

# Introductory Linguistics

A draft textbook by

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## 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 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 you will get practice in 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 all the problems of linguistics.

The reason is this: speaking a language and knowing its structure are two very 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: “What is the word for “duck” in your language?”. Others look for the various different grammatical forms of the same word: “How would you say “two ducks”? (looking, perhaps, for a plural). 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.<sup>1</sup>

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. I hope the analysis illustrates the following crucial point: *the native speaker doesn’t know the answer*. But the native speaker has the tacit, intuitive knowledge that makes it possible to find the answer, or at least get closer to it.

### 3. The reference of *each other*

Supposing, then, that we have a native speaker of English present. Such a speaker is likely to tell you that in (1), *each other* refers to *we*, and that it means something like, “I like you and you like me.”

- (1) We like each other.
- (2) John and Bill 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 (2) has a similar reciprocal reading.

Sentence (3) is a bizarre sentence, in that *each other* cannot logically refer to *I*.

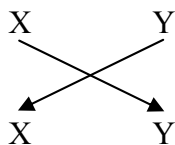
- (3) \*I like each other.

The native speakers 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 (3) is **ungrammatical**; that is, ill-formed. Following standard practice, I will place an asterisk before sentences that are ungrammatical

In (3), the ungrammaticality can be traced to the absence of any plausible interpretation for the sentence; since *each other* describes reciprocal actions, like this:

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<sup>1</sup> 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.



*Each other* cannot be used unless the agent of the action is plural. But not all cases can be explained in this way. In (4), 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:

- (4) \*John and Bill think I like each other.

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

Sentence (5) shows the same thing: you can think up two logically possible meanings, but only one meaning is allowed by the rules of English.

- (5) We believe they like each other.

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:

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 "little sentence".

- (6) [ We like each other. ]<sub>s</sub>  
 (7) [ John and Bill like each other. ]<sub>s</sub>  
 (8) \*[ I like each other. ]<sub>s</sub>  
 (9) \*[ John and Bill think [I like each other. ]<sub>s</sub>]<sub>s</sub>  
 (10) [ We believe [ they like each other. ]<sub>s</sub>]<sub>s</sub>

Note that clauses can have clauses inside them. In (11), 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**.

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

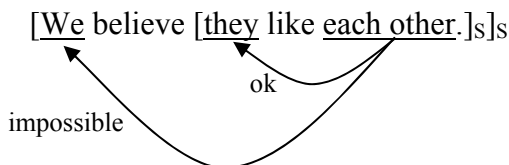
For example, in (6) and (7), the noun phrases are *we*, *each other*, *John and Bill*, and again *each other*.

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

(12) ***Each other* reference rule**

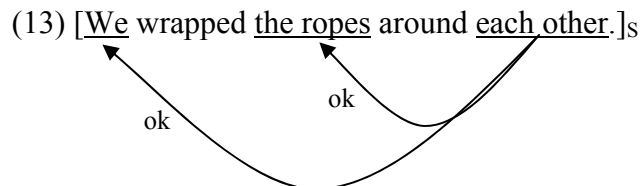
*Each other* can refer only to noun phrases that are inside the smallest clause containing it.

In the tricky cases, (4-5), the rule works fine: it requires that *each other* refer to *I* and *they* respectively. This can be seen graphically for (5) if we make a diagram, using arrows to show legal and illegal reference.



Cases (1)-(3) are easy: there is only one noun phrase for *each other* to refer to, and the rule permits this.

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:



This is just what our rule predicts. Because of this, the sentence has two possible meanings.

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

(14) [We consulted two detectives in order [to find out about each other]s]s

(15) [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 (14), namely, "we", and *someone* is doing the liking in (15), 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.

For purposes of analyzing explicitly, let us fill them in:

(16) [We consulted two detectives in order [(we) to find out about each other]<sub>s</sub>]<sub>s</sub>

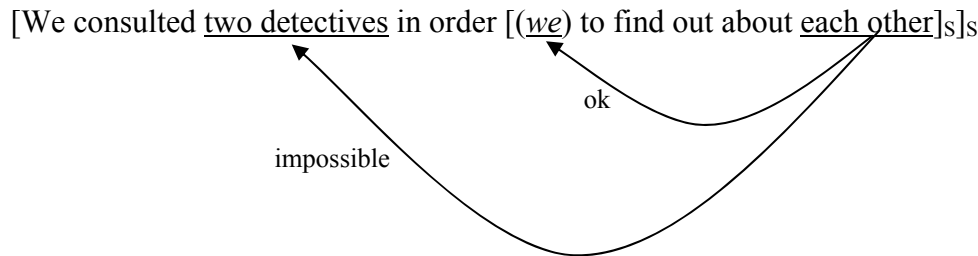
(17) [They seem to us [(they) to like each other]<sub>s</sub>]<sub>s</sub>

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

(18) ***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.

Here is an analytic diagram for sentence (15):



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 (15) 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 *in order to* and many other grammatical constructions.

For now, the point is this: knowing English means that you “know” the *Each Other* Reference Rule, in an intuitive sense. But it does not mean that you know it explicitly. Much of the work of linguistics consists of trying to make implicit knowledge explicit. The method is much the same as in other sciences: we gather data (from the native speaker), formulate hypotheses, test the hypotheses against the data, revise the hypotheses, gather more data, and so on.

## Study Exercises for “each other”

Answers on page 10. 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. Put [ ... ]<sub>s</sub> brackets around them. Be sure to get all of the clauses, sometimes there are more than one. 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: [ Alice believes that [ Fred sang ]<sub>s</sub> ]<sub>s</sub>
- ii. Alice hopes to climb Everest. Answer [ Alice hopes [ (Alice) to climb Everest ]<sub>s</sub> ]<sub>s</sub>

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

### 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.



**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.)

**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 #1

- a. [ I believe that [ turtles can swim. ]<sub>s</sub> ]<sub>s</sub>
- b. [ The fact that [ Fred left ]<sub>s</sub> bothers Alice. ]<sub>s</sub>
- c. [ Bill said that [ [ Jane sang ]<sub>s</sub> and [ Fred danced. ]<sub>s</sub> ]<sub>s</sub> ]<sub>s</sub>

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

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

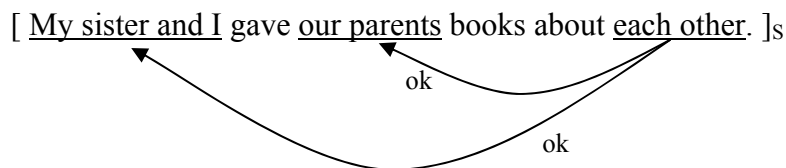
### Answer to Study Exercise #2

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."

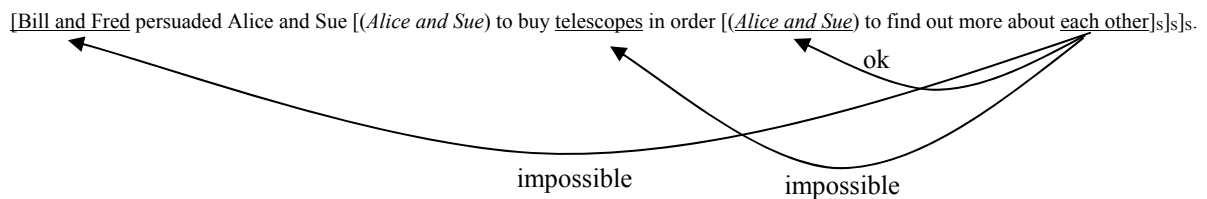
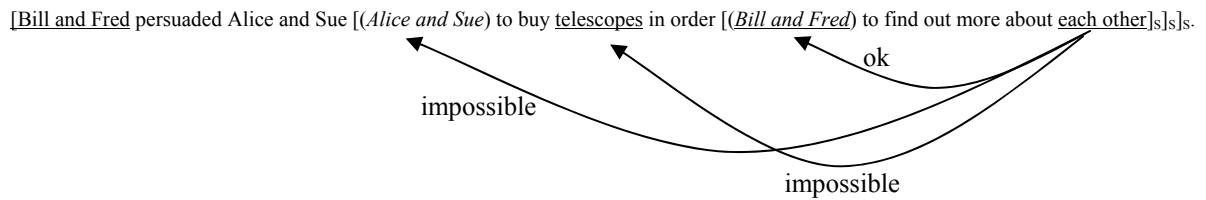
Other meaning: "My sister and I gave our mother a book about our father and gave our father a book about our mother."

Diagram:



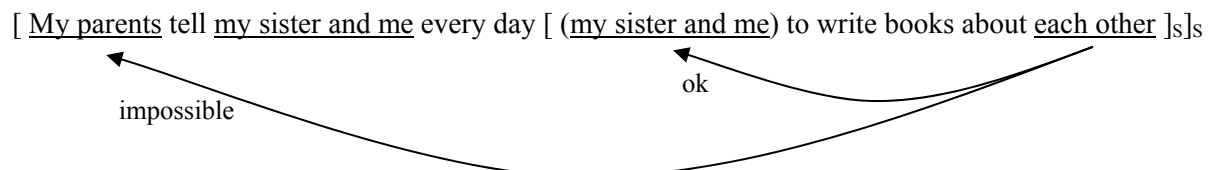
### Answer to Study Exercise #3:

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



### 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*.



## 4. 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:

<b>syntax</b>	study of rules for forming sentences
<b>semantics</b>	study of rules for meaning
<b>morphology</b>	study of rules for forming words
<b>phonology</b>	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.

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.<sup>2</sup> 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.

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.

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<sup>2</sup> The best directory to the world’s languages is the *Ethnologue*, on line at <http://www.ethnologue.com/>.

## Chapter 2: Morphology

### 5. Orientation

In linguistics, “morphology” means “the study of word structure.” We’re interested in the structure of individual words, as well as the grammatical principles whereby 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 prefixed to *deny* to form *deniable*<sup>3</sup>; 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*.

Stem, prefixes, and suffixes are the building blocks from which words are assembled. The term used for such building blocks by linguists is **morpheme**, often defined as follows:

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

Thus, *un-*, *deny*, and *-able* are morphemes; *deniable* is not a morpheme because it can be split; *de* and *ny* are not morphemes because they are meaningless.

We can start with a bit of 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.

### 6. 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:

- **tense** on verbs (present tense *jumps*, past tense *jumped*)
- **number** on nouns (singular *cow*, plural *cows*)
- a small amount of **person and number agreement** in verbs (*She sings*, 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

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<sup>3</sup> We’ll ignore the change of *y* to *i*, a convention of English spelling.

Swahili, Russian, or Turkish, have a great deal, and students of these languages can spend years getting through it all.

## 7. Morphological analysis

When they encounter an unfamiliar language, linguists usually 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.

There are no fancy methods for doing this; basically one must scan a collection of morphologically similar words 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:

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*.<sup>4</sup>

## 8. Breaking up the words into morphemes

The search, as always, is for invariant form paired with invariant meaning. In the first column, 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.

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)”.

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.

<sup>4</sup> Thus the reference source on Turkish I’m using gives the sentence

Beş    adam    heykel-**i**            kırđı  
five    man    statue-**accusative**   broke  
‘Five men broke the statue’

- 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.<sup>5</sup>
- 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 by prepositions.<sup>6</sup>

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.

Inspecting the data in rows 21-40, it is plain that every **plural** noun has the suffix /-ler/.

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*.<sup>7</sup> 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’ |

---

<sup>5</sup> Still other ways exist—in Tagalog, much of this information is given using prefixes or suffixes on the verb.

<sup>6</sup> Or their counterpart, postpositions, which follow their object noun phrase.

<sup>7</sup> 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”.



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

- “**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.<sup>8</sup>
- “**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.

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 meant to clarify structure, rather than give an idiomatic reading.

<i>Word</i>	<i>Gloss</i>	<i>Idiomatic translation</i>
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’

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<sup>8</sup> 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.

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-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’

## 9. 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.

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.)' evinizi
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.

## 10. 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.

<i>Stem</i>	<i>Plural</i>	<i>Possessor Person</i>	<i>Possessor Number</i>	<i>Case</i>
el 'hand'	-ler	-im 1st	-iz plural	Ø 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:

<i>Stem</i>	<i>Plural</i>	<i>Possessor Person</i>	<i>Possessor Number</i>	<i>Case</i>
el hand	-ler plural	-in 1st	-iz plur. poss.	de locative

In analysis, words like *ellerimizde* are very useful, since they demonstrate the need for five slots. 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 ordering. But in fact, 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:

ki-tabu	a-ki-taka- <b>cho</b>	Hamisi	
book	SUBJ-OBJ-want- <b>which</b>	Hamisi	'the book which Hamisi wants'
ki-tabu	a-si- <b>cho</b> -ki-taka	Hamisi	
book	SUBJ-NEG- <b>which</b> -OBJ-want	Hamisi	'the book which Hamisi doesn't want'

## 11. 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.

We'll 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**.<sup>9</sup> 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:

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

The /el/ part is the stem meaning 'hand'; it is enclosed in / / because this is the way you indicate the speech sounds (phonemes) of a word. The part in [ ] is the morphosyntactic representation. It contains four morphological features:

Number  
PossessorNumber  
PossessorPerson  
Case

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.

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<sup>9</sup> Why? We'll see later on: the morphosyntactic representation transfers information over from the syntax to the morphology.

## Number Rule

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

## Possessor Person Rule

Add a possessor suffix, as follows:

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

## Possessor Number Rule

Add a possessor suffix, as follows:

/-iz/      if [PossessorNumber:plural]

## 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.

For the Turkish form ellerinizde ‘in your (plur.) hands’ (#40 in the data from last time), the derivation would look like this:

/el/:[Number:plural, PossPers:2, PossNum:plural, Case:Locative]	‘hand’ with its morphosyntactic representation
/eller/:[ <b>Number:plural</b> , PossPers:2, PossNum:plural, Case:Locative]	Number Rule
/ellerin/:[Number:plural, <b>PossPers:2</b> , PossNum:plural, Case:Locative]	Possessor Person Rule
/elleriniz/:[Number:plural, PossPers:2, <b>PossNum:plural</b> , Case:Locative]	Possessor Number Rule
/ellerinizde/:[Number:plural, PossPers:2, PossNum:plural, <b>Case:Locative</b> ]	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
/eller/:[ <b>Number:plural</b> , PossPers:1, PossNum:plural, Case:Accusative]	Number Rule
/eller <b>im</b> /:[Number:plural, <b>PossPers:1</b> , PossNum:plural, Case:Accusative]	Possessor Person Rule
/eller <b>imiz</b> /:[Number:plural, PossPers:1, <b>PossNum:plural</b> , Case:Accusative]	Possessor Number Rule
/eller <b>imizi</b> /:[Number:plural, PossPers:1, PossNum:plural, <b>Case:Accusative</b> ]	Case Rule

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## 12. The bigger picture

Grammars like the one we are working on can produce a clearer understanding of large amounts 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)  $2 \times 3 \times 3 \times 7 = 84$  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.

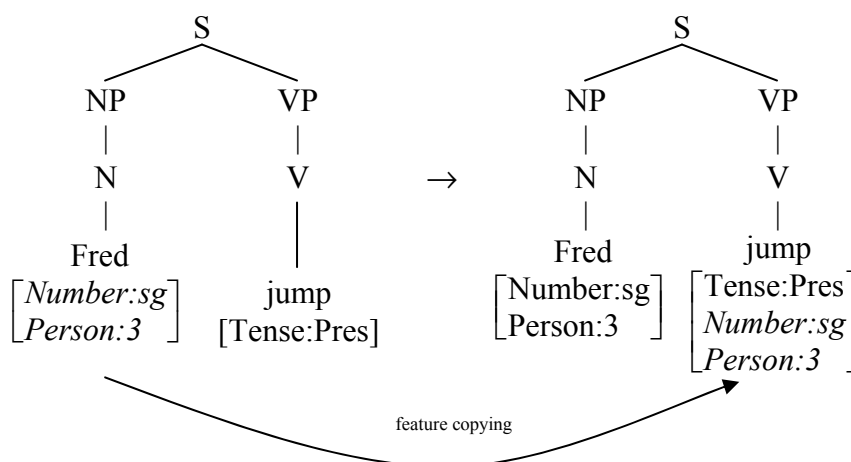
The Turkish nominal system is a fairly simple one; Turkish verbs, for instance, are quite a bit more complex. The most elaborate system I know of is the verbal system of Shona (Bantu), where (according to the linguist David Odden), the typical verb has about 10 trillion possible forms. Odden has developed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

## 13. 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 affixes 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. Thus, in an English sentence like *Fred jumps*, the fact that the subject of the sentence, *Fred*, is in the third person means that the rules of the syntax cause the feature [Person:3, Number:Singular] to appear on the stem *jump*; this is so-called “subject-verb agreement”. Looking ahead to syntax, we can draw a syntactic structure<sup>10</sup> and the process of agreement:



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 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:

### 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.

## 14. German inflection: more than one feature per morpheme

Consider the person-number endings of German, in the present and past:<sup>11</sup>

<sup>10</sup> 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".

<sup>11</sup> I'm glossing over some inessential complications arising from the fact that the stem *wart* ends in a [t].

**Present**

1 sg.	ich warte	‘I wait’
2 sg.	du wartest	‘you-sg. wait’
3 sg.	sie/er wartet	‘she/he waits’
1 pl.	wir warten	‘we wait’
2 pl.	ihr wartet	‘you-plur. wait’
3 pl.	sie warten	‘they wait’

**Past**

ich wartete	‘I waited’
du wartetest	‘You waited’
sie/er wartete	‘she/he waited’
wir warteten	‘we waited’
ihr wartetet	‘you-plur. waited’
sie warteten	‘they waited’

Things here are a bit tricky: 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<sup>12</sup> indicates that the second is correct. Here are the forms broken up into position classes (shown with vertical alignment):

**Present**

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

**Past**

ich	wart	et	e
du	wart	et	est
sie/er	wart	et	e
wir	wart	et	en
ihr	wart	et	et
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” 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 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:

**I. Tense Marking**

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

**II. Person/Number Marking**

Suffix:

- e* if [Person:1, Number:Singular]
- st* if [Person:2, Number:Singular]

<sup>12</sup> Notably, the imperative is just the plain stem: *Wart!* (wait).

**-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* simultaneously manifests [Number:Singular, Person:3, Tense:Present]. In fact, such “tangling” is found in languages all over the world.

Linguists speak of charts like the one at the top of this section as **paradigms**: a paradigm consists of all, or a systematic portion of, the inflected forms of a particular stem. We can also speak of things like the “present paradigm” (left column above) or the “past paradigm” (right column).

Subparadigms often involve **partial overlap**: thus, the German present and past verb paradigms overlap in all but the third singular.

## 15. 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.

### 15.1 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).

#### 15.1.1 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:

<i>der Mann</i>	‘the-masculine man’
<i>die Frau</i>	‘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:

<i>der Löffel</i>	‘the-masculine spoon’
<i>die Gabel</i>	‘the-feminine fork’
<i>das Messer</i>	‘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<sup>13</sup> I quote the following rules:

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 memorized the gender of every word.

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

### 15.1.2 Case

Nouns, and the syntactic phrases they occur in, are marked for **case**, which marks their role in the sentence. (See p. 15 above for discussion of case.)

### 15.2 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.

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<sup>13</sup> <http://montgomery.cas.muohio.edu/meyersde/kitchensink/german-gender/>. Unfortunately, since I wrote this it seems to have been taken down (9/2010).

**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). 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, and Japanese have such systems today.

In various languages verbs are inflected for **degree of belief**; thus from my German textbook:

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 common in American Indian languages.

### 15.3 Adjectival Inflection

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

*ein guter Löffel* ‘a-masculine good-masculine spoon’  
*eine gute Gabel* ‘a-feminine good-feminine fork’  
*ein gutes Messer* ‘a-neuter good-neuter knife’

## 16. The principle of obligatory expression

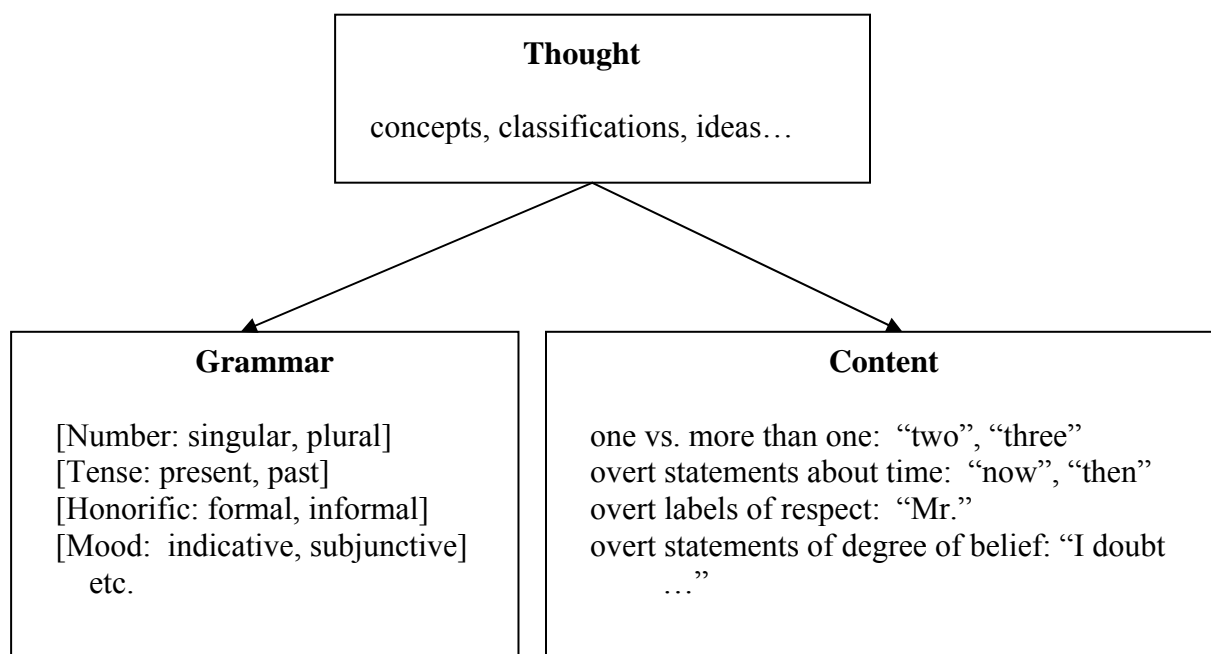
An important aspect of inflectional morphology is that it often involves *obligatory choices*. When in English one says “I bought the book”, it specifically means “one book”, not “any old number of books”. Likewise, “books” necessarily implies the plural. To avoid the obligatory

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:

wǒ<sup>3</sup>    mǎi<sup>3</sup>    shū<sup>1</sup>  
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.



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 uncoded 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 most omnipresent in our lives: time, number, belief vs. doubt, and the fundamental aspects of conversations (speaker/hearer/other and their social relations.)

## 17. The typology of inflection

A rough way of characterizing languages for their system of inflectional morphology is the following three way split:

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 (tends to) 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 express *multiple* features. Example: Latin.

*somnus, somni. nm., sleep.*

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

The point of the example is that (for instance) *-us* 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:

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

In general, the agglutinative languages will have just one, or a few, features mentioned in each rule, whereas the inflecting languages tend to have more. (This is just a more formal way of characterizing the basic distinction.)

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.



## WORD FORMATION

[ xxx note for next time: this is missing a discussion of ambiguous words with two derivations ]

### 18. Rules of word formation

The other function of morphology is to expand the stock of words in the language, 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*.

#### 18.1 Rules of Word Formation

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

*-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:

$$X \rightarrow X + \text{-able}$$

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.

All three aspects of the rule can be expressed more compactly in the following abbreviated form:

#### **-able Rule**

$$[X]_{\text{Verb}} \rightarrow [[X]_{\text{Verb}} \text{-able}]_{\text{Adjective}} \quad \text{Meaning: “able to be V’ed”}$$

You can read this as follows:

“Take some string X that is a Verb. Add to it the string *abl*. Classify the resulting string as an Adjective.”

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*:

[ wash ] <sub>Verb</sub>	Stem
[ [ wash ] <sub>Verb</sub> able ] <sub>Adjective</sub>	-able Rule

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

### **-ity Rule**

[ X ]<sub>Adjective</sub> → [ [ X ]<sub>Adjective</sub> ity ]<sub>Noun</sub>    Meaning: “quality of being Adjective”

This creates structures like [ [ obes ]<sub>A</sub> ity ]<sub>N</sub>.

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

### **un- Rule**

[ X ]<sub>Adjective</sub> → [ un [ X ]<sub>Adjective</sub> ]<sub>Adjective</sub>    Meaning: “not Adjective”

The rule creates structures like [ un [ kind ]<sub>A</sub> ]<sub>A</sub>.

## **19. 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:

[mind] <sub>Noun</sub>	stem
[[mind] <sub>Noun</sub> ful] <sub>A</sub>	<b>-ful Rule:</b>
	[ X ] <sub>N</sub> → [ [ X ] <sub>N</sub> ful ] <sub>Adj</sub>
[un[[mind] <sub>Noun</sub> ful] <sub>Adj</sub> ]	<b>un- Rule</b>
[[un[[mind] <sub>Noun</sub> ful] <sub>Adj</sub> ]ness] <sub>Noun</sub>	<b>-ness Rule:</b>
	[ X ] <sub>Adj</sub> → [ [ X ] <sub>Adj</sub> ness ] <sub>Noun</sub>

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]<sub>Noun</sub>

stem

[[[industry]<sub>Noun</sub> al]<sub>A</sub>]<sup>14</sup>**-al Rule:**[ X ]<sub>N</sub> → [[ X ]<sub>N</sub> al ]<sub>Adj</sub>“[[ X ]<sub>N</sub> al ]<sub>Adj</sub>” means “pertaining to X”[[[industry]<sub>Noun</sub> al]<sub>A</sub> ize ]<sub>V</sub>**-ize Rule:**[ X ]<sub>Adj</sub> → [[ X ]<sub>Adj</sub> ize ]<sub>Verb</sub>“[[ X ]<sub>Adj</sub> ize ]<sub>Verb</sub>” means “to render X”[[[[industry]<sub>Noun</sub> al]<sub>A</sub> iz ]<sub>V</sub> ation ]<sub>Noun</sub>**-ation Rule:**[ X ]<sub>Verb</sub> → [[ X ]<sub>Verb</sub> ation ]<sub>Verb</sub>“[[ X ]<sub>Verb</sub> ation ]<sub>Verb</sub>” means “the process of Xing”[[[[[industry]<sub>Noun</sub> al]<sub>A</sub> iz ]<sub>V</sub> ation ]<sub>Noun</sub> al]<sub>Adj</sub>. **-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.

**20. 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.

**20.1 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)

<sup>14</sup> We may ignore the spelling change, assuming our focus is on spoken English.

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

- Verb to noun: -ation, as above  
 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  
 usual meaning: “the quality of being Adjective”  
 Noun to adjective: -ish, -esque  
 usual meaning: “resembling Noun”
- Verb to adjective: -ent (as in *effervescent*)  
 usual meaning: “tending to Verb”  
 Adjective to verb: -ify (as in *clarify*, *humidify*)  
 usual meaning: “render Adjective”

## 20.2 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:

- |               |                                 |
|---------------|---------------------------------|
| res-idan      | ‘reach-infinitive’              |
| res-a:n-idan  | ‘send-infinitive’               |
| xa:b-idan     | ‘to sleep’                      |
| xa:b-a:n-idan | ‘to put to sleep’ <sup>15</sup> |

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:

### **-a:n Rule**

$[X]_{\text{Verb}} \rightarrow [[X]_{\text{Verb}} \text{ a:n}]_{\text{Verb}}$     Meaning: “to cause to Verb”

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<sup>15</sup> In the International Phonetic Alphabet, the symbol [:] designates a long vowel.

### 20.3 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’
dʒanitor	‘to work as a janitor’
ʔagindʒadʒanitor	‘to pretend to be a janitor’

English has some very specific word formation processes:

<i>bowl-arama, carpet-arama</i>	‘grand emporium for X or X-ing’
<i>Stalin-ism, Mao-ism</i>	‘doctrine propounded by X’
<i>pay-ola, shin-ola, plug-ola</i>	‘bribery involving X’

## 21. 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):

$[n\Lambda l]_{\text{Adj.}}$	root: ‘null’
$[[n\Lambda l]_{\text{Adj.}}\text{Ifai}]_{\text{Verb}}$	Word formation rule: Adjective + /-ifai/ → Verb
$[[n\Lambda l]_{\text{Adj.}}\text{Ifai}+z]_{\text{Verb}}$	Inflectional rule:
	$X \rightarrow Xz$ when [Verb, +3rd person, +singular, +present]

The opposite rule ordering would have derived  $*[n\Lambda l z\text{ifai}]$ , 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.

## 22. 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:

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

Thus: *boat house* (structure:  $[[\text{boat}]_{\text{Noun}} [\text{house}]_{\text{Noun}}]_{\text{Noun}}$ ) 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. You’ll find some double-headed compounds on this week’s homework. You can derive them with a rule that’s 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:

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.

## 22.1 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

### 23. 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*).<sup>16</sup> 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.

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

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<sup>16</sup> 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”.



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.

## 24. 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.

### 24.1 Infixation

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

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:

$[X]_{\text{Adj}} \rightarrow [[X]_{\text{Adj}}]_{\text{Verb}}$   
 Meaning: “become Adjective”

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

$$\begin{array}{ccccccc} [ & C & V & X & ]_{\text{Adj}} & \rightarrow & [[ & C & \text{um} & V & X & ]_{\text{Adj}} ]_{\text{Verb}} \\ & 1 & 2 & 3 & & & & 1 & & 2 & 3 & \end{array}$$

Meaning: “become Adjective”

You can read the rule above as follows:

“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:

$$\begin{array}{ccccccc} [ & f & i & kas & ]_{\text{Adj}} & & [[ & f & \text{um} & i & kas & ]_{\text{Adj}} ]_{\text{Verb}} \\ | & | & | & \vee & | & & | & | & | & | & \vee & | & | \\ [ & C & V & X & ]_{\text{Adj}} & \rightarrow & [[ & C & \text{um} & V & X & ]_{\text{Adj}} ]_{\text{Verb}} \\ & 1 & 2 & 3 & & & & 1 & & 2 & 3 & & \end{array}$$

Infixation is not common in English. You are probably familiar with the colloquial expression *fan*<sup>17</sup> [ˈfʌkən] *tastic*,<sup>17</sup> in which a taboo word is placed in the middle of the stem, as a kind of infix. 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.<sup>18</sup>

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

<sup>17</sup> IPA symbols: [ʌ] is the vowel of *cut*, [ə] is the second vowel of *taken*.

<sup>18</sup> A pretty good analysis appears in John McCarthy (1981) “Prosodic structure and expletive infixation,” *Language* 58, 574–590, available at [http://people.umass.edu/jjmccart/prosodic\\_structure\\_and\\_expletive\\_infixation.pdf](http://people.umass.edu/jjmccart/prosodic_structure_and_expletive_infixation.pdf)

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.

## 24.2 Reduplication

**Reduplication** is a morphological process in which all or part of a word is copied. For example, in Yidj, 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:

mad <sup>j</sup> indan	‘walk up’
mad <sup>j</sup> inmad <sup>j</sup> indan	‘keep walking up’
d <sup>j</sup> ad <sup>j</sup> aman	‘jump’
d <sup>j</sup> ad <sup>j</sup> ad <sup>j</sup> ad <sup>j</sup> aman	‘jump a lot’ <sup>19</sup>

Here is a rule

$$\begin{matrix} [X]_{\text{Verb}} \\ 1 \end{matrix} \rightarrow \begin{matrix} [ [X]_{\text{Verb}} \\ 1 \end{matrix} \begin{matrix} [X]_{\text{Verb}} \\ 1 \end{matrix} ]_{\text{Verb}} \quad \text{Meaning: ‘to Verb repeatedly’}$$

In Samoan (S. Pacific), the plural form of a verb is formed by reduplicating the second-to-last syllable of a verb:

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:

### Samoan Plural Subject Reduplication

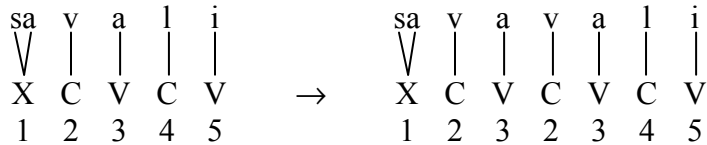
$$\begin{matrix} X & C & V & C & V \\ 1 & 2 & 3 & 4 & 5 \end{matrix} \rightarrow \begin{matrix} X & C & V & C & V & C & V \\ 1 & 2 & 3 & 2 & 3 & 4 & 5 \end{matrix}$$

<sup>1919</sup> d<sup>j</sup> is the IPA for a voiced lamino-palatal stop, similar to the English “j” sound.

when the morphosyntactic representation contains [Number:Plural]

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]



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

The meanings expressed by reduplication are often “symbolic” in nature; languages often use reduplication to express plurals, intensiveness, repeated action, and the like.

