoz	'bed'
mɛlɛg	mɛlɛgnɛk	mɛlɛktøːl	mɛlɛkkeːnt	mɛlɛkhɛz	'heat'
hɛrt͡sɛg	hɛrt͡sɛgnɛk	hɛrt͡sɛktøːl	hɛrt͡sɛkkeːnt	hɛrt͡sɛkhɛz	'duke'
tɛmplom	tɛmplomnɔk	tɛmplomtoːl	tɛmplomkeːnt	tɛmplomhoz	'house of worship'
byːn	byːnnɛk	byːntøːl	byːnkeːnt	byːnhøz	'sin'
torɔɲ	torɔɲnɔk	torɔɲtoːl	torɔɲkeːnt	torɔɲhoz	'tower'
fal	fɔlnɔk	fɔltoːl	fɔlkeːnt	fɔlhoz	'wall'
øːr	øːrnɔk	øːrtøːl	øːrkeːnt	øːrhøz	'guard'

    e. Ponder next the paradigm of 'emerald' below and suggest a minimal change for your analysis to derive it.

    f. Give a derivation for [smɔrɔktkeːnt].

Nominative	Dative	Ablative	Essive	Allative	Gloss
smɔrɔgd	smɔrɔgdnɔk	smɔrɔkttoːl	smɔrɔktkeːnt	smɔrɔkthoz	'emerald'

Answer to Study Exercise #76

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[188] Ablative case means, roughly, "from".

[189] More accurately: essive formal. Essive case means, roughly, "as".

[190] My Hungarian grammar says: "used with expressions of attaching something to, adding to, or communicating to someone or something" (Carol Rounds, *Hungarian: An Essential Grammar*, p. 109).

a.   What stems alternate, and what are their allomorphs?

Stem	Allomorph 1	Allomorph 2
rɔb	rɔb	rɔp
ʒɛb	ʒɛb	ʒɛp
kaːd	kaːd	kaːt
pɔd	pɔd	pɔt
aːɟ	aːɟ	aːc
mɛlɛg	mɛlɛg	mɛlɛk
hɛrt͡sɛg	hɛrt͡sɛg	hɛrt͡sɛk

b.   State a phonological rule that correctly derives the alternation, in both formalism and words. Give your rule a name.

Voicing Assimilation

[+stop] → [−voice] / ___ [−voice]

'A stop becomes voiceless when it precedes a voiceless sound.'

c.   Give underlying forms and derivations for pɔd, pɔdnɔk, and pɔttoːl.

/pɔd/	/pɔdnɔk/	/pɔdtoːl/	underlying forms
—	—	t	Voicing Assimilation
[pɔd]	[pɔdnɔk]	[pɔdtoːl]	underlying forms

d.   Is your rule neutralizing? Explain your answer.

Yes. Look at this quadruplet, focusing on the underlined sounds:

kuːt	kuːttoːl
pɔd	pɔttoːl

There is a /t/-/d/ distinction, but it gets wiped out before a voiceless sound.

e. Ponder next this paradigm and suggest a minimal change for your analysis to derive it.

The crucial forms are forms like [smɔrɔktkeːnt]. It looks like Voicing Assimilation has to be *allowed to apply to its own output* (the standard term for this is "iterative"). The rightmost /k/ turns a /d/ into a [t], and then this [t] turns the preceding /g/ into a [k].

f. Give a derivation for [smɔrɔktkeːnt].

/smɔrɔgdkeːnt/	underlying form
t	Voicing Assimilation: first time
k	Voicing Assimilation: second time
[smɔrɔktkeːnt]	surface form

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11. The organization of grammar

We have now covered (however briefly) most of the central areas of linguistic analysis: syntax, semantics, morphology, and phonology. At this point, we can amplify the "boxological" diagram, covering the organization of grammar, given earlier ((158) on p. 210).

How do the theories in these areas all fit together? This is very much an open question, one that linguists continue to debate. For concreteness, I will give one particular view here. The following chart shows the components and the direction of information flow. Components (modules of the grammar) are shown in dotted boxes; level of representation (linguistic forms) are shown in solid boxes.

S, etc.   (initial symbol fed to the grammar)

Phrase structure rules

(bare tree)

lexicon

Lexical insertion

Derivational morphology

Deep structure

Constraints (acting as filter)

Transformations

Syntactic component

Surface structure

Inflectional morphology

Semantic component

Phonemic form

Logical form

Phonological component:
    Rule 1
    Rule 2
    ...
    Rule *n*

[phonetic form]

The **syntax** is the primary generative component, creating an infinite number of possible sentences.[191] The number is infinite because the phrase structure rules can apply recursively, in loops. **Deep structure** is created by filling the trees created by phrase structure rules with words (lexical insertion). Deep structures are modified by **transformations**, which have the power to copy and move, generating more elaborate structures that could not be formed by phrase structure rules alone. **Constraints** on transformations sometimes filter out sentences that the syntactic component would otherwise generate.

The words that undergo lexical insertion into the syntactic tree are sometimes single-morpheme stems like *cat*, and sometimes the result of rules of word formation. Following the view of many linguists, I have made the morphology of word formation a kind of adjunct to the lexicon. It extracts words from the lexicon and forms new words from them, which are added back to the lexical stock. Word formation rules string together morphemes, which are assumed at this stage to be composed of phonemes, since the rules of the phonology have yet to apply.

Particular syntactic rules (transformations of agreement, case marking, etc.) build up a **morphosyntactic representation** for each inflected word, which specifies the values of features like [Number], [Case], [Tense], and so on. In a postsyntactic component, the **inflectional morphology**, the features of the morphosyntactic representation trigger rules of affixation, which manifest the inflectional categories in audible form. Again, the morphological rules are assumed to manipulate morphemes in their phonemic form, since phonology has not applied yet.

At the bottom of the grammar, the rules of the **phonology** provide a phonetic realization for the syntactic structure; thus they relate it to the physical reality of articulation. They apply (in the theory shown here) after syntax and morphology; an ordering which accounts for the fact that the morphemes **alternate** according to the environments in which they occur, environments that were created by morphological and syntactic combination. Phonological rules can also **neutralize** distinctions, creating ambiguity.

The role of **semantics** in this scheme, is rather speculative; I have placed it in the diagram as applying to syntactic surface structure, and creating a level of **logical form,** in which the aspects of meaning most closely related to syntax, such as predicate-argument structure, pronoun reference, and scope, are derived.

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[191] Word formation is also generative, and in most languages can likewise create an infinite variety of structures (recall (66) from Chapter 2: *eggplant plant plant…*), though the structures typically are far less elaborate.

For further reading (phonology)

Quite a few textbooks lay out the basics of phonological theory in more detail; one is my own text *Introductory Phonology* (2008; Oxford: Blackwell). Another, very data-rich introductory text is David Odden's *Introducing Phonology* (2005: Cambridge University Press). A more advanced introduction with many beautiful problem sets is Michael Kenstowicz and Charles Kisseberth *Generative Phonology: Description and Theory* (1979: Academic Press).

The theory of phonemes was worked out in the earlier part of the 20th century. An acclaimed work from this period is Leonard Bloomfield's *Language* (1932; still in print at University of Chicago Press), a book still worth reading for many reasons.

The system of phonology in which the surface phonetic forms are derived from from an underlying representation using a series of ordered rules is perhaps the oldest part of linguistic theory still in general use today; it was worked out by the grammarians of ancient India, whose leading figure was Pāṇini (ca. 500 B.C.E.). The modern revival of the Pāṇinian system began around Bloomfield's time, but achieved full development with Noam Chomsky and Morris Halle's 1968 book *The Sound Pattern of English*, a massive study of English phonology.

There is no up-to-date textbook covering the many further developments in phonology over the past few decades but a useful survey is *The Handbook of Phonological Theory*, 2nd ed. (2011), ed. by John A. Goldsmith, Jason Riggle, and Alan C. L. Yu (Wiley-Blackwell).

Chapter 13: Historical Linguistics

1. Outline

Languages change over time, in an interesting and paradoxical way. The speakers of a language usually easily with their grandparents in childhood and with their grandchildren in old age. This covers five generations. But consider a passage of prose from the English of about 40 generations ago (Old English, about 1000 A.D.):

urne	*gedæghwamlican*	*hlaf*	*syle*	*us*	*to*	*dæg*
[ˈurnɛ	geˈdæɣwamlikan	ˈl̥af	ˈsylɛ	us	to	ˈdæɣ]
our	daily		bread	give	us	today

'Give us this day our daily bread'

This would be unintelligible to a speaker of Modern English, and many of the morphemes have evolved so as to be only faintly recognizable (e.g. [dæɣ] = *day*, [ˈl̥af] = *loaf*, [lik] = *-ly*). Somehow, a series of changes that were little noticed as they were happening have gradually converted English into an entirely different language.

Just to show an intermediate stage, the following passage is a Middle English translation (ca. 1400 A.D.) of the same Biblical verse. Remember to read it phonetically, not according to spelling. (This should give you a clue why letters have such different values in English than they have in European languages.)

[gevə	to	us	to	dæɪ	urə	etʃə	dæɪəs	bred]
give	to	us	today		our	each	day's	bread

Historical linguistics attempt to understand the process of linguistic change. The two fundamental questions in the field are: (a) How and why do languages change? (b) What is the history of the languages of the world?

2. Descent; related languages

When linguists speak of the "ancestry" of a language, they have a specific meaning in mind. If Language B is descended from Language A, it means that there has been a continuous transmission of the language, from generation to generation, going from A to B (with gradual changes over time). We can speak of this form of language transmission as **descent**. Modern English is related to Old English by descent (is "descended from" Old English), as there is a continuous link through 40 generations of speakers between the two.

We need to be careful about the term "descent": it certainly does not imply an actual chain of *biological* ancestors, because there are countless people who are native speakers of a language whose parents are not. Such speakers are part of the chain of transmission just as much as children of native speakers.
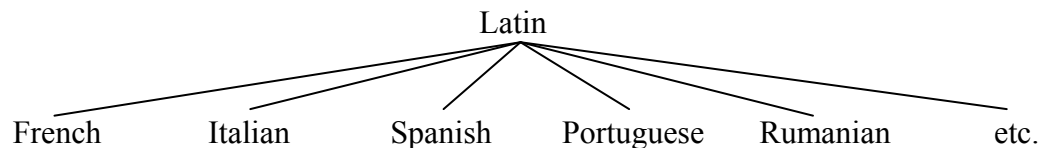
   For linguists, descent is the gold standard for language identity—descent has a completely clear meaning and can be diagnosed with near certainty if enough data are available. Descent is not always used as the criterion of language identity in popular culture, however. For instance, in the real world you will hear people say things like:

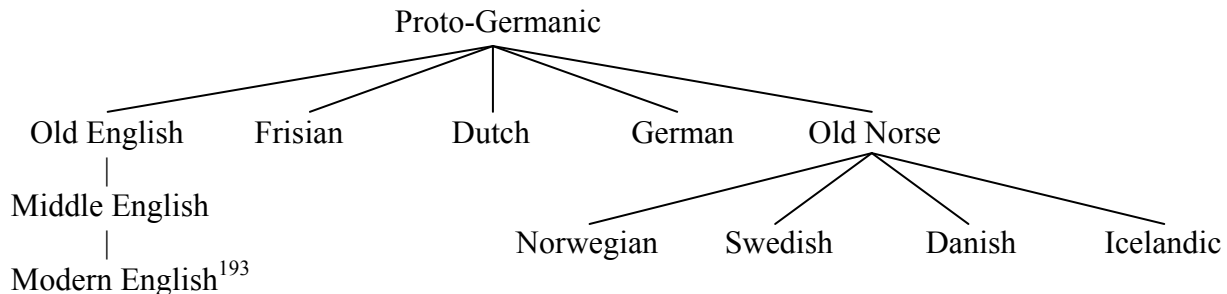   "Modern English is a mixture of Old English, French, and Latin."

This statement is perfectly true as a description of the *vocabulary* of Modern English, since over the centuries English has borrowed thousands of words from French and Latin. But English is *descended* from Old English;[192] there was no continuous transmission of language from generation to generation that leads from French or Latin to English.

   Two languages are said to be **related** if they descend from the same ancestor language. That is, it is often the case that a single language comes to be spoken in two geographically isolated areas, or over a very wide area. Given enough time, such a language is likely to develop more than one descendent. Because of lack of intercommunication, different areas evolve their own descendent languages, which eventually become mutually unintelligible. Exactly this happened in the evolution of the modern Romance languages from Classical Latin. Thus, the Romance languages are related to one another (in the technical sense) because they all descend from the same ancestor.

   Languages can thus be thought of as family groupings. We can use family tree notation to represent the ancestry of languages, in which a line represents a relationship by descent.

```
                              Latin
         ┌──────┬──────┬──────┼──────┬──────┐
      French  Italian  Spanish  Portuguese  Rumanian  etc.
```

   Here are some other examples of language families. The Germanic languages are all closely related. They descend from a common ancestor which was spoken roughly at the same time as Latin. However, this ancestor was spoken by an illiterate people, so we have no records of it. The name used for the common ancestor of the Germanic languages is *Proto-Germanic*.
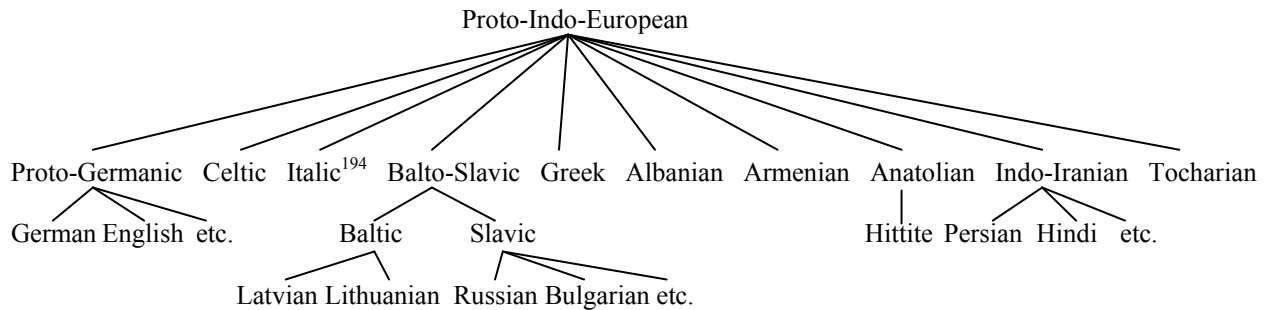
```
                         Proto-Germanic
         ┌────────┬────────┬────────┬────────┐
    Old English  Frisian  Dutch  German  Old Norse
         |                             ┌────┬────┬────┐
    Middle English              Norwegian Swedish Danish Icelandic
         |
    Modern English[193]
```

_____

   [192] … and, at a deeper level, the earlier languages from which Old English is descended; more on this immediately below.

   [193] Only English is shown with stages (following the custom, three of them: Old, Middle, Modern). But the same could be done for all of the languages shown.

Although we have no written records of Proto-Germanic, we nonetheless have a fairly good idea of what it was like. Just how we know this will be a central topic later on.

Latin and Proto-Germanic are in fact related to each other. They are (roughly speaking) sisters, and descend from an ancestor language called *Proto-Indo-European*. The Indo-European language family is a large one, and over half the population of the world speaks an Indo-European language. Here is a very sketchy version of the Indo-European family tree:

Proto-Indo-European

Proto-Germanic Celtic Italic[194] Balto-Slavic Greek Albanian Armenian Anatolian Indo-Iranian Tocharian

German English etc.   Baltic   Slavic   Hittite Persian Hindi   etc.

Latvian Lithuanian Russian Bulgarian etc.

However, a family tree doesn't have to branch. For example, Ancient Greek has only one descendent, namely Modern Greek, so its family tree is just a vertical line, sometimes shown like this:

Ancient Greek
|
Medieval Greek
|
Modern Greek
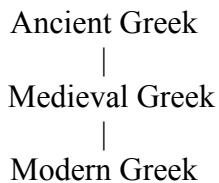
"Relatedness" should not be confused with "similarity". For example, Modern Persian is in a sense far more similar to Arabic than to Modern English, at least in vocabulary; thousands of words of Persian are borrowed from Arabic.

[dʒomˈhur]	'republic'
[ˈelm]	'science'
[mohænˈdes]	'engineer'
[velɑˈjæt]	'province'
[rædd]	'refutation'

If one's goal is to learn Persian, it may well be more useful to start off knowing Arabic than knowing English. Nevertheless, Persian is related to English (they are "cousins", both granddaughters of Proto-Indo-European); and Persian is not at all related to Arabic. One can see this in some of the core vocabulary of English and Persian:

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[194] The Italic family consists of Latin and a few poorly-attested sisters. As noted above, all of the Romance languages (also including: Portuguese, Romanian, Catalan, and others) descend from Latin.

[peˈdær]	'father'
[bærɑˈdær]	'brother'
[setɑˈre]	'star'
[gɑv]	'cow'
[æst]	'is'
[bor-d-æn]	'carry-past stem-infinitive' = "bear"
[bu-d]	'be-past tense'

Notice that these words, which are authentic cognates (shared inheritances) in English and Persian, are core, commonplace words—the kind that a language tends to hang on to. The words shared by Persian and Arabic are mostly more sophicated ones: Persian typically has borrowed its vocabulary for the spheres of higher learning from Arabic.

One result of looking at things in this way is that statements like (261):

(261) "Lithuanian is a very old language"

become meaningless. In fact, they are often just expressions of nationalistic sentiment. Leaving aside invented languages like Esperanto, all languages are equally old, in the sense that they all have an ancestry that goes back farther than linguists can trace. There are only two ways that the statement above could be given a true interpretation. It could mean that we have written records of Lithuanian dating back to the distant past; or it could mean that Lithuanian has changed very little over the centuries.

3. Sound change

Sound change is a fundamental mechanism of language change. That is, one of the principal reasons that languages change is because their sounds change. For example, the voiceless [l̥] in Old English [l̥af] 'bread' has become voiced [l] in Modern English. This change happened to all the voiceless [l̥]'s of Old English; for example, the words the words *lady*, *lot*, and *lean* originally began with voiceless [l̥]'s.[195]

As a language evolves, it is subjected to dozens or even hundreds of sound changes, until it takes on a form that would be unintelligible to the original speakers.

Sound change is connected in a curious way to phonology. Basically, sound change results from the fact that throughout its history, a language has a large number of phonological rules. The rules are the seeds of sound change.

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[195] The Old English for "lady" was *hlǽfdige*, literally "kneader of bread". "Lot" was *hlot*, and "lean" was *hlǽne*. All three forms are from the *Oxford English Dictionary*, available online from many university computers (including UCLA's) at http://dictionary.oed.com/.

However, it is important to see that sound change and phonological rules are not the same thing. A sound change is a *historical event*. For example, if all the words that in 1300 were pronounced with voiceless [l̥] are pronounced with voiced [l] in 1500, then we say that the language has undergone a sound change taking [l̥] to [l]. A phonological rule, on the other hand, is *something in the mind of a native speaker*; it is part of a speaker's unconscious mental grammar.

3.1 Sound change and restructuring

The link between phonological rules and sound change is a phenomenon called restructuring. To understand this concept, it will help to do an example in detail.

The sound change we will examine is a fairly recent one. As I noted earlier, American English is divided into a dialect that has an extra phoneme /ɔ/ and a dialect that lacks this phoneme. I will call the dialect that has /ɔ/ "Dialect A", and the dialect that lacks it "Dialect C" (why not "B" will become clear shortly). In Dialect A, *caught* is pronounced [ˈkɔt] and *cot* is pronounced [ˈkɑt]; whereas in Dialect C, both words are pronounced [ˈkɑt]. In fact, Dialect C has /ɑ/ in all words where Dialect A has /ɔ/.

	Dialect A	**Dialect C**
cot	[ˈkɑt]	[ˈkɑt]
caught	[ˈkɔt]	[ˈkɑt]
la	[ˈlɑ]	[ˈlɑ]
law	[ˈlɔ]	[ˈlɑ]
hock	[ˈhɑk]	[ˈhɑk]
hawk	[ˈhɔk]	[ˈhɑk]
generally:	[ɑ]	[ɑ]
	[ɔ]	[ɑ]

It can be argued that Dialect A represents the original state of the language, and that Innovating American English has undergone a sound change: ɔ has become ɑ in all environments. There are two reasons to believe this.

First, there is the fact that, with just a few exceptions, *speakers of Dialect A agree with each other* on which words have [ɔ] and which words have [ɑ]. This fact would be very difficult to explain unless the distinction is inherited. There's no official committee that decides to change the pronunciation of words. Rather, children usually just adopt the pronunciation of the previous generation.

The other reason to think that the [ɔ]-[ɑ] distinction reflects the earlier state of the language is that all the old written documents through the centuries spell out the distinction.[196] English spelling was *invented*, probably by scribes who already know how to read and write Latin. There's every reason to think that the old scribes did their best to reflect in their spelling what they heard with their ears.

Let us therefore adopt the assumption that Dialect C is the one that has innovated, and that it has undergone a sound change. What was the mechanism of the change? The clue lies in what I will call "Dialect B," the crucial intermediate case.

Speakers of B have free variation in the *caught* class of words. Extending the data above to B, we have:

	Dialect A	**Dialect B**	**Dialect C**
cot	['kɑt]	['kɑt]	['kɑt]
caught	['kɔt]	['kɔt] ~ ['kɑt]	['kɑt]
la	['lɑ]	['lɑ]	['lɑ]
law	['lɔ]	['lɔ] ~ ['lɑ]	['lɑ]
hock	['hɑk]	['hɑk]	['hɑk]
hawk	['hɔk]	['hɔk] ~ ['hɔk]	['hɔk]
generally:	[ɑ]	[ɑ]	[ɑ]
	[ɔ]	[ɑ] ~ [ɔ]	[ɑ]

It is in Dialect B that we can see sound change in progress. Evidently, B speakers have a rule of neutralization, which applies optionally—in other words, they *have* a distinction, but sometimes wipe it out phonologically. Here would be the phonological analysis of Dialect B:

(262) /ɔ/ **Unrounding**

ɔ → [−round] in all environments, optionally

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[196] A 1440 Latin glossary: "Hawke, *falco*". A 1398 source: þe hocke is a nesche herbe (as in *hollyhock*).

Example derivations:

hock	*hawk*		
/ˈhɑk/	/ˈhɔk/		phonemic form
—	ˈhɑk	—	/ɔ/ Unrounding
[ˈhɑk]	[ˈhɑk]	[ˈhɔk]	phonetic form
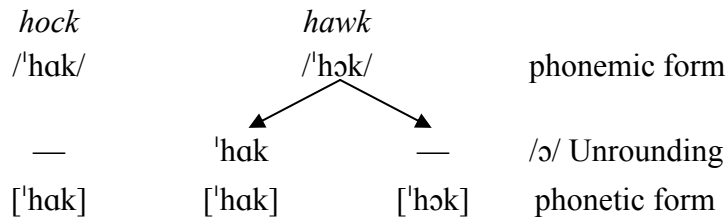
It is claimed here that B represents the intermediate stage in the historical evolution from A to C. When a language has an optional rule, it tends to be applied more and more often through time. That is, people's standards of what constitutes "careful speech" get lowered, and the casual-speech rules get applied more frequently.

The next step involves the introduction of a new generation of speakers. As young children, these speakers face the task of learning the phonemic system of their language. However, in the present case, the task is a very difficult one. The older speakers, who supply the data, have in their minds a phonemic distinction between /ɔ/ and /ɑ/. However, in their actual pronunciations, /ɔ/ is fairly rare, because most of the time these speakers apply the voicing rule. The new generation has very little data that they could use to learn the /ɔ/ phoneme. The potential for acquisition error is great.

It is easy to imagine how this situation will turn out. The younger generation is likely *not to notice the [ɔ]'s at all*, and they will acquire a different phonological system, in which [ɔ] plays no role at all. Here are the oldest, intermediate, and youngest phonological systems compared:

Dialect A

two phonemes, /ɔ/ and /ɑ/
no applicable phonology

Dialect B

two phonemes, /ɔ/ and /ɑ/
Phonological rule: ɔ → ɑ, optionally

Dialect C

one phoneme: /ɑ/
no applicable phonology

The interesting point is this:

- The speech of "late decadent" Dialect B and Dialect C are *almost identical*; B speakers pronounce the old [ɔ] words with [ɑ] (let us say) 95% percent of the time, whereas C speakers pronounce them with [ɑ] 100% of the time.

- But the phonological systems of B and C are drastically different, due to the acquisition error that created C—the children who brought C into existence failed to notice a phoneme, and thus also failed to learn the rule.

The technical name for this phenomenon is *restructuring*:

(263)   *Defn.: Restructuring*

a change in the phonological system of a language, induced by the phonological rules of the older generation.

Dialect C probably arose from a restructuring by younger speakers of the unstable phonological system of Dialect B. Dialect B in turn represents an innovation (through the introduction of the rule of /ɔ/ Unrounding) in Dialect C. American English in fact preserves all three dialects today, though we can perhaps anticipate that in a couple centuries Americans will all speak C.

To summarize, most sound changes are the result of the following process. (a) A new phonological rule is introduced into a language. (b) The rule is applied with increasing frequency. (c) A new generation restructures the system, getting rid of the rule.

It can now be seen why speakers don't notice their language changing. The basic ingredient of the change, the optional phonological rule, is an inherent, normal part of the language. The restructuring by the next generation is phonetically very minor, even though it is a radical change in the underlying system.

A bit of notation: when linguists write "→", the arrow implies a phonological rule: part of the knowledge of a living speaker. When they write ">" instead, they mean a sound change—a historical event that arose as a consequence of phonology. The fact that the material on either side of these sides is the same should not blind us to the fact that a rule and a sound change are logically very different things. Thus:

ɔ → ɑ   "/ɔ/ is realized as [ɑ]", part of grammar

ɔ > ɑ   "[ɔ] evolved into [ɑ]", part of history

4. The regularity of sound change

It is true of most phonological rules that they apply regularly. For example, the rule of Tapping in English is regular; there are no exceptions to it in the whole vocabulary. Now if sound change is the result of phonological rules, then we would expect sound change to be regular as well. In general, this turns out to be true. Thus, for instance, in Dialect C of American English, *not a single former* [ɔ] *is left*; they have all become /ɑ/.

To give another example: another recent, exceptionless sound change of American English converted /æ/ to /e/ before /ɹ/.[197] Here again, the conservative dialect still exists alongside the innovating dialect.

æ > e / ___ ɹ

Conservative dialect:	*marry*	[ˈmæɹi]	*Mary*	[ˈmeɹi]
	carry	[ˈkæɹi]	*Cary*	[ˈkeɹi]
	arable	[ˈæɹəbəl]	*airable*	[ˈeɹəbəl]
	Harry	[ˈhæɹi]	*hairy*	[ˈheɹi]

Innovating dialect:	*marry*	[ˈmeɹi]	*Mary*	[ˈmeɹi]
	carry	[ˈkeɹi]	*Cary*	[ˈkeɹi]
	arable	[ˈeɹəbəl]	*airable*	[ˈeɹəbəl]
	Harry	[ˈheɹi]	*hairy*	[ˈheɹi]

This is intended as one further example of the exceptionlessness of sound change: if you speak the innovating dialect, the odds are that you have no words whatever that still contain /æ/ before /ɹ/; indeed, such pronunciations may seem outright unnatural.

For a sound change that had exceptions, we can consider *ʊ → ʌ, which occurred roughly during the 1600's and affected most dialects of English.[198] This sound change had just a few exceptions (for example, *put*), which means that /ʊ/ survived as a phoneme, but is rare in English today.

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[197] A detail here: the phoneme /eɪ/ has the allophone [e] for most speakers before [ɹ]—it's monophthongal in this context.

[198] The regional dialects of northern England were not affected by this change, and speakers of these dialects use [ʊ] in many words where other speakers would use [ʌ], such as *luck*.

Study Exercise #78

Let's add in "Dialect BR" — standard British English, and do some comparisons with American Dialect A.

Word	BR	A
sore	[sɔ]	[sɔɹ]
saw	[sɔ]	[sɔ]
door	[dɔ]	[dɔɹ]
daw[199]	[dɔ]	[dɔ]
lore	[lɔ]	[lɔɹ]
law	[lɔ]	[lɔ]
pore	[pɔ]	[pɔɹ]
paw	[pɔ]	[pɔ]
roar	[ɹɔ]	[ɹɔɹ]
raw	[ɹɔ]	[ɹɔ]

Using the same reasoning as given earlier, decide which dialect has changed, what the change was, and what the original forms were.

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[199] A kind of bird.

Answer to Study Exercise #77

The original forms were like dialect A, the American one. There are two reasons to believe this is true. First, Americans agree with one another about which words should have an /ɹ/ in them. This would be very hard to explain if the /ɹ/'s were innovated. Second, the spelling of the words, established long before British and American English split, indicates the early presence of /ɹ/ in *sore*, *door*, *lore*, *pore*, and *raw*.

_____

The answer just given can be based on very little background knowledge. Looking up these words in the *Oxford English Dictionary*, I find that for all of these words, there are attestations that predate the split of American and British English (no earlier than 1607, the date of the first permanent English colony in America at Jamestown, Virginia). These clearly show an *r* in exactly the words that Southern Californians pronounce with /ɹ/ to this day.

1300:	þe touche of senewes haþ no feling of **soore** and of smerte.
1340:	File **sawe** and spindelle
1000:	Seo **duru** wæs belocen [200]
1600:	The theevish **Daw**, and the dissembling Pye.
1502:	Who wil not for shame a short tyme suffir **lore** and lerne.
1596:	The Venetian **Law** cannot impugne you as you do proceed.[201]
1400:	þat neiþer cold ne hoot ne schulde not sodeynli entre þe **poris** of the skyn.
1380:	This egle..with hys grymme **pawes** stronge (Chaucer)
1391:	With such a noise and such a **rore**
1325:	þe deuel huem afretye, **Rau** oþer a-roste![202]

One other fact: the *geography* of deleted /ɹ/ is what we would expect if it originated among fashionable people in London sometime in the 1600's or 1700's. It spread outward from London, reaching the large cities of Birmingham and Liverpool, but never reaching Scotland or Ireland or indeed much of the rural territory of England. R-less pronunciation was exported from England by emigration to Australia and New Zealand. To some degree it was exported to America and became part of the dialects of coastal cities such as Boston, New York, and Charleston, South Carolina. However, it arrived too late to affect the people who had already settled inland; hence the majority dialect in America (including California) preserves historical /ɹ/.

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[200] "The door was shut", from an English version of the Bible, Matthew 25:10.

[201] Shakespeare, *The Merchant of Venice* IV.1.178.

[202] I believe this is something like "The devil him affright, raw or roasted!".

5. How do languages make up for lost phonemes?

Before going on, I will address a problem that is raised by the sound changes we have seen. Notice that two of these sound changes eliminated phonemes from the language: ɔ > ɑ eliminated the /ɔ/ phoneme, and æ > e / ___ ɹ eliminated the /æ/ - /eɪ/ distinction before /ɹ/. In fact, sound changes do this fairly often. If this is so, why don't the world's languages gradually lose all their distinctions, and become an incoherent stream of muttering, say [dədədədədədədə]?

One answer is that languages **borrow** phonemes from neighboring languages. This happens frequently; for example, English borrowed the phoneme /v/ from French (it had a [v] before, but only as an allophone of /f/, not as a separate phoneme.)   Here are examples:

value   from French *vallue* ca. 1300
vanquish from French *vencus* ca. 1330
view   from French *veue* ca. 1415

Japanese long ago borrowed [tʃ] from Chinese ([tʃa] 'tea'), and much later [f] from English.[203]

However, it is also possible for a language to create a new phoneme entirely on its own. Here is an example of how this can happen, from the history of German. I will show how German created a new phoneme, during the transition from Old High German (the ancestor of Modern German, spoken around 1000 A.D.) to Middle High German (an intermediate stage, spoken around 1400 A.D.).

Here are the relevant facts. I give a partial paradigm for the adjective *hox* 'high' in both Old High German and Middle High German. [x] stands for a voiceless velar fricative, and [ø] is a front rounded vowel.

	OHG	*MHG*
'high'	ˈhox	ˈhox
'higher'	ˈhox-iro	ˈhøx-ərə
'highest'	ˈhox-isto	ˈhøx-əstə
'high (adv.)'	ˈhox-o	ˈhox-ə

You can see from the data that Middle High German has two sounds, /o/ and /ø/, where Old High German has only /o/. Further, /o/ and /ø/ must be separate phonemes, because there is no reasonable way to predict which one will occur in a given environment. Thus Middle High German has created a new phoneme. How was this done? The mechanism was simply sound

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[203] More precisely, Japanese uses the sound [ɸ], a voiceless bilabial fricative, to render English the phonetically similar /f/, as in [ɸaito] 'fight'; [ɸesutibaɾu] 'festival'.

change. The evolution of the forms above is the result of the following two sound changes, applying in the (historical) order given:

I. **Umlaut**:   o > ø / ___ [−syllabic] i

II. **Vowel Reduction**: $\begin{bmatrix} +\text{syllabic} \\ -\text{stress} \end{bmatrix}$ > ə

Umlaut turned /o/ into the corresponding front vowel [ø] when the vowel /i/ occurred in the next syllable (this makes sense, since /i/ is itself a front vowel). Vowel Reduction converted all the unstressed vowels into schwa. The stress in Old High German and Middle High German always fell on the first syllable, so in effect Vowel Reduction applied to all vowels in non-initial syllables.

The following derivations show how Umlaut and Vowel Reduction jointly created a new phoneme:

    hox-iro   hox-o
    höx-iro   hox-o   Umlaut
    höx-ərə   hox-ə   Vowel Reduction

By itself, Umlaut introduced only a new allophone. At the beginning of its existence, [ø] was only a phonetic variant of /o/. The dirty work was done by Vowel Reduction: this sound change obliterated the environment that had triggered Umlaut. The sound [ø] was "stranded"; it was no longer predictable from the context, and thus came to be a phoneme on its own.

You can see, then, that it is possible for a language to acquire a new phoneme, strictly from its own resources, without borrowing it. The general mechanism is this: a new rule created an allophone, then a later sound change wipes out the conditioning environment for that allophone. The allophone then stands alone as a new phoneme.

One further point: it's clear that the "wiping out of conditioning environments" often will happen, as it did in German, by removing phonemes—what averts the crisis of the language's words becoming so short that they get confused with each other? The answer appears to be that morphology comes to the rescue. For instance, a striking aspect of Mandarin Chinese is that a great fraction of its basic vocabulary consists of compound words. It is thought that this compounding arose as a response to massive phonological erosion, the result of sequence of dramatic sound changes in the earlier history of the language.[204]

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[204] A miniature example of the same kind, from the Web, where a Southerner reports: "The reason we say *straight pin* is that, in many Southern dialects, *pin* and *pen* are homonyms. To ensure that the correct item is fetched, one says *Please fetch me a straight pin* or *Please fetch me an ink pen*. (Source: http://everything2.com/e2node/straight%2520pin) The sound change that took place in Southern dialects is *ɛ > ɪ / __ [+nasal], hence [pɪn] for both *pin* and *pen*.

The overall picture is that languages manage (probably through the efforts of innovating children during the course of acquisition) to retain a kind of balance, in which there are sufficient phonemic contrasts, and the words are sufficiently long, to keep the vocabulary items reasonably distinct from one another.

6. The Comparative Method

I said earlier that the modern Germanic languages all descend from a single ancestor, called Proto-Germanic. In addition, both Proto-Germanic and Latin descend from a common ancestor called Proto-Indo-European. We do not have written records of either Proto-Germanic or Proto-Indo-European. How do we know that these languages existed, and how do we know what they looked like?

Our knowledge is the result of the **Comparative Method**. The Comparative Method is a way of recovering information about a lost proto-language by comparing its known daughter languages. This method was worked out over the course of the 19th century by a research community of mostly European linguists.[205]

The basis of the Comparative Method is the fact that sound change is normally regular. It is the regularity of sound change that permits us to prove that languages are related, and to recover information about their lost ancestor.

In outline, the Comparative Method works like this:

a) Compare sister languages sound by sound.
b) Determine what *regular* sound changes could have given rise to the correspondence of different sounds across languages.
c) "Reconstruct" the original language by undoing the various sound changes.

To illustrate the Comparative Method, I will apply it to the language of instruction in this course, comparing it with its sister languages German and Swedish to recover information about the hypothesized answer, namely Proto-Germanic. Here is the first batch of data:[206]

		English	*German*	*Swedish*
A.	*good*	ˈgʊd	ˈguːt	ˈguːd
	drive	ˈdraɪv	ˈtraɪb-ən	ˈdriːv-a[207]

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[205] A picture of one of them, Jacob Grimm, appears on the course Web site. Grimm was also a pioneer, in collaboration with his brother Wilhelm, in the scholarly collection of folklore.