### Study Exercise #8

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

duk	‘to build’	tuduk	‘to cause to build’
lel	‘to be glad’	telel	‘to gladden’
nam	‘eat’	tapam	‘feed’
wadik	‘write’	tawadik	‘cause to write’
cak	‘throw’	tacak	‘cause to throw’

## Answer to Study Exercise #8

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

$$\begin{array}{c} [ \text{ C } \text{ V } \text{ X } ]_{\text{Verb}} \\ \text{1} \quad \text{2} \quad \text{3} \end{array} \rightarrow \begin{array}{c} [[ \text{ t } \text{ V } \text{ C } \text{ V } \text{ X } ]_{\text{Verb}} ]_{\text{Verb}} \\ \text{2} \quad \text{1} \quad \text{2} \quad \text{3} \end{array}$$

Meaning: “cause to verb”

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

### 24.3 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]:

Present	Past
<i>cling</i>	<i>clung</i>
<i>sling</i>	<i>slung</i>
<i>fling</i>	<i>flung</i>
<i>string</i>	<i>strung</i>
<i>wring</i>	<i>wrung</i>

While these are irregular verbs (and thus are probably memorized), the process is nevertheless a little bit productive: forms have arising in dialects like *sing* - *sung*, *ring* - *rung*; and many children explore the possibility of *bring* - *brung*. 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:

$$\begin{array}{c} [ \text{ X } \text{ ɪ } \text{ ŋ } ] \\ \text{1} \quad \text{2} \quad \text{3} \end{array} \rightarrow \begin{array}{c} [ \text{ X } \text{ ʌ } \text{ ŋ } ] \\ \text{1} \quad \text{2} \quad \text{3} \end{array}$$

when the morphosyntactic representation contains [Tense:Past]

### 24.4 Morphological Conversion

Consider:

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:

Answer: **Verb-Noun Conversion**

$$[X]_{\text{Verb}} \rightarrow [[X]_{\text{Verb}}]_{\text{Noun}}$$

meaning: “an instance of Verbing”

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

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:

**Verb-Noun Conversion**

$$[X]_{\text{Noun}} \rightarrow [[X]_{\text{Noun}}]_{\text{Verb}}$$

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.

## 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:

<i>Present</i>	<i>Past participle</i>
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.

- “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/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 really make them go away. To speak personally on this point: I find that whenever I encounter a phrase like “very unique,” or the pronunciation [ˈnukjʊlər] (“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.<sup>20</sup> 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 [ˈnukjʊlər]! 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, linguists tend to use carefully-selected vocabulary that shows that, for professional purposes, they are not buying into the beliefs that are held by (many of) 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”.

Second, the 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 poor and working-class people in poorer neighborhoods of London. It is fairly familiar to Americans because we hear it in mouths of fictional characters of these 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.”<sup>21</sup>

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<sup>20</sup> “Unique” originally meant “just one”; nowadays it is gradually coming to mean “unusual”. It makes sense to say “very unusual” but not to say “very one”. “Nucular” [ˈnukjʊlər] reflects the large number of words in English that end in *-ular*, and is also perhaps easier to say than the older pronunciation [ˈnukliər].

<sup>21</sup> Source: *Does Accent Matter?* (1989) by John Honey.



The description may surprise us, since the Cockney we hear is sentimentalized; usually placed in the mouths of 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 (of which Cockney is one example). The non-prestigious dialects are spoken on various bases:

- **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:<sup>22</sup> 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 speakers of prestigious dialects 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 native speakers of the non-prestigious variety.

This is what such experiments teach us. However, they are limited in their scope - a formal experimental setting might well bias the subjects' responses. 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" that might not be particularly desirable to be sending.

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<sup>22</sup> A good review is in Ralph Fasold (1984) *The Sociolinguistics of Society*, Basil Blackwell, Oxford, Chapter 6.

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.

##### *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”, [ˈnukjʊlər]) 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. Are normative beliefs ever justified?**

Let us now take on the most loaded question about normative beliefs: is it really true that one language or dialect 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 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 intensity 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,"<sup>23</sup> made a case for the grammatical integrity of Black English as a system (a well known fact about the dialect is that it has distinctions of verbal tense not available in the standard), 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 derivational morphology) to accommodate any culturally-novel concept.

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

Earlier in this text I very tentatively suggested that there may be some virtue in inflectionally-impooverished languages like 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.

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<sup>23</sup> In his book *Language and the Inner City* (University of Pennsylvania Press, Philadelphia 1974).

### 5.1 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 Black 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.

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.

## 6. 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.

## 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 *\*Bill and Fred think that I like each other* (p. 5) 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 sentence in English (or any other human language). It is easy to show this. A list of sentences like the following:

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

can be extended onward to infinity.

Since syntactic knowledge cannot take the form of a list, we are led to the more reasonable 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. Just what sort of rules could do this will become clear later on.

(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:

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)  
 Sue saw (the man with the telescope)

Bill (gave)(the Chinese vases)                    (...to someone)  
 Bill (gave)(the Chinese)(vases)                (...even though they already had vases)

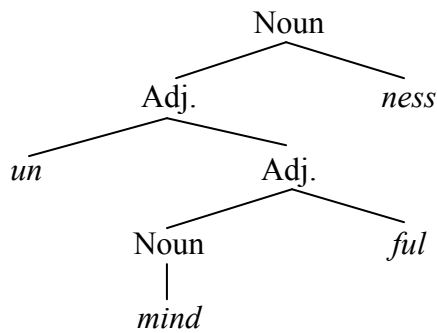
## 2. Constituent structure

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. We gave a derivation for the word *unmindfulness*, as follows.

[mind] <sub>Noun</sub>	stem
[[mind] <sub>Noun</sub> ful] <sub>A</sub>	<b>-ful Rule:</b>
	[ X ] <sub>N</sub> → [[ X ] <sub>N</sub> ful ] <sub>Adj</sub>
[un[[mind] <sub>Noun</sub> ful] <sub>Adj</sub> ]	<b>un- Rule</b>
[[un[[mind] <sub>Noun</sub> ful] <sub>Adj</sub> ness] <sub>Noun</sub>	<b>-ness Rule:</b>
	[ X ] <sub>Adj</sub> → [[ X ] <sub>Adj</sub> ness ] <sub>Noun</sub>

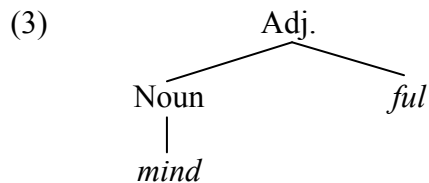
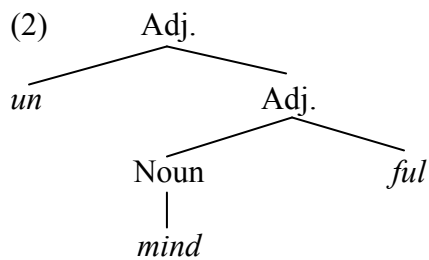
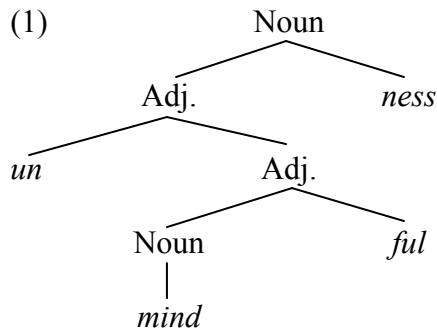
The output, [[un[[mind]<sub>Noun</sub> ful]<sub>Adj</sub>ness]<sub>Noun</sub>, can be shown more clearly with a tree, as follows:

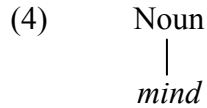


As you can see, the tree metaphor is a bit odd, since linguistic trees are virtually always drawn upside down relative to biological ones. The virtue of the term “tree” is that it is briefer than “root system”, ‘tree located in Australia’, or whatever...

Definition: any unit in a tree is called a **node**. The nodes in the tree above are { 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:





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 usually 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.

- (1) = [[un[[mind]<sub>Noun</sub> ful]<sub>Adj</sub>]ness]<sub>Noun</sub>  
 (2) = [un[[mind]<sub>Noun</sub> ful]<sub>Adj</sub>]  
 (3) = [[mind]<sub>Noun</sub> ful]<sub>Adj</sub>  
 (4) = [mind]<sub>Noun</sub>

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.

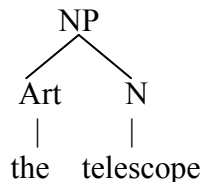
You can *name* a constituent by pronouncing its terminal nodes in order. So, for example, you can say things like: “in the word *unmindfulness*, *unmindful* is a constituent, and *mindfulness* is not a constituent.”

### 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.

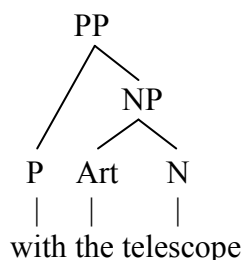
I believe it is pretty intuitive that *the telescope* is a linguistic unit. We show this with a tree diagram.





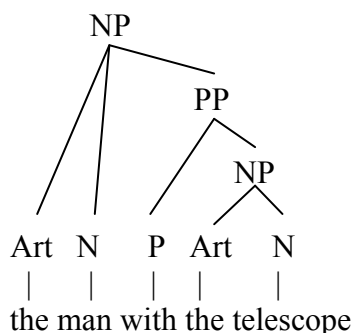
What does this diagram mean? The basic idea is that *the* is classified as an Article, and *telescope* as a Noun, and the entire unit is a **Noun Phrase**, abbreviated NP.<sup>24</sup> This NP can stand alone, for instance as the answer to the question “What did the man have with him?”

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



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*.

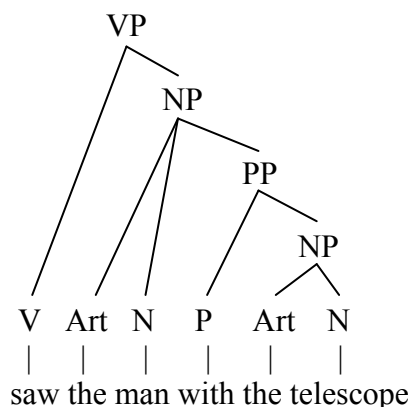
We can continue, building up the structure as follows:



(Which man are we speaking of?)

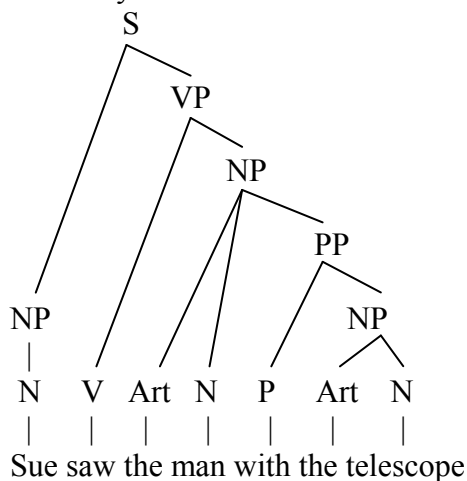
This is a bigger Noun Phrase, involving a *man*, further identified with the article *the* and the Prepositional Phrase *with the telescope*. It could answer the question, “Which man are we speaking of?”

<sup>24</sup> 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>.



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:



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*.<sup>25</sup>

Trees of this kind will be the formalism we will be using for syntactic structure. Trees in syntax are also referred to as **phrase structure diagrams**.

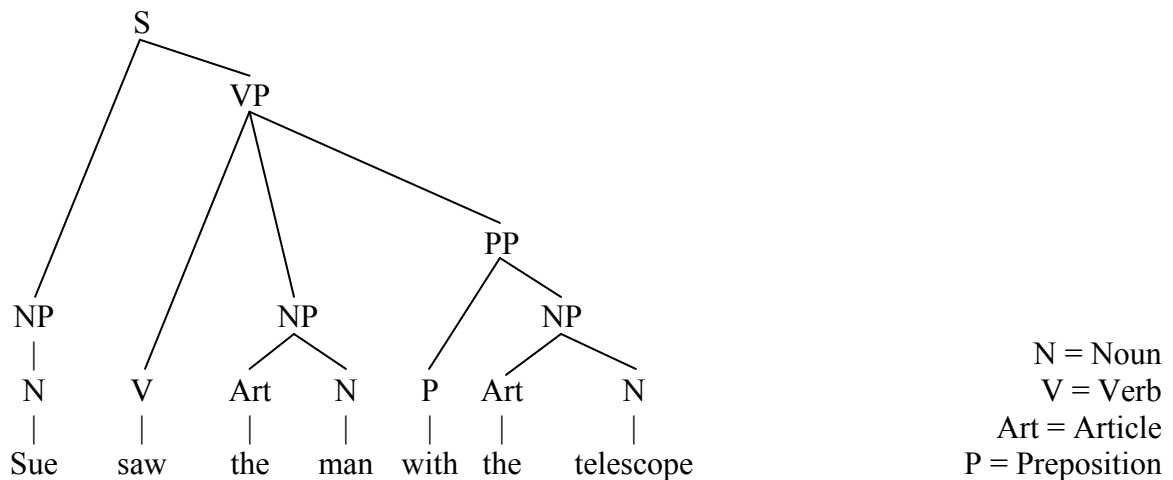
#### 4. Phrase structure and ambiguity

As mentioned above, one of the first and most obvious descriptive benefits of constituent structure is that it provide 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

<sup>25</sup> For why we are treating *Sue* as a full NP, not just an N, see below.

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:



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.

You can think of heads either formally (as a property of trees), 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 necessarily 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.

(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.

### Principles of Parsing

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

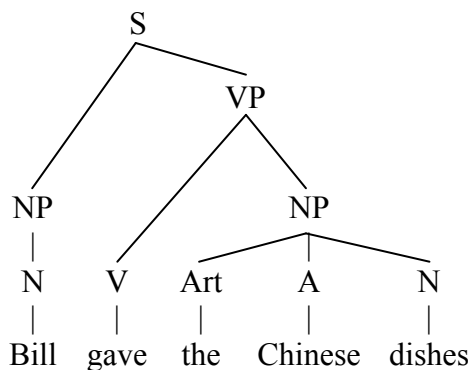
Returning to the two structures of *Sue saw the man with the telescope*, the crucial distinction is what the PP *with a telescope* is a modifier of: in one reading, it modifies *man* (that is, it specifies which man), and thus belongs as part of NP; in the other reading, it modifies *see* (that is, it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

**Study Exercise #9**

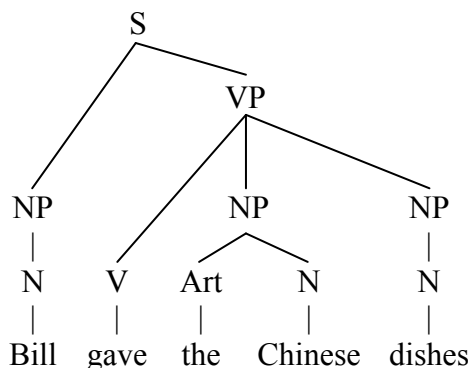
Diagram (that is, parse) both readings of the sentence *Bill gave the Chinese dishes*. The answer is given on the next page.

### Answer to Study Exercise #9

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. With both readings, we can get two parses, as follows:



(That is, gave the Chinese dishes to someone, unspecified. *Chinese* is an adjectival modifier of *dishes*.)



(That is, Bill gave dishes to the Chinese. *Chinese* is the head of a NP;<sup>26</sup> *gave* as head of VP takes two modifying NP, one the recipient of the giving, the other the thing given.)

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:

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<sup>26</sup> How do we get *Chinese* as a Noun? The analysis I assume here uses the morphology, with a rule of morphological conversion:

[ X ]<sub>Adj</sub> → [ [ X ]<sub>Adj</sub> ]<sub>Noun</sub>    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.

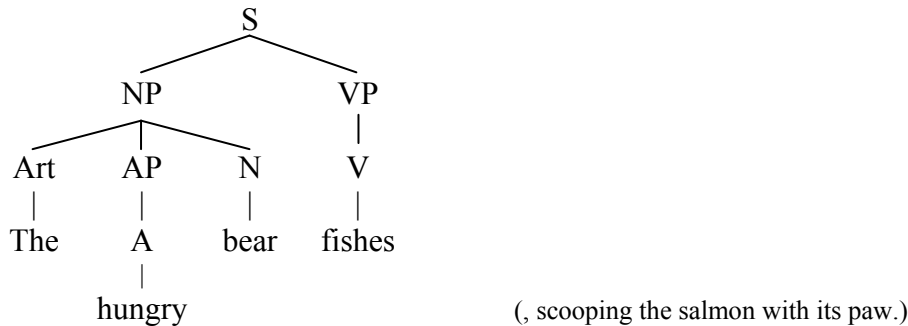
- Homophonous words: *We walked to the bank.*
- Multiple quantifier words: *Three men were examined by each doctor.*
- Phonological merger: *We were patting/We were padding*, which are identical in many North American English dialects

**Study Exercise #10**

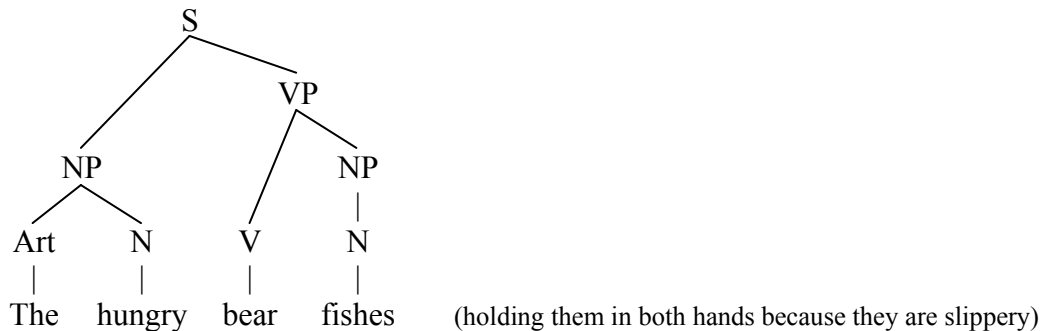
Here is one more ambiguity with its two parses (check that you know the answer before you look). The sentence is: *The hungry bear fishes*, and the answer is on the next page.

## Answer to Study Exercise #10

The far more likely reading uses the noun meaning of *bear*, making it the head of an NP; *fishes* is the head of VP.<sup>27</sup>



In the less likely reading, *hungry* is treated as a noun, and *bear* as a verb:<sup>28</sup>



## 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.

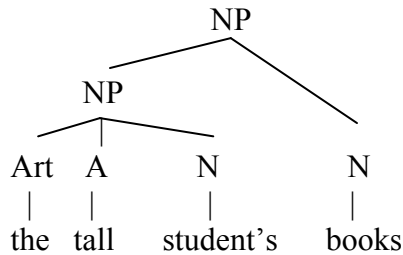
One very common noun modifier is the possessive construction, as in *the tall student's books*. *The tall student's* modifies *books*, but in its internal structure it looks just like an NP. (except for the extra material 's). It couldn't possibly be an Adjective; an Adjective is a word, but *The tall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

<sup>27</sup> 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.

<sup>28</sup> As a student 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 the earlier morphology readings. Multiple parses lurk everywhere.



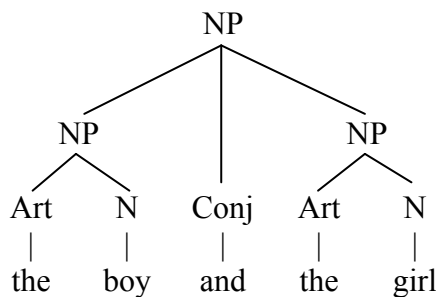
We will assume here that *the tall student's* is in fact an NP, and it sits inside the larger NP *the tall student's books*, modifying the head *books* (i.e., it says in effect, “whose books?”). Thus the structure is:



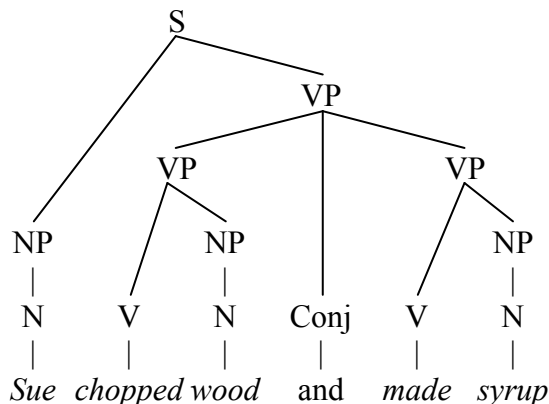
There's a debt to pay here: where does the 's morpheme come from, and where should it sit in the tree? We'll cover this next time. The brief answer is that the 's will be treated as inflectional morphology. What we need is a way to relate the inflectional morphology to the syntax, which is what we will take up later on. For now, we'll just take the -'s as something we need to handle eventually, but will ignore for now.

## 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



We say that the two NP's *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:

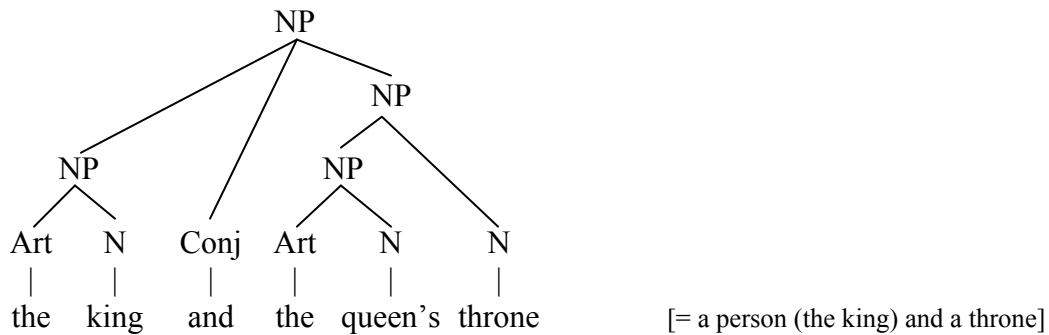
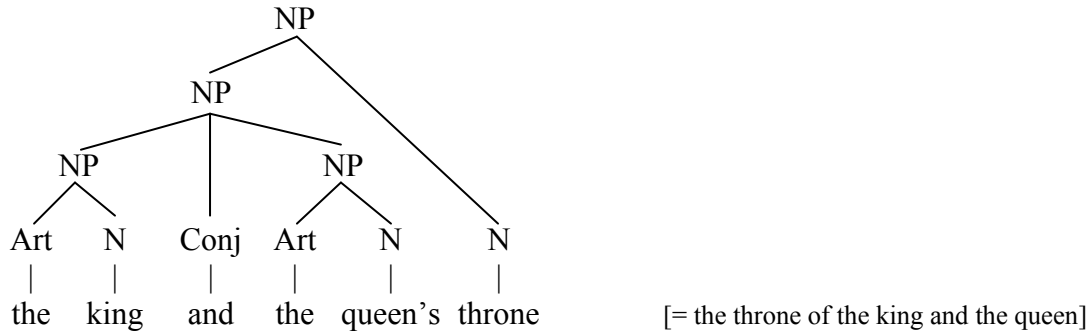


Several other categories, including Adjective Phrases, PP, and S, can participate in this construction: examples of these (same order) are *very tall but quite thin*; *over the river and through the woods*; *I like coffee and you like tea*.

**Study Exercise #11**

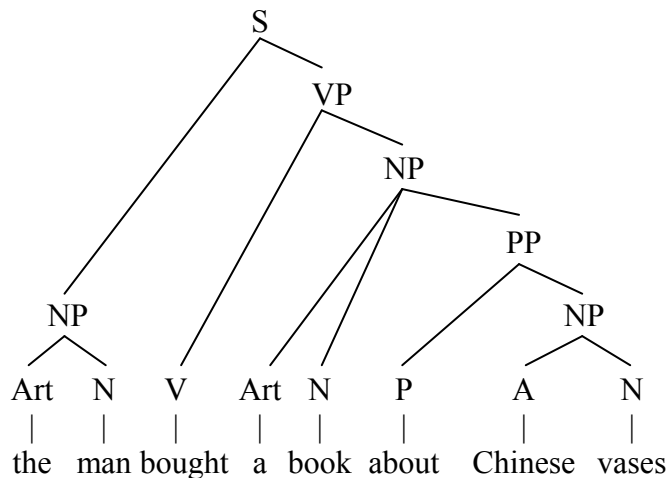
Parse *the king and the queen's throne*.

### Answer to Study Exercise #11



### 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:



**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*.

**Constituent:** We can redefine this formally as 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*.<sup>29</sup>

**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*.

**daughter:** if X directly dominates Y, then Y is X’s daughter

**sister:** two daughters of the same node are sisters.

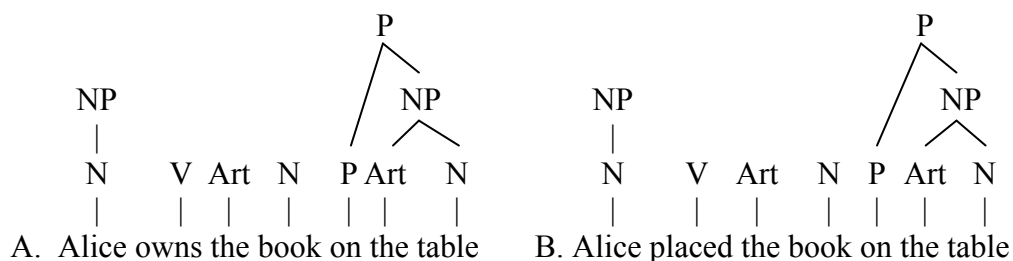
**head:** We’ve defined this casually, but can now give the tree-based formal version: the head of an NP is the N that it directly dominates. The head of a VP is the V that it directly dominates. For example, the head of the NP *a book about Chinese vases* is *book*. The head of the VP *bought a book 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.)

## 10. More on parsing

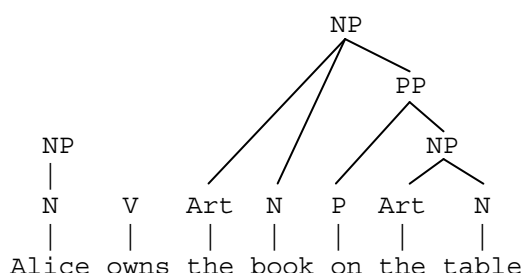
Coming up with the phrase structure tree for a sentence is a skill that is crucial for studying syntax. There are two useful principles to keep in mind. First, until you’ve had some practice it’s easier to *work from the bottom up*: label each word with its part of speech, form small phrases out of the single words, group the small phrases into bigger phrases, and so on up the tree. For example, if you were diagramming the two sentences below, you might start like this:

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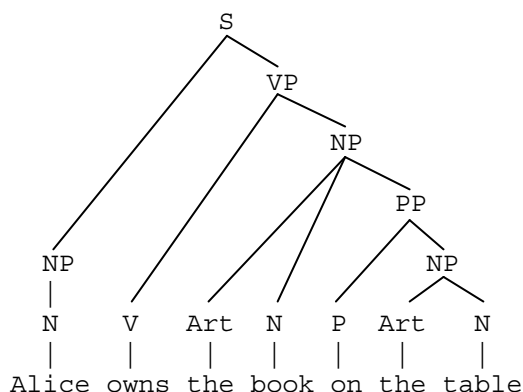
<sup>29</sup> As mentioned above, this is one of the principal difficulties in parsing; that is, not to get distracted by mere “potential” constituents like these, and instead choose *complete* constituents.



Second, 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’.

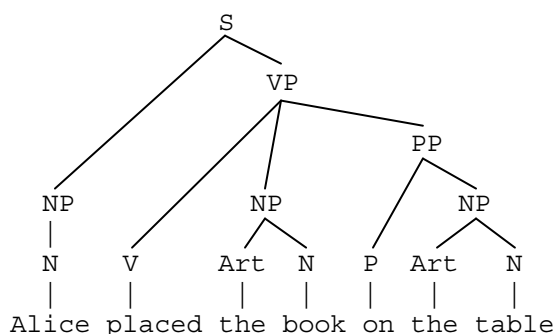


From there on, the diagramming is straightforward; you just need a VP (verb and object) plus the whole sentence:

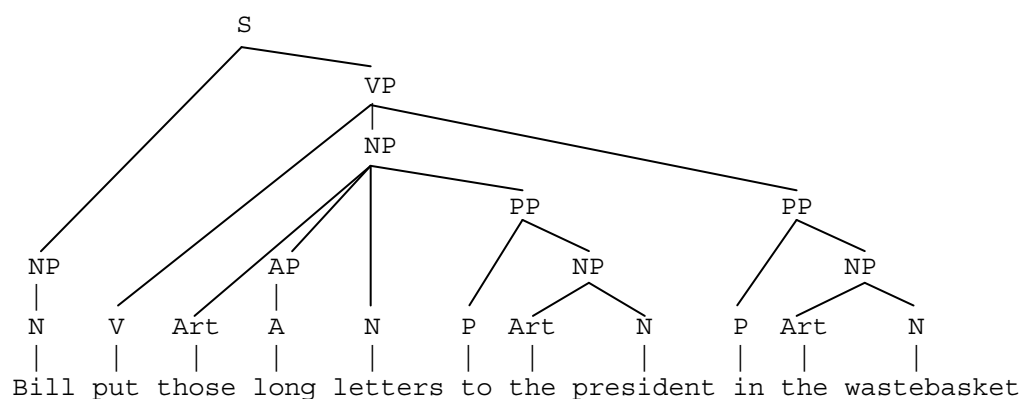


Note that *the book* is not an NP; it is only *part* of an NP because the head is missing one of its modifiers.

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.



The following sentence has two PP's, which get placed in different positions according to what they modify:



A fundamental principle for diagramming sentences, worth memorizing perhaps, is:

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

You can see this principle in effect in all of the parsing done so far.

I have one other handy hint in parsing. It's often easiest to parse English sentences going backwards, starting with the end of a sentence.<sup>30</sup>

## 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 diagram 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:"

<sup>30</sup> Why so? If you're curious: 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.

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):

### **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 constituent, the result should be ungrammatical. If you look at the tree drawn earlier 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 ‘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 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 #12**

- (a) In 'They sent the king to Barataria' is 'the king to Barataria' a constituent? Support your answer with evidence from Clefting.
- (b) Substitute *to* for *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 #12

(a) ‘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.

(clefting the NP *the table*)

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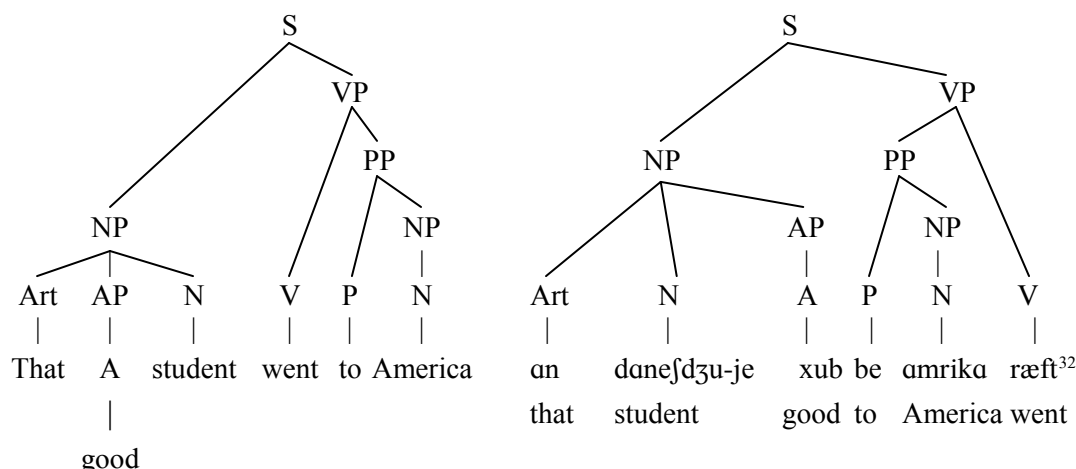
## 12. Grammars for syntactic structure I: Phrase structure rules

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

The need for such grammars should be clear: although nodes like NP and S seem to occur in all languages,<sup>31</sup> the actual order of the constituents of a phrase varies from language to language. For example, consider the following English sentence and its literal translation into Persian (=Farsi):

---

<sup>31</sup> 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).



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 A N  
 VP → V PP

Persian: NP → Art N A  
 VP → PP V

You can read the rules as follows: “an NP may consist of the sequence *Art*, *A*, *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 A N  
 VP → V NP  
 AP → A<sup>33</sup>

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.

Here is the procedure.

<sup>32</sup> IPA symbols: ʌ = somewhat like *ah*; ʃ = *sh*, dʒ = *j*, x as in *ch* of German *Bach*, æ = somewhat like the vowel of *cat*.