[206] Swedish forms were converted to IPA using the rules given in Philip Holmes and Ian Hinchcliffe (1997) *Swedish: An Essential Grammar*, Routledge. I have not yet checked my conversions with a Swedish speaker. For future reference, the Swedish words below are spelled: *god*, *driva*, *rida*, *vid*, *dåd*, *grön*, *gå*, *giva*, *gås*, *binda*, *rund*, *land*, *hund*, *lind*, *stol*, *sten*, *bäst*, *lista*, *vit*, *fot*, *söt*, *ut*, *tecken*, *salt*, *smärta*, *spinna*, *spade*, *löpa*, *hop*, *pund*, and *pipa*.

[207] For simplicity I'll ignore the phonetic differences between English, German, and Swedish *r*, which are actually [ɹ], [ʁ] (voiced uvular approximant), and [r].

ride	ˈraɪd	ˈraɪt-ən	ˈriːd-a
wide	ˈwaɪd	ˈvaɪt	ˈviːd
deed	ˈdid	ˈtaːt	ˈdoːd

The data have been chosen in the following way. They all contain a /d/ in English, and the corresponding German and Swedish forms are phonetically similar and mean roughly the same thing. (In the German forms, I have added a suffix in various places. This simplifies the problem, without distorting it in any crucial way.)

The crucial observation to be made here is this: wherever English has /d/, Swedish also has /d/ in the same location of the word; but German has /t/. We can express this as a formula:

English	*German*	*Swedish*
d	t	d

The formula holds true not just for these words, but for hundreds of words throughout vocabularies of the three languages.

What could account for the d-t-d correspondence? The answer proposed here is:

(a) English, German, and Swedish all descend from the same proto-language. That is, at one time they all *were* the same language, namely Proto-Germanic.
(b) Following the breakup of Proto-Germanic, German underwent a sound change that changed /d/ to /t/ in all environments.

Because sound change is regular, this explanation accounts for the regularity of the t-d-t correspondence.

There is a standard way of expressing our hypothesis in a compact form. We use an asterisk to designate a hypothetical sound; thus if we assume that Proto-Germanic had a /d/, we designate the /d/ as *d. (Thus in historical linguistics, asterisk means "hypothetical", not "ungrammatical".). We can write the proposed sound changes with the same notation as phonological rules. Here, then, is the analysis:

Correspondence:

English	*German*	*Swedish*	*Proto-Germanic*
d	t	d	*d

Sound change:

d > t   in German

Notice that this is not the only possible analysis. It is conceivable that Proto-Germanic had *t, and that English and Swedish changed; or even that Proto-Germanic had something completely different, and all three daughters changed. What we say about the *phonetic identity* of the original

sound is a more or less educated guess; what we can be sure about is that there was some particular sound in Proto-Germanic that gave rise to English /d/, German /t/, and Swedish /d/.

Note finally that the sound change is hypothesized to have once been a phonological rule; that is, that the early speakers of German first optionally changed their /d/'s to [t]'s, and gradually came to do this regularly, causing the next generation to restructure (see section 3.1 above).

Let us continue the reconstruction, with the following data:

		English	*German*	*Swedish*
B.	*good*	ˈgʊd	ˈguːt	ˈguːd
	green	ˈgrin	ˈgryːn	ˈgrøːn
	go	ˈgoʊ	ˈgeː-ən	ˈgoː
	give	ˈgɪv	ˈgeːb-ən	ˈgiːva
	goose	ˈgus	ˈgans	ˈgoːs

Here the focus is on /g/. Clearly, not much work is needed here, since all three language have this sound. The most reasonable hypothesis is that Proto-Germanic had *g, and that it has evolved unchanged in the daughter languages.

Correspondence:

English	*German*	*Swedish*	*Proto-Germanic*
g	g	g	*g

The following examples look like they might be a problem. Where English and Swedish have /d/, German has /d/, rather than the expected /t/:

		English	*German*	*Swedish*
C.	*bind*	ˈbaɪnd	ˈbind-ən	ˈbind-a
	round	ˈraʊnd	ˈrund-ə	ˈrund
	land	ˈlænd	ˈland-əs	ˈland
	hound	ˈhaʊnd	ˈhund-ə	ˈhund
	linden	ˈlɪndən	ˈlind-ə	ˈlind

The problem can be resolved if we carefully compare the data under A with the data under C. In all the examples of C, the /d/ of German occurs *after /n/*. In the examples of A, the /t/ of German never occurs after /n/. We know already that phonological rules have environments; so it is reasonable to suppose that the *d > t change had one. In particular, it was blocked after /n/, so that in this set of words German retains the Proto-Germanic /d/. The analysis, then, must be something like this:

Correspondence:

	English	German	Swedish	Proto-Germanic
	d	t	d	*d
	d	d	d	*d

Sound change:

   d > t except / n ___   in German

Sometime the environments for a sound change are more complicated. In the following data, we are looking at what corresponds to English /t/. In German, /ts/ stands for an alveolar affricate:

		English	German	Swedish
D(i)	*stool*	ˈstul	ˈʃtuːl	ˈstuːl
	stone	ˈstoʊn	ˈʃtaɪn	ˈsteːn
	best	ˈbɛst	ˈbɛst-ə	ˈbɛst
	list	ˈlɪst	ˈlɪst	ˈlista
(ii)	*white*	ˈwaɪt	ˈvaɪs	ˈviːt
	foot	ˈfʊt	ˈfuːs	ˈfuːt
	sweet	ˈswit	ˈzyːs	ˈsøːt
	out	ˈaʊt	ˈaʊs	ˈʉːt[208]
(iii)	*token*	ˈtoʊkən	ˈtsaɪxən	ˈtɛken
	salt	ˈsɔlt	ˈzalts	ˈsalt
	smart[209]	ˈsmart	ˈʃmɛrts-ən	ˈsmerta
	Lent	ˈlɛnt	ˈlents	?

The correspondences are as follows:

---

[208] [ʉ] is a high central rounded vowel.

[209] In the sense of pain, as in "that smarts".

		English	German	Swedish
D.	i.	t	t	t
	ii.	t	s	t
	iii.	t	ts	t

It is possible to show that all three rows reflect *t in Proto-Germanic. German retains /t/ after a fricative, shifts *t to /s/ after a vowel (including a diphthong), and shifts *t to the affricate /ts/ in word initial position or after a non-fricative consonant. The analysis would be as follows:

		English	German	Swedish	Proto-Germanic
D.	i.	t	t	t	*t
	ii.	t	s	t	*t
	iii.	t	ts	t	*t

Sound Changes in German:

t > [+fricative] /   [+syllabic] ___

$$t \; > \; [\text{+affricate}] \; / \; \begin{bmatrix} -\text{syllabic} \\ -\text{fricative} \end{bmatrix} \underline{\quad}$$

One more set of data suggests a slight revision of the analysis:

		English	German	Swedish
E.	*spin*	ˈspɪn	ˈʃpɪn-ən	ˈspɪna
	spade	ˈspeɪd	ˈʃpaːtən	ˈspaːde
	leap	ˈlip	ˈlaʊf-ən	ˈløːpa
	heap	ˈhip	ˈhaʊfən	ˈhuːp
	pound	ˈpaʊnd	ˈpfund-əs	ˈpund
	pipe	ˈpaɪp	ˈpfaɪf	ˈpiːpa

Here the correspondences are as follows:

English	German	Swedish
p	p	p
p	f	p
p	pf	p

In analyzing these data, the trick is to ignore temporarily the minor difference between bilabials and labio-dentals, and refer to them collectively as "labials". If we do this, we find a close similarity between the labials and the alveolars. That is, German has converted stops to fricatives after a vowel or glide, and has converted stops to affricates after a non-fricative consonant. Thus to

handle the labials, we needn't assume additional sound changes, but only generalize the previous ones:

	English	*German*	*Swedish*	*Proto-Germanic*
	p	p	p	*p
	p	f	p	*p
	p	pf	p	*p

Sound Changes in German:

$$\begin{bmatrix} +\text{stop} \\ -\text{voiced} \end{bmatrix} \; > \; [+\text{fricative}] \;/\; [+\text{syllabic}] \underline{}$$

$$\begin{bmatrix} +\text{stop} \\ -\text{voiced} \end{bmatrix} \; > \; [+\text{affricate}] \;/ \begin{bmatrix} -\text{syllabic} \\ -\text{fricative} \end{bmatrix} \underline{}$$

There are a couple of loose ends to clear up. First, we have to add some detailed sound changes to specify our rather vague "labials" of German as either bilabial or labiodental. This step is not particular interesting, so I will skip it here. We also have to determine the facts for the third voiceless stop of Proto-Germanic, namely *k.

For the first sound change (the one that created fricatives), we are on safe ground. Proto-Germanic *k did indeed become a fricative (the velar one) in German, as is shown by cases like *token = tsaɪxən, seek = zux-ən, make = max-ən*. The messy part concerns the expected velar affricate /kx/. This does exist in Swiss German, and written records show that it once existed through much of the German-speaking area. However, a later sound change caused /kx/ to revert back to /k/ in most German dialects. Thus the system as it stands today is not as symmetrical as we might expect.

At this point we have reconstructed several sounds of Proto-Germanic using the Comparative Method:

> *p   *t   *k
>   *d   *g

We could go on, until we have reconstructed the entire inventory of Proto-Germanic phonemes. When this is done, we can reconstruct entire words. For example, the Proto-Germanic word for 'good' (English *gʊd*, German *guːt*, Swedish *guːd*) has been reconstructed as **guːd*. One can use similar methods to reconstruct much of the morphological system, and, to a limited extent, even the syntax.

I should admit that this exercise is artificial in an important way. No one seriously attempting to reconstruct Proto-Germanic would use Modern English, Modern German, and Modern Swedish as the basis of the reconstruction. Much better results are obtained by using the oldest available written records of these languages. Real reconstructions employ Old English (oldest records 800's

A.D.) instead of Modern English, Old High German (800's A.D.) instead of Modern German, and Old Norse (800's) instead of Swedish. Other languages are used as well. The oldest attested data from a Germanic language is from Gothic, a language now extinct that was spoken by one of the tribes that overran the Roman Empire. Parts of the Bible were translated into Gothic around 600 A.D.

To summarize: the comparative method involves (a) locating "sister words" from sister languages; (b) determining the sound correspondences; (c) writing the sound changes in each language; and (d) determining the original forms to which the sound changes applied.

Study Exercise #79: Proto-Germanic θ

The following correspondence sets illustrate the fate of Proto-Germanic *θ in English, German, and Swedish. The German data are slightly fudged, as *bad*, *klaɪd*, *tod*, and *laɪd* are actually pronounced [bat], [klaɪt], [tot], and [laɪt]. The pronunciations shown are used whenever an ending is added to the word. For purposes of the problem, assume the pronunciations given.

		English	*German*	*Swedish*
1.	*bath*	[bæθ]	bad	bad
2.	*brother*	[brʌðɚ]	bruder	bruder
3.	*cloth*	[klɔθ]	klaɪd	kled
4.	*death*	[dɛθ]	tod	dod
5.	*further*	[fɚðɚ]	(be)fordərn	(be)furdra
6.	*loath*	[loʊθ]	laɪd	led
7.	*thank*	[θɪŋk]	daŋk	takk
8.	*thing*	[θɪŋ]	dɪŋ	tiŋ
9.	*three*	[θri]	draɪ	tre

a. Arrange the data into phonetic correspondence sets, i.e. complete the chart that would begin as follows:

```
Eng.   Ger.   Swed.
θ      d      d      1,3...
ð      d      d      2,5
```

b. Determine the sound changes that *θ has undergone in the three languages, and write them in the format

X > Y / P___Q   in Language L

c. The following cases seem to go against what you've seen before (cf. nos. 1, 3, 4, and 6). How might they be explained?

10. *bathe*	[beɪð]	baden	bada
11. *clothe*	[kloʊð]	klaɪden	kleda
12. *loathe*	[loʊð]	laɪden	leda

There are two clues to consider: first, the spelling of English was established long ago in the history of the language, before a number of sound changes took place. Second, consider differences in the corresponding German and Swedish forms.

Answer to Study Exercise #78

a. *English German Swedish*

θ	d	d	1,3,4,6
ð	d	d	2,5
θ	d	t	7,8,9

b. English: θ > ð / [+syllabic] ___ [+syllabic]

German: θ > d   (everywhere)

Swedish: θ > t / [_word_ ___
            θ > d / elsewhere

c. These forms have English /ð/ matching German and Swedish /d/, whereas the "normal" forms of 1, 3, 4, and 6 have English /θ/ matching German and Swedish /d/.

We know that in English, *θ became [ð] just in case it was between two [+syllabic] segments. A reasonable hypothesis would be that *at the time of the θ > ð sound change*, the *θ's of *bathe*, *clothe*, and *loathe* really were between two [+syllabic] sounds; in particular, that there was a final vowel in these words that is no longer pronounced. The final vowel dropped out only after the θ > ð change had already happened.

The history of *bathe* under this hypothesis would be as follows:

*beɪθə   (assuming that the final vowel was schwa)
beɪðə   θ > ð / [+syllabic] ___ [+syllabic]
beɪð   dropping of final schwas

There are a number of facts supporting this hypothesis. First of all, the "missing vowel" really is present in German and Swedish. That is, in those cases in which English has "mysterious ð", German and Swedish have an extra vowel that is missing in English; and in those cases in which English has the normal final [θ], German and Swedish do not have an extra vowel. That is, we can use German and Swedish to suggest what English originally looked like, and thus explain an otherwise mysterious change.

In addition, notice that in just those cases where English has "mysterious ð", the spelling puts a "silent *e*" at the end of the word. This silent *e* is pointless from a modern point of view, but it makes sense if the *e* was at one time pronounced. The spelling of these words remained the same, even though one of the vowels was no longer present.

7. Study Exercise #80: Proto-ABC

This problem has made-up data, but the patterns are patterns seen in real language histories.

We assume a proto-language, called ABC, with three attested daughter languages, A, B, and C. The goal is to characterize the sound system of Proto-ABC and all of the sound changes that applied in its daughter languages.

The data below are alphabetized by Language A, but not otherwise organized.

No.	Language A	Language B	Language C	gloss[210]
1	kaku	kaku	kaku	'snow'
2	kapo	kabo	kaba	'daughter-in-law'
3	kawi	gawi	gawi	'lamb'
4	kene	gene	dʒana	'salmon'
5	kepi	gebi	dʒabi	'victory'
6	keta	geda	dʒada	'cow'
7	kiko	giko	dʒika	'grass'
8	kiko	giko	dʒika	'ancestor'
9	kita	kida	tʃida	'rye'
10	kitu	kitu	tʃitu	'weft'
11	kopa	kopa	kapa	'loom'
12	kopu	kobu	kabu	'harness'
13	kuki	kugi	kudʒi	'reins'
14	mame	mame	mama	'battle'
15	maru	malu	maru	'goddess of the hearth'
16	mupu	mubu	mubu	'bridle'
17	mura	mula	mura	'sacrifice'
18	mura	mula	mura	'wine'
19	naki	naki	natʃi	'wheat'
20	nari	nali	nari	'rain'
21	newi	newi	nawi	'sheep'
22	niwo	niwo	niwa	'elbow'
23	noto	noto	nata	'goddess of wisdom'
24	pako	pako	paka	'chicken'
25	peka	peka	paka	'old'
26	peko	bego	baga	'wool'
27	pika	bika	bika	'wheel'
28	poke	boke	batʃa	'brother-in-law'

---

[210] The glosses are meant to be words that could have occurred in Proto-Indo-European, a society that (as we know from the actual reconstructed vocabulary) raised crops, milked cows, obtained wool from sheep, spun and wove cloth, fought with chariots, and worshipped many gods.

29	poku	pogu	pagu	'linen'
30	pomo	pomo	pama	'god of thunder'
31	pono	bono	bana	'sow (seeds)'
32	popa	bopa	bapa	'young'
33	puke	puke	putʃa	'plow'
34	punu	punu	punu	'goat'
35	putu	budu	budu	'shield'
36	rike	like	ritʃa	'household god'
37	riwu	liwu	riwu	'blanket'
38	roti	loti	rati	'sky'
39	ruti	ludi	rudi	'chief'
40	taki	tagi	tadʒi	'roast'
41	tawo	dawo	dawa	'cloud'
42	tepo	depo	dapa	'altar'
43	tewe	tewe	tawa	'pray'
44	tinu	dinu	dinu	'harvest'
45	tipi	dibi	dibi	'god of war'
46	tipu	dibu	dibu	'chariot'
47	tita	dida	dida	'gizzard'
48	tito	dito	dita	'amphora'
49	towu	towu	tawu	'beget'
50	wute	wute	wuta	'spear'
51	kupa	kupa	kupa	'sword'
52	kuma	guma	guma	'leather'

Here is the problem solved, through a series of Socratic questions.

Question: (a) Find the correspondence series for liquids (l, r), and conjecture what was the ancestor sound.

Answer to Study Exercise #79, part (a):

Everywhere (for example: 15, 17, 18, 36-39), we find that A, B, C, have [r, l, r]. The simplest guess is that *r in Proto-ABC evolved into [l] in B.

R to L

r > l   in Language B

Study Exercise #79, Question (b)

 Give the inventories of stops and affricates in A, B, and C, arranging them into one chart for each language.

Answer to Study Exercise #79, question (b)

			[+bilabial]	[+alveolar]	$\begin{bmatrix} \text{+palato-} \\ \text{alveolar} \end{bmatrix}$	[+velar]
A	[+stop]	[−voice]	p	t		k
B:	[+stop]	[−voice]	p	t		k
		[+voice]	b	d		g
C:	[+stop]	[−voice]	p	t		k
		[+voice]	b	d		g
	[+affricate]	[−voice]			tʃ	
		[+voice]			dʒ	

Study Exercise #79, Question (c)

Find the correspondence series for bilabial stops and reconstruct the ancestor sounds.

Answer to Study Exercise #79, question (c)

There are two series:

    A   B   C
    p   b   b   as in 2, 5, 12, 16, 26-28, etc.
    p   p   p   as in 11, 24, 25, 30, etc.

Two possibilities: one single proto-sound *p, with it changing to [b] in some context in Languages B and C. Or, two proto-sounds *p and *b, with a merger to p in Language A.

It seems pretty hopeless to find a context into which *p could have evolved into b: look for instance at

    B 30 [pomo] vs. 31 [bono]

or at

    B 25 [peka] vs. B 26 [bego].

So it seems more sensible to set up two proto-stops, as follows:

    *p
    *b

and assume

    b > p in A.

This sound change works perfectly for the data, since there are no [b] in Language A.

_____

Study Exercise #79, Question (d)

Find the correspondence series for alveolar stops and reconstruct the ancestor sounds.

Answer to Study Exercise #79, question (d)

This works very similarly. There are two series.

t d d   as in 6, 9, 41, 42, 44, 45, etc.
t t t   as in 10, 23, 40, 43, etc.

It looks pretty hopeless to try to derive the modern [d] from *t—for instance, why would t become d in Language B 42 [depo], but remain t in Language B 43 [tewe]? Better to assume that *t and *d were proto-sounds, and that the distinction got wiped out everywhere in A.

*t
*d

*d > t in A

This is actually encouraging, because it's entirely similar to the bilabials above. So it now becomes sensible, indeed imperative, to look at the velars.

_____

Study Exercise #79, Question (e)

For the moment, ignore the palato-alveolars. Find the correspondence series for velar stops and reconstruct the ancestor sounds.

Answer to Study Exercise #79, question (e)

With the hint that we ignore palato-alveolars, the data look very much like the data for the last two cases.

k g g   as in 3, 26, 29
k k k   as in 1, 2, 11, 12, 13, 24, 25, 27, etc.

As before, it's very unlikely that the voicing distinction arose by a sound change — compare 25 and 26 in Languages B and C. So we can set up:

*k
*g

*g > k in A

_____

Study Exercise #79, Question (f)

Generalize your findings of the last three sections using features.

Answer to Study Exercise #79, question (f)

    Stop Devoicing

    *[+stop] > [−voice] in A

_____

Study Exercise #79, Question (g)

What are the vowel inventories of A, B, and C? Form a chart listing the vowels by their features.

Answer to Study Exercise #79, question (g)

[ieaou], [ieaou], and [iau], respectively. Here is the chart:

	[−back]	[+back]
$\begin{bmatrix} +\text{high} \\ -\text{low} \end{bmatrix}$	i	u
$\begin{bmatrix} -\text{high} \\ -\text{low} \end{bmatrix}$	e	o
$\begin{bmatrix} -\text{high} \\ +\text{low} \end{bmatrix}$		a

---

Study Exercise #79, Question (h)

Find the correspondence series for vowels and reconstruct. To save time, here is a hint: the original system had five vowels.

Answer to Study Exercise #79, question (h)

    a a a   1, 2, 10, etc.
    e e a   4, 14, 21, etc.
    o o a   2, 7, 8, 11, 12, etc.
    i i i   3, 7, 8, 9, 10, etc.
    u u u   1, 10, 12 etc.

Given the hint, it's a fairly obvious move to set up this proto-vowel system:

*i, *e, *a, *o, *u

and then assume a massive wiping out of distinctions in C: all three of [e,a,o] emerged as [a].

Mid Vowel Lowering

*e, *o > a in Language C

In features, this would be:

$$*\begin{bmatrix} +\text{syllabic} \\ -\text{high} \end{bmatrix} > [+\text{low}, +\text{back}]$$

Study Exercise #79, Question (i)

Collect local environments for [k], [tʃ], [g], [dʒ] in Language C. Retain the original data next to them. What vowels can follow k, g in C?

Answer to Study Exercise #79, question (i)

[k]:

No.	Language A	Language B	Language C	environment
1	kaku	kaku	kaku	[___a
1	kaku	kaku	kaku	a___u
2	kapo	kabo	kaba	[___a
11	kopa	kopa	kapa	[___a
12	kopu	kobu	kabu	[___a
24	pako	pako	paka	a___a
25	peka	peka	paka	a___a
27	pika	bika	bika	i___a
51	kupa	kupa	kupa	[___u

[g]:

No.	Language A	Language B	Language C	environment
3	kawi	gawi	gawi	[___a
26	peko	bego	baga	a___a
29	poku	pogu	pagu	a___u
52	kuma	guma	guma	[___u

[tʃ]:

No.	Language A	Language B	Language C	environment
9	kita	kida	tʃida	[___i
10	kitu	kitu	tʃitu	[___i
19	naki	naki	natʃi	a___i
28	poke	boke	batʃa	a___a
33	puke	puke	putʃa	u___a
36	rike	like	ritʃa	i___a

[dʒ]:

No.	Language A	Language B	Language C	environment
4	kene	gene	dʒana	[___a
5	kepi	gebi	dʒabi	[___a
6	keta	geda	dʒada	[___a
7	kiko	giko	dʒika	[___i
8	kiko	giko	dʒika	[___i
13	kuki	kugi	kudʒi	u___i

40   taki   tagi   tadʒi   a___i

In C:
[k] and [g] can be followed by [a] or [u].
[tʃ] and [dʒ] can be followed by [a] or [i].

Study Exercise #79, Question (k)

See if you can find a solution in which there were only *k and *g in Proto-ABC, with all instances
of [tʃ] and [dʒ] resulting from sound change. The big challenge is that in C, both [k] and [tʃ] can
occur before [a], and likewise both [g] and [dʒ] can occur before [a]. Hint: look at the *original*
vowel of the [a]'s preceded by [tʃ] and [dʒ], versus the original form of the [a]'s preceded by [k]
and [g].)

Answer to Study Exercise #79, question (k)

Cases where *k evolved into [tʃ]:

Environment   *Example*

- followed by an [i]   9 [tʃida]
- followed by an [a] that used to be an [e]   28, [batʃa]; compare B [boke]

Cases where *k stayed [k]:

- followed by an [u]   1 [kaku]
- followed by an [a] has always been [a]   1 [kaku]; compare B [kaku]
- followed by an [a] that used to be an [o]   11 [kapa]; compare B [kopa]

So it looks like *k evolved into [tʃ] just in case—at the time—it was followed by [i] or [e]. These are the [−back] vowels.

We can confirm this with the voiced counterparts [g] and [dʒ].

Cases where *g evolved into [dʒ]:

- followed by an [i]   7, [dʒika]
- followed by an [a] that used to be an [e]   6, [dʒada]; compare B [geda]

Cases where *g stayed [g]:

- followed an [u]   29 [pagu]
- followed by an [a] that has always been [a]   3 [gawi]; compare B [gawi]
- followed by an [a] that used to be [o]   26, [baga]; compare B [bego]

So it looks like *g evolved into [dʒ] just in case—at the time—it was followed by [i] or [e], that is, by a front vowel.

Here is everything set up by sound changes.

(264) **Palatalization**[211]

$$*\begin{bmatrix} +\text{velar} \\ +\text{stop} \end{bmatrix} > \begin{bmatrix} -\text{velar} \\ +\text{palato-alveolar} \\ -\text{stop} \\ +\text{affricate} \end{bmatrix} / \underline{\quad} \begin{bmatrix} +\text{syllabic} \\ -\text{back} \end{bmatrix}$$

"Velar stops evolved into palato-alveolar affricates when they preceded a front vowel."

Historically, Palatalization must have taken place before Mid Vowel Lowering, since it was triggered by proto-*e, before *e was converted to [a].

_____

Study Exercise #79, Question (l)

Provide historical derivations for 15, 3, 4, 8, 9, and 33, in each language.

_____

[211] This is the general term for any phonological rule or sound change that moves sounds into the general territory of the hard palate (including not just the palatal place of articulation, but also the palato-alveolar).

Answer to Study Exercise #79, question (l)

Language A:

15	3	4	8	9	33	
*maru	*gawi	*gene	*giko	*kida	*puke	Proto-ABC
—	k	k	k	t	—	Stop Devoicing
maru	kawi	kene	kiko	kita	puke	Language A

Language B:

15	3	4	8	9	33	
*maru	*gawi	*gene	*giko	*kida	*puke	Proto-ABC
l						R to L
malu	gawi	gene	giko	kida	puke	Language B

Language C:

15	3	4	8	9	33	
*maru	*gawi	*gene	*giko	*kida	*puke	Proto-ABC
—	—	dʒ	dʒ	tʃ	tʃ	Palatalization
—		a a	a	—	a	Mid Vowel Lowering
maru	gawi	dʒana	dʒika	tʃida	putʃa	Language C

Thus, we see Proto-ABC as having had a fairly simple phonological system, with the six stops [ptk bdg], various other consonants, and five vowels [ieaou]. The voicing contrast was wiped out in A. C underwent a fairly complex chained development, first developing the palato-alveolars from velars before front vowels, then radically simplifying the vowel system to just [iau]. In B, a trivial change shifted *r to [l].

8. The reconstruction of Proto-Indo-European

The greatest achievement of the comparative method has been the reconstruction of Proto-Indo-European. Indo-European is so-called because the Indo-European languages in their original territory (before the age of Western expansion) stretched from Europe to India. Proto-Indo-European was reconstructed over a long period of research that spanned most of the 19th century; the details are still being worked out today. The field of historical linguistics in fact was developed mostly as a result of the efforts to understand the relationships of the Indo-European languages.

The Indo-European family was mentioned above in connection with the concept of descent. Here is a more detailed family tree given in outline form. Extinct languages are shown in italics.

(265)   *The Indo-European family tree*

Italic, comprising
    Latin and its modern descendents, the Romance languages
    various ill-attested ancient languages of Italy
Greek (*Ancient Greek*, *Medieval Greek*, Modern Greek)
Indo-Iranian, comprising
    Indic (*Sanskrit*, Hindi, Bengali, Marathi, Sinhala, many others)
    Iranian (Persian, Pashto, Kurdish, others)
Balto-Slavic, comprising
Baltic (Latvian, Lithuanian)
Slavic (Russian, Ukrainian, Polish, Czech, Serbo-Croatian, Slovenian, Bulgarian,
    Macedonian)
Germanic (see above)
Celtic (ancestor of Irish, Scots Gaelic, Welsh, Breton, *Gaulish*, *Cornish*)
Albanian
Armenian (today attested in two main daughter languages, Eastern and Western Armenian)
Hittite (Turkey, earliest written records of any Indo-European language)
Tocharian (Central Asia)

The reconstruction of the family was made much easier by the fact that so many branches of the family are attested in very old written documents; roughly 1700 B.C. for Hittite, 1500 B.C. for Sanskrit, 1200 B.C. for Mycenaean Greek.

One can find numerous foreign words that descend from the same Proto-Indo-European root as familiar English words. These words are familiar, because English has borrowed heavily from Latin and Greek. The following table gives some examples.

	PIE
English *father*	*pəter
Latin *pater* (cf. *pater*nal)	
Greek *pate:r* (cf. *patri*arch)	
Persian *pedær*	
English *heart*	*kerd
Greek *kardia* (cf. *cardiac*)	
Latin *kord* (cf. *cord*ial)	
English *bear*	
Latin *fer* (cf. trans*fer*)	*bher
Greek *pherein* (cf. am*phor*a) 'vessel to carry things in'	
English *two*	
Latin *duo* (cf. *du*al)	*dwo
Greek *dis* (cf. *di*syllabic)	
Armenian *erku*	

Proto-Indo-European is believed to have been spoken about 6000 years ago, give or take a few thousand years. The Armenian form *erku* in the table gives an idea of how far a word can evolve through sound change in this amount of time.

9. Grimm's Law

You'll see in the examples above that the consonants of Germanic generally deviate from those of the remaining Indo-European languages. This is due to what is probably the most famous of all sound changes, **Grimm's Law**. In very rough outline, Grimm's Law looked like this:

Proto-Indo-European		*Proto-Germanic*
p t k	>	f θ h[212]
b d g	>	p t k
bʰ dʰ gʰ	>	b d g

Here are examples:

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[212] On grounds of phonetic symmetry we would expect a voiceless velar fricative [x]. This probably was an intermediate stage on the way to [h]; for example, in Polish [x] can be optionally pronounced [h].

father, Latin *pater*   *three*, Greek *treis*   *heart*, Greek kardia:

hemp, Greek *kannabis*   *two*, Latin *duo*   *knee*, Latin *genu:*[213]

brother, Latin *fra:ter*[214]   *do*, Sanskrit *dʰa:-*[215]   *guest*, Latin *hostis*[216]

The American Heritage Dictionary is to my knowledge the only dictionary that bothers to take the etymologies all the way back to Proto-Indo-European. You can find the original roots for these correspondences in their Indo-European appendix:

*pəter	*trei	*kerd
*kannabis	*dwo	*genu
*bhra:ter	*dhe:	*ghosti

10. The method of reconstructed environments

The most virtuosic application of the Comparative Method uses a technique that, oddly, has no standard name. To fill this gap, I will call it here the **method of reconstructed environments** here.

> In the **method of reconstructed environments**, the environment for a sound change in Language A, which is no longer present in A, is determined using data from sister language B.

The method was already illustrated in the Proto-ABC example above. We used the vowels of A and B to solve the problem of the sound change k g > tʃ dʒ in C.

Proto-ABC is modeled on a real-life case, namely the history of Sanskrit, of which the following data are representative.

Latin	Old English	Greek	Sanskrit	gloss
-kwe	—	-te	-tʃa	'and'
kwis	hwa:	tis	tʃid	'who'
kwod	hwæt	—	-kas	'what'
—	hwæθer	poteros	kataras	'which of the two'
kwando	hwanne	—	kada:	'when'

The correspondence series here are these:

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[213] [kni], until about 1700

[214] The Proto-Indo-European bʰ, preserved in Sanskrit bʰa:tar, became f in Latin.

[215] Meaning "to set".

[216] The Proto-Indo-European gʰ became h in Latin.

Latin	*Old English*	*Greek*	*Sanskrit*	
kw	hw	t	tʃ	(first two)
kw	hw	p	k	(last three)

Normally, these are attributed to Proto-Indo-European *kw, which survived intact in Latin and became [hw] in Germanic by Grimm's Law. In Greek, the fate of *kw depended on the following vowel: if this vowel was front, *kw evolved into [t], as in the first two rows; otherwise *kw evolved into [p].

It is the Sanskrit forms that are the puzzle: they show sometimes [tʃ], and sometimes [k], but in exactly the same environment, namely before [a].

The solution to the problem is to use the method of reconstructed environments. The crucial insight is that the Sanskrit vowel inventory is missing vowels found in its sister languages, namely the mid vowels [e] and [o]. If we consider just Greek *poteros* vs. Sanskrit *kataras*, it is plausible that the Sanskrit vowel were (at some pre-attested phase of Sanskrit) the same as the Greek ones, and that there was a merger:

(266) **Mid Vowel Lowering**

    *e, *o > a   in Sanskrit

In other words, we use Greek and Latin as a guide to the former quality of the Sanskrit vowels. This lets us explain the behavior of *kw, as follows:

*-kwe	*kwid	*-kwos	*kwoteros	Pre-Sanskrit
tʃe	tʃid	—	—	*kw > tʃ before front vowels
—	—	kos	koteros	*kw > k elsewhere
tʃa	—	kas	kataras	*e, *o > a
tʃa	tʃid	kas	kataras	attested Sanskrit

This account both rationalizes the gap in the Sanskrit vowel system, and explains the development of [tʃ] from *k.[217]

The method of reconstructed environments was introduced as a technique by several scholars more or less simultaneously during the 1870's, and marked the maturity of reconstruction as a method. Further developments have mostly followed developments in phonology: we can make better guess about old phoneme inventories by the study of what are typically phoneme inventories

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[217] Curiously, the very same pattern appears in the history of Salishan languages (northwestern United States). Nez Perce plays the role of Sanskrit here. The scholars who reconstructed proto-Salishan presumably didn't have as hard a time figuring this out, since they already had the Sanskrit example to work with.

today; and our increased knowledge of phonological rules in the world's languages permits more informed guesswork about old sound changes.

11. Validating the comparative method

The best way to evaluate the comparative method is to apply it to a language family whose ancestor is known from written evidence. Plausible candidates:

- Apply method to Romance languages, compare result with Latin
- Apply method to Hindi, Bengali, etc., compare result with Sanskrit
- Apply method to Slavic languages, compare result with Old Church Slavonic
- Apply method to Mandarin, Cantonese, etc.; compare result with oldest written Chinese

The result is generally encouraging, but also shows the limitations. Thus, Proto-Romance, the reconstructed answer of the modern Romance languages, is not unsimilar to Classical Latin, but departs from it in many important ways. Similar conclusions follow, I believe, in the other examples just given.

11.1 Confirming Proto-Germanic Reconstructions

Opportunities to confirm Proto-Germanic reconstructions directly are almost non-existent, but a famous case of this sort is often mentioned. The reconstruction is of interest, because it shows how knowledge of phonology and sound change in general guides reconstruction.

The following forms are the oldest attested versions in Germanic languages of the word "guest":

Gothic	gasts
Old Norse	gestr
Old High German	gast
Old English	gæst

Given this data, a historical linguist experienced in the typical sound changes found in languages might reason as follows:

- The final consonant of Gothic and Old Norse is plausibly the result of a long-lost [z]—this sound can become [r] by weakening from fricative to liquid, and [s] by assimilating the voicing of a preceding [z].
- Long consonant clusters are historically usually the result of the loss of vowels; thus *gVstVz.
- The absence of the *z in some of the daughter languages (Old High German, Old English) is hardly surprising, given the tendency of languages to simplify their consonant clusters.
- Again on the basis of examples seen elsewhere, it is likely that the Gothic and Old High German vowels ([a]) represent the original form, and that the front vowels of Old Norse and Old English are the result of assimilation: the vowel of the stem becomes front under

the influence of a following front vowel.[218] The mostly likely such vowel is [i]—it is the most common trigger of this kind of process, and is also the most likely vowel to delete.

- Thus, the ancestor form was plausibly *gastiz, and the history of the descendent forms is perhaps something like this:

Gothic	Old Norse	OHG	Old English	
*ˈgastiz	*ˈgastiz	*ˈgastiz	*ˈgastiz	Proto-Germanic
—	ˈgestiz	—	ˈgæstiz	vowel assimilation
—	ˈgestir	—	—	weakening of z to r
ˈgastz	ˈgestr	ˈgastz	ˈgæstz	loss of stressless vowel
—	—	ˈgast	ˈgæst	cluster simplification
ˈgasts	—	ˈgast	ˈgæst	voicing assimilation
ˈgasts	ˈgestr	ˈgast	ˈgæst	attested forms

This is going fairly far out on a limb, and can only be called informed conjecture. Yet in this case the conjecture was pleasingly confirmed by an archaeological discovery; a horn found in southern Denmark, dated to about 400 A.D—only shortly after the breakup of Proto-Germanic. The runic inscription on the horn is transcribed thus:

Ek Hlewagastiz Holtijaz horna tawido
I, Hlewagastiz, son of Holti, made (this) horn.