<sup>33</sup> This rule looks trivial right now—we’ll beef it up a bit later by allowing Adverbs.

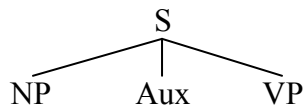
- (a) Provide the rules with the symbol S (or NP, or whatever) to start out with;
- (b) Whenever a symbol appears in a tree that is found on the left side of the rule, give that symbol daughters according to what the rule says;
- (c) Do this over and over until you can't apply any more rules.

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

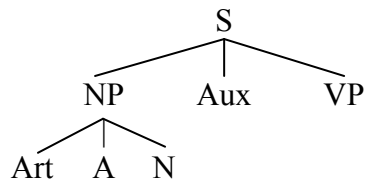
1. Starting point:

S

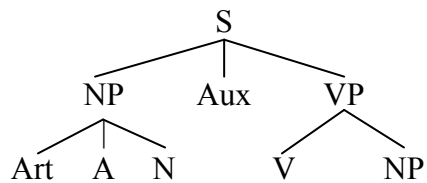
2: apply  $S \rightarrow NP \text{ Aux VP}$



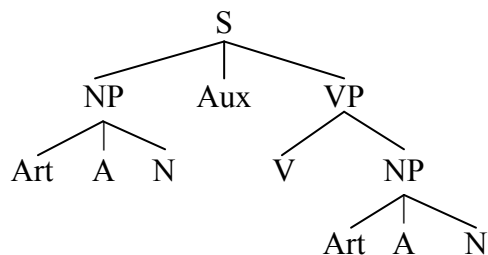
3: apply  $NP \rightarrow \text{Art A N}$



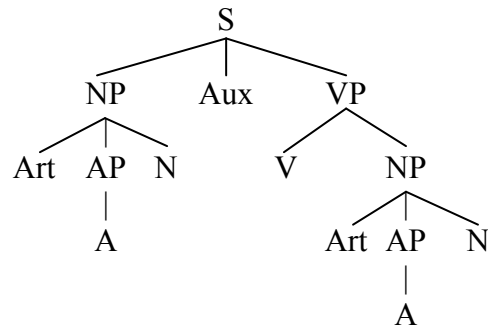
4: Apply  $VP \rightarrow V \text{ NP}$



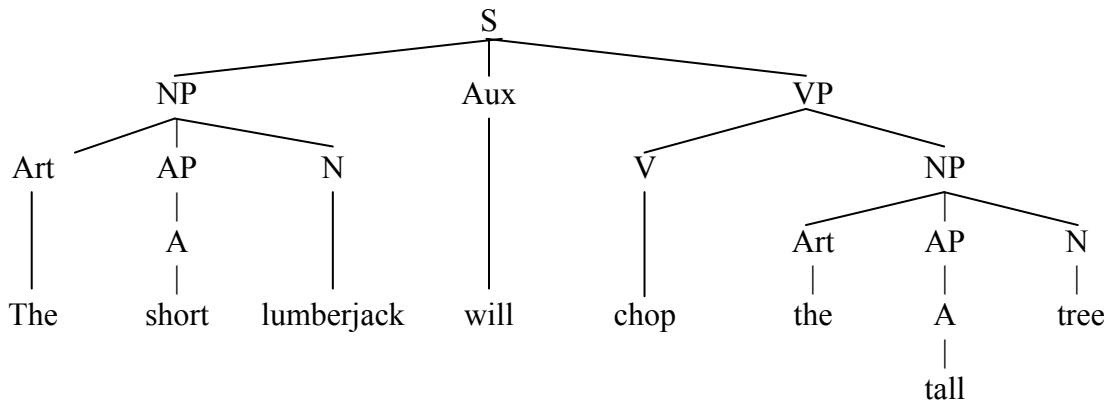
4: Apply  $NP \rightarrow \text{Art A N}$



5: Apply  $NP \rightarrow \text{Art AP N}$



All that remains is to insert actual words into the tree (a process called **lexical insertion**), and you get sentences:



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.

The phrase structure rules just proposed are obviously primitive. We can improve them 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:

$S \rightarrow NP (Aux) VP$   
 $NP \rightarrow (Art) (A) N$   
 $VP \rightarrow V (NP)$

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

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.

$AP \rightarrow (Adv) A$

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:

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

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:

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

## 14. Phrase structure rules for English sentences given so far

As we continue through syntax, 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.

- S → NP (Aux) VP  
 NP →  $\left( \begin{Bmatrix} \text{Art} \\ \text{NP} \end{Bmatrix} \right) (\text{AP}) \text{N} (\text{PP})$   
 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

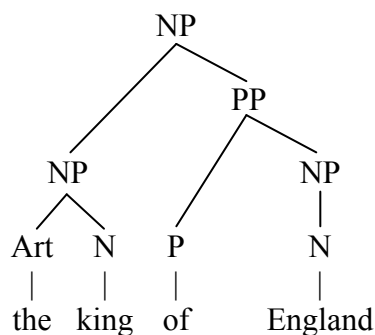
## 15. Parsing: using the phrase structure rules as a guide

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:

- 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 parentheses). 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*



you can tell it's not right because the grammar above contains no rule that permits NP to dominate NP followed by PP.<sup>34</sup>

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 (unless I've made a mistake). But of course real life is different: a grammar that could parse all of English would be quite large and a real challenge to create.

## 16. Further details of our current grammar

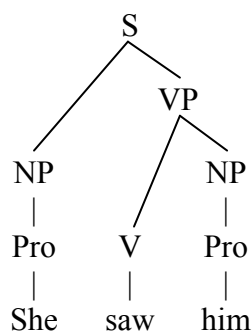
A few of our phrase structure rules need clarification.

### 16.1 Pronouns

The phrase structure rule above that introduces Pronouns is very simple:

NP → Pronoun

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



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.<sup>35</sup> 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, long ago) was Accusative or Dative. Different authors will give different names to these cases.

<sup>34</sup> 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.

<sup>35</sup> Examples: *Poor me*, a “frozen” memorized expression; *He who dares to go...*, with a relative clause.

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

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 ( $S \rightarrow NP (Aux) VP$ ). 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.*

**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.

## 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 early in the course when we looked at the patterning of *each other*. Thus, \*[John and Bill think [I like each other.]<sub>S</sub>]<sub>S</sub> 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] <sub>S</sub>. 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.

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 ]<sub>S</sub>

There is also *for*, as in:

I would prefer *for* [ John and Bill to like each other ]<sub>S</sub>.

Such words are called **subordinating conjunctions** in traditional terminology. Linguists use the slightly shorter term **complementizer**, abbreviated **Comp**.

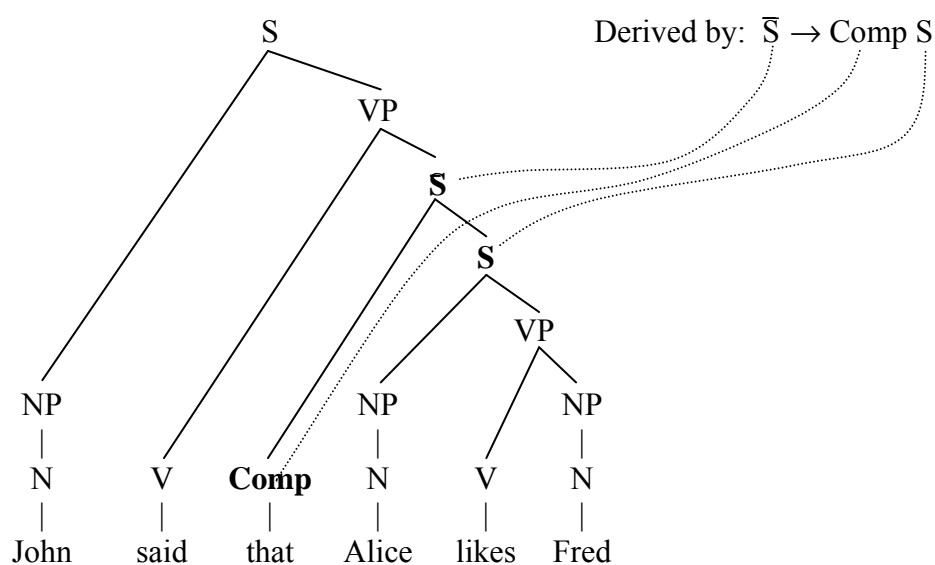
Other complementizers include *if*, *(al)though*, *when*, *whether*, and some others we’ll mention later.

With this apparatus, we can set up rules like these (I’m omitting optional material; see below for the full rules):

$VP \rightarrow V \bar{S}$

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

$\bar{S}$  is read **S-bar**, and is simply the category that provides the syntactic “slot” for the complementizer. Here is an example sentence that can be generated by these rules:



Since  $\bar{S}$  is a nuisance to type on a word processor; a prime ( $S'$ ) or apostrophe ( $S'$ ) is considered an acceptable substitute.

#### 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:

We said [ that we were going ]<sub>S</sub>  
We told Alice [ that we were going ]<sub>S</sub>  
We gave Bill notice [ that we were going ]<sub>S</sub>  
We sent word to Jane [ that we were going ]<sub>S</sub>

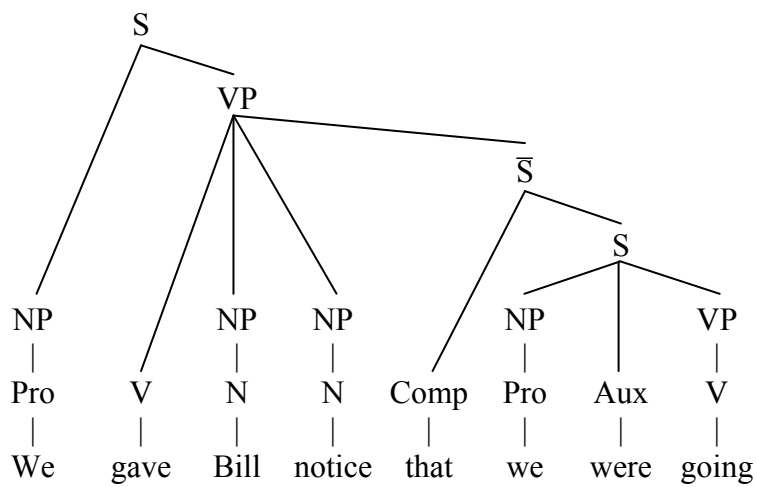
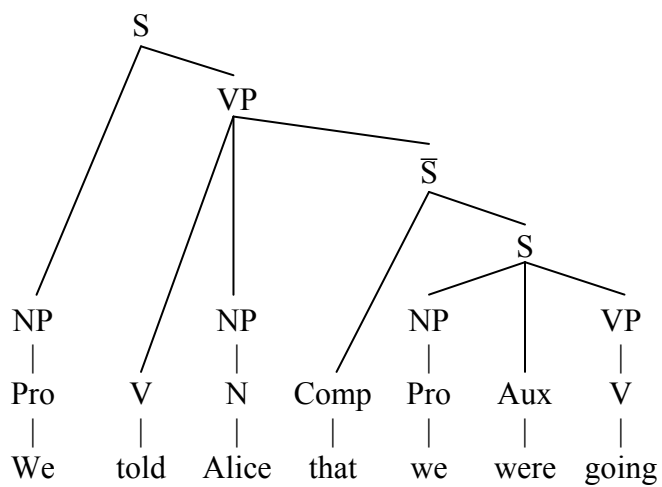
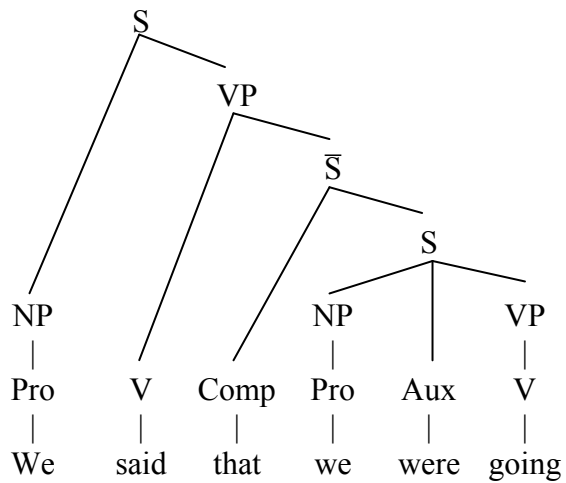
From these sentences, you can see that the Verb Phrase can, in addition to its subordinate clause, include one or two NP objects and a PP, all of them preceding the  $\bar{S}$ . Thus the phrase structure rule needed is something like:

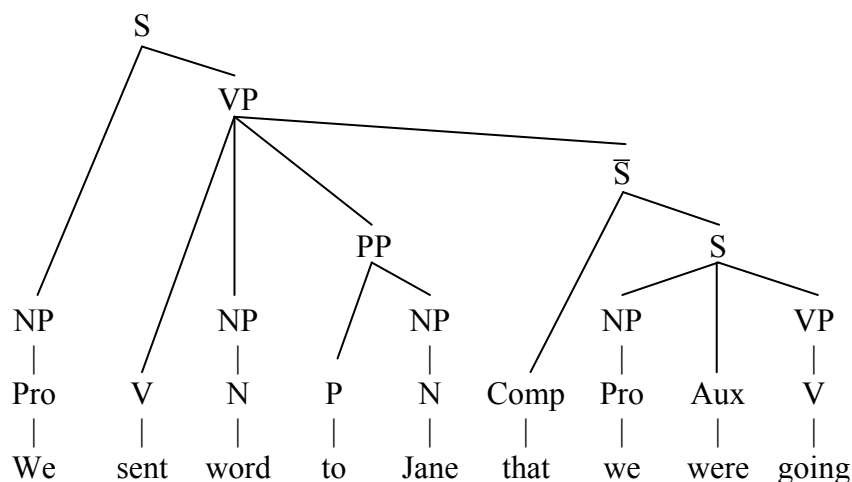
$$VP \rightarrow V (NP)(NP)(PP)(\bar{S})$$

#### **Study Exercise #13**

Parse the four sentences given above. Answers on next page.

## Answers to Study Exercise #13

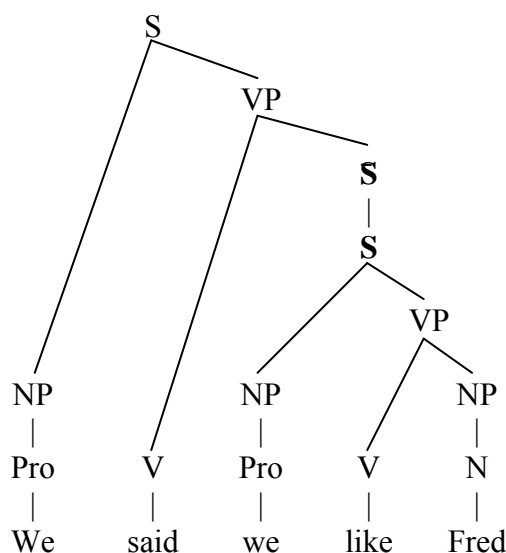




The rule for  $\bar{S}$  needs to let Comp be optional, since we have sentences like:

We said we were going.

Note that the tree for this sentence must have a “vacuous”  $\bar{S}$  node, at least under the phrase structure rules we’ve got, since with those rules only  $\bar{S}$ , not S, can be a daughter of VP.



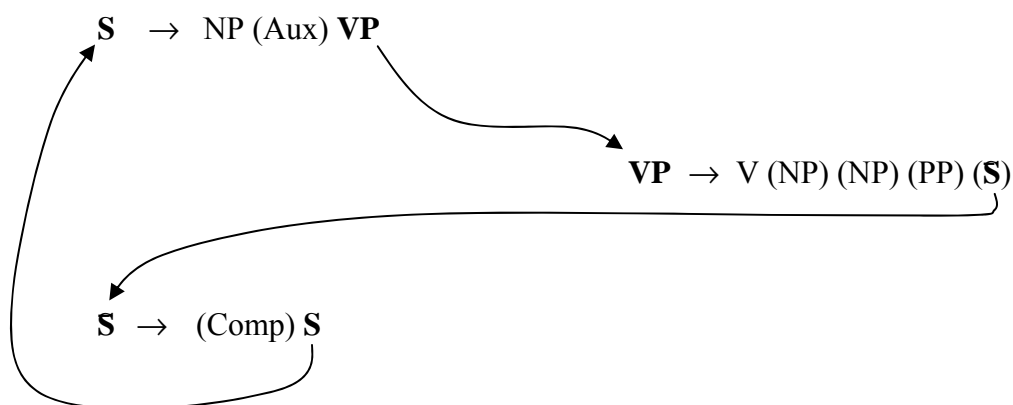
## 17. Recursive application of phrase structure rules

I mentioned above 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 (p. 53). The following partial list was meant as a demonstration:

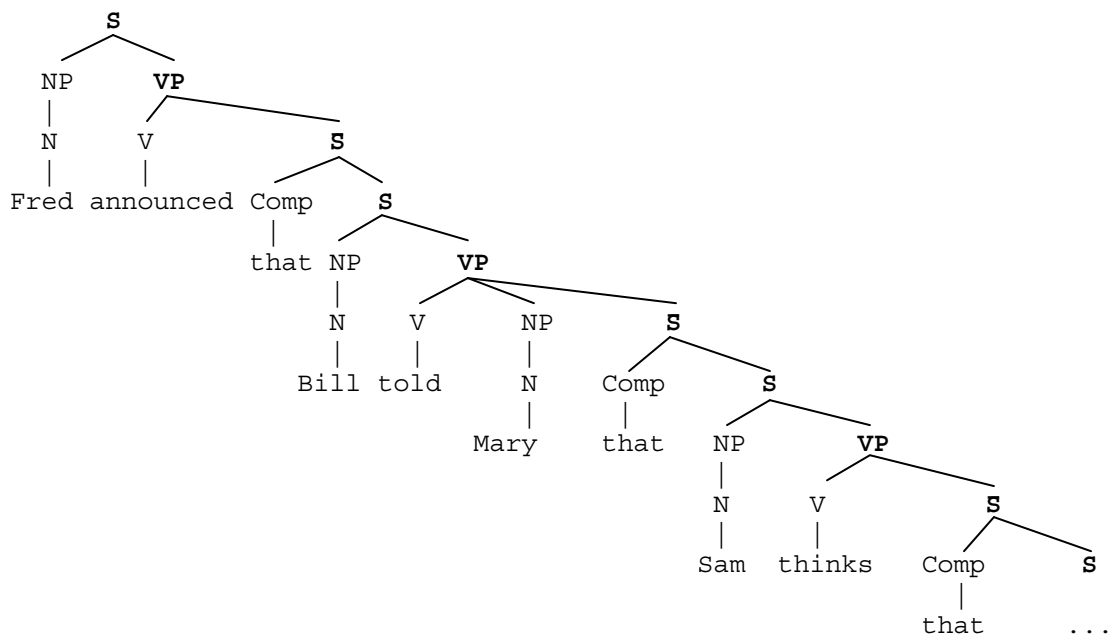
Alice likes Fred  
 John said that Alice likes Fred  
 Bill believes that John said that Alice likes Fred  
 ...etc.

This infinity results, by and large, from a particular property of phrase structure rules, namely that they permit application in **loops**.

Below, I demonstrate one of these loops, taken from the phrase structure rules given so far. With this more interesting grammar, we arrive at a crucial property: the rules in our grammar can apply *recursively*. That is, by following the appropriate procedure it is possible to make the same rule apply over and over, “recurring” in the derivation. The procedure requires finding a repeating loop, such as the following:



If we employ this loop 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.

As far as we know, *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.

## 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. You can think of the morphosyntactic representation as the means by which the syntax communicates with 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 conventional to use the word **lexicon** to refer to the speaker's mental dictionary; their store of memorized stems, words, and other entities.<sup>36</sup> 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. The German word *Messer* (knife) is inherently, and arbitrarily, neuter. Its lexical entry must look something like this:

*Messer* [Gender:Neuter]

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  $[X]_{Adj} \rightarrow [[X]_{Adj}]_{Noun}$  (example: *The French care a lot about food*) are inherently [Number:Plural].<sup>37</sup> This is also true for a small number of words for “pairlike” things, such as *trousers*, *scissors*, and so on.

<sup>36</sup> We also memorize a great number of word sequences, often called **idioms**.

<sup>37</sup> Thus, a fully explicit version of the conversion rule would actually attach a partial morphosyntactic representation:  $[X]_{Adj} \rightarrow [[X]_{Adj}]_{Noun,[Number:Plural]}$ .

## 18.2 Speaker-selected features

Other features of the morphosyntactic representation are meaningful; they represent **choices made by the speaker**. When we say *book* in English we are implicitly conveying the partial morphosyntactic representation [Number:singular], and similarly [Number:plural] when we say *books*. (This raises the question of how linguistic entities bear meaning, a question we will postpone to Chapter 9.)

## 18.3 Features derived by syntactic rules

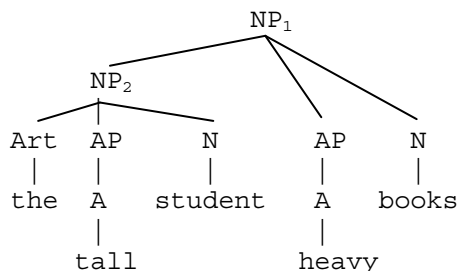
The remaining source for the features in morphosyntactic is **syntactic rules**. These attach the features that depend on what else occurs in the tree. There are (at least) two kinds of rule of this sort: rules of **case marking** and rules of **agreement**.

# 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.

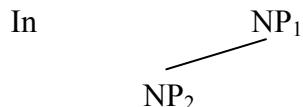
Here is a tree to serve as an example. The phrase structure rules given so far generate this:



Choices employed: for NP<sub>1</sub>:  $NP \rightarrow (\begin{smallmatrix} \text{Art} \\ \text{NP} \end{smallmatrix}) (\underline{AP}) \underline{N} (PP) (\bar{S})$   
 for NP<sub>2</sub>:  $NP \rightarrow (\begin{smallmatrix} \text{Art} \\ \text{NP} \end{smallmatrix}) (\underline{A}) \underline{N} (PP) (\bar{S})$

The syntactic rule of case marking that is needed is as follows:

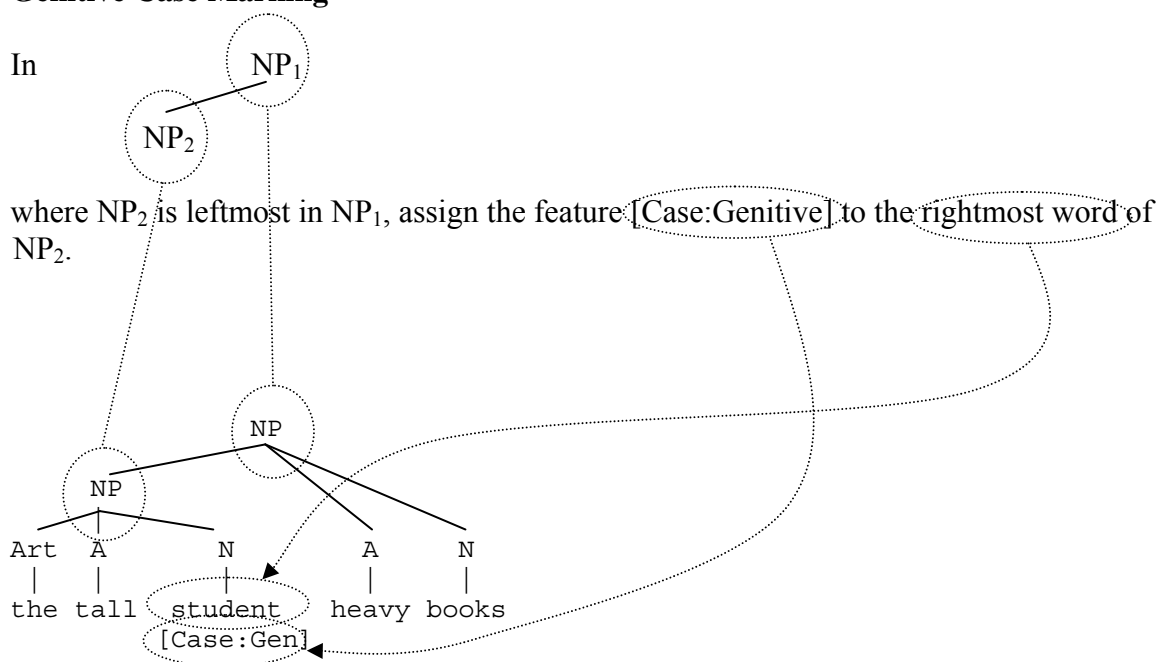
## Genitive Case Marking



where NP<sub>2</sub> is leftmost in NP<sub>1</sub>, assign the feature [Case:Genitive] to the rightmost word of NP<sub>2</sub>.

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

## Genitive Case Marking



where [Case:Genitive] is the morphosyntactic representation of *student*.

That is the most complicated part. Once we have the feature [Case:Genitive] sitting on the word *student*, it is straightforward to get the suffix in place, with an ordinary rule of inflectional suffixation, as follows:

## Genitive Inflection

Suffix -s if [Case:Genitive].

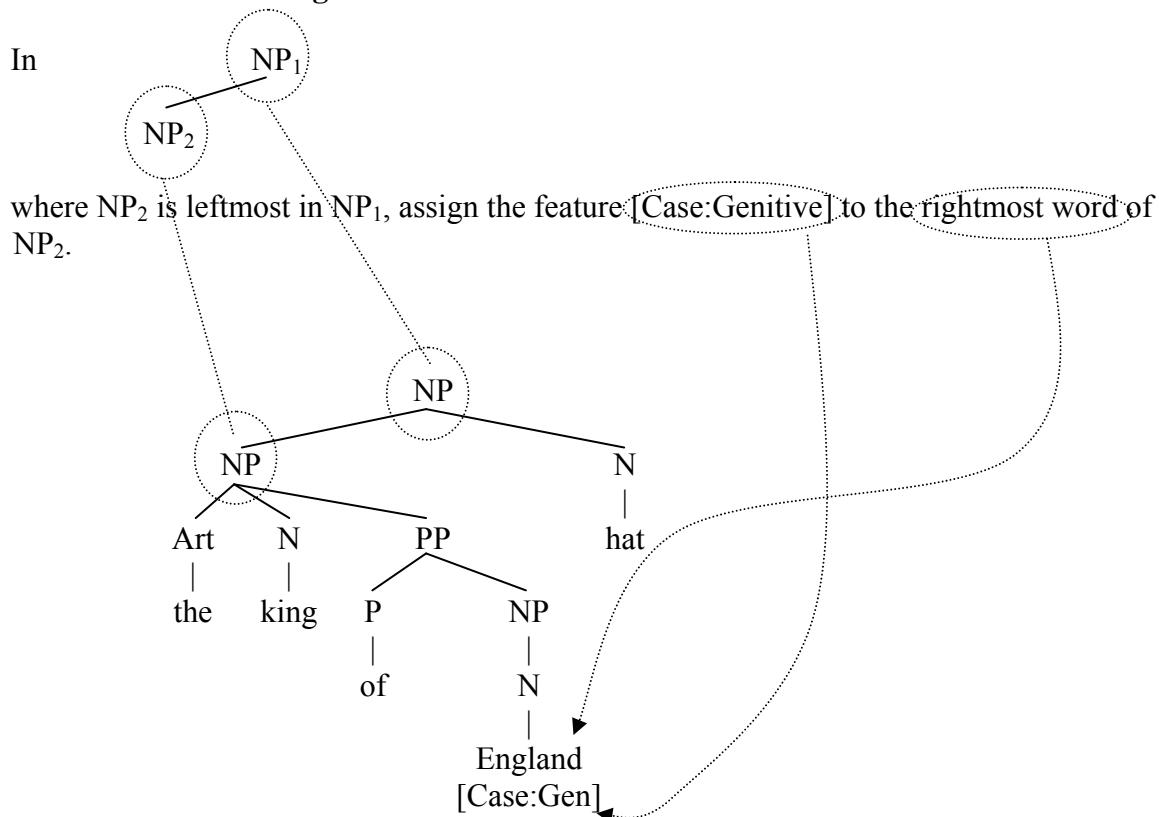
Thus the full NP *the tall student's* is the combined result of syntactic and morphological rules.



## 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* ]<sub>NP</sub> *hat*, where *England* is the rightmost word of its NP. The matchup is shown below:

### Genitive Case Marking

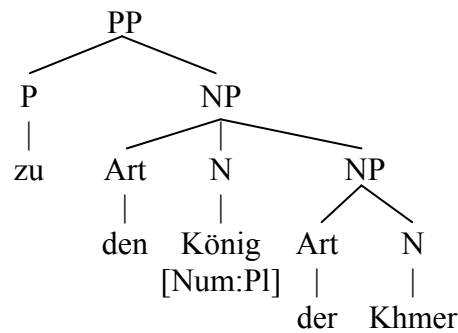


The other major form of case marking targets the *head* of the NP that is to bear case. Let us consider an example from German. On German Amazon I found an entry for a book with this title:

Schliemanns	Erben,	Von	den	Herrschern	der	Hethiter
Schliemann's	legacy	from	the	ruler-dative-plural	the	Hittite-genitive plural
zu	den	Königen	der	Khmer		
to	the	king- <b>dative plural</b>	the	Khmer-genitive plural		
'Schliemann's legacy: from the rulers of the Hittites to the kings of the Khmers' <sup>38</sup>						

We're interested in *zu den König-en der Khmer*, meaning 'to the kings of the Khmers'.<sup>39</sup> 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):

<sup>38</sup> Hermann Schliemann was the archaeologist who excavated the ruins of Troy.

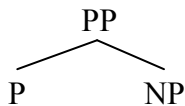


[Number:Plural] is already attached to *König* ‘king’; this reflects a semantic choice made by the person who made up this title.

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:

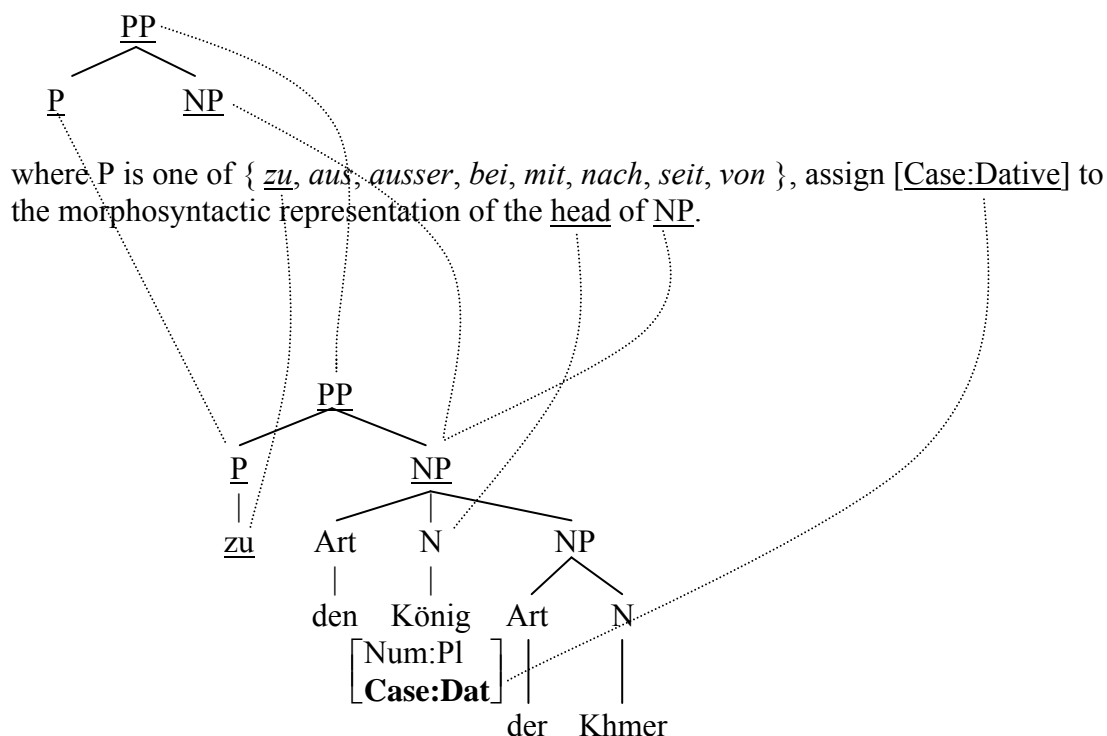


where P is one of { *zu*, *aus*, *ausser*, *bei*, *mit*, *nach*, *seit*, *von* },<sup>40</sup> assign [Case:Dative] to the morphosyntactic representation of the head of NP.

This rule targets the *head* of NP for dative case realization, hence applies to our example as follows:

<sup>39</sup> The Khmers are the Cambodians.