Gold horn of Gallehus,
Jutland, Denmark, c. 400 AD

From http://alcor.concordia.ca/~shannon/335PP/Lecture01Germania.ppt#270,11,Runes

e k h l e wa ga s t i z | h o l t i j a z | h o r n a | ta wid o

---

[218] Old Norse also shows a partial height assimilation.

Following the general pattern of early Germanic names, "Hlewagastiz" is interpreted as "fame-guest"—thus giving *gastiz* as confirmation of the reconstructed Proto-Germanic form. Latin *hostis* 'enemy' is taken to be further confirmation; its [h] is the normal counterpart of Germanic [g]; and the two are thought to descend from Proto-Indo-European *g^hostis 'stranger'—with opposite semantic drift in the two daughter language families.

In a similar case, the reconstruction for "king":

Old English	cyning
Old Frisian	koning
Old Saxon	kuning
Old High German	kuning
Old Norse	konongr

is taken to be *kuningVz, where V is some vowel that *didn't* cause the stem vowel to become front—probably a non-front vowel. Conveniently, this word was borrowed very early into Finnish (not an Indo-European language), which preserved it in the form *kuningas*, essentially unaltered (save for the z > s; Finnish has no [z]) for 2000 years.

11.2 Why the Comparative Method is imperfect

In spite of such gratifying examples, the more general truth is that the Comparative Method cannot in general recover the prior state of languages intact, but only bring us closer to it than any other procedure could. The problem is gradual data loss over time. If any part of a word is lost in *all* of the daughter languages, it will not be recoverable by the Comparative Method. In section this week, you'll see some examples of reconstructed Proto-Romance, and you'll see that they involve very considerable differences from Classical Latin.

It is not just the sound that get irrecoverably lost. Whole words get replaced over time, gradually removing the historical linguist's raw material entirely. Thus, English marginally preserves the Proto-Germanic word *hundo-z* in the form of *hound*, but in general to refer to dogs we say *dog*, of which the Oxford English Dictionary says:

"Late Old English; previous history and origin unknown"

Many words do not have etymologies—the best-informed scholars just plain don't know. (OED on *big*: "its derivation is entirely unknown"; on *boy* "of obscure origin"; on *tag*: "origin obscure"; on *miffed* "origin uncertain".)

12. How far back can we go?

Given the gradual loss of data over time, most linguists have been reluctant to pursue the deeper ancestry of the Indo-European languages (and similarly for very deep relationships around the world). It is generally agreed that the data aren't sufficient to relate Indo-European to any of

the neighboring language families[219] using the Comparative Method, and the debate hinges on whether we are entitled to use any *other* method less rigorous than the Comparative Method, such as merely combing through the data for resemblances that may well be quite accidental.

I believe most linguists are skeptical of such efforts. The world abounds in **false cognates**, that is to say, words that look like they come from the same proto-word, but can be shown through reasoning and evidence that they are not. A classic case is the Persian word [bæd], which means, of all things, "bad", but (as careful study of the sound correspondences and ancient Persian documents will show) is not etymologically related to English "bad" at all.[220]

Thus, scholars who try to demonstrate deep relationships (of which the logical extreme is the hypothetical "Proto-World") risk the scorn of their colleagues. Typically a scholar who uses "trans-comparative" scholarly methods will be regarded by a few colleagues as a visionary, and by others as exhibiting scholarly irresponsibility.

The failure of the Comparative Method to go "really deep" is perhaps a bit sad, since it would be nice to know the language our remote ancestors spoke. A useful comparison here is a parallel discipline—evolutionary biology—that likewise has established the family trees of things (species) through careful and systematic comparison. Evolutionary biology has better data—such as DNA sequences—that have enabled biologists to reconstruct the unitary Tree of Life almost to its origin. Historical linguistics, alas, only has words, which gradually get replaced over the centuries. The complete Tree of Languages may be valid as a concept, but it cannot be accessed with the methods we have and is unlikely ever to be.

An even less likely prospect is pinpointing when and how language first came to be. It seems essentially certain that this required advances in human evolution, and, as we saw in Chapter 7, some of the adaptations involved may have involved linguistic ability itself. But barring the invention of time travel, we are not likely to find out much about the early stages of human language.

13. Borrowing

Sound change is not the only way in which languages can change. Another important mechanism is borrowing, the adoption of words from other languages. Over time, languages can borrow thousands of words; indeed, Albanian is an Indo-European language, but it is of little use in reconstructing Indo-European, because it has borrowed so heavily from other languages that there are only a few hundred native Albanian words left.

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[219] Candidates include Uralic (Finnish, Hungarian, Estonian, etc.), Altaic (Turkish, Mongolian, etc), Basque, and others.

[220] The Middle Persian form is recorded as *vat*, more distant already…

Study Exercise #81

    a. Use your knowledge of the sound changes developed earlier to predict what will be the German words for *to* and *pepper*.

    b. Given this, what would you expect the German word for *party* (in the sense of 'political party') to be?

Answer to Study Exercise #80

a. The German for *to* is /tsu/, spelled *zu*. The German for *pepper* is /pfɛfər/. Obviously, this procedure doesn't work all the time, since many other sound changes separate German and English.

b. /pfartsi/. This is actually not right; see immediately following discussion.

Borrowing makes trouble for the Comparative Method. The difficulty is that words that are borrowed after a given sound change look like exceptions to that sound change. The German for *party* is in fact not /pfartsi/ but rather /partaɪ/. The word was borrowed from French, long after the sound change that converted *t and *p into affricates.

In this particular case, the difficulty is not great. We have extensive old records of both German and French, and it is not difficult to trace the history of the word through both languages. But in other cases there is no documentation.

The procedure used in such cases is more subtle. Usually, one does a tentative reconstruction based only on basic, core vocabulary items that are not often borrowed—words like *father*, *arm*, *moon*, *three*, *water*, etc. From these basic words, one can get a rough idea of the sound correspondences.

Once this is done, the sound correspondences themselves can be used to check for borrowings. That is, the words that violate known sound correspondences are likely to be the borrowed words.

Study Exercise #82

Consider the following correspondences:

English	German	Swedish	Proto-Germanic
fish	fɪʃ	fɪʃ	*fisk
shoe	ʃu	ʃuː	*skuː
flesh	flɛʃ	flaɪʃ	*flesk

In these cases, we have [ʃ] in English matched with [ʃ] in German matched with [sk] in Swedish.

The English words *skirt* and *shirt* are both descended from the same Proto-Germanic root. One of them is a borrowing, the other is native. Which is which?

Answers to Study Exercise #81

Skirt is borrowed from English in Old Norse around the time of the partial Danish conquest of England. The Old Norse form was *skyrta*. The form is recognizable as a borrowing because all native *sk clusters had been converted to [ʃ].

Shirt and *skirt* were the same word in Proto-Germanic, reconstructed by the Oxford English Dictionary as *skurtjoːn.

_____

Once one has filtered out the borrowings, one can use the words that remain to get a better idea of the sound changes. With this done, one can make a more accurate judgment of which words are borrowed, which then permits a through a series of gradual improvements.

14. Grammatical simplification

I will discuss one further mechanism of language change: grammatical simplification. The basic picture is this: sound changes over time tend to make the grammar of a language, particularly its morphological rules, very complicated. In compensation, languages often spontaneously simplify their morphological rules.

I will first show how sound change complicates the morphological rules. An example of complexity in morphology is the set of irregular plurals in English, such as *foot-feet*, *mouse - mice*. These are exceptions to the normal pattern of plural formation in English, which would lead us to expect *foots* and *mouses*.

In the theory of inflectional morphology given in the course, a form like *feet* must be listed in the lexicon, with its phonological form and a sort of pre-formed morphosyntactic representation. Here are sample lexical entries for *foot* and *feet*:

foot   /fʊt/   *feet*   /fit/$_{[Number:plural]}$ 'appendage at end of leg'

The theory of lexical insertion must stated such that, whenever there is a special listed entry like *feet*, that entry is lexically inserted, and the form that would be derived by the rules of the inflectional morphology, namely *foots* [fʊts], is preempted.

14.1 The origin of irregular forms

The existence of irregular forms can, in most cases, be attributed to sound changes of long ago. The plurals *feet* and *mice* are in fact the historical descendents, through sound change, of a system that was quite regular thousands of years ago, in Proto-Germanic times. What made them irregular was a lengthy sequence of sound changes. I will go over them briefly here.

Here are the reconstructed forms for *foot*, *feet*, *mouse*, and *mice* in Proto-Germanic (around 500 B.C.):

<div align="center">

foot   *feet*   *mouse*   *mice*

*ˈfot   *ˈfot-i   *ˈmus   *ˈmus-i

</div>

Notice that there is nothing particularly irregular about them. The plural is formed by attaching a suffix of the form *-i*, which in fact was the regular plural suffix for this class of nouns. In the system of inflectional morphology used in this course, the rule would have been (approximately) the following:

Early English Plural Formation

Suffix -i when [Number:plural]

The first step towards irregularity for these words was an innocent-looking phonological rule, which created front vowel allophones of the back vowels /o/ and /u/:

Early English Umlaut

$$*\begin{bmatrix} +\text{syllabic} \\ +\text{round} \end{bmatrix} > [-\text{back}] / \underline{\quad} [-\text{syllabic}] \ i$$

This change produced the following forms:

<div align="center">

foot   *feet*   *mouse*   *mice*

ˈfot   ˈføt-i   ˈmus   ˈmys-i

</div>

To understand the next change, you need to know that in Proto-Germanic, the first syllable of a word (and only the first syllable) was stressed. The next sound change converted all the stressless vowels into schwa:

Vowel Reduction

$$*\begin{bmatrix} +\text{syllabic} \\ -\text{stress} \end{bmatrix} > \text{ə}$$

foot	*feet*	*mouse*	*mice*
ˈfot	ˈføtə	ˈmus	ˈmysə

This is reminiscent of how German acquired the phoneme /ø/ (see section 5 of this chapter, above). In fact, pretty much the same thing happened in early English: when the triggering environment for an Umlaut rule was lost, the language acquired front rounded vowel phonemes.

The next step in English was to lose the schwas:

Final Schwa Drop

*ə > ∅ / ___]word

foot	*feet*	*mouse*	*mice*
ˈfot	ˈføt	ˈmus	ˈmys

Then the vowel /ø/ lost its rounding, and became the corresponding unrounded vowel /e/:

ø Unrounding

*ø > [–round]

foot	*feet*	*mouse*	*mice*
ˈfot	ˈfet	ˈmus	ˈmys

Once we have reached this stage, we are no longer relying on reconstruction. The above forms appear in the oldest written documents for Old English.

- Beowulf 745 *Sona hæfde unlifiȝendes eal ȝefeormod **fet** and folma*
  'swiftly thus the lifeless corse was clear devoured, even feet and hands.'

- 1297 *He vel of is palefrey, & brec is **fot***.
  'He fell off his horse and broke his foot'

- Late Old English: King Alfred's translation of Boethius's *The Consolation of Philosophy*:
  *Gif ge nu gesawan hwelce **mus** þæt wære hlaford ofer oðre **mys***
  'If you saw in a community of mice, one mouse asserting his rights and his power over the others'

Around 1050 to 1100, the front rounded vowel /y/ underwent the same fate that /ø/ had undergone earlier: it lost its rounding, becoming the corresponding front vowel /i/:

y Unrounding

*y > [–round]

	foot	feet	mouse	mice
	ˈfot	ˈfet	ˈmus	ˈmis

Around 1500, for reasons that are not known, the tense vowels of English suffered a convulsive change, which sent them all over the phonetic chart. This change is called the Great Vowel Shift, and it marks the boundary between Middle English and Early Modern English.

Great Vowel Shift

i	>	aɪ		u	>	aʊ
e	>	i		o	>	u
æ	>	e		ɔ	>	o

	foot	feet	mouse	mice
	ˈfut	ˈfit	ˈmaʊs	ˈmaɪs

Our words are now in recognizably modern state. There was one more sound change: the vowel /u/ became lax in certain environments, in a complex and somewhat irregular change:

/u/ Laxing

*u > [−tense] in certain environments

	foot	feet	mouse	mice
	ˈfʊt	ˈfit	ˈmaʊs	ˈmaɪs

This is the end of journey of these vowels, for now. It is interesting to plot their trajectories on a phonetic chart, to see how far the vowels have migrated in 2500 years:

The vowel of *mus*:

u
↓
aʊ

The vowel of *musi*:

i ← y ← u
↘
aɪ

The point of this example is to show that 2500 years of sound change can make a very simple morphological rule into a complex one. It would be very hard to write a general rule that predicts *mice* as the plural of *mouse* and *feet* as the plural of *foot*.

14.2 Grammatical regularization as a source of change

In fact, the language didn't really tolerate the situation. At some point in the history of English, the old, increasingly irregular system of plural formation was discarded and replaced by a simpler rule. Basically, in Modern English plurals are formed by suffixing *-z*.[221]

Modern English Plural Formation

Suffix   -z when [Number:plural]

The plurals *mice* and *feet* are relic forms; they have managed to hang on as exceptions to the general rule.

The change in the system of plural formation in English is a classical case of grammatical simplification. The language changed not through sound change, but in response to sound change. It created a new rule for plurals, and replaced most of the old irregular plurals with newly created forms.

Who is responsible for grammatical simplification? The most likely answer is small children, who are still acquiring language. It is not hard to see why: one constantly observes small children *over*simplifying the grammar of the language they are learning. In particular, they don't know, or neglect to use, the special lexical entry for forms like *feet*. Instead, they generate *foots* using the regular grammatical system. In some cases, particularly with less common words, such regularized forms can be adopted by the speech community as a whole.

An example: the plural of *cow* was once [kaɪ], or something like it (note the archaic form *kine*). [kaɪ] is the plural inherited though sound change from Proto-Germanic; its history is essentially the same as that of *mice*, with the same vowel. The plural we use today, *cows*, was the invention of children. It differs from *foots* only in that it managed to get adopted for general use.

Quite a few forms in English today are creations of children, of this kind. Another plural form of this type is *brothers* (formerly *brethren*) and the past tenses *helped* (formerly *halp*) and *melted* (formerly *malt*).

The upshot of this is that language change can be thought of as an eternal struggle. Over the centuries, sound change alters the morphological system, making it more complex and obscure. Fighting on the other side are small children, who refuse to learn the irregular forms, and replace

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[221] There is a bit of phonology going on: the underlying /-z/ becomes [-s] after voiceless consonants (*cats*, with /kæt-z/ → [kæts]) and a schwa is inserted to break up clusters of the form [s, z, ʃ, ʒ, tʃ, dʒ] + [z], as in *badges* (/bædʒ-z/ → [bædʒəz].)

them with regular forms, as generated by the rules of the language at the time they learn it. The current state of a language is the result of a temporary balance between these opposing forces.

15. Summary of historical linguistics

At this point we have covered the basic mechanisms of language change. An outline of the field is as follows:

First, all languages have phonological rules. Phonological rules are vulnerable to restructuring by the next generation, which results in sound change. Sound change is normally regular. It is this regularity that makes it possible to reconstruct lost proto-languages, using the Comparative Method.

Borrowing is another major source of language change. Borrowed words make the Comparative Method more difficult to apply, but they can often be detected because they are exceptions to the sound correspondences.

A third major source of language change is grammatical simplification, the abandonment by children of irregular forms resulting from sound change in favor of regular forms. Sound change and grammatical simplification are in eternal conflict: sound change complicates the morphology, and grammatical simplification "repairs" the damage.

The Comparative Method yields well-supported family trees and the changes that the languages underwent during their descent. It cannot go back more than a few thousand years and thus the deep history of languages, as well as the origin of language in general, is not accessible to investigation by this method.

Study Exercise #83: Historical Linguistics

Here are matched sets from three dialects of English. Apply the Comparative Method, forming correspondence sets and positing sound changes. Here, is it best to compare sequences rather than sounds. Do: [juɹ, uɹ, oɹ].

		Dialect A	*Dialect B*	*Dialect C*
1.	*Muir*	[ˈmjuɹ]	[ˈmjuɹ]	[ˈmjoɹ]
2.	*moor*	[ˈmuɹ]	[ˈmuɹ]	[ˈmoɹ]
3.	*more*	[ˈmoɹ]	[ˈmoɹ]	[ˈmoɹ]
4.	*cure*	[ˈkjuɹ]	[ˈkjuɹ]	[ˈkjoɹ]
5.	*Coors*	[ˈkuɹz]	[ˈkuɹz]	[ˈkoɹz]
6.	*core*	[ˈkoɹ]	[ˈkoɹ]	[ˈkoɹ]
7.	*Buhr*	[ˈbjuɹ]	[ˈbjuɹ]	[ˈbjoɹ]

8.	*boor*	[ˈbuɹ]	[ˈbuɹ]	[ˈboɹ]
9.	*bore*	[ˈboɹ]	[ˈboɹ]	[ˈboɹ]
10.	*endure*	[ɛnˈdjuɹ]	[ɛnˈduɹ]	[ɛnˈdoɹ]
11.	*dour*	[ˈduɹ]	[ˈduɹ]	[ˈdoɹ]
12.	*door*	[ˈdoɹ]	[ˈdoɹ]	[ˈdoɹ]
13.	*Turing*	[ˈtjuɹɪŋ]	[ˈtuɹɪŋ]	[ˈtoɹɪŋ]
14.	*tour*	[ˈtuɹ]	[ˈtuɹ]	[ˈtoɹ]
15.	*tore*	[ˈtoɹ]	[ˈtoɹ]	[ˈtoɹ]
16.	*inure*	[ɪˈnjuɹ]	[ɪˈnuɹ]	[ɪˈnoɹ]
17.	*Koh-i-noor*[222]	[ˈkoʊhɪnuɹ]	[ˈkoʊhɪnuɹ]	[ˈkoʊhɪnoɹ]
18.	*nor*	[ˈnoɹ]	[ˈnoɹ]	[ˈnoɹ]

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[222] A famous diamond, from the Persian for "mountain of light".

Answer to Study Exercise #82

Correspondence sets:

Proto	A	B	C	Examples
*juɹ	juɹ	juɹ	joɹ	1, 4, 7
*juɹ	juɹ	uɹ	oɹ	10, 13, 16
*uɹ	uɹ	uɹ	oɹ	2, 5, 8, 11, 14, 17
*or	oɹ	oɹ	oɹ	3, 6, 9, 12, 15, 18

The proto-language is identical to Dialect A.

B and C have both undergone:

*j > ∅ / [+alveolar] ___

See *endure*, *Turing*, and *inure*

C has also undergone:

*u > o / ___ ɹ

which has merged *moor* with *more*, *boor* with *bore*, and so on.

For Further Reading

Two textbooks fine in historical linguistics are the following. *Introduction to Historical Linguistics* by Anthony Arlotto (1981: University Press of America) is very brief and quite clear; *Historical Linguistics* by Theodora Bynon (1979: Cambridge University Press) goes into greater depth. Leonard Bloomfield's *Language* (1933, still in print), cited above for phonology, has a wealth of good material on historical linguistics.

Chapter 14:   Applications and Outlook

1. This course and linguistics in general

In this text I've presented *one* theory, and for almost every particular area of data, *one* analysis. This has given us the tools to analyze a great deal of data, and to illustrate what it means to carry out linguistic analysis. If you study linguistics further, you'll get more elaborate theories — for one thing, for purposes of an introductory text I've mostly picked theories on the basis that they can be taught in a short period of time, and specialist courses can be more ambitious.

In addition, at the level of research, linguists explore *many* different theories, and try to find evidence for which one is right. As research proceeds, the theories have tended to become more subtle, more ambitious, and more accurate. But there's a great deal of work yet to be done, and at the present stage of research disagreement among linguists is very common.

2. Unsolved research problems in linguistics

One indication that linguistic theory is making progress is that descriptive grammars are getting better. Grammar authors, equipped with better theories, and better knowledge of what languages are like in general, seem to be able to lay out languages more completely and systematically than their predecessors 50 or 100 years ago.

On the other hand, I think most progress in linguistics is yet to come, and the linguistics of 100 years from now may be very different from the linguistics of today.

For what it's worth, here are what I take to be three of the leading unsolved research problems in linguistics.

2.1 The island problem

Our islands (Chapter 6) have been a "laundry list" of syntactic structures, some of them evidently universal and some language-particular. One area where theorizing has been intensive is the attempt to unify and simplify the theory of islands. An approach that is commonly taken is that it's probably better to specify where wh- phrases *can* be extracted from rather than making a big list of where they can't. No current theory has obtained the agreement of all specialists.[223]

2.2 The acquisition problem

We solve linguistics problems through patience, guile, and occasionally inspiration. It is unlikely that children learn language this way, since they seem more reliable than we are—they

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[223] A quick, and pessimistic, overview may be read at
https://www.researchgate.net/publication/265764977_Syntactic_islands_by_Cedric_Boeckx_%28review%29

proceed steadily onward to become fluent native speakers. Moreover, they don't get stuck: there are a number of Bantu languages that have very complex tonal systems that that skilled linguists have not yet been able to reduce to rule, but that hasn't stopped the human children who learn these languages from apprehending the tonal pattern and applying it correctly in speech.

To solve the problem of how children acquire language so well, three things will be needed. First, we need to develop adequate grammars of individual languages, which characterize the native speaker's knowledge and intuitions with complete accuracy. We also need adequate general theories of language that say what grammars can be like. Both of these issues have been taken on, at least in an elementary way, in this course.

The next step would be to start modeling the child's behavior directly: linguistics will gradually develop formal systems (probably implemented as computer programs) that mimic the child, learning grammars when exposed to realistic data from languages. This task has only begun to be taken on by linguists in the past few years.

One of the very simplest such problems to learn a grammar that can form the past tense of English verbs, given the present stem. The rules of the game are that the system is given a set of verbs (perhaps a couple thousand) with their past tense, learns a grammar, and then is tested on new verbs. One system of this sort[224] when asked for the past tense of "*spling*", guesses as follows:

(267) *Three machine-generated guesses for the past tense of* "spling" [ˈsplɪŋ]

splung	[ˈsplʌŋ]	first choice
splinged	[ˈsplɪŋd]	close second
splang	[ˈsplæŋ]	third choice

These guesses roughly matches the preference of people, who vary in the same way. Many vastly harder tasks in modeling learning have yet to be addressed, since we don't yet know how. Ultimately, I think, linguistics should try to pass the "Turing test", as it applies for language—the creation of an artificial system that behaves identically (from the observer's perspective) to humans.

2.3 The parsing problem

A parser is a procedure (usually a computer program) that, given a grammar and a sentence, can figure out the phrase structure tree that the grammar assigns to the sentence. One problem in parsing is that sentences often have many more parses than we as linguists think they do. To give one example, the sentence:
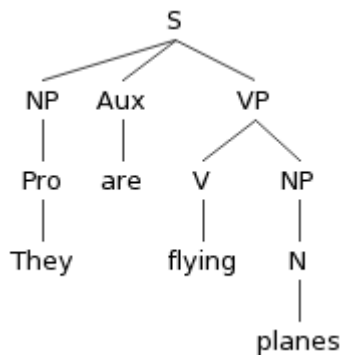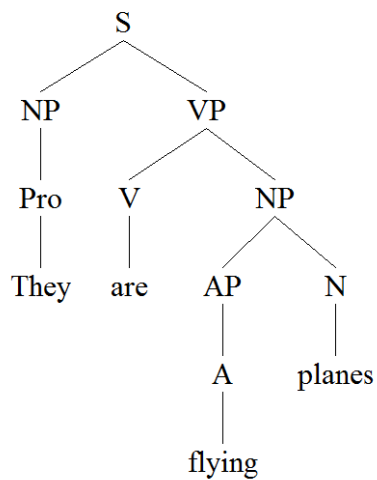
They are flying planes.

---

[224] Adam Albright and Bruce Hayes (2003) "Rules vs. Analogy in English Past Tenses: A Computational/Experimental Study," *Cognition* 90: 119-161 [http://www.linguistics.ucla.edu/people/hayes/#acquisition]

has two obvious parses:

```
                      S
            _____/|_____
          NP      Aux          VP
           |       |          /\
          Pro     are       V    NP
           |                |     |
         They            flying   N
                                  |
                               planes
```

(They are acting as pilots)

```
              S
           __/ \__
         NP       VP
          |      / \__
         Pro    V     NP
          |     |    /  \
        They   are  AP   N
                     |    |
                     A  planes
                     |
                  flying
```

(Those things up in the air are planes that are flying)

But a complete and thorough search yields parses that are absurd but possible. Thus, consider the following set-up:

Smoking kills.
What are the facts? The facts are, smoking kills.
They are, smoking kills.
They are, flying planes.

```
                    S
              _____
             NP         VP
             |        _____
            Pro      V      CP
             |       |      |
           They    are      S
                         _____
                        NP      VP
                        |       |
                        N       V
                        |       |
                      flying  planes
```
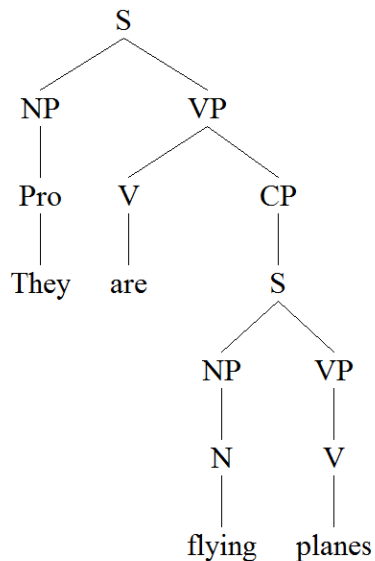
(I envision small bits of a large board being slowly removed by impact with the propellers.)

The absurdity, indeed the "cheapness" of this example is perhaps even irritating, but it illustrates a general problem. Parsers implemented as computer programs arrive at a great number of parses that would never occur to people. In contrast, people seem to be able to arrive at the correct parses almost instantaneously, without distraction. Much current research is devoted to inventing parsers that can mimic the high level of human performance—partly in the hope that this will shed light on how people perform this task.

2.4 Other kinds of parsing

Parsing is not just a matter of syntax. In morphological parsing, we seek to recover the stem and the features of the morphosyntactic representation from the phonological form of an inflected word. In "phonemic parsing" — better known as speech recognition — we seek to find the phonemic representation (and possibly, also the lexical items present) from a raw acoustic signal. Like syntactic parsing, morphological and phonemic parsing are unsolved problems, the topic of current research.

3. Linguistics: what is it good for?

Enrollment in undergraduate majors in linguistics has tripled in the U.S. since 2000.[225] This is a good thing for linguistics departments. Is it a good thing for society?

I actually think it is; that is, I feel society would be better off if more people had knowledge of linguistics. Some specific areas where linguistics could make a difference in real life are as follows.

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[225] See http://www.linguisticsociety.org/files/Annual_Report_2013.pdf, p. 10.

3.1 Teaching reading and writing

Children learn to read, in part, by establishing correspondences between the phonemes they learned in infancy and the letters used to spell the language. The spelling system is like a code, with the phonemes behind it, and many children have the experience of "breaking" the code rather suddenly, becoming able to read at a beginning level.

"Phonics" is the standard term in the teaching profession for what a linguist might call "the system of letter-phoneme correspondences". Phonics was eclipsed for a number of decades in the United States by an alternative "whole word" or "whole language" method, which became quite controversial. The Congress appealed to the National Institutes of Health to make a scientifically-guided comparison of the two methods, and the NIH panel (reporting in 2000) came out firmly in favor of phonics.[226]

But beyond just adopting phonics, I think there could be some very useful further applications of linguistics in the teaching of reading. In particular, it would pay for teachers to know and understand the phonemic systems of their students. Thus, if a student has no phonemic distinction between [ɪ] and [ɛ] before nasals (saying, as millions of Americans do, both *pin* and *pen* as [pɪn]), then a reading teacher should not correct the student who reads *pen* as [pɪn] —this can only confuse the student and undermines her confidence, given that she correctly interpreted the letters within her own phonemic system.[227]

In the later school years, children are taught to write in a standardized, normatively-defined style. We can debate the merits of having such a style (see Chapter 3), but let's just assume for purposes of argument that ability to write in the standard variety is of sufficient value to students' future lives that they ought to be taught it. Here, having teachers who understand syntax can help in making clear to children what the requirements of this style are. One common instance arises in sentences like the following.

Being in a dilapidated condition, I was able to buy the house very cheap.

In many English dialects, this sentence can have a meaning in which it is the house that is dilapidated. However, this reading is not possible in the written standard, where the only possible reading is one in which the speaker is dilapidated. Since people who command the written standard often hold strong normative views (chapter 3) against the non-standard pattern, teachers can protect their students from future harm by teaching them the standard pattern.

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[226] You can read their basic recommendations at http://www.nichd.nih.gov/research/supported/Pages/nrp.aspx/

[227] Far more tricky is the case of a child who has learned a theta-less dialect like Cockney or African American Vernacular English at home, and interprets (say) *myth* in the correct way under her own phonemic system, namely as [mɪf]. Given people's normative views (chapter 3), use of this pronunciation is a career barrier, no matter how high the intelligence or skill of the person who uses it. I can see no way that a school teacher could tactfully inform a child that the dialect she learned at her parent's knee is widely despised; presumably, some teachers just go ahead and do it untactfully.

To do this, it is necessary to have at least an elementary theory of syntax. For example, an English teacher might tell his students: "the implicit subject of a preposed clause may only refer to the subject of the main clause".[228] The concepts of clause, implicit subject, and coreference—all covered in this text — are clearly relevant here.

3.2 Teaching foreign languages

Language instruction can be either intuitive or structural. The latter approach, one lays out the grammar in a systematic way, much as a linguist tries to do. The teaching of pronunciation varies perhaps most of all. Some language textbooks give the student nothing but orthography, along with the advice that they should imitate native speakers. In contrast, some texts include training in basic phonetics. Although not in America, many language textbooks around the worl actually use the IPA, as a tool for making the target pronunciation as clear as possible.

In some cases, linguistic theorizing has produced better descriptions of how the language works, notably in Japanese and other tonal languages. It remains to be seen whether such developments will help in language instruction. Here again, the question is whether the students should be told "Listen closely to native speakers and mimic their pitch patterns" or given a clear description of how the system works phonologically, then try to make adherence to the system an automatic pattern.

3.3 Alphabet design

Many of the world's peoples cannot write their native language because it has not yet been given an orthography. As mentioned Chapter 11, phonemic analysis is commonly used to determine what sounds need to be symbolized by letters in a new spelling system.

3.4 Human-machine interaction

It is of course a goal of many people and companies that we will someday engage in fluent conversations with computers and other machines; presumably when this happens our interactions with machines will be far more convenient and helpful to us.

However, those who buy computers and software for synthesis and recognition will know that neither of these capacities has reached the point where they are useful for more than fairly low-level tasks. We experience frustration when the speech recognizer cannot understand our utterances, and fatigue when we try to listen to the unrealistic productions of synthesizers. What is needed to make things better?

Different people will give different answers to this question. Obviously, the answer I feel most sympathetic to is, "more and better linguistics."— we cannot hope to have a good speech synthesizer until we have exquisitely detailed — and generalizable — knowledge of the rules for

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[228] Strunk and White's book of normative grammar, *The Elements of Style* (from which the example above derives) says "A participial phrase at the beginning of a sentence must refer to the grammatical subject." This is vague in using the term "refer to", but not bad for non-linguists. Link: http://orwell.ru/library/others/style/english/estyle.

English allophones, both within the word and across word boundaries within the phrase. Whether this knowledge will take the form of a traditional rule-based linguistic description or something different is not firmly established. The problem of speech recognition may also benefit from deeper and more detailed phonetic description and grammars.

Syntax and semantics must also be invoked to improve the abilities of computers to converse with us. We can get an idea of the state of advancement achieved here by examining the behavior of the grammar checker included in a leading word processor. Examples like the following indicate that the busy crew at Microsoft has gotten strikingly good at parsing long noun phrases and making sure that the verb agrees in number with their head (sequences underlined are those identified as a problem by the grammar-checker in Word 2010):

The turtles is green.
The turtles are green.

The turtles in the pond is green.
The turtles in the pond are green.

The turtles that many of us believe to be swimming in the pond is green.
The turtles that many of us believe to be swimming in the pond are green.

The turtles that the ducklings that the wolves ate believe to be swimming in the pond is green.
The turtles that the ducklings that the wolves ate believe to be swimming in the pond are
    green.

On the other hand, any student who has learned the content of this text could tell what is wrong with the ungrammatical sentences below, which the Word grammar checker fails to detect:

Which books do you think are on the table?
*Which books do you think is on the table?
*Which book do you think are on the table?
Which book do you think is on the table?

That is to say, verbs must agree with their subject NP when it is *in situ*, prior to the possible leftward displacement of that NP by Wh- Movement.[229]

Not surprisingly, there are industrial syntacticians, who develop detailed grammars for various languages, and use the grammars to assign parses to sentences (as in the grammar-checking application above.) There are also industrial semanticists, who attempt to extract meanings from sentences in the primitive mentalese of computers.

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[229] In 2014 I asked the language research staff at Microsoft about this, and they told me they *do* have Wh-movement in their grammar checker, and that it *ought* to be catching the agreement error described here. Perhaps there is a bug in the implementation. Thanks to Bill Dolan and Karen Jensen for their help.

Quite a few students from UCLA (both undergraduate and graduate) have gone on to careers in "industrial linguistics." Often, though not always, they have expertise in both linguistics and computing.

Chapter 15: More review problems

These are given in the same order in which the topics appear in the text.

Study Exercise #84: Inflectional morphology in an imaginary language

a. Set up inflectional rules to derive these forms. Be sure to state your rules in the correct order. Give your rules names. Assume features [PossessorPerson, Number, PossessorNumber].

kitab	'book'
kitabam	'my book'
kitabi	'your book'
kitabeʃ	'his/her book'
kitabilam	'our book'
kitabili	'you-all's books'
kitabil	'their book' (not a typo)
kitabim	'books'
kitabimam	'my books'
kitabimi	'your books'
kitabimeʃ	'his/her books'
kitabimilam	'our books'
kitabimili	'you-all's bookss'
kitabimil	'their books' (not a typo)

b. Provide a derivation for kitabimilam 'our books'.

Answer to Study Exercise #83

a. Rules in correct order:

Number Rule

X → Xim   if   [Number:plural]

Possessor Number Rule

X → Xil   if   [PossessorNumber:Plural]

Possessor Person Rule

X → Xam   if   [PossessorPerson:1]
X → Xi   if   [PossessorPerson:2]
X → Xeʃ   if   [PossessorPerson:3, PossessorNumber:Singular]

Note that the third part of the Possessor Person Rule must include the feature [PossessorNumber:Singular], because otherwise it would attach the suffix -eʃ in plurals, deriving **kitabileʃ* rather than the correct *kitabil* for 'their book'.

b. Provide a derivation for *kitabimilam* 'our books'.

The morphosyntactic representation is:
[Number:Plural, PossessorNumber:Plural, PossessorPerson:3]

kitab	stem	
kitabim	Number Rule	(since [Number:Plural] is present)
kitabimil	Possessor Number Rule	(since [PossessorNumber:Plural] is present)
kitabimilam	Possessor Person Rule	(since [PossessorPerson:3] is present).