<sup>40</sup> ‘to’, ‘from’, ‘except’, ‘at X’s home’, ‘with’, ‘after’, ‘since’, ‘of’



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 Königen 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 Khmeren* (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>I jump</i>	<i>we jump</i>
<i>you jump</i>	<i>you jump</i>
<i>he/she/it jumps</i>	<i>they jump</i>

There is only one ending, *-s*, which occurs when the subject is [Person:3, Number: singular]. 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>I am</i>	<i>we are</i>
<i>you are</i>	<i>you are</i>
<i>he/she/it is</i>	<i>they are</i>

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)

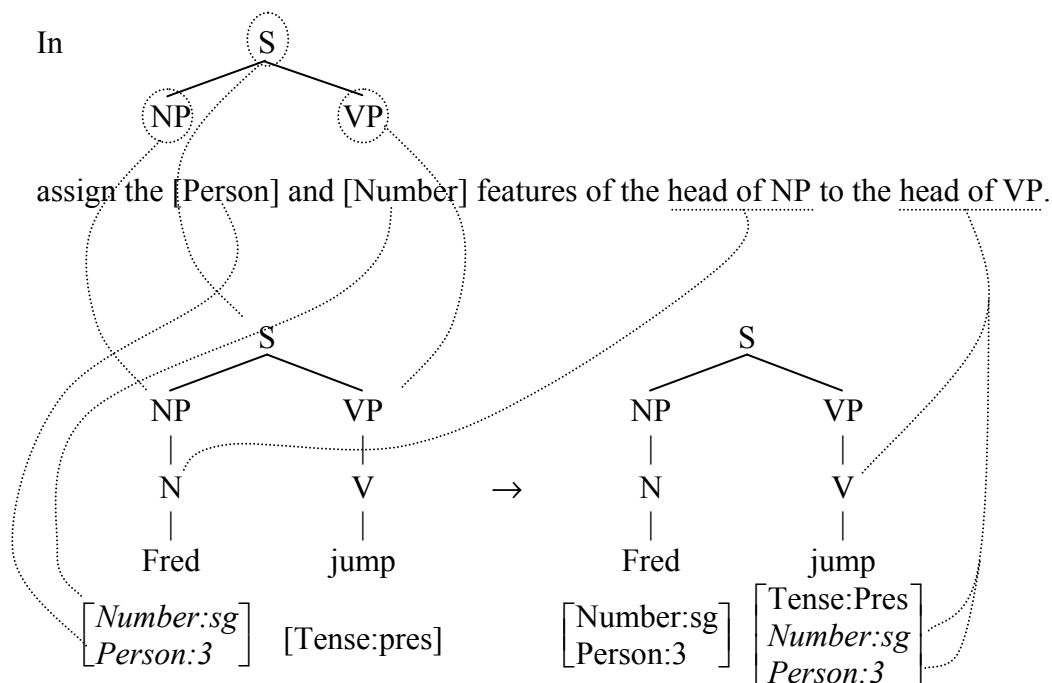


assign the [Person] and [Number] features of the head of NP to the head of VP.

An application is shown as follows.

### Verbal Agreement (English)

In



The rule of inflectional morphology that generates the -s suffix is given below:

### 3rd Singular Present Rule

Suffix -s if the morphosyntactic representation contains:  
[Tense:Pres, Person:Singular, Number:3]

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 describe 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 all the sentences
- Look at all 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 top 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.<sup>41</sup> 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 *jamón* or German *Bach* (voiceless velar fricative).

1. nu    xassus    sallī            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.'

---

<sup>41</sup> 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  $\bar{S}$ 's, not  $S$ 's, though in certain contexts it was possible to say just a plain  $S$ . Thus we will start our derivations with  $\bar{S}$  and assume this phrase structure rule:

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

NP could be derived by the following rule:

$$NP \rightarrow (A) N^{42}$$

Probably the  $A$  should be an AP, but we will skip this for brevity.

Another simple rule is for PP, which in 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:

$$PP \rightarrow NP P$$

In sentences, the subject evidently comes before the predicate, justifying the rule

$$S \rightarrow NP VP$$

The trickiest phrase structure rule to write here is for VP. Below are all of the data aligned in a format that places similar phrases vertically underneath one another.

---

<sup>42</sup> In truth we cannot know the relative order of Art and A; they never appear together in the data.



	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:

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

This completes the set of phrase structure rules, stated all in one place thus:

### Phrase structure rules for Hittite

$$S \rightarrow NP VP$$

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

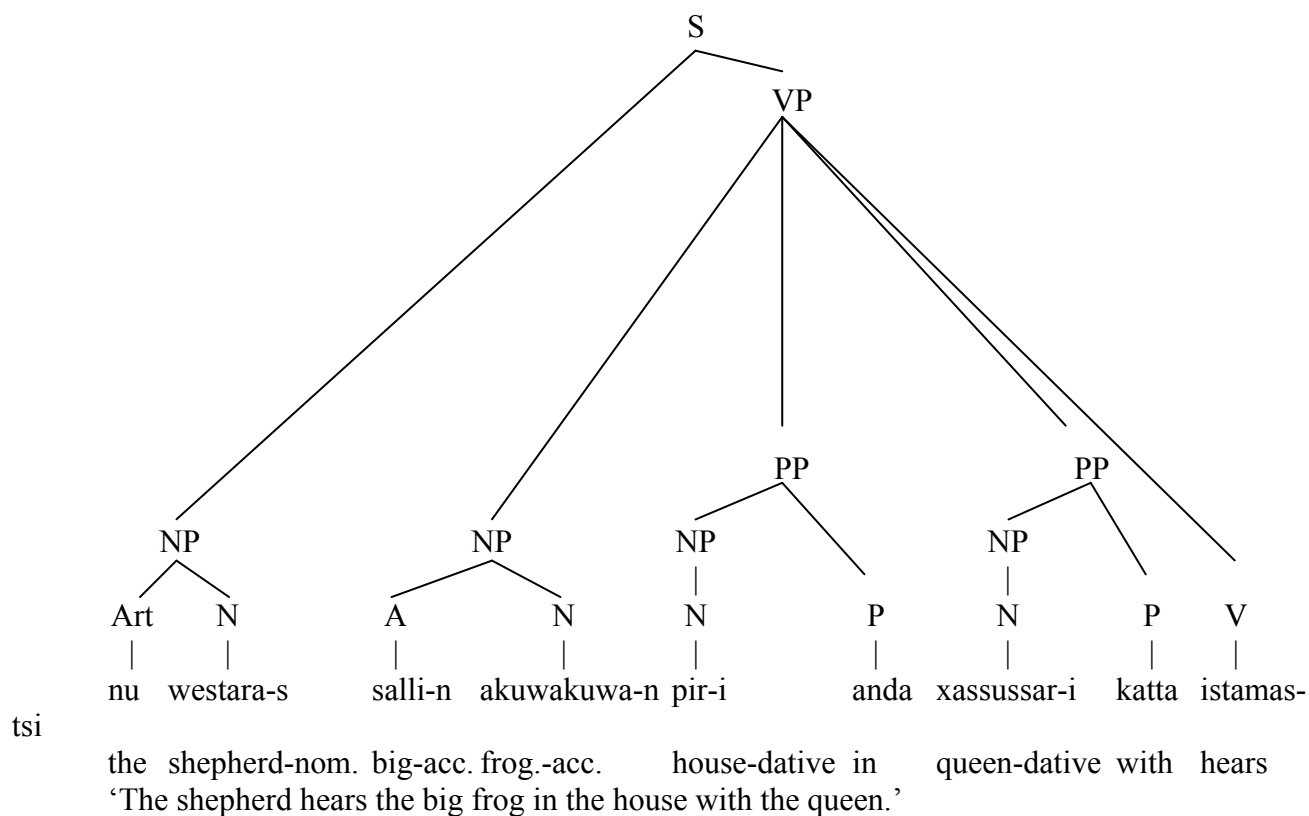
$$NP \rightarrow (Art) (A) N$$

$$PP \rightarrow NP P$$

“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.



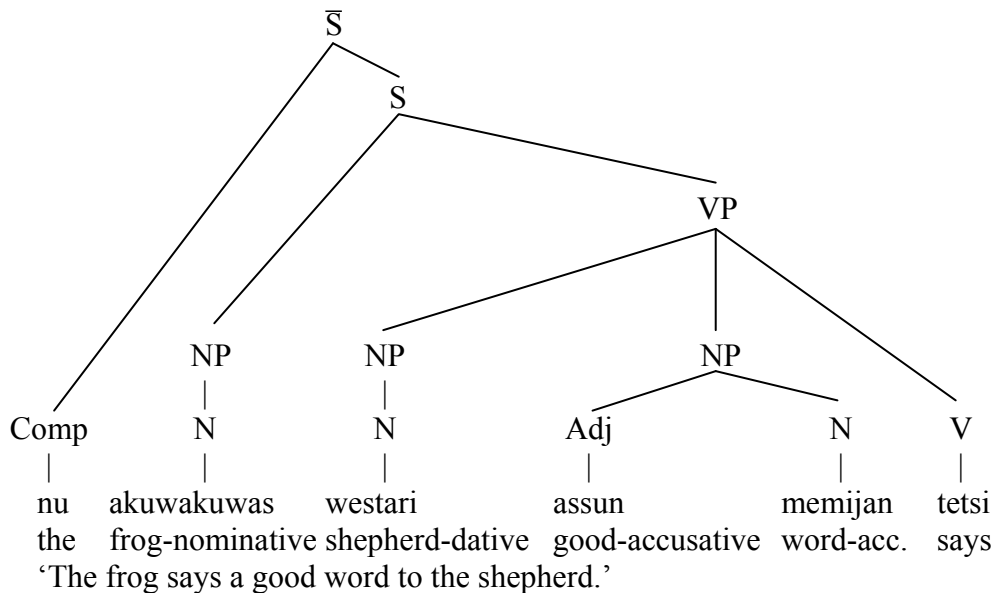
### Study Exercise #14

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 #14



### 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** ]<sub>N</sub> about linguistics ]<sub>NP</sub>

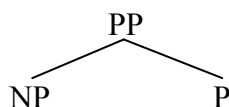
### 21.3 Case marking in Hittite

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 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

In the configuration



add [Case:Dative] to the morphosyntactic representation of the head of NP.

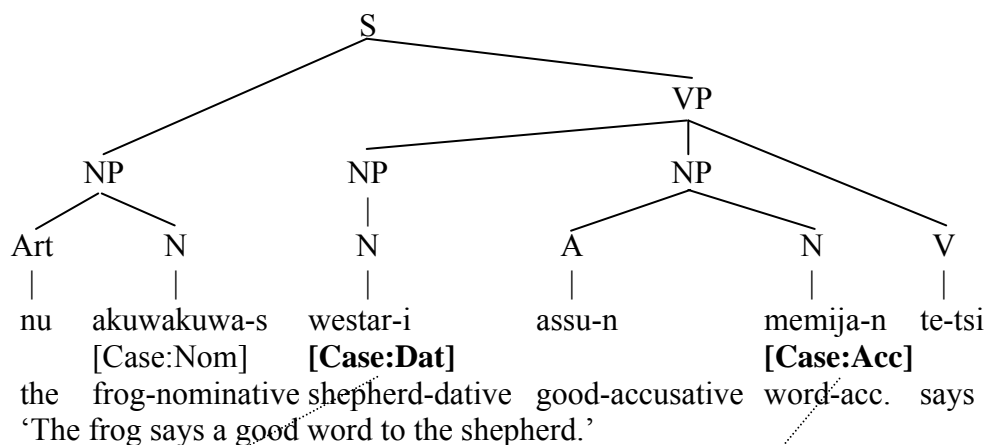
Getting Accusative and Dative objects right is trickier, and we also have very few data, so the following is really something of a guess:

## Case Marking for Objects

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 NP's 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 *assu-n* above) to agree with their head nouns in case.

## 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 Adjectives preceding the noun, as in 'a long, dull,

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). For example, the phrase structure rule for NP can be written as follows:

$$\text{NP} \rightarrow (\text{Art}) (\text{A})^* \text{N} (\text{PP})^*.$$

An NP that uses both (A)\* and (PP)\* would be ‘the big blue book 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:

S	→ NP (Aux) VP	
NP	→ $\left( \left\{ \begin{smallmatrix} \text{Art} \\ \text{NP} \end{smallmatrix} \right\} \right) (\text{AP})^* \text{N} (\text{PP})^*$	Example: <i>his noble, inspiring gift of \$1,000,000 to X</i>
NP	→ Pronoun	
AP	→ (Adv) A	
VP	→ V (NP) (NP) (PP)* ( $\bar{\text{S}}$ )	Ex.: <i>sold books to students for \$50</i>
PP	→ P NP	
$\bar{\text{S}}$	→ (Comp) S	
NP	→ NP (Conj NP)*	Ex. <i>Alice and Sally and Bill left.</i>
VP	→ VP (Conj VP)*	Ex. <i>We sang the song and danced the dance.</i>
PP	→ PP (Conj PP)*	Ex. <i>We tossed it over the fence and through the window.</i>
S	→ S (Conj S)*	Ex. <i>He said that he was sick and he would go.</i>
$\bar{\text{S}}$	→ $\bar{\text{S}}$ (Conj $\bar{\text{S}}$ )*	Ex. <i>He said that he was sick and that he would go.</i>
V	→ V (Conj V)*	Ex. <i>They washed and diced the vegetables.</i>

## 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 grammatical 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:

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 school grammar calls them), we need minor morphological “spell-out” rules, of which the following are a partial list:

#### Some Spell-Out Rules of English

*will not* → *won't*  
*can not* → *can't*  
*am not* → *aren't*<sup>43</sup>  
*do not* → *don't*  
*shall not* → *shan't*<sup>44</sup>  
etc.

---

<sup>43</sup> As in *I'm tall, aren't I?*, used only in vernacular speech. (Remember your white lab coat...)

<sup>44</sup> 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 it 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:

### Failed Hypothesis for Tags

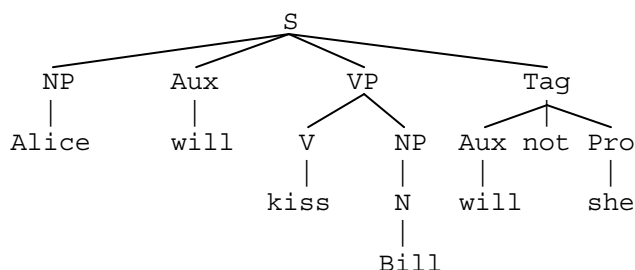
(a) Change the phrase structure for S to:

$$S \rightarrow NP \text{ (Aux) VP (Tag)}$$

(b) Add the phrase structure rule:

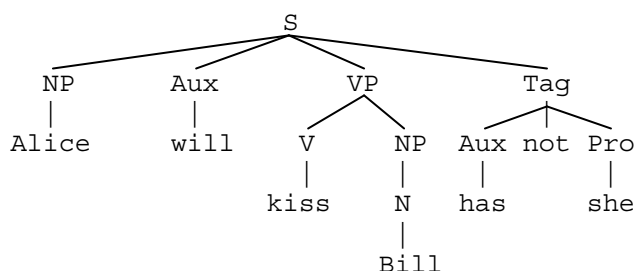
$$\text{Tag} \rightarrow \text{Aux not Pro}$$

This hypothesis derives *Alice will kiss Bill, won't she?* as follows:



(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 copying. We can apply the very same rules and derive preposterous sentences:



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 or revise our thinking.

Some terminology for failed grammars that is widely used:

- undergenerate:** A grammar *undergenerates* when there are grammatical sentences that it can't 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 suggested earlier, the failed grammar given above is failing because nothing in the rule apparatus developed so far can copy. (The failed hypothesis just given is a poor substitute for copying: it copies the structure, but not the actual words involved.) Plainly, we need more kinds of rules.<sup>45</sup>

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 rules takes as its input a sentence generated by the phrase structure rules and alters it in some way.

---

<sup>45</sup> 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<sub>can</sub> "S with *can* as its Aux", S<sub>will</sub> "S with *will* as its Aux", each allowing a matching daughter Tag<sub>can</sub>, Tag<sub>will</sub>, etc. This gets the facts but fails to characterize the tags as involving *copying in general*.



- A syntactic rule that alters a tree structure is called a **transformation**.
- 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 word-movement processes we will cover in what follows; as they change only the morphosyntactic representation.

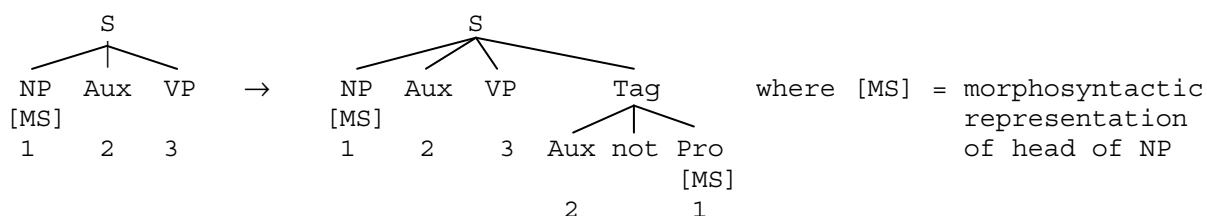
The general strategy seen in transformations is to let the phrase structure rules define the “basic inventory” of sentences in the language, and let the transformations apply to generate a wider variety of sentences that go beyond the capacity of phrase structure rules. For example, the sentence *Alice 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.<sup>46</sup>

### 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.

#### Tag Question Transformation



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 consist of an Aux, the

<sup>46</sup> 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 syntax courses (the UCLA sequence is: 120B, 165B, various graduate courses...)

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], [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 pronoun, plural subjects will get plural pronouns, and so on.

For explicitness, here are the nominative pronouns of English with their inflectional features (for the non-nominative pronouns, see p. 80 above).

<i>I</i>	[Case:Nominative, Person:1, Number:Singular]	(Gender is free) <sup>47</sup>
<i>you</i>	[Case:Nominative, Person:2]	(Gender and number are free)
<i>he</i>	[Case:Nominative, Person:3, Number:Singular, Gender:Masculine]	
<i>she</i>	[Case:Nominative, Person:3, Number:Singular, Gender:Feminine]	
<i>it</i>	[Case:Nominative, Person:3, Number:Singular, Gender:Neuter]	
<i>we</i>	[Case:Nominative, Person:1, Number:Plural]	(Gender is free)
<i>they</i>	[Case:Nominative, Person:3, Number:Plural]	(Gender is free)

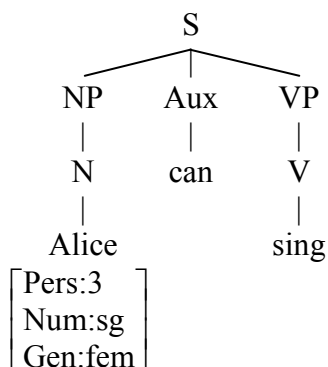
We assume, for example, that an abstract entity like

Pro
[Case:Nominative]
Person:3
Number:Singular
Gender:Feminine]

would be spelled out as *she*.

Here is a derivation for the sentence *Alice can sing, can't she?*

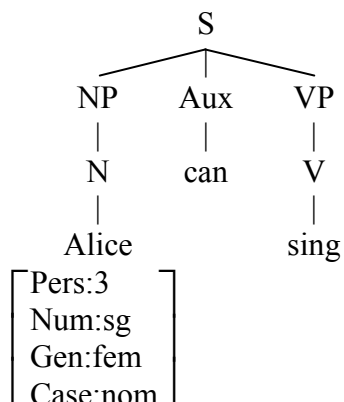
First step: application of the phrase structure rules to derive *Alice can sing*



<sup>47</sup> By “free”, I mean that you can use this pronoun no matter what the specification in the morphosyntactic representation.

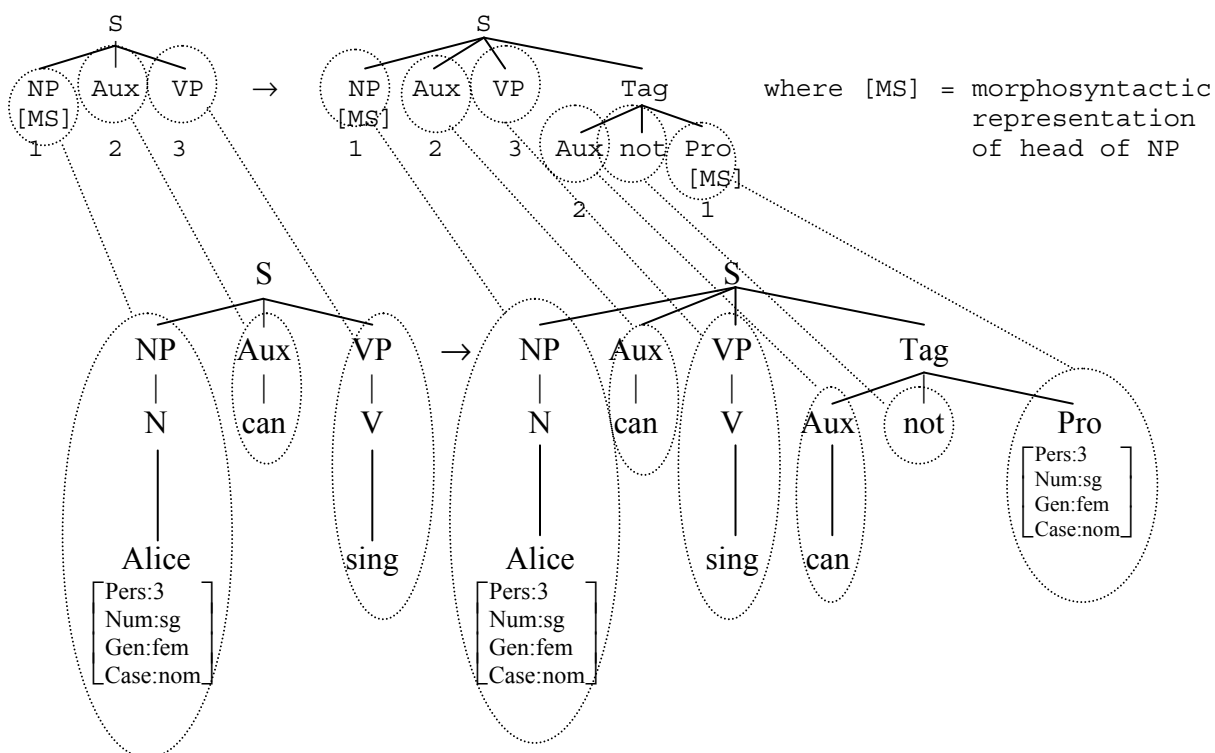
Note that *Alice* by its meaning is inherently 3rd person, singular, and feminine.

Second step: since Alice is the subject, a rule of case marking makes it Nominative:



Third step: application of Tag Question Transformation (matchup shown with dotted lines):

### Tag Question Formation



Fourth step: spell out the pronoun that is [Pers:3, Num:sg, Gen:fem, Case:nom] as *she* (tree omitted):

Alice can sing, can not she?

Last step: spell out the sequence *can not* as *can't*:

Alice can sing, can't she?

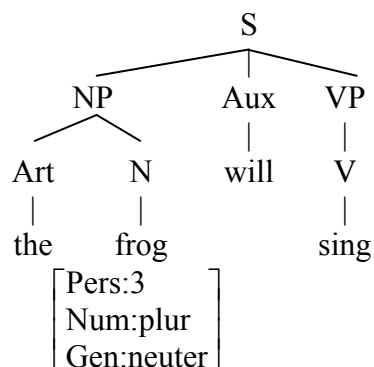
**Study Exercise #15**

Derive *The frogs will sing, won't they?*

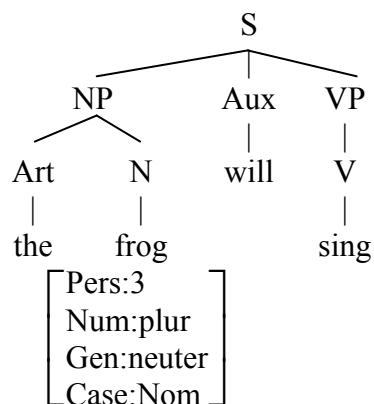
The steps should include Phrase Structure rules, Tag Question formation, spelling out of the pronoun *they*, spell-out of *won't*, and attachment of the plural suffix (inflectional morphology) to *frog*.

## Answer to Study Exercise #15

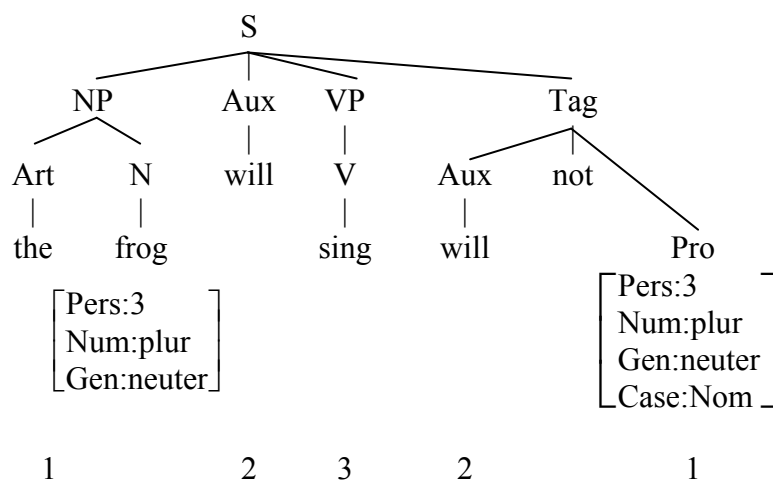
### I. Phrase structure rules and lexical insertion:



### II. Nominative Case Marking:



### III. Tag Question Transformation (see rule on p. 5 above for the numbered items)



IV. spell out the pronoun that is [Pers:3, Num:plur, Gen:neuter, Case:nom] as *they*:

The frog<sub>[Pers:3, Num:plur, Gen:Neuter]</sub> will sing, will not **they**?

V. Spell out *will not* as *won't*:

The frog<sub>[Pers:3, Num:plur, Gen:Neuter]</sub> will sing, **won't** they?

VI. Suffix -s when [Number:Plural]

The frogs 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

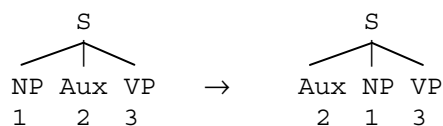
The frog might hop.

we have

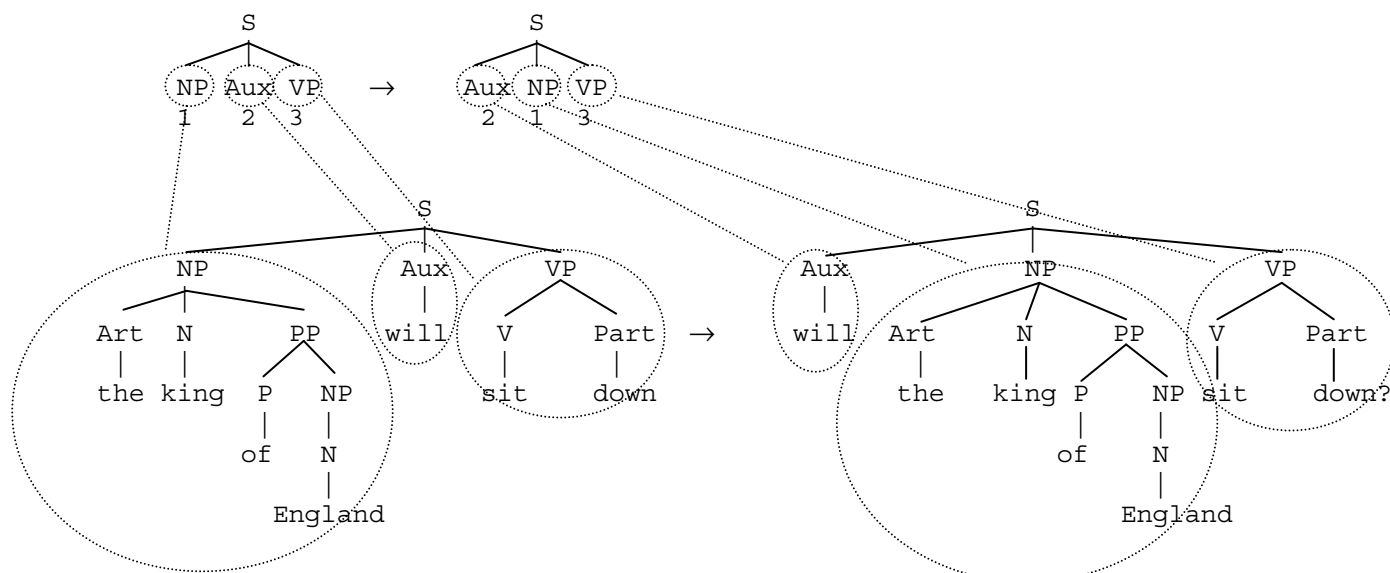
Might the frog hop?

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:

### Yes/No Question Formation



Here is a derivation; dotted lines show the matchup between rule and form:



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:

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

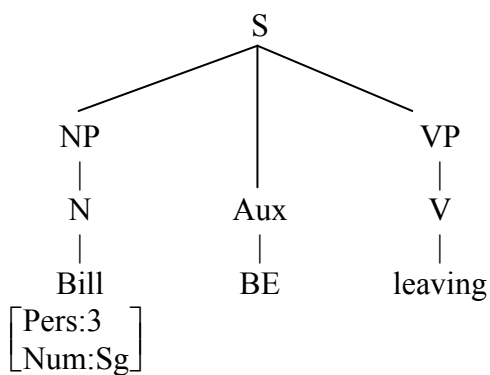
However, there seem to be at least two reasons that at least suggest that the transformational approach is better. First, speakers seem to recognize that (for example) *Is Bill leaving?* is the yes/no question that “goes with”, or is appropriately paired with, *Bill is leaving*. We can characterize this 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:

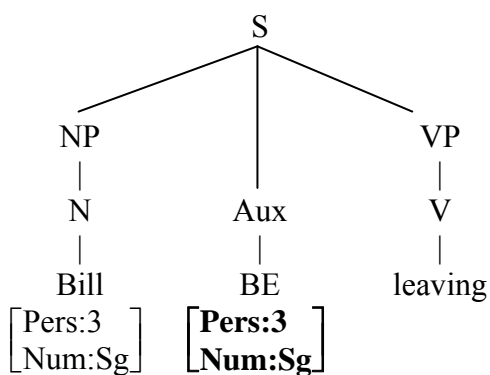
Is Bill leaving?  
Are Bill and Fred leaving?

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:

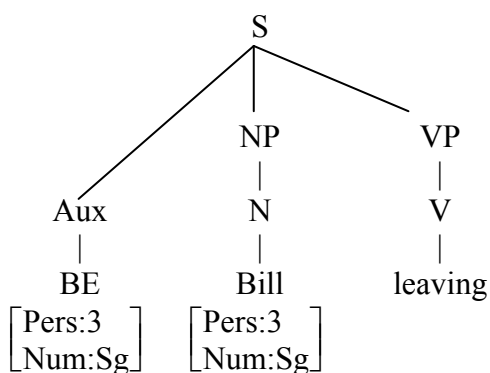


output of phrase structure rules

features of *Bill* are inherent in this noun



Agreement: copy the subject features onto the Aux



Yes/No Question formation

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, doesn't he?

We left early, didn't we?

For yes/no questions:

Does John like turnips?

Did 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 have not done my practicing.

I will not take out the trash.

He cannot play this concerto.

Where the basic sentence has no aux (as in “He likes turnips”), *do* is inserted to provide one:

I do not 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.

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:

I wonder if there are any people who grow turnips around here. / Well, Bill does.

It would appear then, that some kind of process provide 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.

#### 4. Summing up so far

Transformations have been posited to perform a variety of functions, as follows:

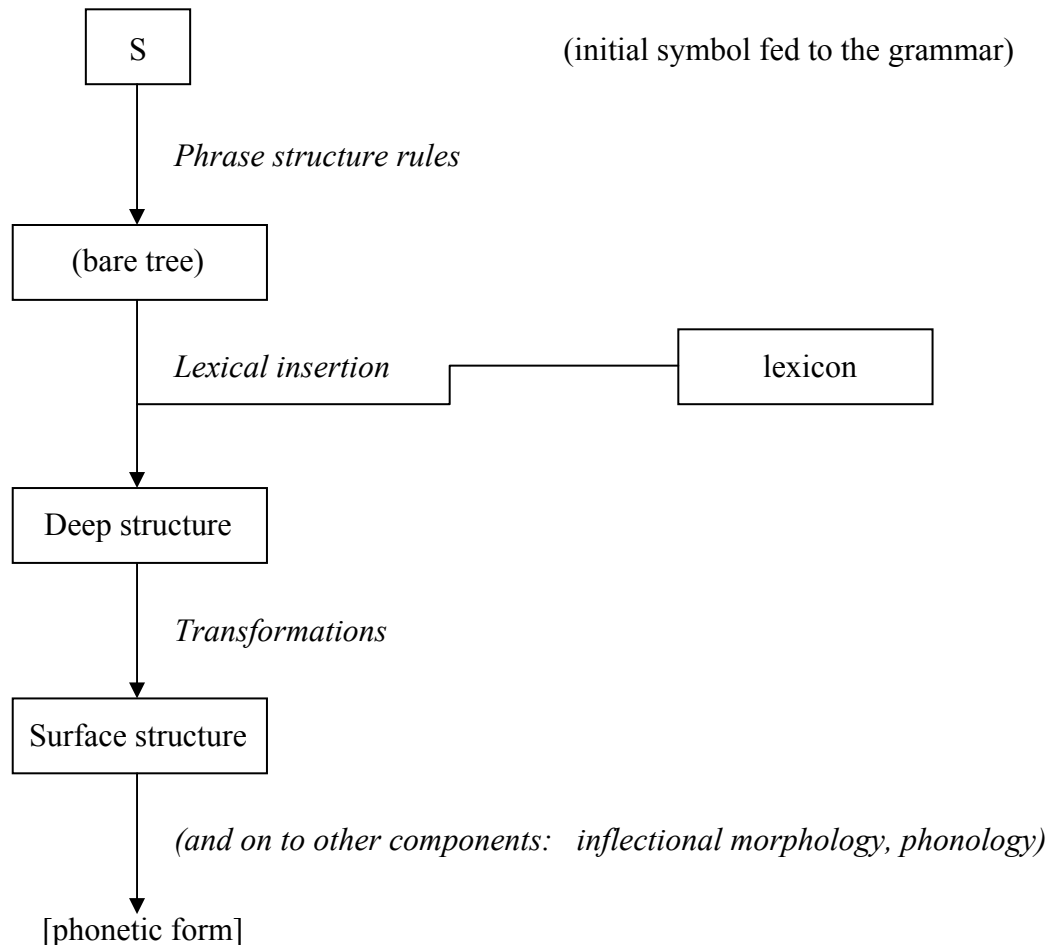
- **Assignment of inflectional features** to morphosyntactic representations (agreement and case marking)
- **Copying** of material (as in tags)
- **Movement** of parts of the tree (as in Yes/No Question Formation)
- **Insertion** (unformalized here) the of semantically empty words like the Aux *do*.

What remains to be covered are the most dramatic of transformations, the so-called long-distance movements. These will be studied in the next lecture, 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**.



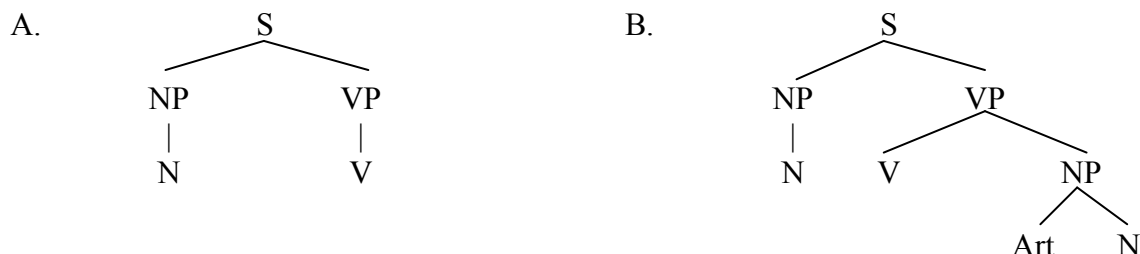
The terms “deep” and “surface” involve no notion of profundity or superficiality. Deep structure is simply the output of the phrase structure rules with words plugged in by lexical insertion. Surface structure is the output of the syntax as a whole. In a sentence in which no transformations have applied, 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. Lexical insertion and subcategorization

Our phrase structure rules generate, among many others, the following trees:



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:

Bill destroyed his car.

\*Bill destroyed.

Verbs like *destroy*, which must take an object, are called **transitive** verbs; verbs like ‘sigh’, which must not 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.

The process of “inserting words into the tree” is called **lexical insertion**. The idea given here is that speakers possess a mental dictionary, generally referred to as the **lexicon**. 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**.

Thus, the lexical entry for *destroy* would be like this:

**destroy:**

Pronunciation: /dis'trɔɪ/

(more on this later)

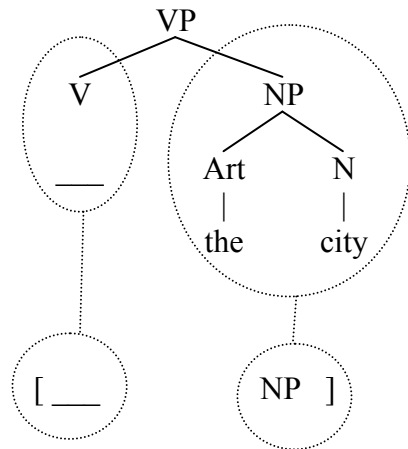
Meaning: “violently cause no longer to exist”

(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 below is meant to explicate this notation:



Where a subcategorization frame does *not* include some particular phrase, then lexical insertion is impossible for where that phrase 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.

Optionally transitive verbs like *sing* (*John sang*, *John sang the song*.) have subcategorization frames that employ parentheses to show the optionality:

**sing**: pronunciation: /sɪŋ/  
 meaning: “use one’s voice to produce music”  
 syntactic category: verb  
 subcategorization: [ \_\_\_\_ (NP) ]

Verbs of saying and belief often subcategorize for an  $\bar{S}$ . For example, *say* has the subcategorization [ \_\_\_\_ (PP)  $\bar{S}$  ] and *tell* has the subcategorization [ \_\_\_\_ NP ( $\bar{S}$ ) ]. This can be justified by the following sentences:

\*Alice said.  
 Alice said to Bill that she would be going.  
 Alice said that she would be going.

\*Fred told.  
 \*Fred told that he would be going.  
 Fred told us.  
 Fred told us that he would be going.<sup>48</sup>

Nouns have subcategorization frames as well. For example, the subcategorization frame of *gift* is [ \_\_\_\_ (PP) (PP) ], as in *a gift of \$10 to the Red Cross*. The subcategorization frame of *picture* is [ \_\_\_\_ (PP) ], as in *picture of Alice*. The subcategorization of *dog* is [ \_\_\_\_ ] (there are no noun phrases like *\*dog of teeth*). When a rule of word formation derives a noun from a verb that subcategorizes for  $\bar{S}$ , the resulting noun tends also to subcategorize for  $\bar{S}$ :

They believe that Sue left  
 their belief that Sue left

They assert that Sue left.  
 their assertion that Sue left

They claim the Sue left.<sup>49</sup>  
 their claim that Sue left.

Such constructions require us to modify the phrase structure rule for NP to the following:

$$NP \rightarrow \left( \left\{ \begin{array}{c} \text{Art} \\ \text{NP} \end{array} \right\} \right) (AP)^* N (PP)^* (\bar{S})$$

For discussion, see section 13.1 below.

<sup>48</sup> For completeness, observe that *tell* also has the subcategorization [ \_\_\_\_ (NP)(NP) ]: *Fred told us his sorrows*, *Alice told them her name*.

<sup>49</sup> The word formation rule here is conversion, which adds no suffix or prefix; see p. 45 above.

### 1.1 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:

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.<sup>50</sup>

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

dog in the garden  
 the party on Tuesday  
 a person in a good mood

would not justify a frame like [ \_\_\_\_ PP ] for their nouns. Likewise, articles and possessors are not considered in the subcategorization frame, since they are possible for any noun (*the dog*, *Alice’s dog*).

## 2. Subcategorization and meaning

**Error! Bookmark not defined.**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 S ] 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*.

---

<sup>50</sup> In a more thorough grammar, we place the subcategorized PP under the VP node, and the uncategorized PP for place/time/manner under S. This permits us to say that subcategorization is (normally) reserved for sister nodes.

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.

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.

There is one more phenomenon that suggests that subcategorization has a slightly arbitrary character. Consider verbs like:

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.

### 3. Solving subcategorization problems

The best method seems to be the following:

- Sit and think of lots of words and sentences that include the word you're considering.<sup>51</sup>

---

<sup>51</sup> 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



- 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  $NP \rightarrow (Art)(A) N (PP)^* (\bar{S})$ ). This will tell you the sisters that at least *might* be present.
- 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  $\bar{S}$  because the  $\bar{S}$  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.

**Study Exercise #16**

Give subcategorizations for the following words, justifying them with example sentences.

- a. Verbs: elapse, award, tell, shout, die
- b. Nouns: turtle, bowl, announcement, reason

---

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.

**Answer to Study Exercise #16**

a. Verbs:

*elapse*: [ \_\_\_\_ ]

Time elapsed

\*Time elapsed me

\*Time elapsed to the losing team.

\*Time elapsed 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 ( $\bar{S}$ ) ]

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)( $\bar{S}$ )]

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) ( $\bar{S}$ ) ]

the announcement

the announcement to Bill

the announcement that they were leaving

the announcement to Bill that they were leaving

*reason*: [ \_\_\_\_ ( $\bar{S}$ ) ]

the reason

the reason that we are going

\*the reason to Fred

\*the reason to Fred that we are going

---

## 4. Wh-Movement

### 4.1 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.

#### 4.2 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:

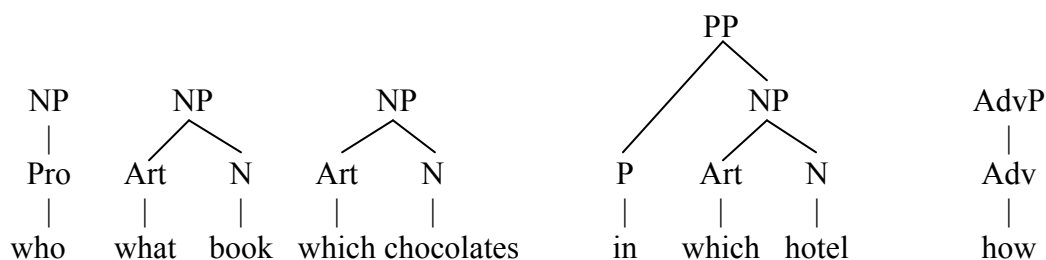
<i>which</i>	Article
<i>whose</i>	Article
<i>who</i>	Pronoun
<i>whom</i>	Pronoun
<i>what</i>	either an Article or Pronoun
<i>how</i>	Adverb
<i>when</i>	Adverb
<i>why</i>	Adverb
<i>where</i>	Adverb

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 focus of the questioning.

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.

### 4.3 *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.<sup>52</sup>

It is a bit surprising, then, that the following sentences should be grammatical:

Into what oven will Fred put the chicken?

What chicken will Fred put into the oven?

These sentences, which are wh- questions, contain what are commonly called **gaps**. Instead of the NP or PP that the subcategorization calls for, one finds — nothing. The gaps are shown below, denoted with a \_\_\_\_:

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:

- 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.

---

<sup>52</sup> 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.

There is an intimate connection between wh- phrases<sup>53</sup> 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

Moreover, most people who ponder the question will judge that gaps are somehow “filled” by the wh- phrase. In

What chicken will Fred put \_\_\_\_ into the oven?

we understand *what chicken* to be the object of *put*, and in

Into which oven will Fred put the chicken \_\_\_\_ ?

we understand *into which oven* to be the PP indicating where Fred put the chicken.

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 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.

## 5. 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 replies to a parallel statement:

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.

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<sup>53</sup> And, as we’ll see later on, phrases that behave quite similarly to wh- phrases.

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”.<sup>54</sup>

## 6. 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.

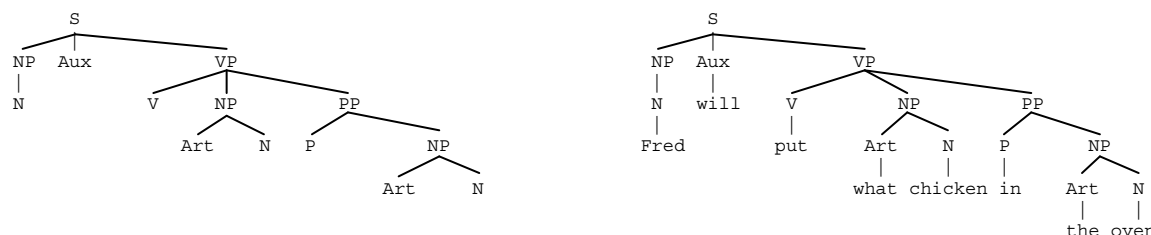
The intuitive idea behind our transformation analysis will be to let normal questions be derived from deep structures that look like echo questions. That is, we will have a transformation that will move the wh- phrase out of its *in situ* deep structure position (where it satisfies the subcategorization of the verb) to the beginning of the sentence. As a first approximation:

### Wh- Movement

Move a wh- phrase to the beginning of the sentence, leaving a trace.

The term “trace” will be defined shortly.

Here is a derivation to illustrate the analysis. We begin with the phrase structure rules (on the left), then do lexical insertion (on the right):

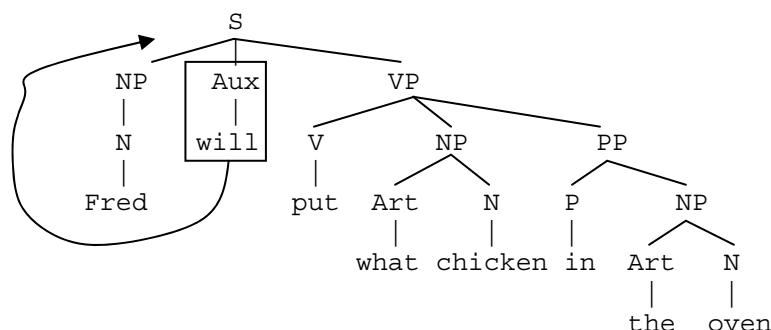


This creates the stage of deep structure, with *what chicken* in situ. The crucial point at this stage is that we have not violated the subcategorization of ‘put’, which in deep structure does have the required NP and PP sisters. In fact, with the theory we are working on, ultimately this will be seen to be true even in surface structure (more on this below).

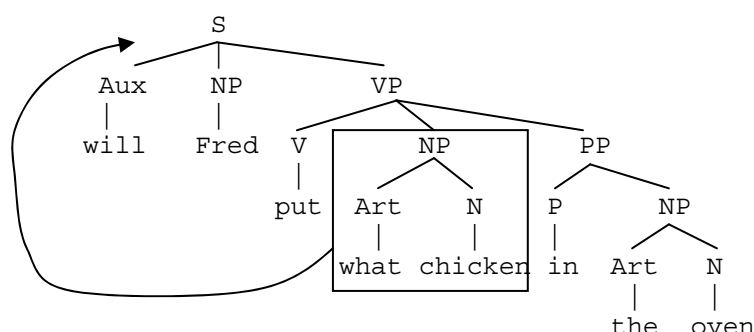
To derive surface structure, we apply two transformations: Subject/Aux Inversion (which, as mentioned earlier, is applicable to questions in general) and Wh- Movement. I show this below first by drawing arrows to show what moves where, then showing the surface structure that results. A caution: the destination of *what chicken* is provisional; we will change the analysis a bit below.

<sup>54</sup> *Situ* is an inflected form ([Case:ablative, Number:singular]) of *situs* ‘place’.

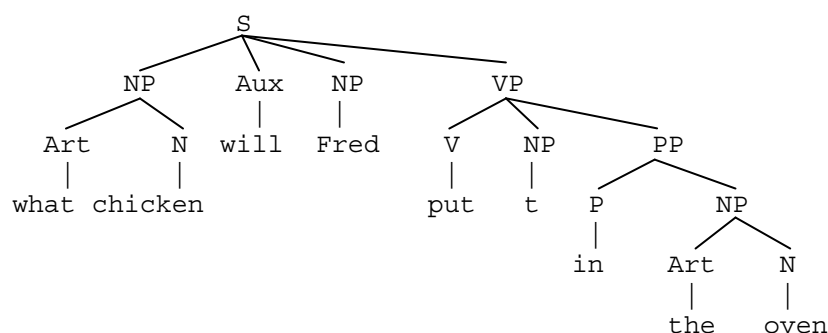
(1) Deep structure, showing Subject/Aux Inversion:



(2) Output of Subject/Aux Inversion, showing Wh- Movement:



(3) Surface structure:



As stated in the Wh- Movement rule, the movement of *what chicken* is assumed to leave a **trace**. A trace is essentially an empty copy of what got moved; it has the same category, but 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 will see later on that it plays an important role when we do 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.

To review the general purpose of this transformational analysis: it offers an account of subcategorization gaps that does better justice to the facts than a phrase structure



grammar could. In this theory, gaps only arise from movement,<sup>55</sup> 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.

**Study Exercise #17**

Explain how our grammar predicts that \*‘What city have the Romans destroyed Carthage?’ is ungrammatical.

**Study Exercise #18**

Explain how our grammar predicts that \*‘Who will the princess sigh?’ is ungrammatical.

**Study Exercise #19**

Derive the question ‘Who will leave?’.

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<sup>55</sup> A caution: there are many other sources of gaps, such as 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.

### Answer to Study Exercise #17

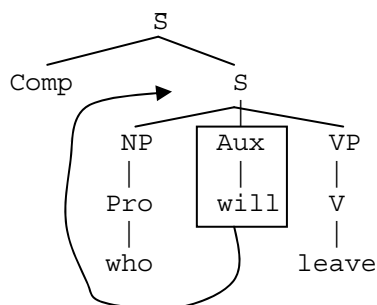
This sentence is a wh- question. Accordingly to our analysis, the wh- phrase in such a question must have originated in deep structure in some position inside the sentence. But there cannot be any such position. The subject position is already filled by ‘the Romans’, and the verb ‘destroy’ subcategorizes 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 #18

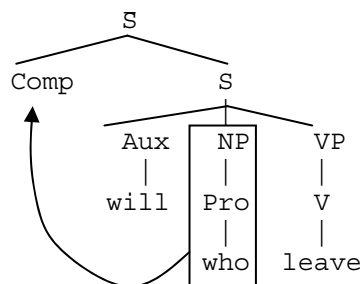
This sentence has essentially the same problem as in Study Exercise #2: there is no place that the NP ‘who’ could have come from: the subject position is already taken up by ‘the princess’, and ‘sigh’ doesn’t subcategorize for any sister NP’s. Thus there is no possible deep structure, so our grammar cannot generate the surface structure. It therefore predicts ungrammaticality.

### Answer to Study Exercise #19

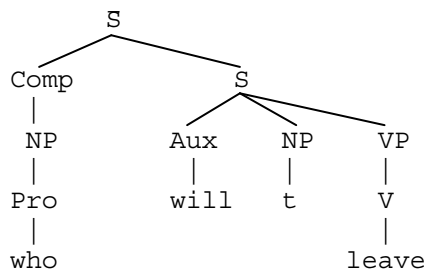
(1) Deep structure, showing Subject/Aux Inversion:



(2) Result of Subject/Aux Inversion, showing Wh-movement



### (3) Surface structure



This is sometimes called a “string-vacuous” derivation; the surface structure word order hasn’t changed (trace being silent), but the structure is different.

## 7. 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.

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, that they take an  $\bar{S}$  which is not a declarative (the usual case), but a wh-question.

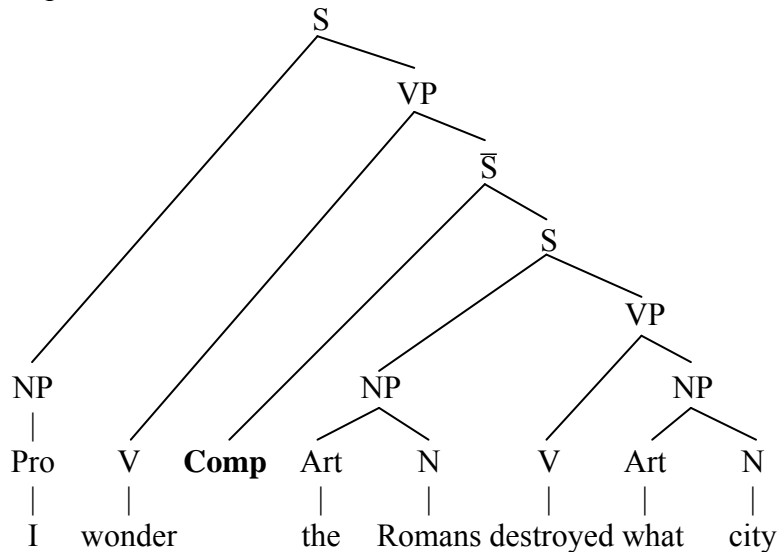
An intriguing aspect of embedded questions is that they don’t occur with the complementizer *that*:

\*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.

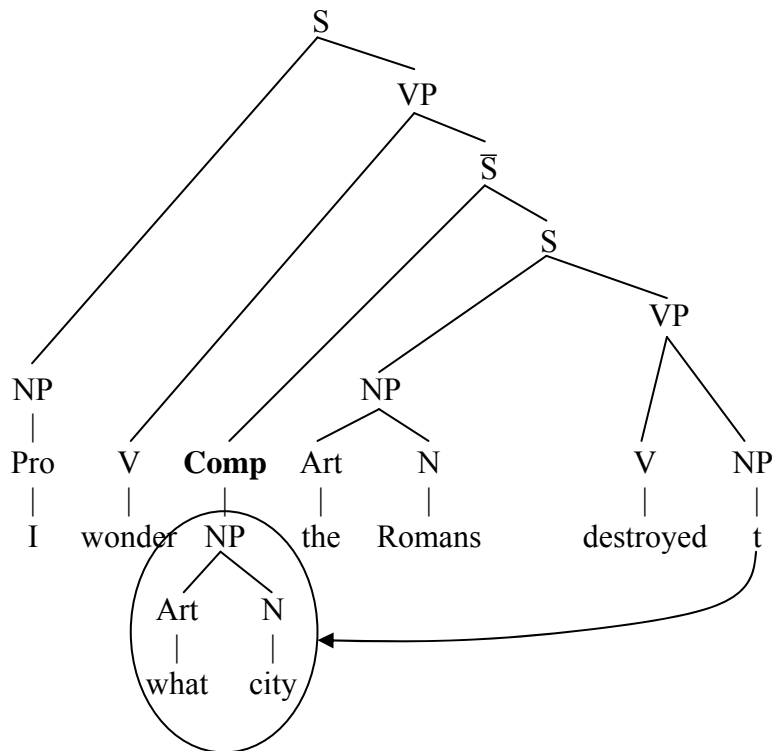
The interaction of such movement with complementizers (such as *that*) requires us to refine the analysis somewhat. An influential idea in syntactic theory is that the order of words in sentences can be explicated in terms of **slots**, which the words compete to fill. We’ve already said that the Complementizer *that* occupies the position Comp, a daughter of  $\bar{S}$ . 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*, which is semantically empty in any event.

Under this view, 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:

Deep structure:



### Wh- Movement and surface structure:



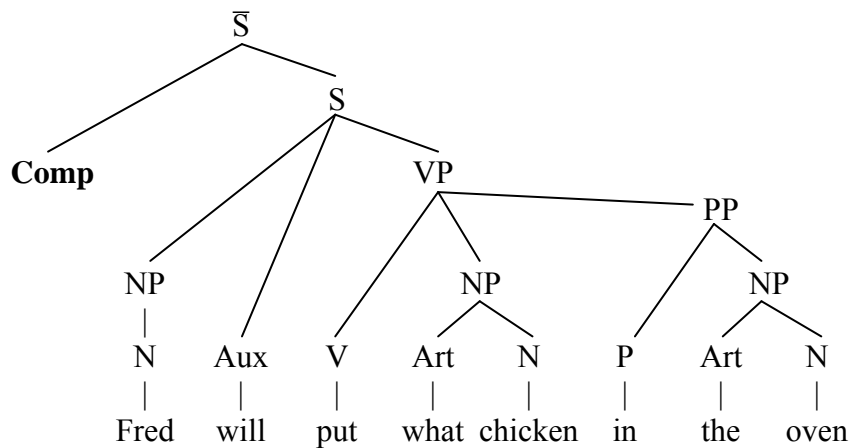
In this view, the empty Comp node provides a “landing site” for the moved Wh- phrase.

If this theory is going to work, 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 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  $\bar{S}$ .
- They require (by means not stated here) that the initial *Comp* be empty in Deep Structure.<sup>56</sup>

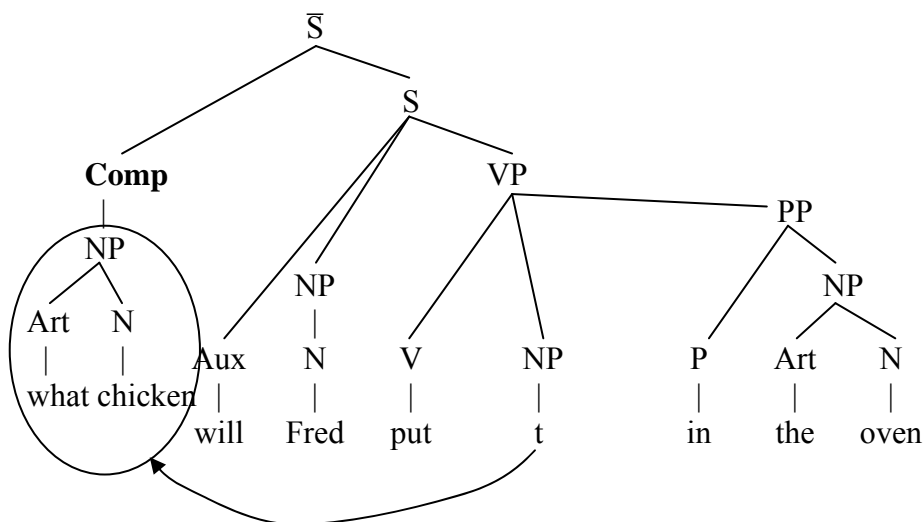
Under this analysis, the derivation of “What chicken will Fred put in the oven?” comes out slightly differently:

Deep structure:



<sup>56</sup> 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.

Wh- movement (and Subject-Aux inversion), yielding surface structure:



With this in mind, we can express the Wh- Movement transformation more explicitly. To keep the notation from becoming rather messy, I will define a preliminary notation:

- Let wh- denote an NP, PP, or AdvP (Adverb Phrase) containing a wh- word.

This said, Wh- Movement can be stated as follows.

### Wh- Movement

$$\begin{array}{ccccccccc}
 W & [ & [ & X & ]_{\text{Comp}} & X & \text{wh-} & Y & ]_{\bar{S}} & Z \\
 1 & & 2 & & 3 & 4 & 5 & 6 & & \\
 \rightarrow & W & [ & [ & \text{wh-} & ]_{\text{Comp}} & X & t & Y & ]_{\bar{S}} & Z \\
 & 1 & & 4 & & 3 & 4 & 5 & 6 & & 
 \end{array}$$

where  $t$  is an empty element of the same category as wh-.

That is to say: when a sentence contains an  $\bar{S}$ , and the  $\bar{S}$  begins with a Comp and contains a wh- phrase, the wh- phrase is moved to occupy the Comp position, leaving behind a trace of the same category.

### 7.1 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 encounter this approach further if/when you study more syntax.<sup>57</sup>

<sup>57</sup> The next course in the Linguistics Dept. undergraduate sequence is Linguistics 120B, offered Winter 2009.

## 8. 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 a:n keta:b-ra: xa:nd  
Ali that book read  
'Ali read that book'

Ali tʃe keta:b-i xa:nd?<sup>58</sup>  
 Ali what book read  
 ‘What book did Ali read?’

\*tʃe keta:b-i Ali xa:nd?  
 what book Ali read

Japanese is similar:

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?’<sup>59</sup>

It’s striking that the languages seem to pattern together; for instance, unbounded movement to the *right* is apparently exceedingly rare in language. 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.

## 9. 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 where they inherently belong? Surely it would be clearer for the listener to interpret the wh- word in its proper syntactic location.<sup>60</sup>

---

<sup>58</sup> If you’re thinking about case marking here, the answer to your question is that the Accusative suffix *-ra* only attaches to *definite* Noun Phrases, the kind that would be translated with *the* in English.

<sup>59</sup> An odd custom of linguists writing in English about Japanese syntax is to use English first names. I don’t know why they do this.

<sup>60</sup> 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.



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 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.

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 their listeners in the form of gap detection.

## 10. 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* ?

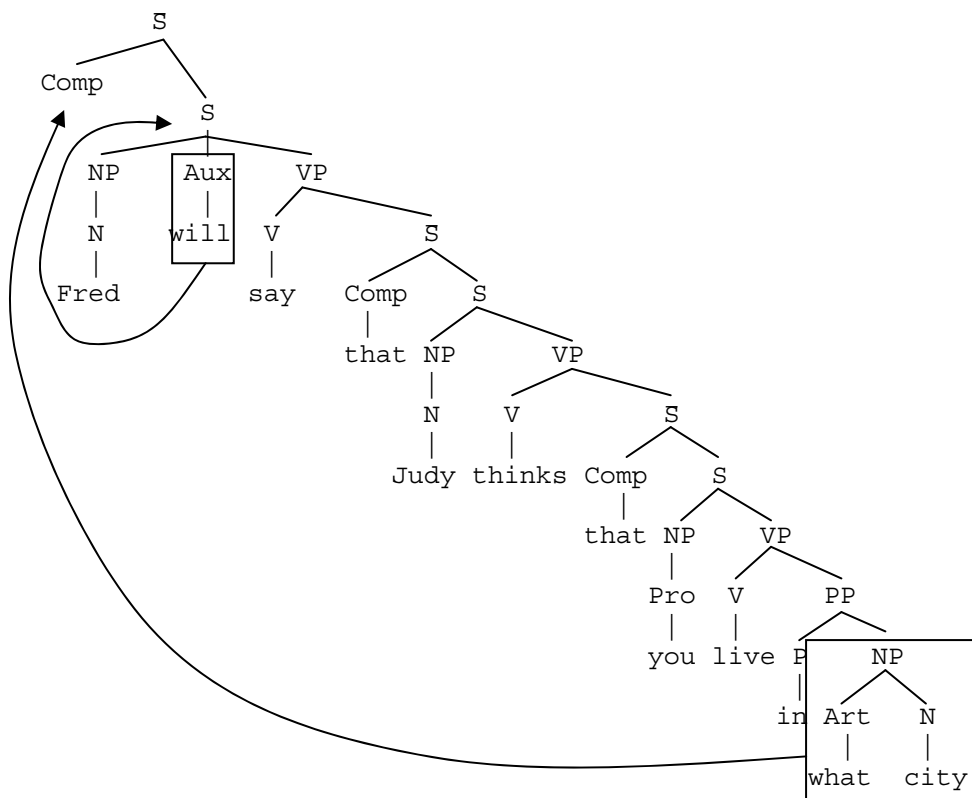
Sally believes that Bill would imagine that Joan thinks that you have seen who.  
Who does Sally believe that Bill would imagine that Joan thinks that you have seen?

### Study Exercise #20

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?'.

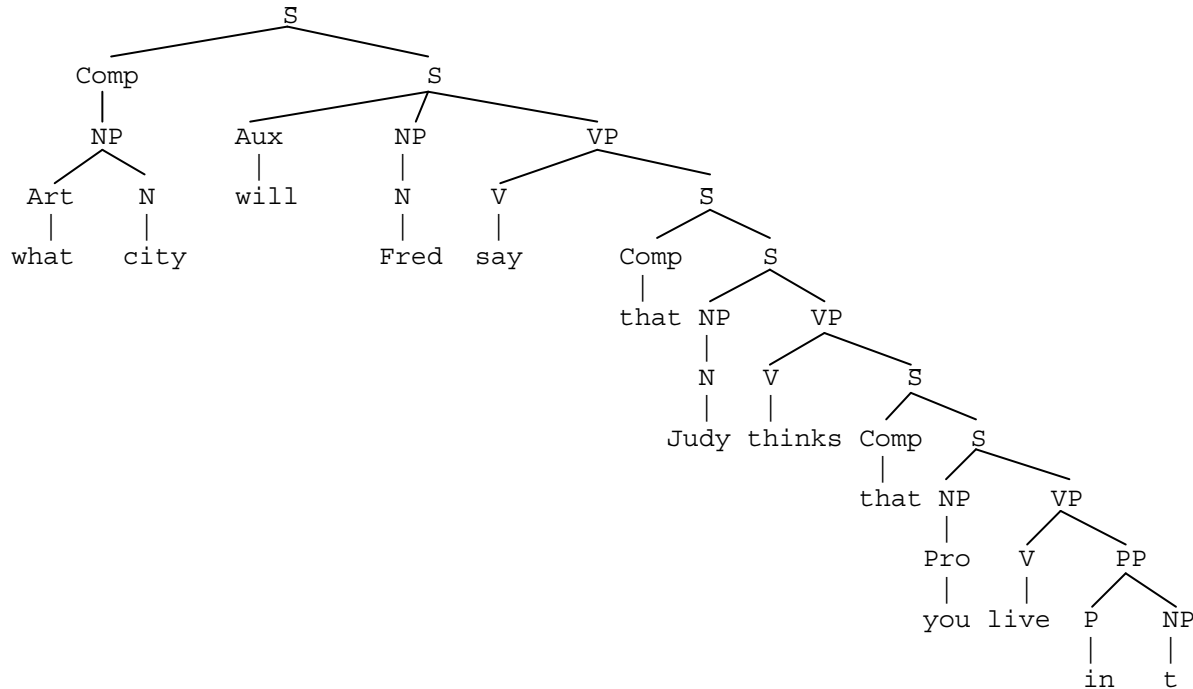
**Answer to Study Exercise #20**

Deep structure, showing Subject-Aux Inversion and Wh-movement:



*(continued on next page)*

Surface structure:



## 11. 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.

Thus I will state the rule as simply moving a phrase to the left edge of S, as follows:

## Topicalization

$$\begin{array}{ccccccccc} V & [ & X & \left\{ \begin{array}{c} \text{NP} \\ \text{PP} \end{array} \right\} & Y & ]_S & Z & & \rightarrow & V & [ & \left\{ \begin{array}{c} \text{NP} \\ \text{PP} \end{array} \right\} & X & t & Y & ]_S & Z \\ 1 & & 2 & 3 & 4 & 5 & & & & 1 & & 3 & 2 & 3 & 4 & 5 \end{array}$$

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 next week in discussing "islands".