Study Exercise #85: Wh- Movement and islands

Show why

*What donor might Sue wonder what books donated to the library?

is ungrammatical, given the Wh- Island Constraint below. In particular, first extract *what books* to the lower Comp, then extract *what donor* to the higher Comp, showing the island violation graphically.
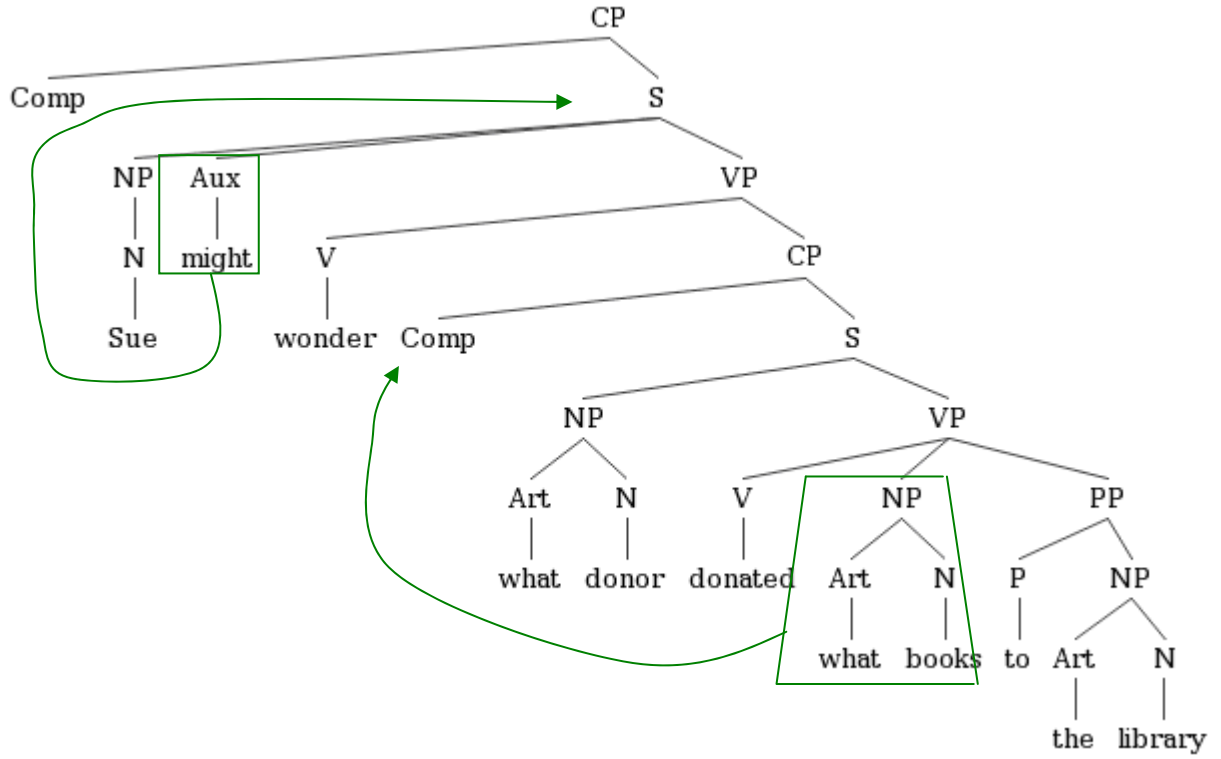
Wh- Island Constraint

Mark as ungrammatical any sentence in which a constituent has been extracted from inside a CP whose Comp contains a wh- phrase.

```
                    CP
      *          /      \
             Comp          S
              |         /\    
             wh-   
```
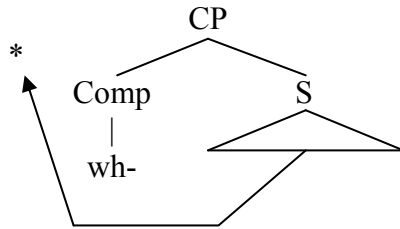
Answer to Study Exercise #84

Deep structure (all wh- phrases *in situ*), with lower instance of Wh-Movement; also Subject-Aux Inversion in upper clause:

CP
Comp   S
NP   Aux   VP
N   might   V   CP
Sue   wonder Comp   S
NP   VP
Art   N   V   NP   PP
what donor donated Art   N   P   NP
what books to Art   N
the library

Resulting tree, with subsequent movement of *what donor* into the higher Comp. This violates the Wh-Island Constraint; the island is enclosed in a dotted box:
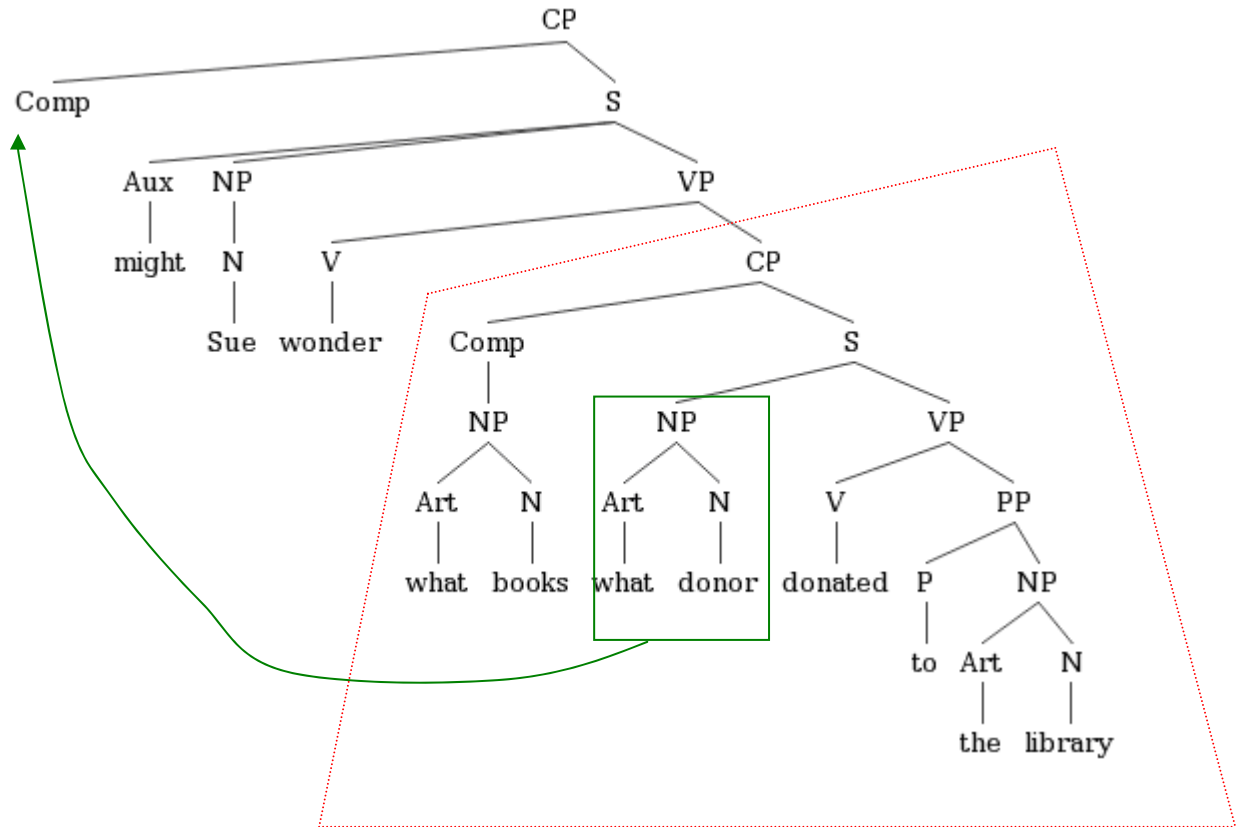
Since a wh-phrase is moved out of the island, the resulting sentence is ungrammatical.

Study Exercise #86: Semantics; anaphora

The wizards believe that the witches turned the girls into copies of each other.

a. Produce the phrase structure tree.
b. Show clausemates with brackets, show c-command with arrows.
c. Explain with reference to rule given below the possible reference of *each other*.

Each Other Reference

Each other may refer only to a plural c-commanding clausemate.

Answer to Study Exercise #85

The wizards believe that the witches turned the girls into copies of each other.

a. Diagram/b. Show clausemates with brackets, show c-command with arrows.
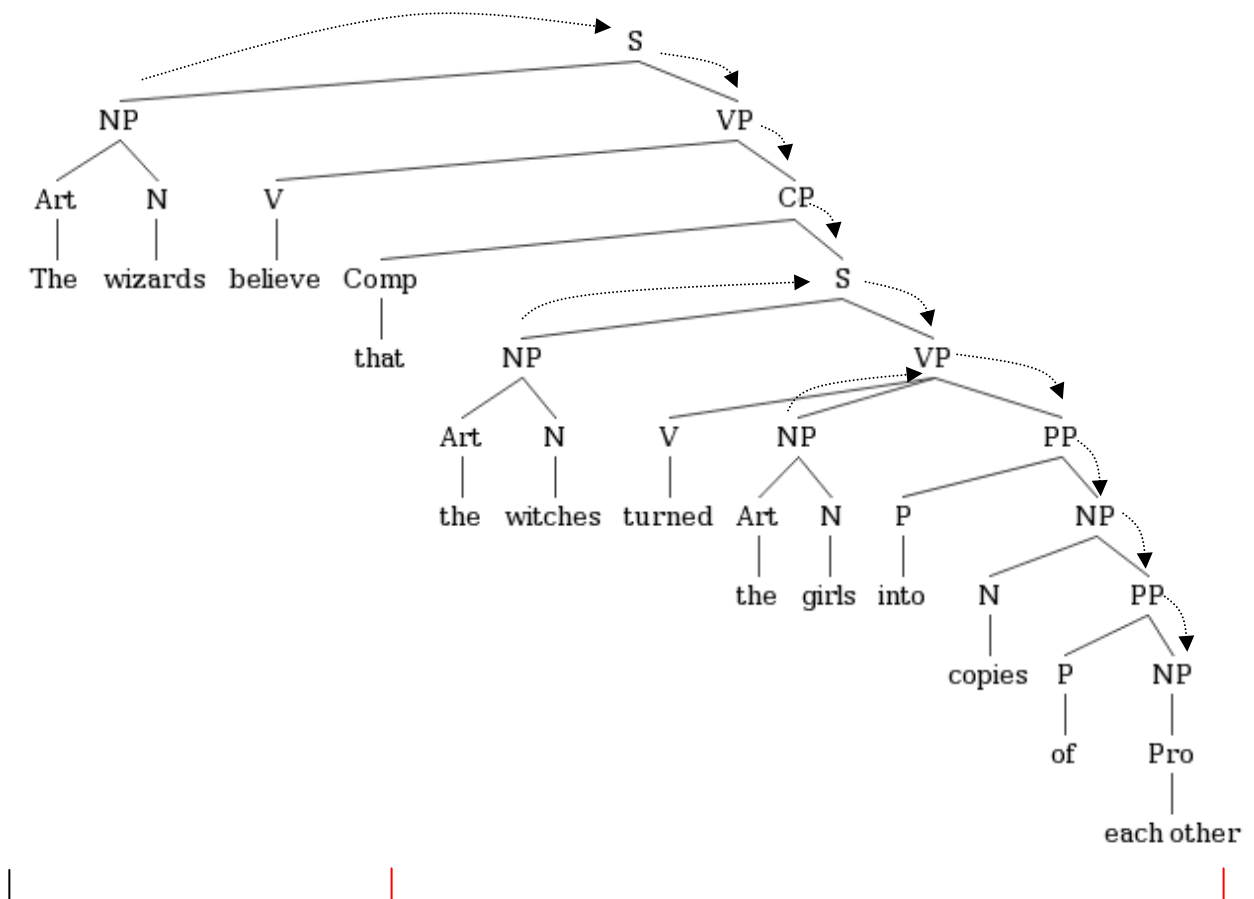
The witches, *the girls*, and *each other* are all clausemates, but *the wizards* is not clausemates with any of them.

Looking at the tree and the crucial NPs, we see the following relations of c-command:[230]
the wizards c-commands the other three NPs
the witches c-command *the girls* and *each other*
the girls c-commands *each other*

---

[230] Recall how this is determined: go up one node from any NP, and anything dominated by this node is dominated by this NP.

c. Putting it all together, we see that:

- *the girls* c-commands and is a clausemate of *each other*, and so can be coreferent with *each other*

    Scenario: The wizards believe that the witches turned Sue into a copy of Ellen, and turned Ellen into a copy of Sue.

- *the witches* c-commands and is a clausemate of *each other*, and so can be coreferent with *each other*

    Scenario: The wizards believe that Alice, a witch, turned the girls into copies of Miriam (another witch), and that Miriam turned the girls into copies of Alice.

- While *the wizards* c-commands *each other*, it is not a clausemate of *each* other, and so it cannot be coreferent with *each other*

    Scenario: Bob, a wizard, believes the witches turned the girls into copies of Ted, another wizard; and Ted believes the witches turned the girls into copies of Bob. Logically possible, but evidently not available linguistically.

_____

Study Exercise #87: Semantics, Scope I

This sentence has a scope-based ambiguity.

    Many people visit two islands.

i.   Describe clearly in words the two meanings of these sentence.
ii. Using Quantifier Translation and Quantifier Raising, derive the logical forms for each meaning.

> **Quantifier Translation**
>
> Replace
>
> [every N]$_{NP}$ with   [for every x, x an N]$_{NP}$
> [some N]$_{NP}$ with   [for some x, x an N]$_{NP}$
>
> …
>
> and similarly for other quantified expressions. If the variable *x* is already in use, use *y* instead; etc.

> **Quantifier Raising**
> Left-adjoin a quantified NP to S, leaving behind a variable in its original location.

Answer to Study Exercise #86

Describe clearly in words the two meanings of this sentence. Give a scenario of which it could hold true.

Many people visit two islands.

i. Describe clearly in words the two meanings of this sentence.
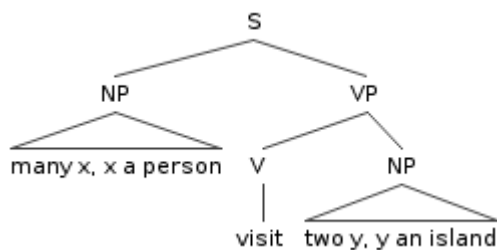
(a) It is true of many people that they visit two islands (not necessarily the same two).
(b) It is true of two islands that many people visit them (not necessarily the same people).
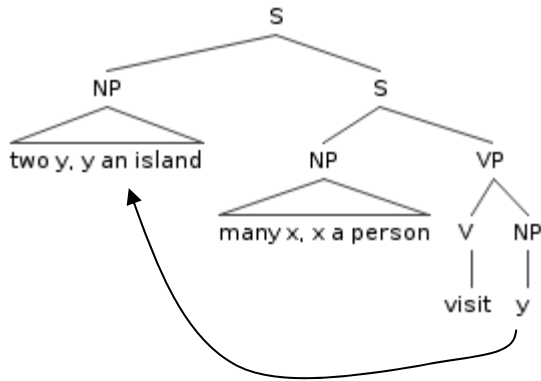
ii. Derivation of logical forms

Surface structure:
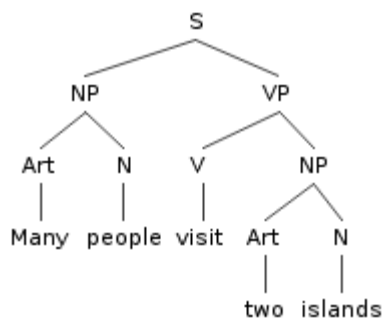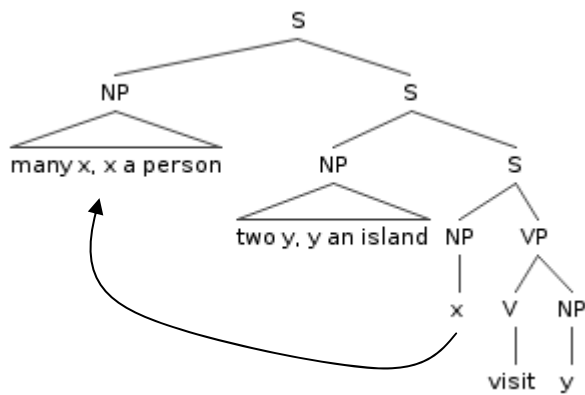

Quantifier Conversion:

At this point, the meanings depend on the order in which the quantifier operators are raised.
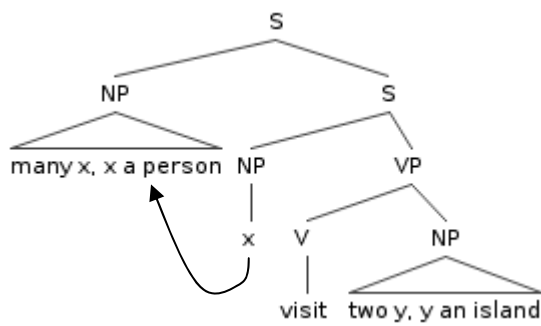
(a)

Quantifier Raising I
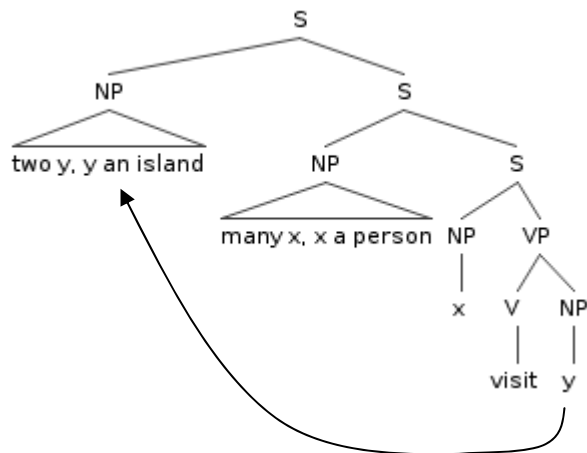
Quantifier Raising II

"It is true of many people that they visit two islands"

(b)

Quantifier Raising I

Quantifier Raising II

"It is true of two islands that many people visit them."

**Study Exercise #88: Semantics / raising quantifiers different distances**

Sentence: *John has a plan to visit every city*

a. Explicate both meanings in philosopher's language.
b. Apply Quantifier Translation and Quantifier Raising to derive both meanings.

See previous question for the rules you need.