## 12. Syntactic derivations

In a "derivation", one applies the rules in order. In the theory we are working with, sentences are derived by first creating a deep structure with the phrase structure rules and lexical insertion, then by applying the transformations in order.

Here is a formalized version of Subject Aux Inversion.

### Subject-Aux Inversion

$$\begin{array}{ccccccc} X & [ & \text{NP} & \text{Aux} & \text{VP} & ]_S & \\ 1 & & 2 & 3 & 4 & & \end{array} \rightarrow \begin{array}{ccccccc} X & [ & \text{Aux} & \text{NP} & \text{VP} & ]_S & \\ 1 & & 3 & 2 & 4 & & \end{array}$$

In words, it says, essentially: "Switch the order of Aux and NP, under S."

Wh-Movement is stated as follows:

### Wh- Movement

$$\begin{array}{ccccccccccc} W & [ & [ & X & ]_{\text{Comp}} & X & wh- & Y & ]_S & Z & \rightarrow & W & [ & [ & wh- & ]_{\text{Comp}} & X & t & Y & ]_S & Z \\ 1 & & 2 & & 3 & 4 & 5 & 6 & & & & 1 & & 4 & & 3 & 4 & 5 & 6 \end{array}$$

where

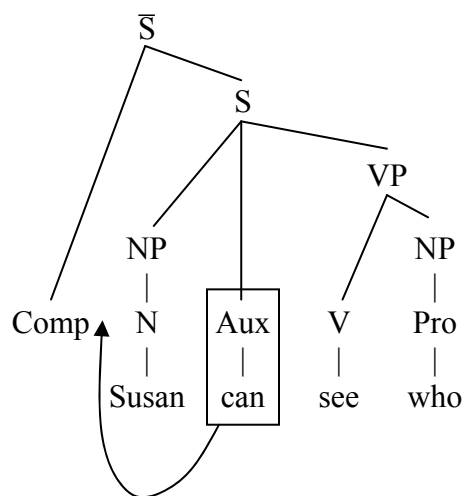
- *wh-* is a phrase containing a *wh-* word
- *t* is an empty element of the same category as *wh-*.
- *W*, *X*, *Y*, and *Z* are variables, standing for any word sequence.

This, too, is a bit more intuitive expressed in words:

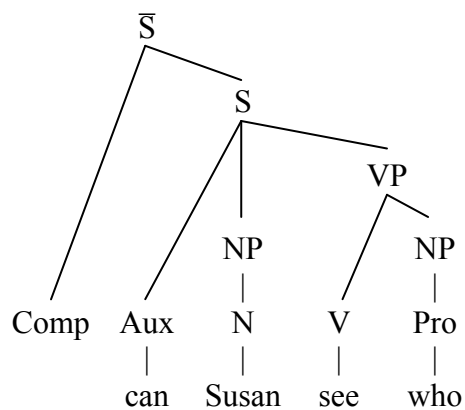
"Move a *wh-* phrase into Comp, leaving a trace."

In many English questions, both Subject-Aux Inversion and Wh- Movement both apply. Here is the sentence *Who can Susan see*.

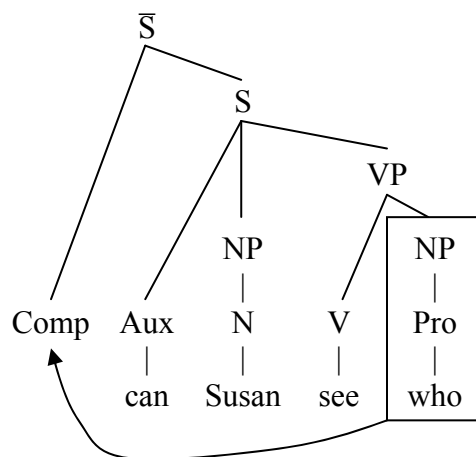
Deep structure, with box around the Aux that is going to move by Subject-Aux Inversion:



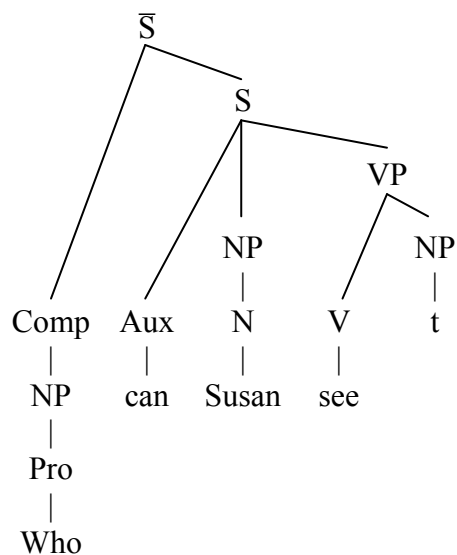
Result of moving the Aux:



Now showing how Wh- Movement is going to work:



Surface structure:



### Study Exercise #21

Provide a syntactic derivation (that is, deep structure, arrows showing what moves where, surface structure) for the following sentences:

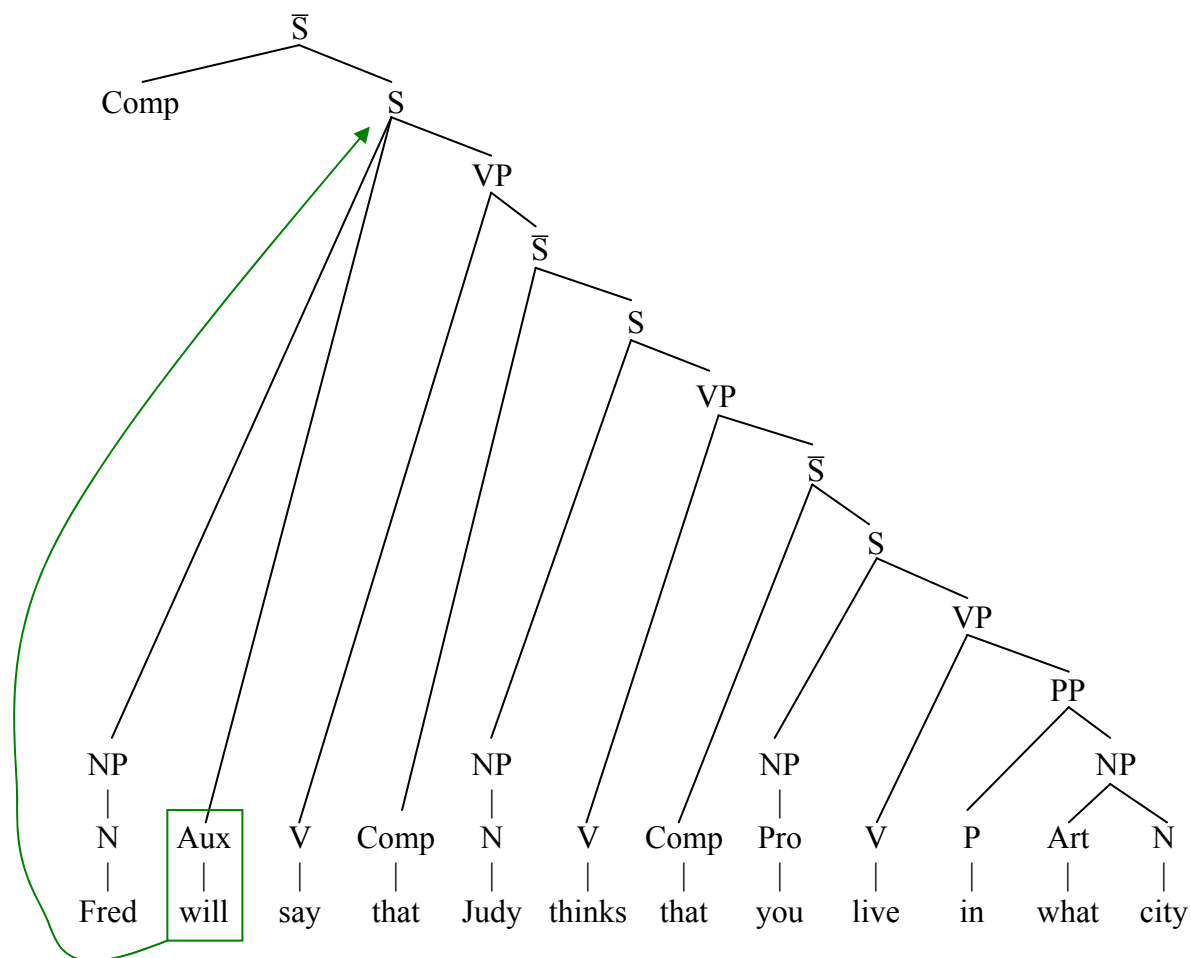
- What city will Fred say that Judy thinks that you live in?
- Which book will Sue ask that we study?
- Sue will ask which book we should study.

Assume the transformations of Subject/Aux Inversion and Wh- Movement.

**Answer to Study Exercise #21**

*What city will Fred say that Judy thinks that you live in?*

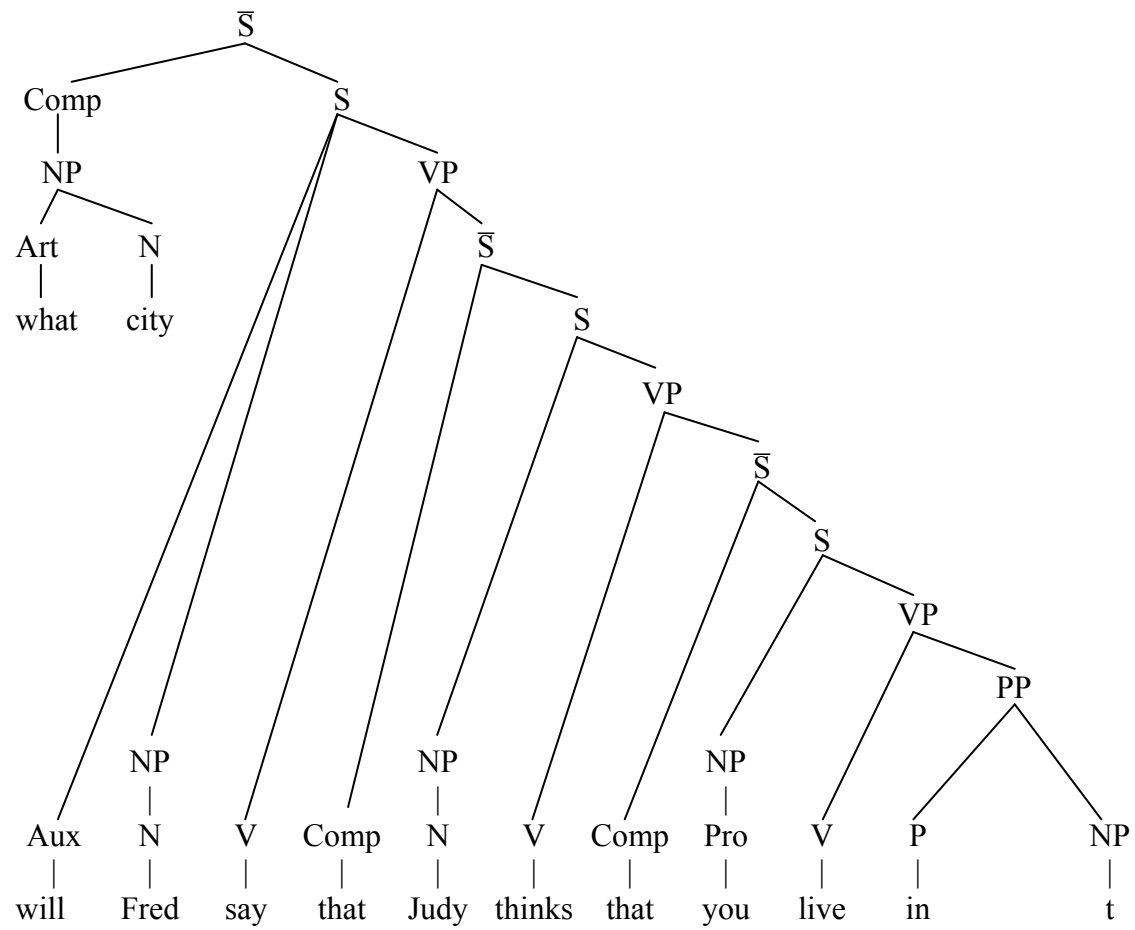
Deep structure. The wh- phrase is in situ, so that the preposition has an object. The arrow shows the movement attributed to Subject/Aux Inversion:







Surface structure, with trace of *what city*:

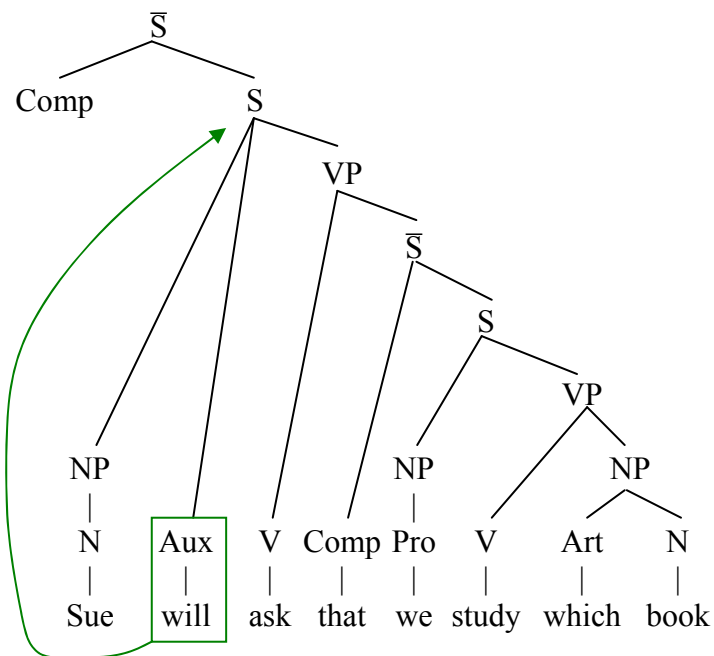


**Which book will Sue ask that we study?**

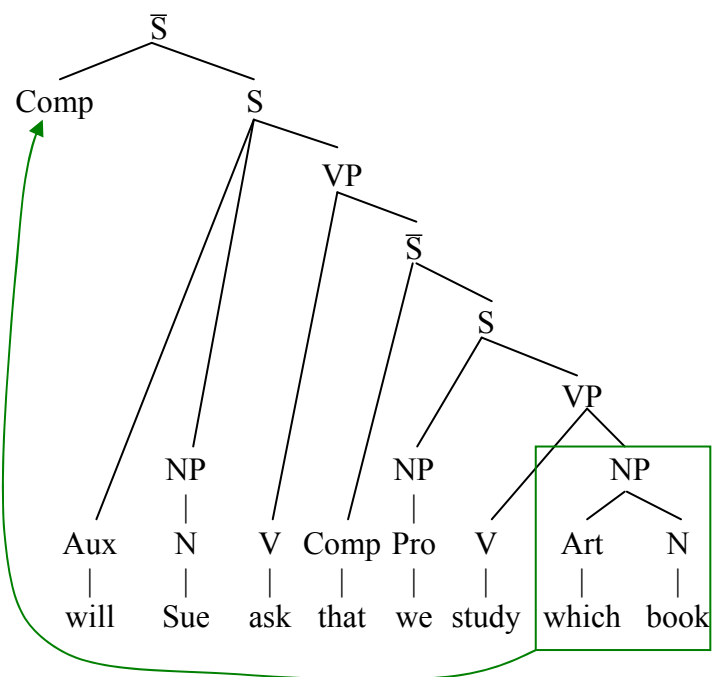
Deep structure, with *which book* in situ.

Note presence of empty Comp, the “landing site” for wh-phrases.

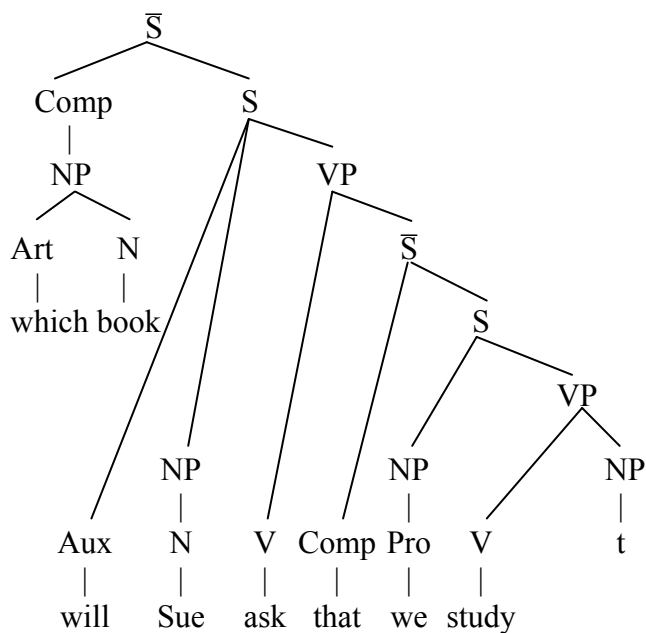
Arrow shows application of Subj/Aux Inversion:



Output of Subject/Aux Inversion. Arrow shows application of Wh-Movement, moving the wh- phrase into *Comp*.



Surface structure, with *wh*- phrase in Comp and a trace left behind:



*Sue will ask which book we should study*

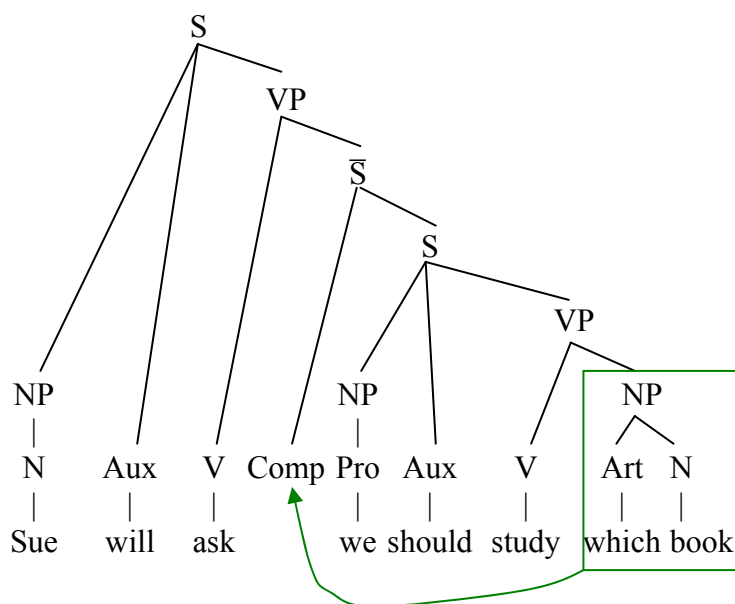
Deep structure, with *which book* in situ.

Now the empty *Comp* is an embedded *Comp*.

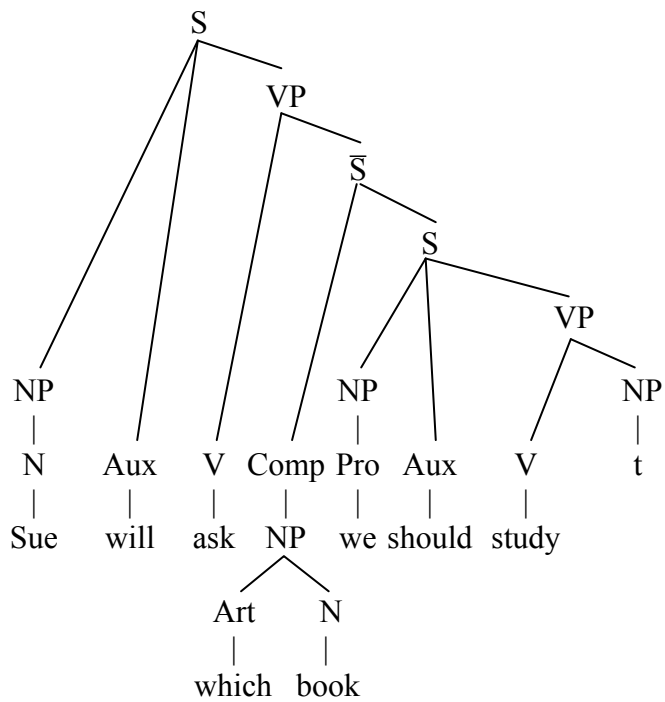
The full sentence, being a statement, is an *S*, not an  $\bar{S}$ .

Subject/Aux Inversion does not apply in embedded questions.

Arrow shows application of Wh-Movement:



Surface structure:



### 13. Update of Phrase Structure Rules

[ note to self: this belongs a few pages earlier, under subcategorization. 2010: better late than never. ]

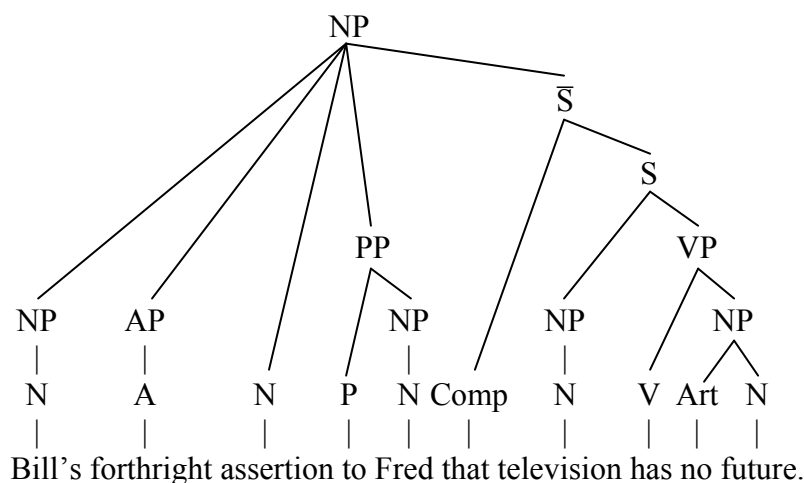
Here are the last two steps in our gradual update of the phrase structure rules.

#### 13.1 $\bar{S}$ as daughter of NP

In the discussion of subcategorization above (p. 118), we found that there are a few nouns that subcategorize for  $\bar{S}$ . Typically these are nouns that express beliefs or statements, such as *belief*, *claim*, *assertion*, and so on. Thus, the NP phrase structure rule has to include the option of an  $\bar{S}$  under NP.

$$NP \rightarrow \left( \left\{ \begin{array}{c} \text{Art} \\ \text{NP} \end{array} \right\} \right) (AP)^* N (PP)^* (\bar{S})$$

A long NP that includes every possibility for the main NP phrase structure rule is the following:



Further example sentences showing the  $\bar{S}$  option are as follows:

Fred's *belief* [ $\bar{S}$  that he is a genius ]  
 George's *insistence* [ $\bar{S}$  that he be included ]  
 the *claim* [ $\bar{S}$  that this structure is an island ]  
 Sally's *assertion* [ $\bar{S}$  that we should eat pasta ]

Note that all of these nouns are created by a rule of word formation from verbs that themselves categorize for  $\bar{S}$  (*believe*, *insist*, *claim*, *assert*). (Others are not, however: *hypothesis*, *hunch*.)

In passing, observe that there is another kind of  $\bar{S}$  that can occur as part of an NP. It is *not* subcategorized. You can tell that it is different because it includes a gap.

the turtles [ $\bar{S}$  that we caught \_\_\_\_ in the pond ]  
 the beliefs [ $\bar{S}$  that we hold \_\_\_\_ ]  
 the king [ $\bar{S}$  who the peasant deposed \_\_\_\_ last year ]

This is called a **relative clause**; we won't have the time to analyze them here.

To see the difference between subcategorized  $\bar{S}$ 's and relative clauses, it may help to observe that you can get both of them in the same NP:

the assertion [ $\bar{S}$  that we should eat pasta ] [ $\bar{S}$  that you made \_\_\_\_ ]  
 head of NP                      Subcategorized  $\bar{S}$                        $\bar{S}$  forming a relative clause

### 13.2 AP as daughter of VP

The Persian homework had the VP *raftani ast*, 'go-incipient adjective be-3 singular present'. This implies a phrase structure rule  $VP \rightarrow AP V$ . English has the same thing, only in verb-initial order:

$V \rightarrow V AP$

Fred is sick.  
 Bill looks tired.  
 Alice seems very friendly.

These three examples make use of three of the (fairly unusual) verbs of English that subcategorize for an AP.

### 13.3 Final phrase structure rule list

Putting all of these together, we have the phrase structure rules shown:

S       $\rightarrow$  NP (Aux) VP  
 NP     $\rightarrow$   $\left( \left\{ \begin{array}{c} \text{Art} \\ \text{NP} \end{array} \right\} \right) (AP)^* N (PP)^* (\bar{S})$   
 NP     $\rightarrow$  Pronoun  
 VP     $\rightarrow$  V (NP) (NP) (PP)\* ( $\bar{S}$ )  
 VP     $\rightarrow$  V AP  
 PP     $\rightarrow$  P NP  
 $\bar{S}$      $\rightarrow$  (Comp) S

NP → NP (Conj NP)\*  
 VP → VP (Conj VP)\*  
 PP → PP (Conj PP)\*  
 S → S (Conj S)\*  
 $\bar{S}$  →  $\bar{S}$  (Conj  $\bar{S}$ )\*  
 V → V (Conj V)\*

#### 14. 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 or PP 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 appears *not* to be Comp, since you can get both *that* and the fronted topic in sequence:

I’d say that linguistics, I can teach.

Thus we should state the rule as simply moving a phrase to the left edge of S, as follows:

##### Topicalization

$$\begin{array}{ccccccccc}
 W & [ & X & NP & Y & ]_S & Z & & \rightarrow & W & [ & NP & X & t & Y & ]_S & Z \\
 1 & & 2 & 3 & 4 & 5 & & & & 1 & & 3 & 2 & 3 & 4 & 5
 \end{array}$$

“Move an NP to the beginning of S.”

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.

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.

**Study Exercise #22**

Derive *I'd say that linguistics, I can teach.*



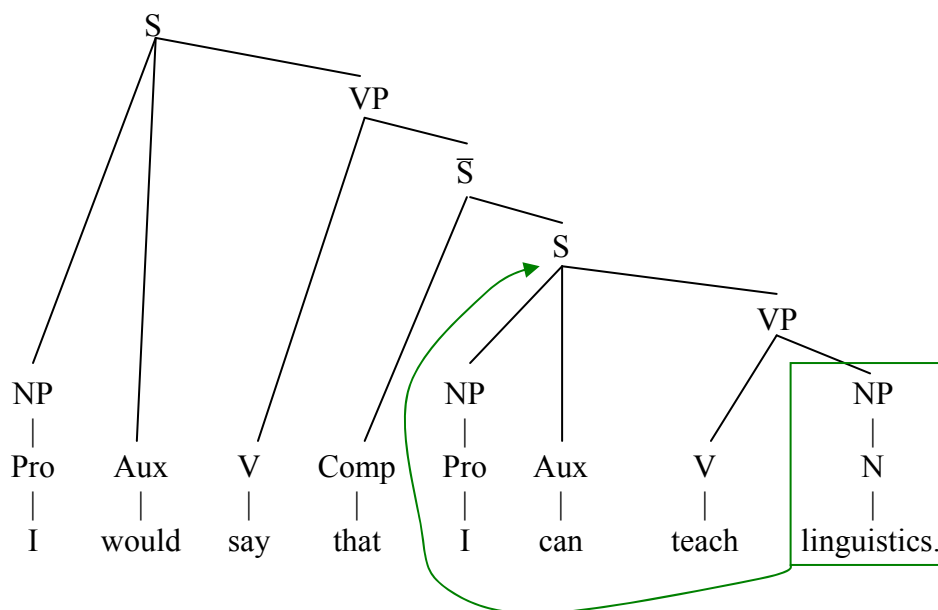
## Answer to Study Exercise #22

*I'd say that linguistics, I can teach.*

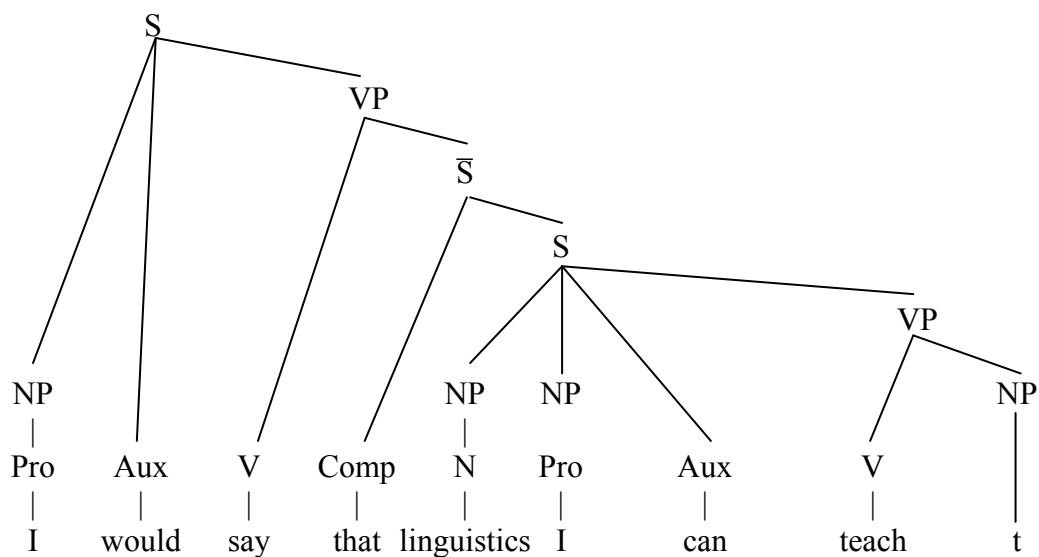
Deep structure, with *linguistics* in situ.

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.



## 15. 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**.<sup>61</sup> The sort of data that justify the rule are given below.

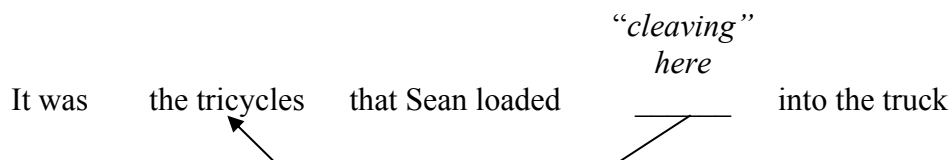
a. *Sean loaded the tricycles into the truck.*

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.

The transformation needed is pretty complicated and so I give below first an abbreviated version showing the essentials, then a more careful version, and lastly a prose version.

### It Clefting

a. Abbreviated version:

$$\begin{array}{ccccc}
 [s & X & \left\{ \begin{array}{c} \text{NP} \\ \text{PP} \end{array} \right\} & Y & ] \\
 1 & 2 & 3 & & \\
 \rightarrow & [s & \text{it} & \text{be} & \left\{ \begin{array}{c} \text{NP} \\ \text{PP} \end{array} \right\} & [s & \text{that} & [s & X & t & Y & ]]] \\
 & & & 2 & & 1 & 2 & 3
 \end{array}$$

<sup>61</sup> 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.

b. Full version:

$$\begin{array}{ccc}
 [s \ X \ \left\{ \begin{array}{c} \text{NP} \\ \text{PP} \end{array} \right\} \ Y ]_s & \rightarrow & [s \ [NP \ [_{\text{Pro}} \text{it}]] \ [VP \ [ \text{be} ]_V \ \left\{ \begin{array}{c} \text{NP} \\ \text{PP} \end{array} \right\} \ [s \ \text{that} \ [s \ X \ t \ Y ]]]]] \\
 \begin{array}{ccc} 1 & 2 & 3 \end{array} & & \begin{array}{ccc} 2 & 1 & 2 \ 3 \end{array}
 \end{array}$$

c. In words:

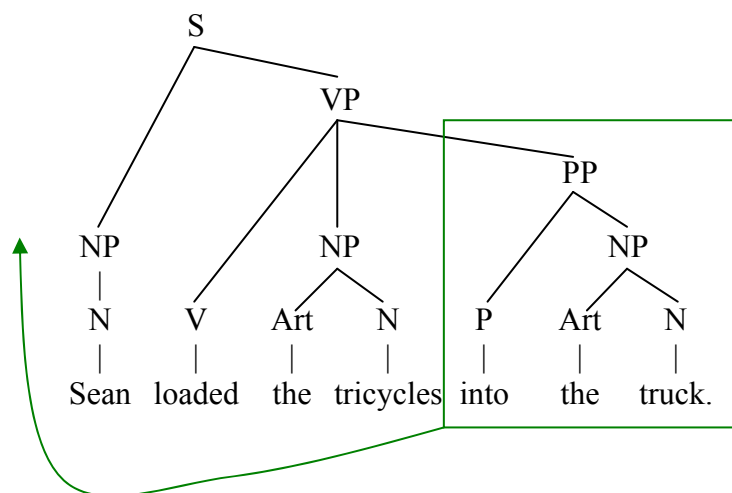
- Take a Sentence containing an NP or PP.
- Construct “on top” of it a new Sentence, with subject *it*, verb *be*, and an  $\bar{S}$  sister to V within its VP. The new  $\bar{S}$  contains the original S.
- Move the NP or PP to a position following *be*.

Even this is not quite enough; we need to specify how a Tense feature gets into the morphosyntactic representation of the *be*. We could do this by copying the morphosyntactic representation of the original main verb onto the inserted *be*. We’ll skip this part in the interest of brevity.

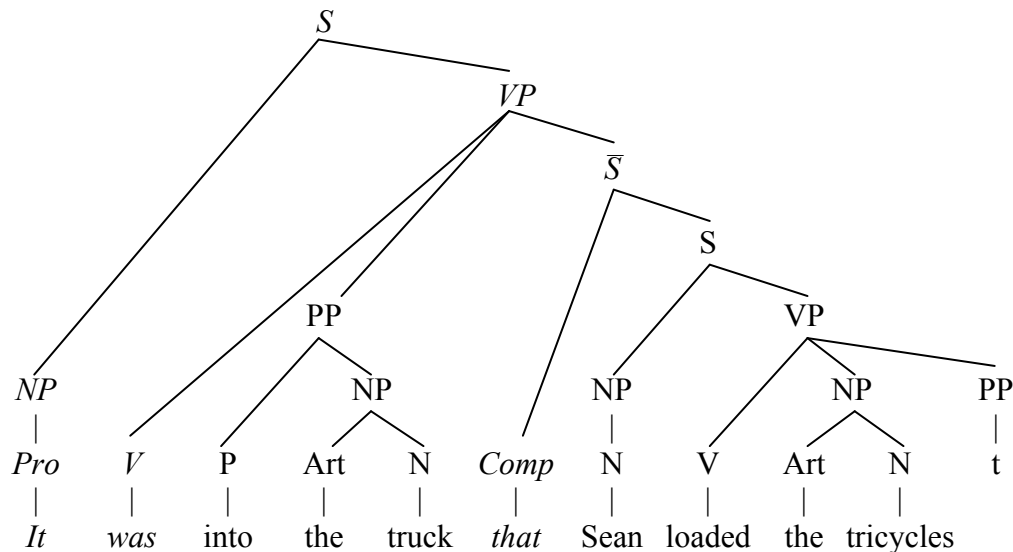
It Clefting is another instance of an unbounded dependency, and for the same reason as in Wh- Movement requires a movement analysis.

Here is an example of how It Clefting applies. Structure added by the rules is shown in italics.

Deep structure and movement:



Surface structure, with trace:



Like Wh- Movement and Topicalization, It Clefting is an unbounded rule:

It was [ the tricycles ]<sub>NP</sub> that Tom thinks Sue knows that Bill loaded \_\_\_\_ onto the truck.

## 16. Constituency testing

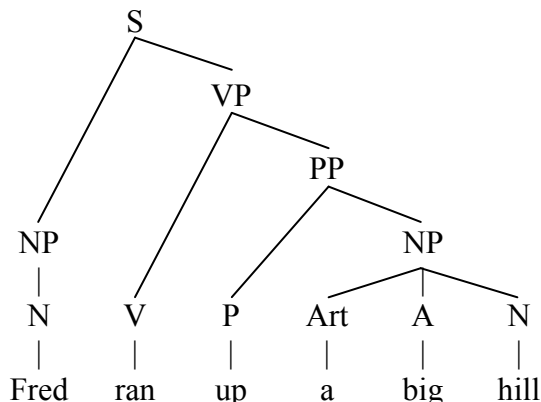
As noted in Chapter 4, section 11, It Clefting can be used as a **constituency test**. Here is the rationale: the rule requires there to be an NP or PP to move; so if you're not sure whether a particular sequence of words is an NP or a PP, try It Clefting it. (The other transformations also can be used, 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:

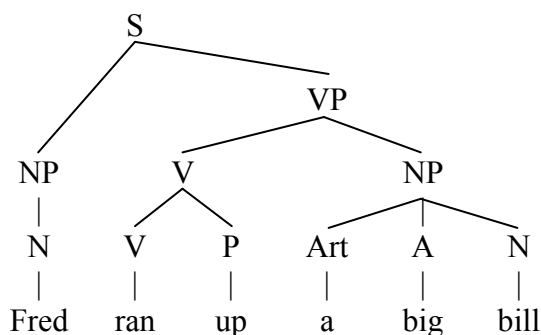
Fred ran up a big hill.

Fred ran up a big bill.

The correct structures are evidently as follows:



(Prepositional phrase *up a big hill*, indicating the direction Fred ran)



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 up a big hill that Fred ran.

(Fine, clefting PP)

It was a big hill that Fred ran up.

(Fine, clefting NP)

\*It was up a big bill that Fred ran.

(Bad, result of trying to It-Cleft a nonconstituent)

It was a big bill 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 NP's)
*Fred ran <u>up a big bill</u> and <u>over a cat</u> .	(Conjoining nonconstituents) <sup>62</sup>
Fred ran up <u>a big bill</u> and <u>a big tab</u>	(Conjoining two NP's)

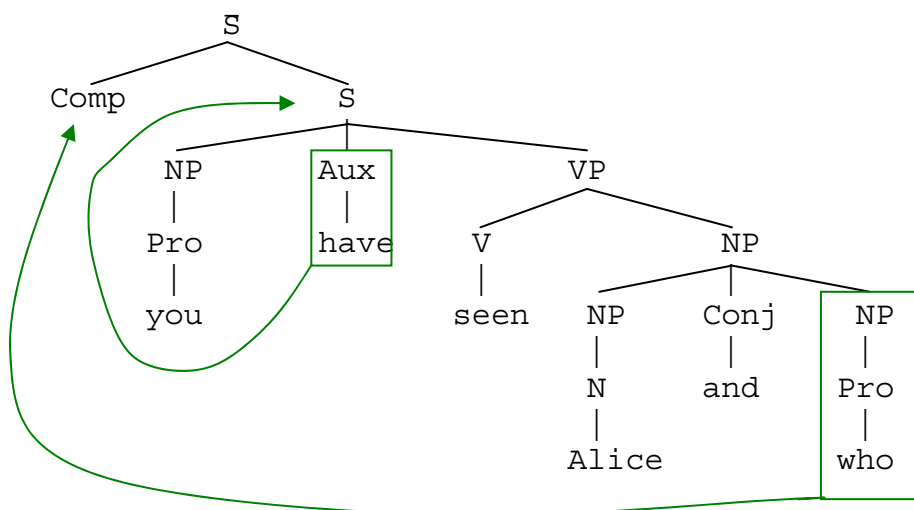
## 17. Island constraints

Consider the following deep structure:

You have seen Alice and who?

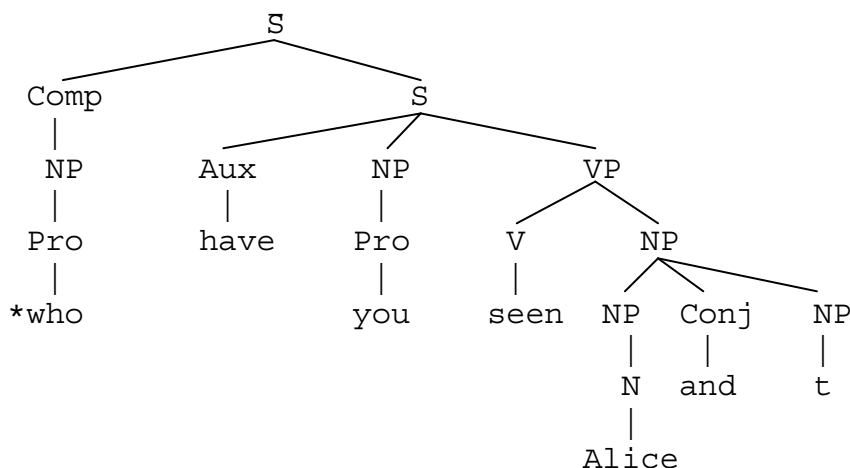
This is clearly a possible deep structure, as it can be an echo question if nothing applies to it. However, if make it part of an  $\bar{S}$ , in anticipation of making it into a Wh- question (see previous notes for why), and then apply Wh- movement to this deep structure, the result is unexpectedly ungrammatical:

Deep structure, Subject/Aux Inversion, and Wh- Movement:



<sup>62</sup> 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:



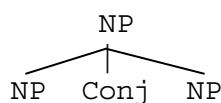
Note that we really are dealing with ungrammaticality rather than nonsense; the question is perfectly reasonable, and could mean roughly 'Who did you see Alice with'.

The ungrammaticality of this sentence is a serious problem for our grammar: 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:

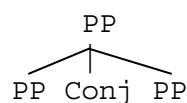
- a. You have seen who and Alice (okay as echo question)  
 \*Who have you seen and Alice?
- b. Bill will take pictures of Fred and Alice (not the same deep structure, but close enough)  
 \*Who will Bill take pictures of and Alice?  
 \*Who will Bill take pictures of Fred and?
- c. Jay jumped onto the trampoline and into the pool.  
 \*What did Jay jump onto the trampoline and into? (moving NP)  
 \*What did Jay jump onto and into the pool? (moving PP)
- d. Phil loves Coke and abhors Pepsi.  
 \*What beverage does Phil love Coke and abhor?  
 \*What beverage does Phil love and abhor Pepsi?

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. In the four groups the sentences above, the structures are as follows:

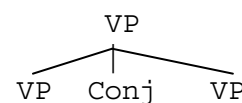
a, b:



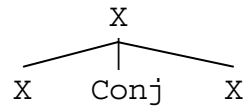
c:



d:



Structures of this sort are called **coordinate structures**. A general notation for coordinate structures is as follows:<sup>63</sup>



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 exactly the same way. If we added exactly the same complication to all the other rules, we would be missing a generalization.

## 18. Constraints in grammar

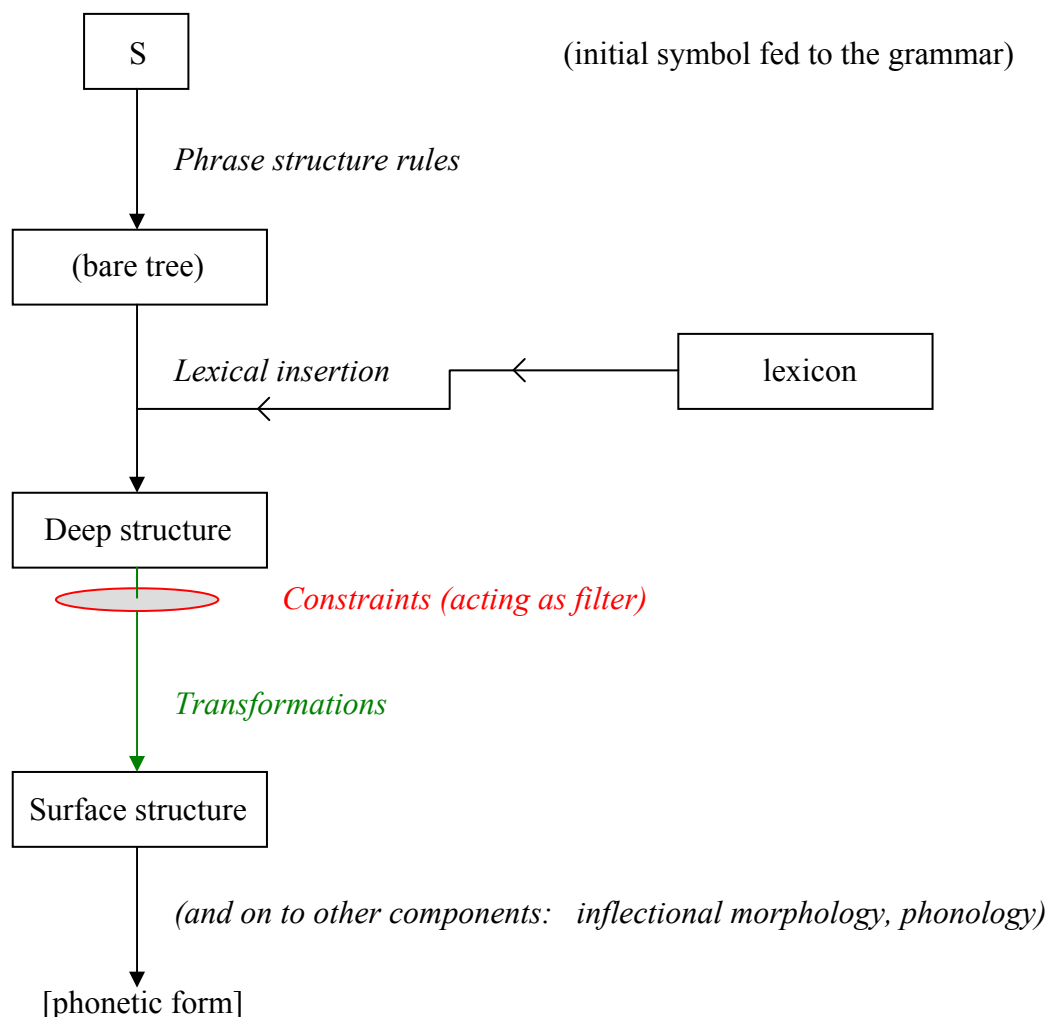
A better solution is to add to grammar a **constraint** on possible derivations. A constraint could be thought of as a “filter” on the operation of the grammar: if the derivation of a sentence violates the constraint, then the constraint marks the sentence as ungrammatical, and it is eliminated from the (infinite) set of sentences that the grammar generates.

The general organization of such a grammar can be imagined as follows:

---

<sup>63</sup> We could generalize this to cover multiple conjuncts (NP *and* NP *and* NP...), but won't take the time.





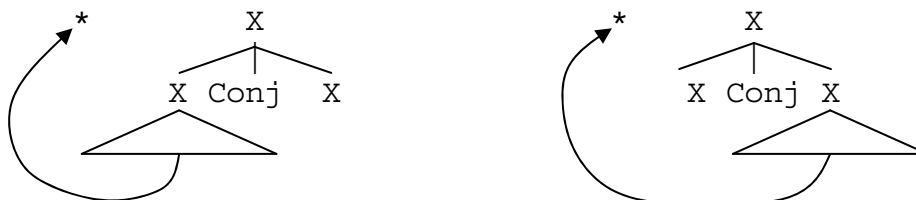
This conception includes three of (what I take to be) the four basic formal mechanisms of linguistic theory: (a) generative rules (here, phrase structure rules); (b) transformations (converting one structure to another); (c) filters (throwing out the result of a derivation).<sup>64</sup>

For the data under discussion, the constraint we need is the following:

<sup>64</sup> The fourth rule type is interpretation, which we will cover when we get to semantics.

## Coordinate Structure Constraint

Mark as ungrammatical any sentence in which a constituent has been extracted from inside a coordinate structure.

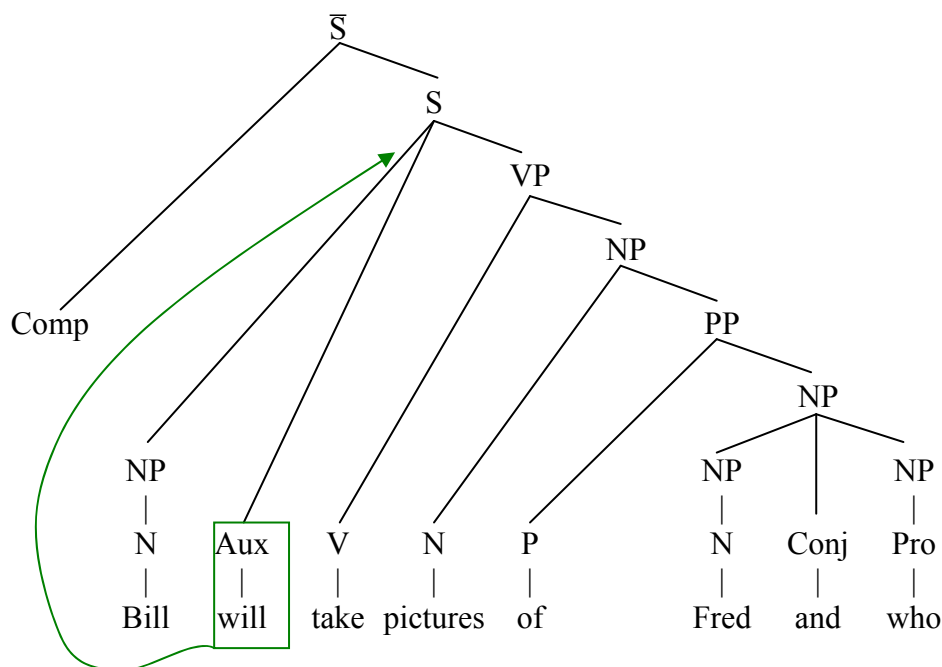


The notation of the triangle seen here means, “any structure dominated by X”.

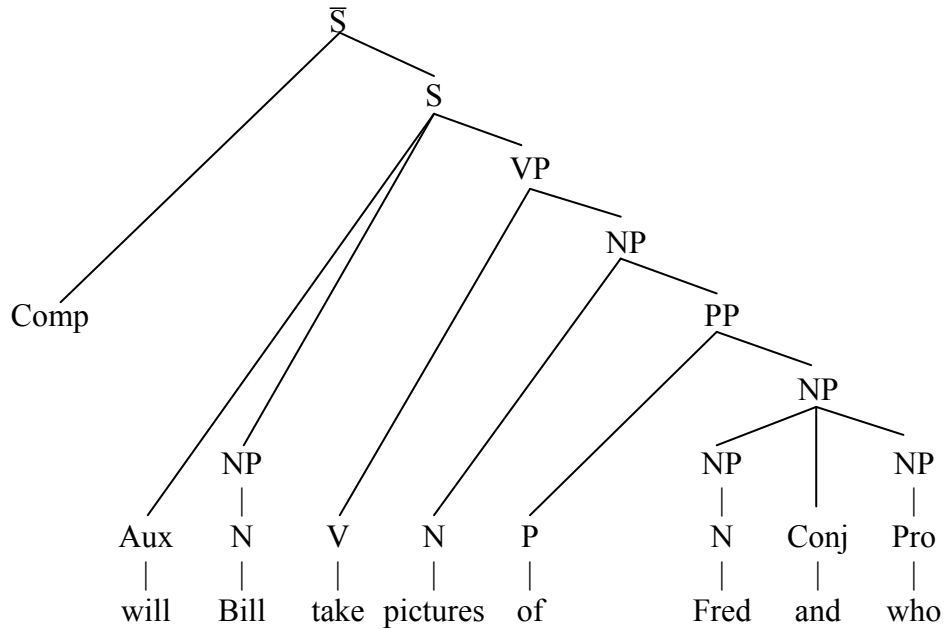
The Coordinate Structure Constraint is called an **island constraint**. A coordinate structure acts as an “island,” in that it is inaccessible to the efforts of transformations to remove things out of it. The Coordinate Structure constraint will correctly rule out the ungrammatical sentences given earlier.

Here is one way (which you can use on the homework) 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 arrow, to indicate that this movement results in ungrammaticality.)

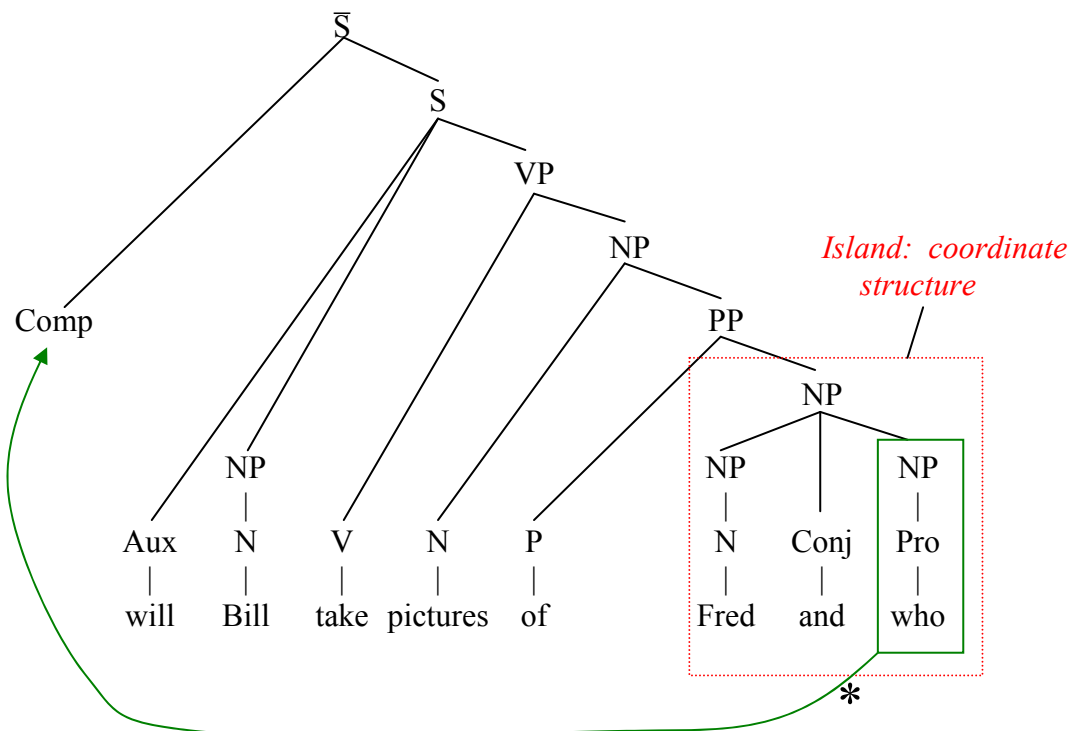
Deep structure (empty Comp is the landing site for Wh- Movement)  
Arrow shows application of Subject/Aux Inversion.



Output of Subject/Aux Inversion:



2nd transformation (attempted): Wh-Movement:



Result: \*Who will Bill take pictures of Fred and?

**Study Exercise #23**

Explain why the sentence

\*What city have the Romans destroyed and attacked Athens?

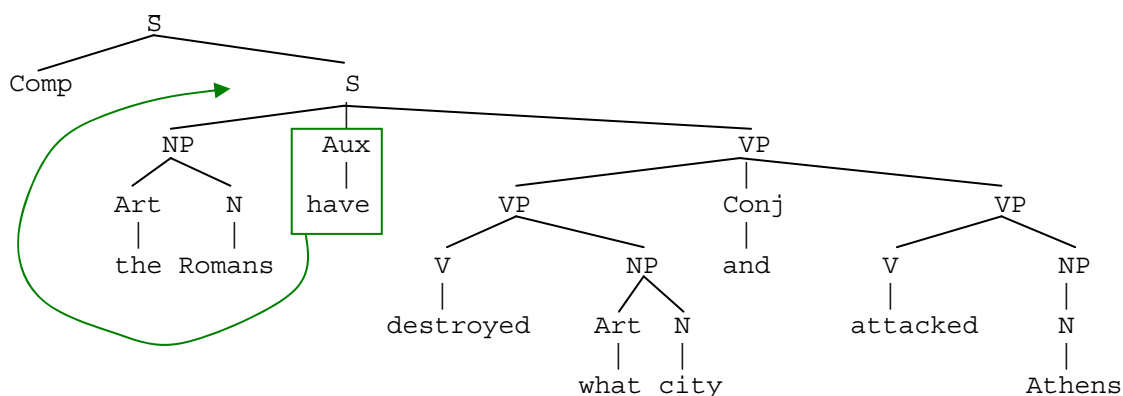
is ungrammatical. Illustrate with a derivation.

### Answer to Study Exercise #23

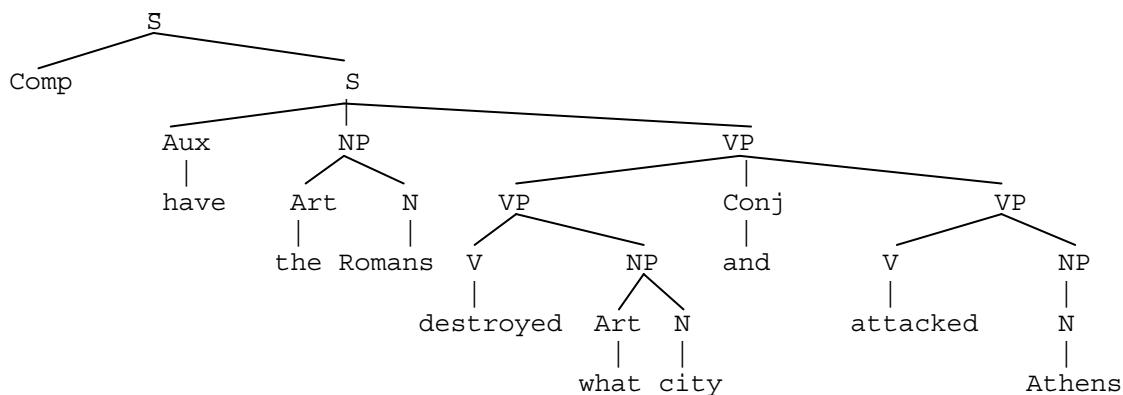
***What city have the Romans destroyed and attacked Athens?***

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.

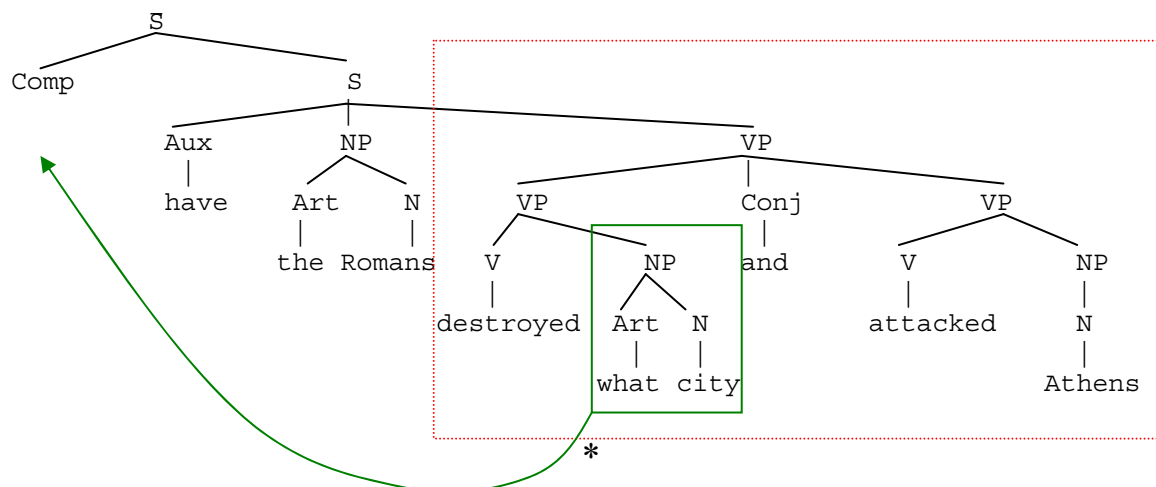
Deep structure, showing Subject/Aux Inversion:



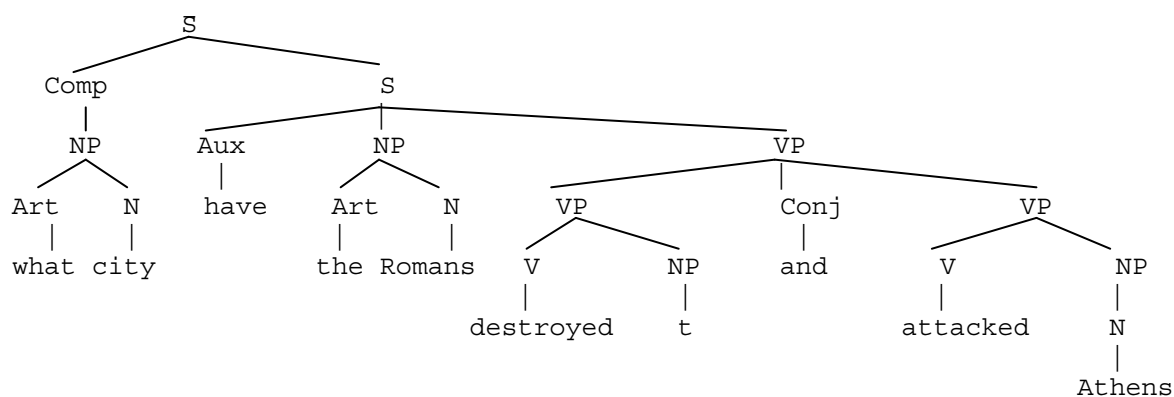
Output of Subject/Aux Inversion:



Wh- Movement, moving outside coordinate structure:



Illegal surface structure:



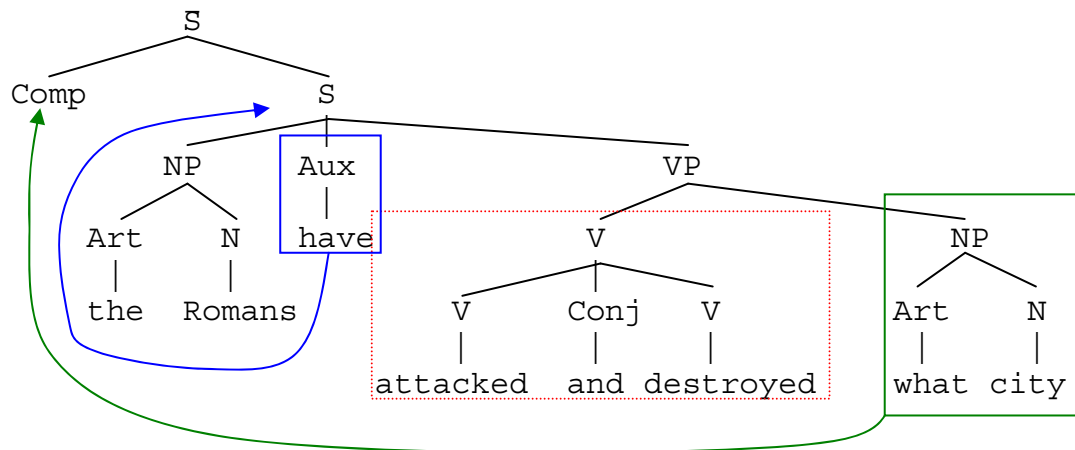
### Study Exercise #24

Explain why the sentence 'What city have the Romans attacked and destroyed?' is grammatical. Illustrate with a derivation. Hint: recall that  $V \rightarrow V \text{ Conj } V$  is a phrase structure rule of English.