To answer this question, you'll need a bit of help with the syntax, there being material that this text does not cover. We'll assume that the clause *to visit every city* is an S, and it has an NP subject that is empty (but is interpreted as being coreferent to *John*). This is the same sort of empty subject discussed in section 4 of Chapter 1 of this text, under the name "implicit noun phrases". We'll use the standard notation for this empty subject, which is: PRO (it is essentially a kind of pronoun). If, further, we say that *to* is an Aux, the structure will be as follows:
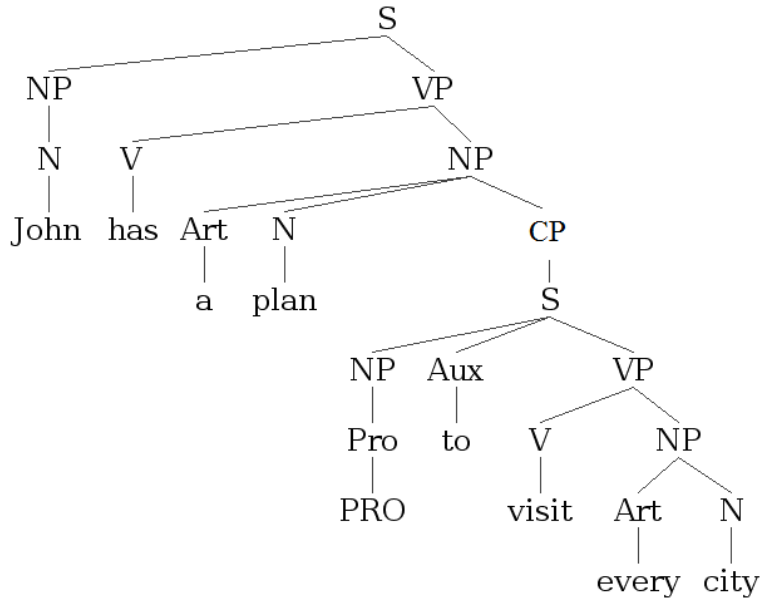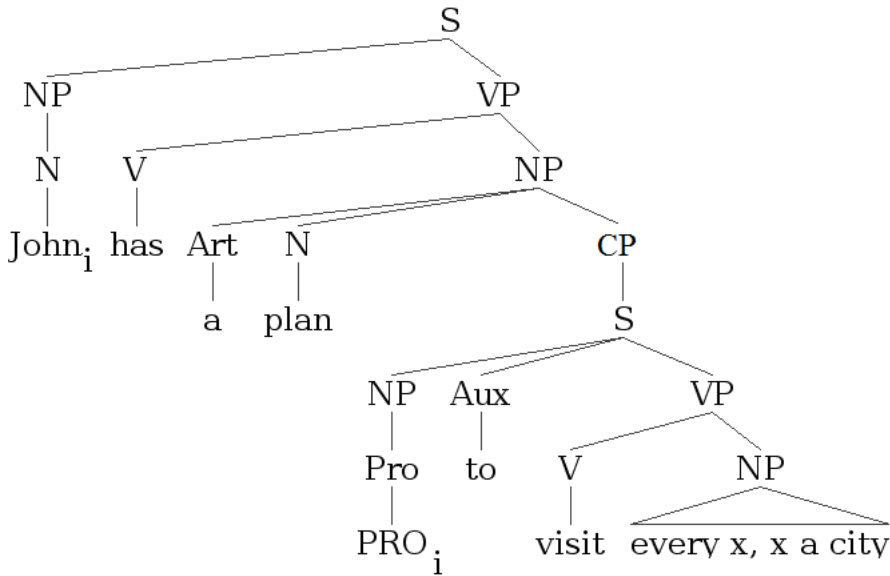
It also seems appropriate to indicate that PRO refers to *John*; we can do this in the usual way with indices, though we have no rules yet that can carry this out:
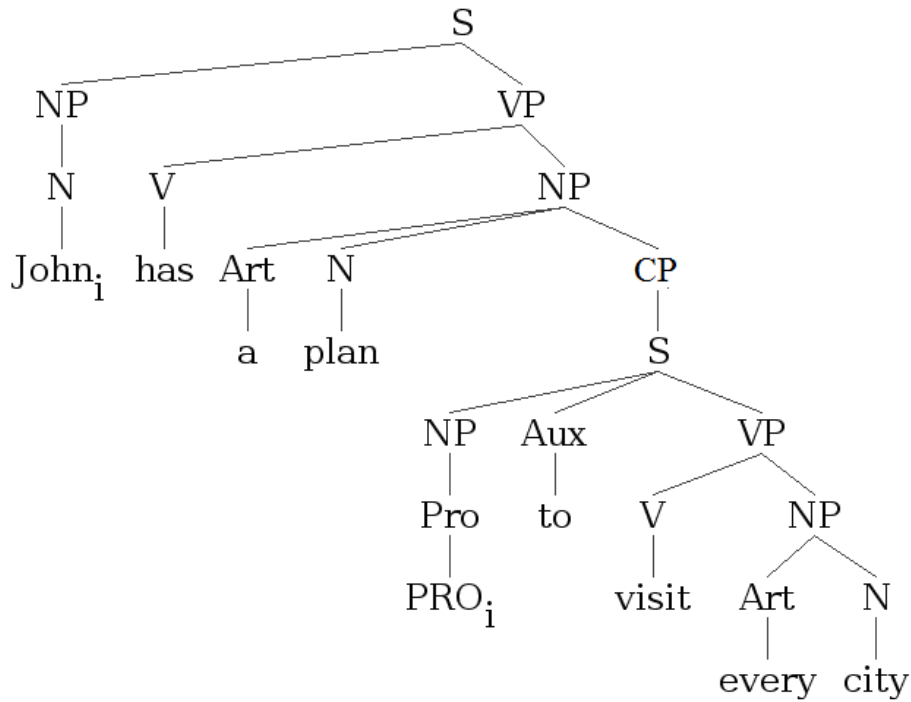
Answer to Study Exercise #87

a.   I. For every city, John has a plan to visit it.
   II. John has a plan such that in it, he visits every city.

b. For both readings, we start with Quantifier Conversion, deriving:

To derive meaning I, we raise the quantifier to the highest S, adjoining it there, as follows:
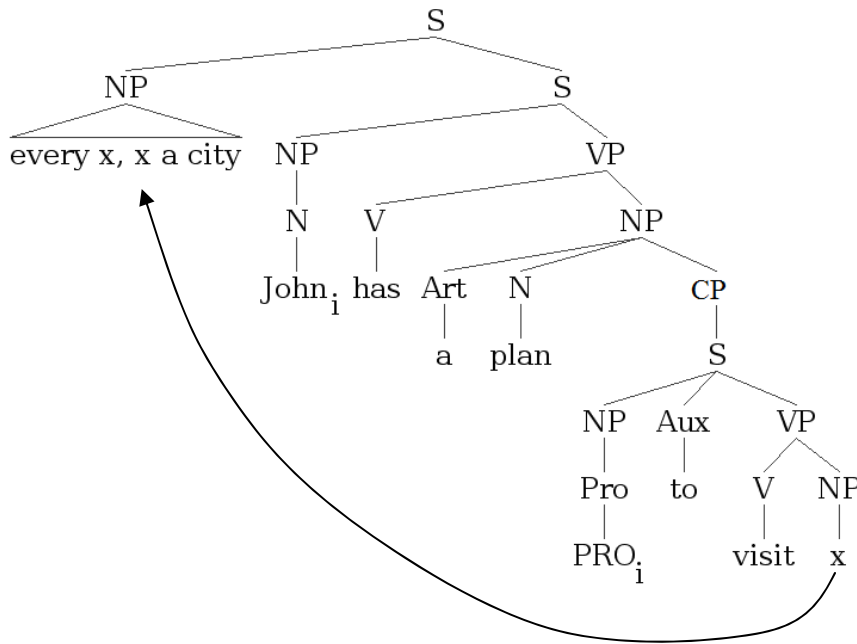
To derive meaning II, we raise the quantifier to the lower S, adjoining it there, as follows:

S
NP VP
N V NP
John_i has Art N CP
a plan S
NP S
every x, x a city NP Aux VP
Pro to V NP
PRO_i visit x
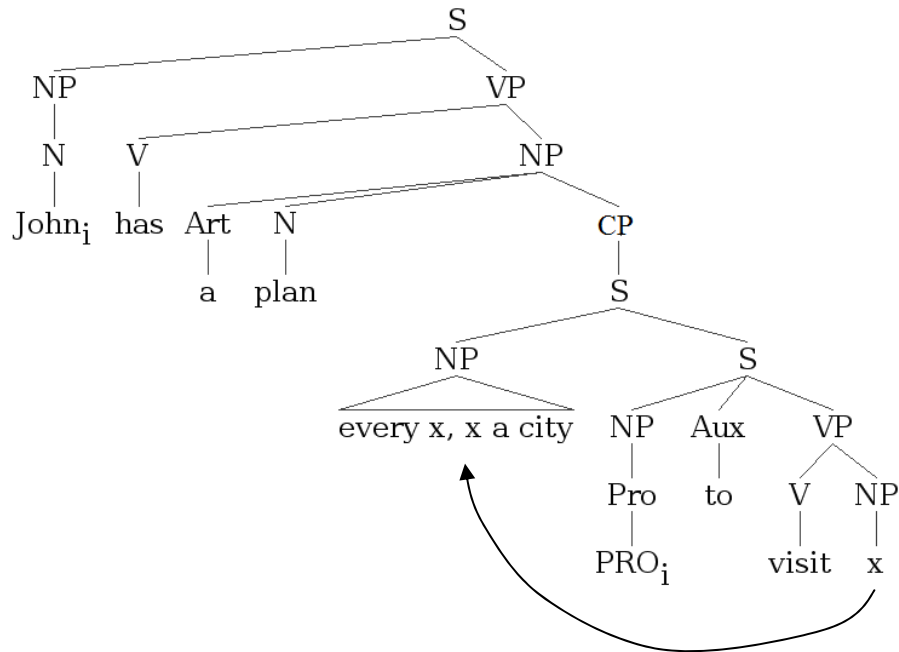
Study Exercise #89: Phonetic Dictations

southern
myrrh
corpulent
whether
multiple
coinage
parameter
ostentatious
turmoil
trapezium

Answer to Study Exercise #88

southern	[ˈsʌðɚn]
myrrh	[ˈmɚ˞]
corpulent	[ˈk{oʊ,o,ɔ}ɹpj{u,ʊ,ə}lənt]
whether	[ˈwɛðɚ˞]
multiple	[ˈmʌlt{ɪ, ə}p{əl, l̩}]
coinage	[ˈkɔɪn{ə,ɪ}dʒ]
parameter	[pəˈɹæmɚɾɚ˞] [ɚ˞] for first [ə] or [əɹ] ok
turmoil	[ˈtɚ˞mɔɪl]
ostentatious	[ɔstɛnˈteɪʃəs]
trapezium	[tɹɹəˈpiziəm]

Study Exercise #90: Phonology

This is an imaginary language but the rules it has are found in real languages.
[β, ð, ɣ] are voiced fricatives (bilabial, dental, velar). [t̪, d̪, n̪] are dental.

	'Noun'	*'the Noun'*	*'two Nouns'*	*'five Nouns'*	
1.	[pama]	[la bama]	[d̪ue bamas]	[kwin̪d̪o bamas]	'tuna'
2.	[peli]	[la beli]	[d̪ue belis]	[kwin̪d̪o belis]	'swordfish'
3.	[t̪ube]	[la d̪ube]	[d̪ue d̪ube]	[kwin̪d̪o d̪ube]	'mackerel'
4.	[t̪azo]	[la d̪azo]	[d̪ue d̪azo]	[kwin̪d̪o d̪azo]	'cod'
5.	[kame]	[la game]	[d̪ue game]	[kwin̪d̪o game]	'mahi mahi'
6.	[koli]	[la goli]	[d̪ue goli]	[kwin̪d̪o goli]	'carp'
7.	[bafi]	[la βafi]	[d̪ue βafi]	[kwin̪d̪o βafi]	'catfish'
8.	[belu]	[la βelu]	[d̪ue βelu]	[kwin̪d̪o βelu]	'pollock'
9.	[d̪aba]	[la ðaba]	[d̪ue ðaba]	[kwin̪d̪o ðaba]	'yellowtail'
10.	[d̪azo]	[la ðazo]	[d̪ue ðazo]	[kwin̪d̪o ðazo]	'sturgeon'
11.	[gele]	[la ɣele]	[d̪ue ɣele]	[kwin̪d̪o ɣele]	'halibut'
12.	[gova]	[la ɣova]	[d̪ue ɣova]	[kwin̪d̪o ɣova]	'salmon'

a) Produce consonant and vowel charts, labeling the rows and columns with features. You may assume [+dental] is a feature.
b) Do the stems alternate? Explain
c) Give rules, naming them.
d) Is any rule ordering required?
e) Give right order/wrong order derivations for *la dazo* and *la ðazo*.

Answer to Study Exercise #89

   a) Produce consonant and vowel charts.

		[+bilabial]	[+labiodental]	[+dental]	[+alveolar]	[+velar]
[+stop]	[−voice]	p		t		k
	[+voice]	b		d		g
[+fricative]	[−voice]		f		s	
	[+voice]	ß	v	ð	z	ɣ
[+nasal]		m		n		
[+liquid]					l	
[+glide]		w				

	$\begin{bmatrix} -\text{back} \\ -\text{round} \end{bmatrix}$	$\begin{bmatrix} +\text{back} \\ -\text{round} \end{bmatrix}$	$\begin{bmatrix} +\text{back} \\ +\text{round} \end{bmatrix}$
$\begin{bmatrix} +\text{high} \\ -\text{low} \end{bmatrix}$	i		u
$\begin{bmatrix} -\text{high} \\ -\text{low} \end{bmatrix}$	e		o
$\begin{bmatrix} -\text{high} \\ +\text{low} \end{bmatrix}$		a	

   b) Do the stems alternate? Explain

   Yes, for example the stem for "tuna" has the two allomorphs [pama] and [bama].

   c) Give rules, naming them.

   Intervocalic Voicing

   [+stop] → [+voiced] / [+syllabic] ___ [+syllabic]

   This voices any stop occurring between vowels. It can be applied harmlessly to [b, d, g], since they are already voiced, so I left out [−voice] from the left side of the arrow.

   Intervocalic Spirantization[231]

   $\begin{bmatrix} +\text{stop} \\ +\text{voice} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{stop} \\ +\text{fricative} \end{bmatrix}$ / [+syllabic] ___ [+syllabic]

   This turns any voiced stop between vowels to its fricative counterpart, thus [b, d, g] →
   [ß, ð, ɣ].

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[231] Standard terminology for a rule that creates fricatives. "Spirant" is an old-fashioned synonym for "fricative."

d) Is any order required?

Intervocalic Spirantization must precede Intervocalic Voicing, to keep the voiced stops that derive from voiceless from turning into fricatives—we want Intervocalic Frication to apply "too late" to affect those stops.

e) Give right order/wrong order derivations for la dazo and la ðazo.

Correct:

/la tazo/	/la dazo/	underlying representation
—	ð	Intervocalic Spirantization
d	—	Intervocalic Voicing
[la dazo]	[la ðazo]	surface representation

Incorrect:

/la tazo/	/la dazo/	underlying representation
d	—	Intervocalic Voicing
ð	ð	Intervocalic Spirantization
*[la ðazo]	[la ðazo]	surface representation

Study Exercise #91: Phonemics of Alabama English

This exercise is based on an unpublished article by Prof. Elliott Moreton, an eminent linguist who teaches in the Linguistics Department at the University of North Carolina. The article is posted on his web site: www.unc.edu/~moreton/Papers/RaiseAlphaNotes1999.pdf. The native speaker is Prof. Moreton himself, who writes, "If you're going to imitate my accent, you might as well do it right."

Data for Part I

gripe	[gɹɑɪp]	*bribe*	[bɹaːb]	*I*	[aː]
light	[laɪt]	*slide*	[slaːd]	*thigh*	[θaː]
spike	[spaɪk]	*migrant*	[maːgɹənt]	*sigh*	[saː]
knife	[naɪf]	*hive*	[haːv]		
price	[pɹɑɪs]	*prize*	[pɹaːz]		
		line	[laːn]		
		lime	[laːm]		
		fire	[faːɹ]		

also: *bias* [baːəs], *biology* [baːˈɑlədʒi]

Directions. [aː] and [aɪ] are allophones of the same phoneme.

a. Decide what form the underlying phoneme should take. Justify your decision. As always, you should select the simplest analysis.

b. Write a rule to derive the contextual allophone.

c. Give derivations for *price*, *prize*, s*i*gh, and *bias*.

Data for Part II.

write	[ɹaɪt]
writer	[ˈɹaɪɾɚ]
ride	[ɹaːd]
rider	[ɹaːɾɚ]

d. How should the rule your wrote be ordered with respect to the rule of Tapping (discussed above on p. 442)?

e. Justify your answer with right and wrong derivations for the four words just given.

Here is Tapping, restated for convenience.

Tapping

$$\begin{bmatrix} +\text{alveolar} \\ +\text{stop} \end{bmatrix} \rightarrow ɾ \ / \ [+\text{syllabic}] \underline{\hspace{1cm}} \begin{bmatrix} +\text{syllabic} \\ -\text{stress} \end{bmatrix}$$

Answer to Study Exercise #90

a. We should pick underlying /aː/. This is the "elsewhere" allophone, and we can get a nice clean analysis picking it as the phonemic representation. All we have to do is set up a rule turning it into [aɪ] before a voiceless consonant. If we set up underlying /aɪ/ and tried to turn it into [aː] as an allophone, the rule needed would be very complicated, since you need three environments (voiced consonant, vowel, end of word).

b. The rule that is needed is this:

Diphthongization

aː → aɪ / __ [−voice]

(Obviously, you could give it other names.)

A lesson that emerges (if your own English happens not to be Southern) is: don't assume that another person's phoneme is necessarily the way *you* say a sound! Phonemic pattern must be analyzed in its own terms, dialect by dialect.

c. Derivations

/ˈpɹaːs/	/ˈpɹaːz/	/ˈsaː/	/ˈbaːəs/	underlying representations
aɪ	—	—	—	Diphthongization
[ˈpɹaɪs]	[ˈpɹaːz]	[ˈsaː]	[ˈbaːəs]	surface representations

d. Diphthongization must preceding Tapping, because it applies based on the *underlying*, not derived, voicing value of the tap.

e. Good derivations:

write	*writer*	*ride*	*rider*	
/ˈɹaːt/	/ˈɹaːt-ɚ/	/ˈɹaːd/	/ˈɹaːd-ɚ/	underlying representation
aɪ	ˈɹaɪtɚ	—	—	Diphthongization
—	ˈɹaɪɾɚ	—	ˈɹaːɾ-ɚ	Tapping
[ˈɹaɪt]	[ˈɹaɪɾɚ]	[ˈɹaːd]	[ˈɹaːɾɚ]	phonetic representation

Bad derivations:

write	*writer*	*ride*	*rider*	
/ˈɹaɪt/	/ˈɹaɪt-ɚ/	/ˈɹaɪd/	/ˈɹaɪd-ɚ/	underlying representation
—	ˈɹaːɾɚ	—	ˈɹaːɾ-ɚ	Tapping
aɪ	—	—	—	Diphthongization
[ˈɹaɪt]	*[ˈɹaːɾɚ]	[ˈɹaɪd]	[ˈɹaːɾɚ]	phonetic representation