### Answer to Study Exercise #24

#### *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:



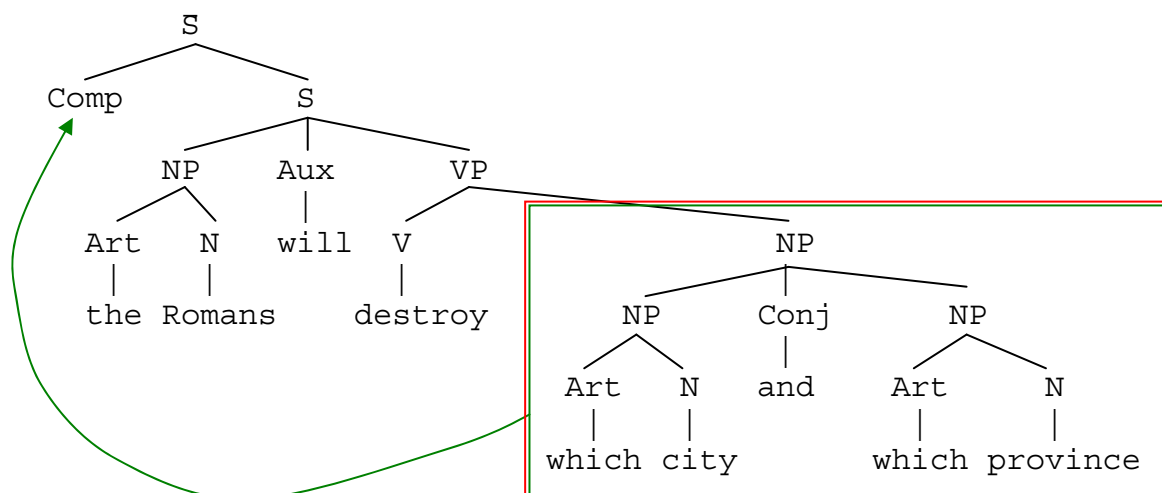
### Study Exercise #25

Explain why the sentence ‘Which city and which province will the Romans destroy?’ is grammatical. Illustrate with a derivation.

## Answer to Study Exercise #25

### *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.



## 19. 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 central 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.<sup>65</sup> No universal has been checked against all 8000, however, at least some proposed universals

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]<sup>66</sup> or something phonetically close to it.

<sup>65</sup> This number is, alas, declining steadily; probably the best list of languages is the *Ethnologue*, at <http://www.ethnologue.com/>.

<sup>66</sup> 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 it is often felt that 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

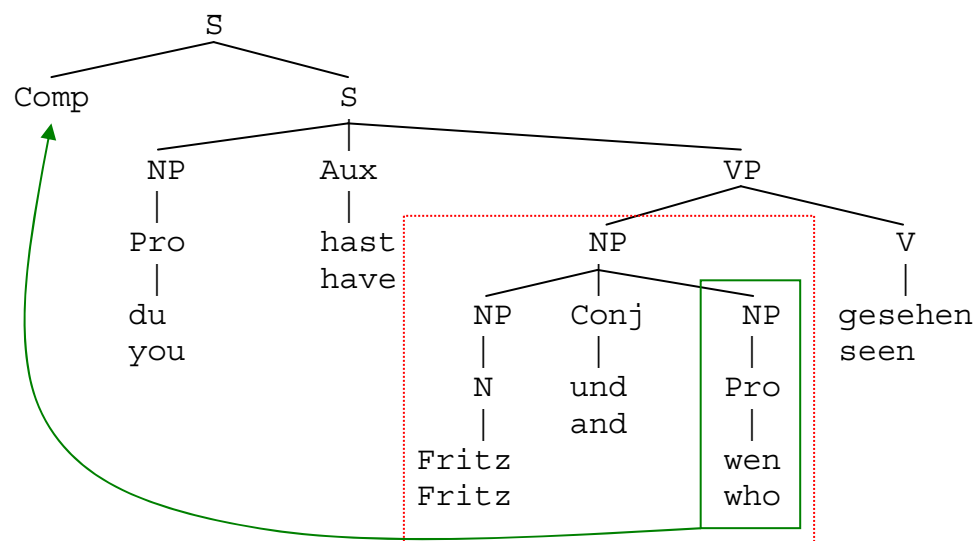
Simple sentence:

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  
coordinate structure:

\*Wen hast du Fritz und \_\_\_\_ gesehen?  
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

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.

### 19.1 Looking ahead

The combination of long-distance transformations and islands leads to a fair amount of 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.

## 20. The transformations restated intuitively

In previous readings, I’ve given formalized versions of the three transformations Wh- Movement, Topicalization, and It-Clefting. Here are informal working versions, which may be useful for problem solving:

### Subject-Aux Inversion

In a yes/no question or a Wh- question, move the highest Aux in the sentence to the left of the subject, keeping it a daughter of S, and leaving no trace.

### Wh- Movement

Move a wh- phrase into Comp, leaving a trace.

### Topicalization

Move an NP or PP to the beginning of S, making it a daughter of S, and leaving a trace.

### It-Clefting

Add *it be that* to the top of the sentence, giving it the expected parse (new S,  $\bar{S}$ , NP, Pro, V, and Comp). Then move some NP or PP from the original sentence so it comes after *be*. Leave a trace.

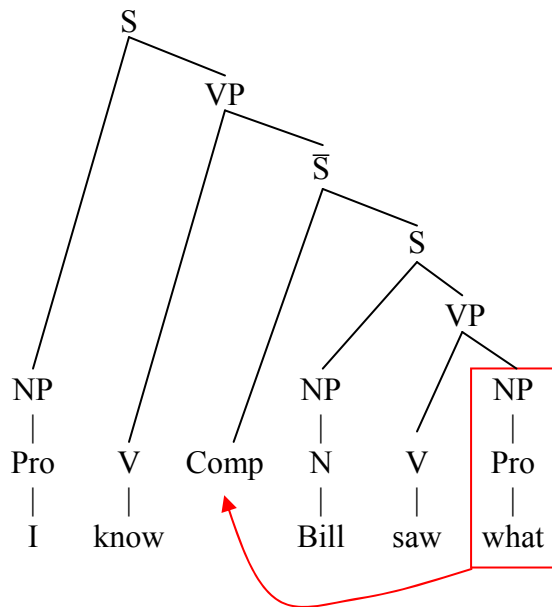
## 21. Two more islands

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).

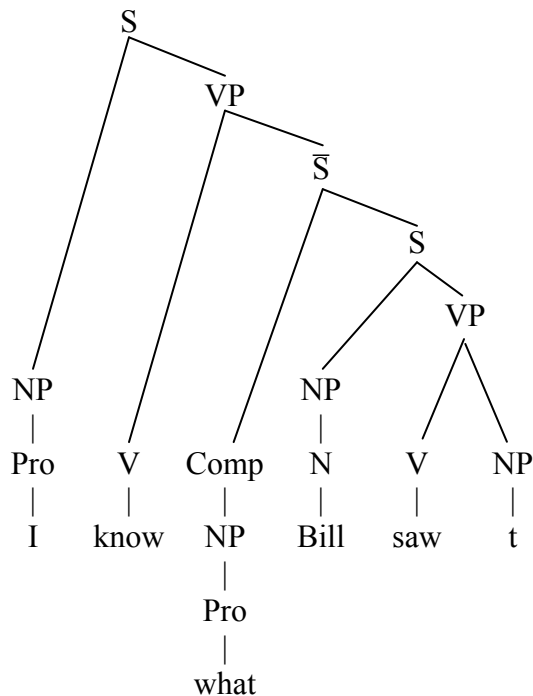
### 21.1 The Wh- Island Constraint

Recall embedded wh- questions, like *I know what Bill saw*. We already have the means to derive this, and the example is reviewed below.

Deep structure and Wh- Movement:



Surface structure:



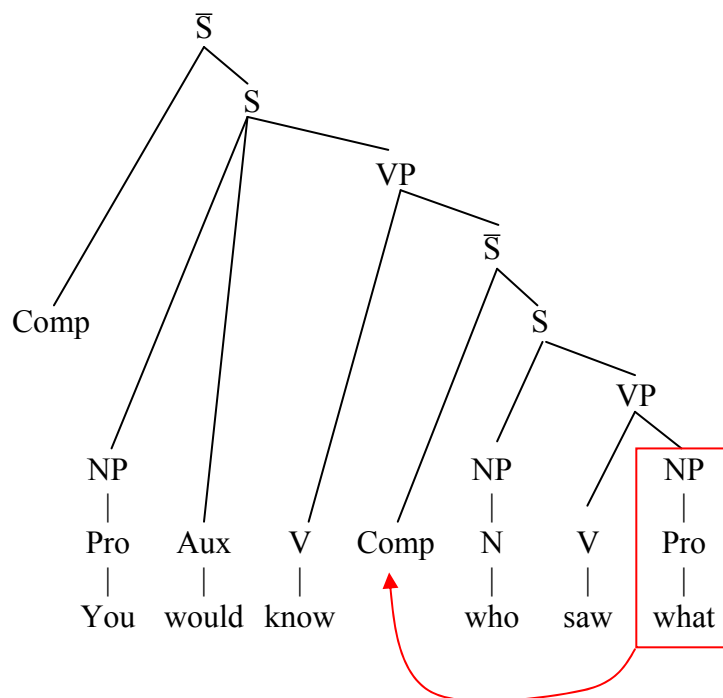
But now consider the following scenario: what if, at the level of deep structure, there were *two* wh- phrases in the same clause? This is not so absurd, since we actually have sentences like the following:

I know [ who saw what ]<sub>S</sub>

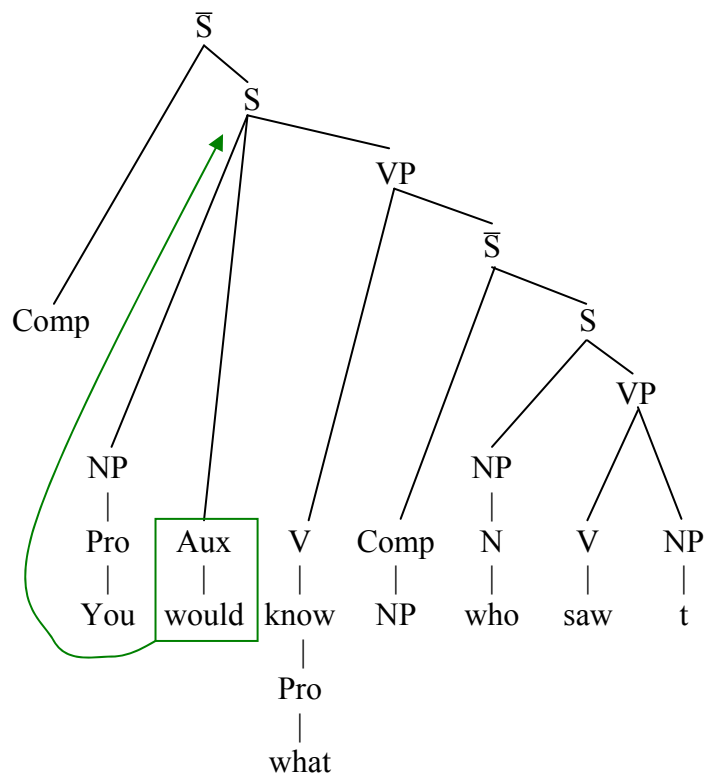
Here, the wh- word *what* remains in situ, as the object of *saw*. We won't be able to cover here just what circumstances permit a wh- phrase to remain in situ in English, but for now this sentence suffices to show that it is quite possible to have a clause with two wh- phrases.

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:

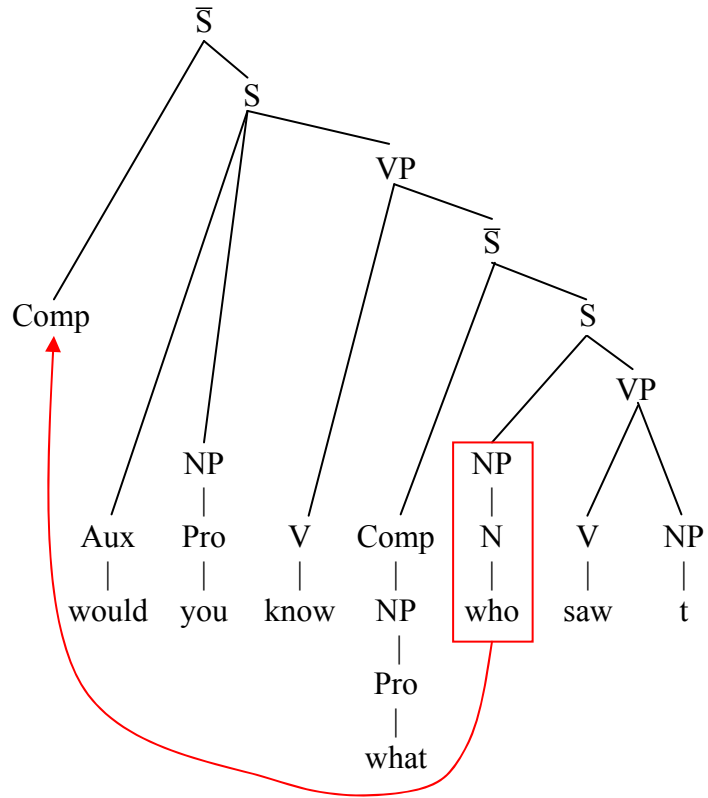
Deep structure and first application of Wh- Movement:



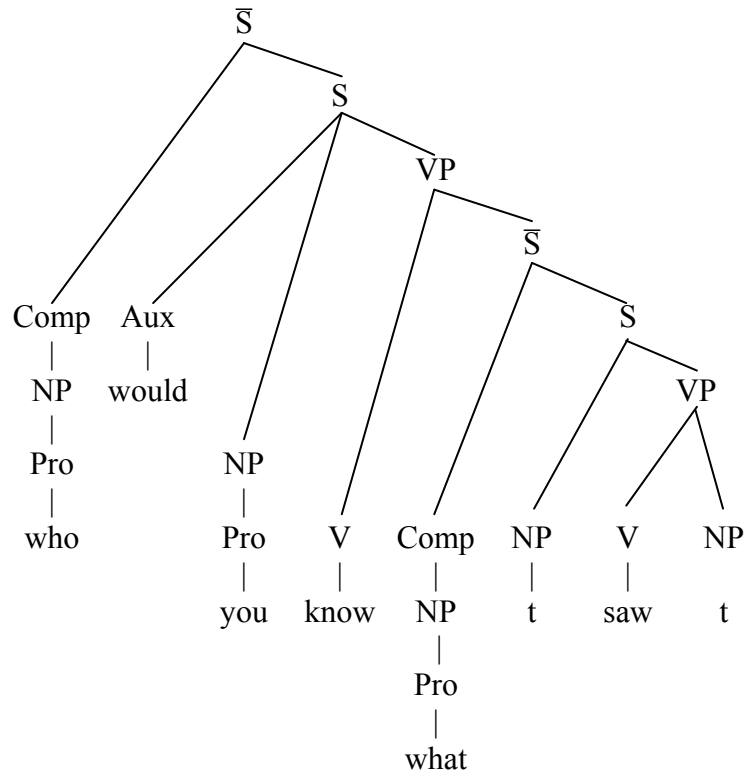
Result of first application of Wh- Movement, with arrow showing Subject-Aux inversion:



Result of Subject-Aux Inversion, showing second application of Wh- Movement:



Surface structure:



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:

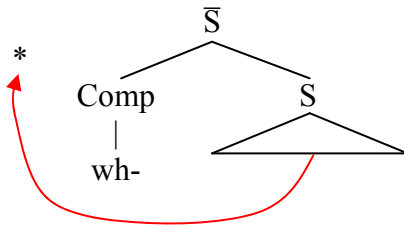
“What is the person such that you know what that person saw?”

The meaning is hard to access, given the extreme ungrammaticality 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:

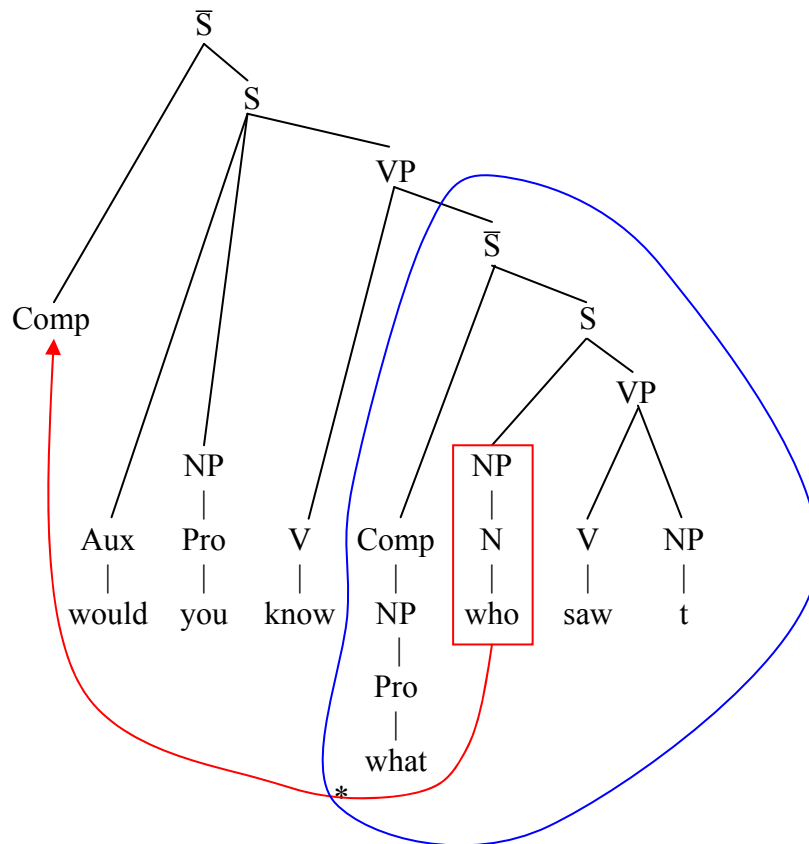
## Wh- Island Constraint

Mark as ungrammatical any sentence in which a constituent has been extracted from inside an  $\bar{S}$  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  $\bar{S}$  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 \_\_\_\_ ] $\bar{S}$ ?



Fred doesn't care how long you take on this exam.

\*[ Which exam ] doesn't Fred care [ how long you take on \_\_\_\_ ] $\bar{S}$ ?



Alice doesn't care which exam you take a long time on.

\*[ How long ] doesn't Alice care [ which exam you take \_\_\_\_ on ] $\bar{S}$ ?

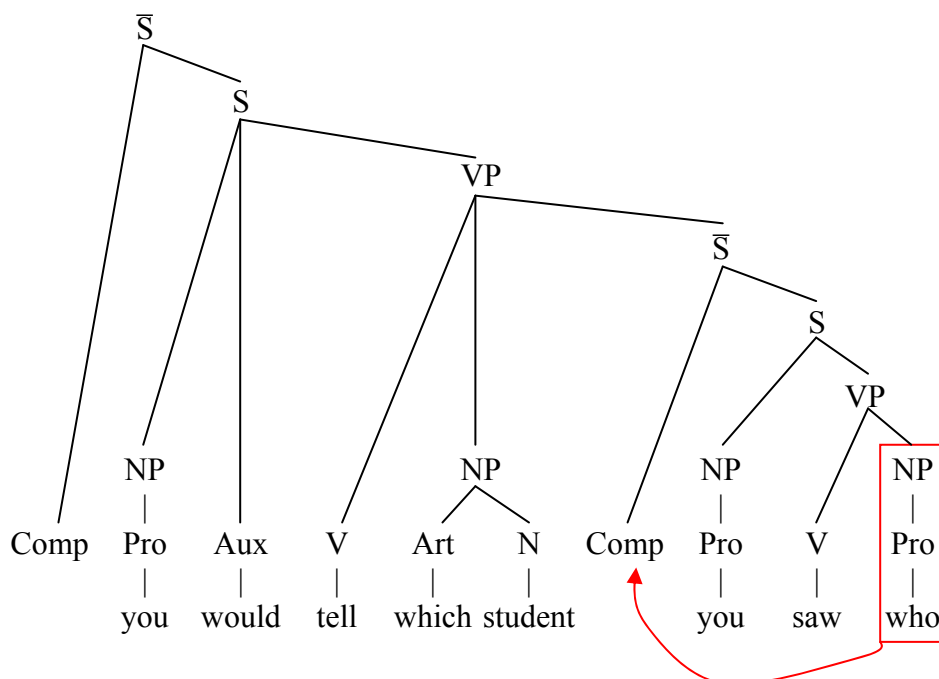


Observe further that there is nothing wrong with having two wh- phrases in the same sentence. It's only when one wh-phrase is moved *out of the  $\bar{S}$  that the other one begins* that you get a bad result. Here is an example. In the sentence

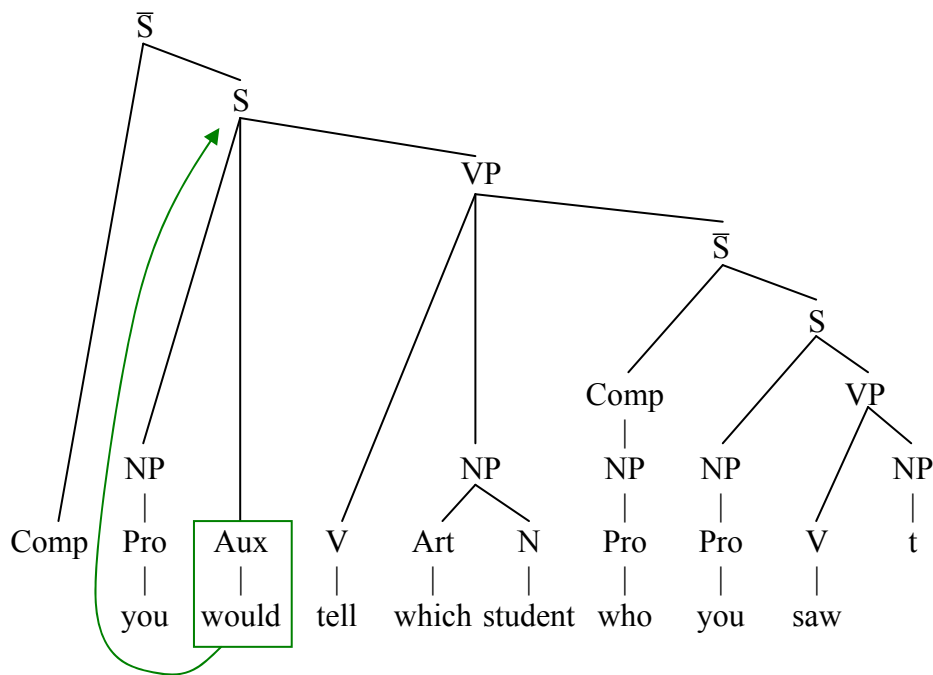
Which student would you tell who you saw?

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.

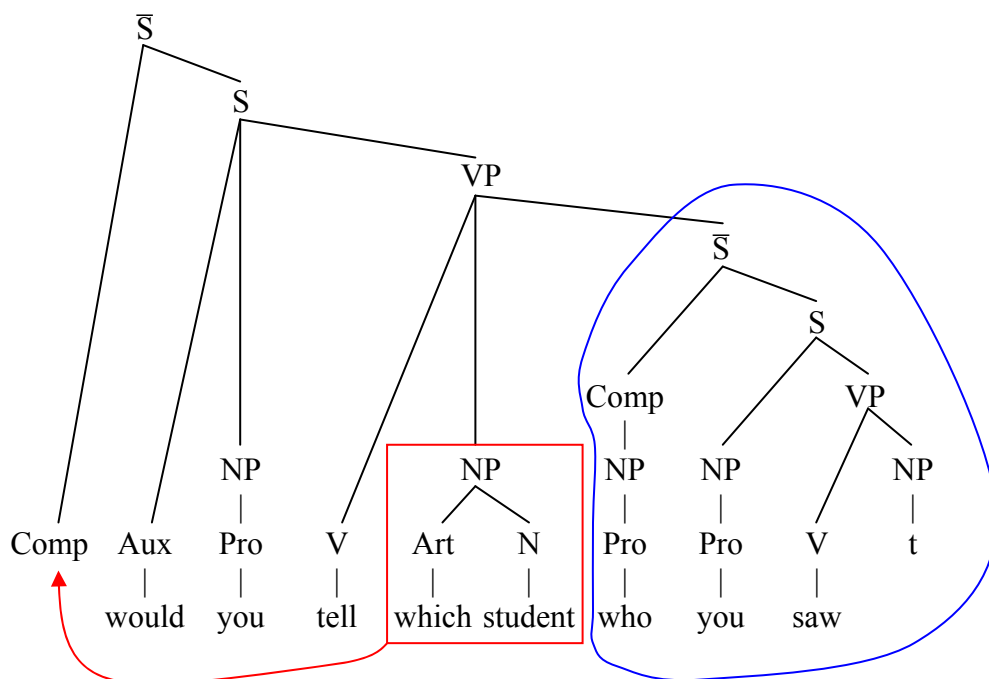
Deep structure with lower wh- movement:



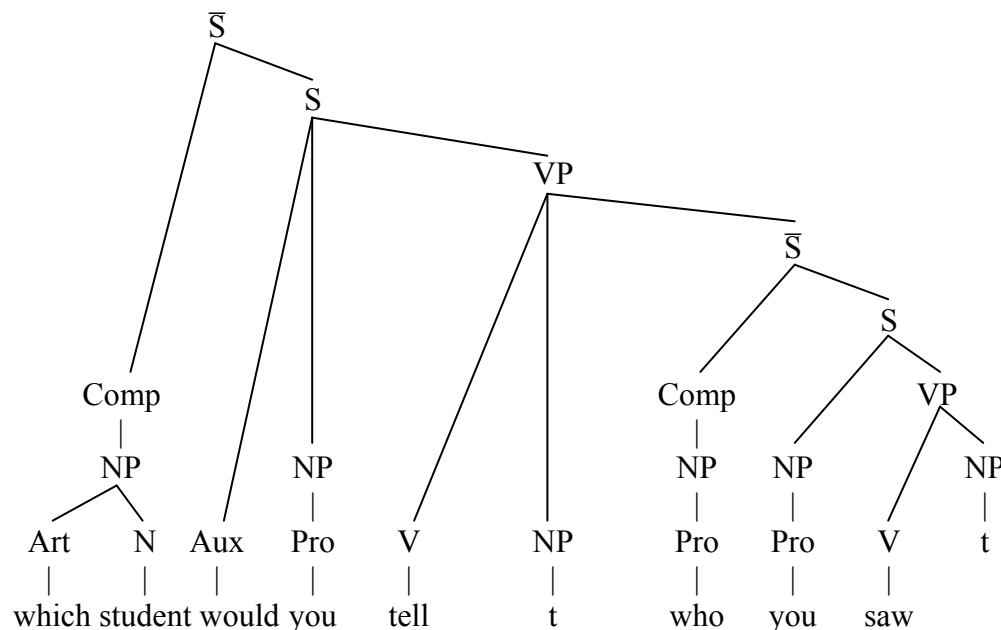
Output of lower wh- movement, showing Subject-Aux Inversion:



Output of upper wh- movement. Note that this is *not* movement outside of the wh-island, shown in red.



Surface structure:



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 \_\_\_\_ ]<sub>S</sub>?

Note finally that Topicalization and It-Clefting obey the Wh- Island Constraint:

### Topicalization:

\*[ Kate ], I realized [ to whom they would send \_\_\_\_ ]<sub>S</sub>.

### It-Clefting:

\*It was [ Oliver ] that I wondered [ which book \_\_\_\_ would read ]<sub>S</sub>.

## 21.2 The Complex NP Constraint

Another kind of island is the so-called “complex noun phrase”. Recall the main phrase structure rule in English for NP, the one to which we have just added a possible  $\bar{S}$  daughter:

$$NP \rightarrow (\left\{ \begin{array}{c} NP \\ Art \end{array} \right\}) (AP)^* N (PP)^* (\bar{S})$$

A complex NP is an NP having  $\bar{S}$  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.

$$NP \rightarrow (\{ \begin{matrix} NP \\ \text{Art} \end{matrix} \}) (AP)^* N (PP)^* (\bar{S})$$

Some examples of complex NP's include

Sue's belief that Sam is leaving Omaha

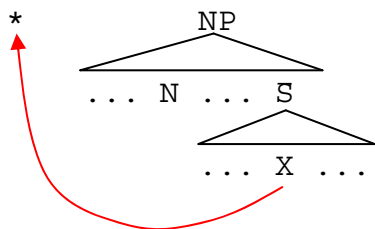
Alice's hunch that the burglar used this window

Bill's inane hypothesis that Frieda saw Jack<sup>67</sup>

The island constraint for complex NP's, called the Complex NP Constraint, is stated as follows:

### Complex NP Constraint

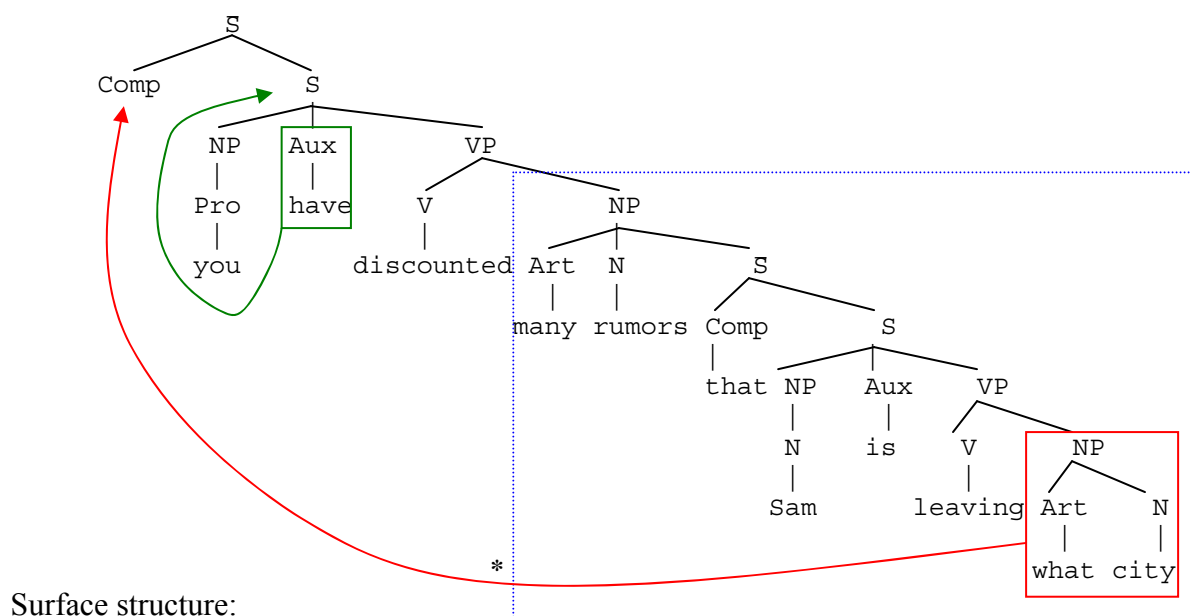
Mark as ungrammatical any sentence in which a constituent has been extracted from inside a complex NP.



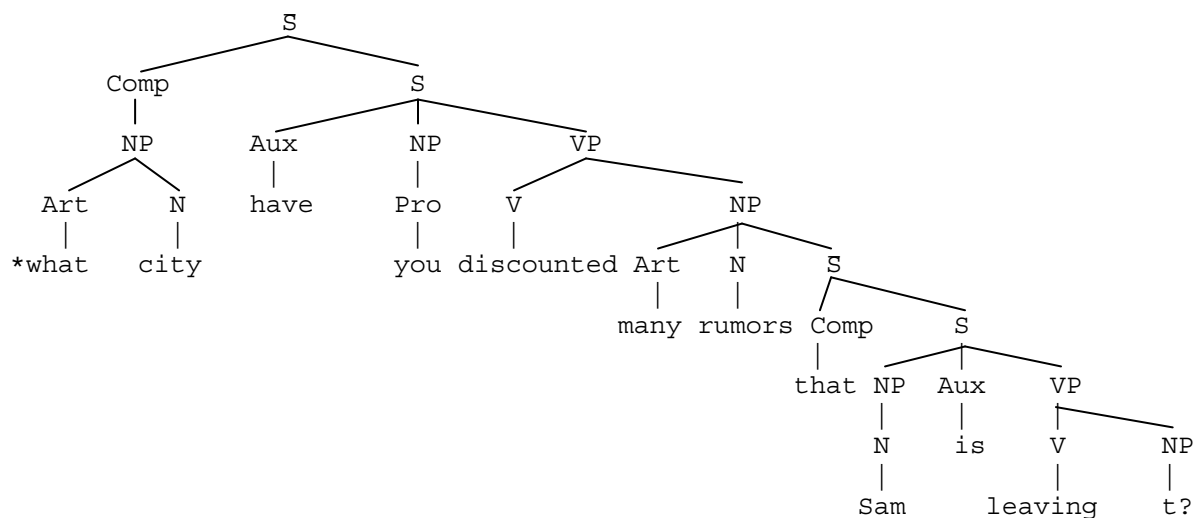
To demonstrate that complex NP's are islands, one does the following. (a) Set up a deep structure that contains a complex NP; (b) make sure that in this deep structure, there is a wh-phrase contained within the complex NP; (c) apply Subject Aux Inversion and Wh- Movement to the deep structure and see 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.

<sup>67</sup> The relative clauses mentioned above (p. 150) 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?

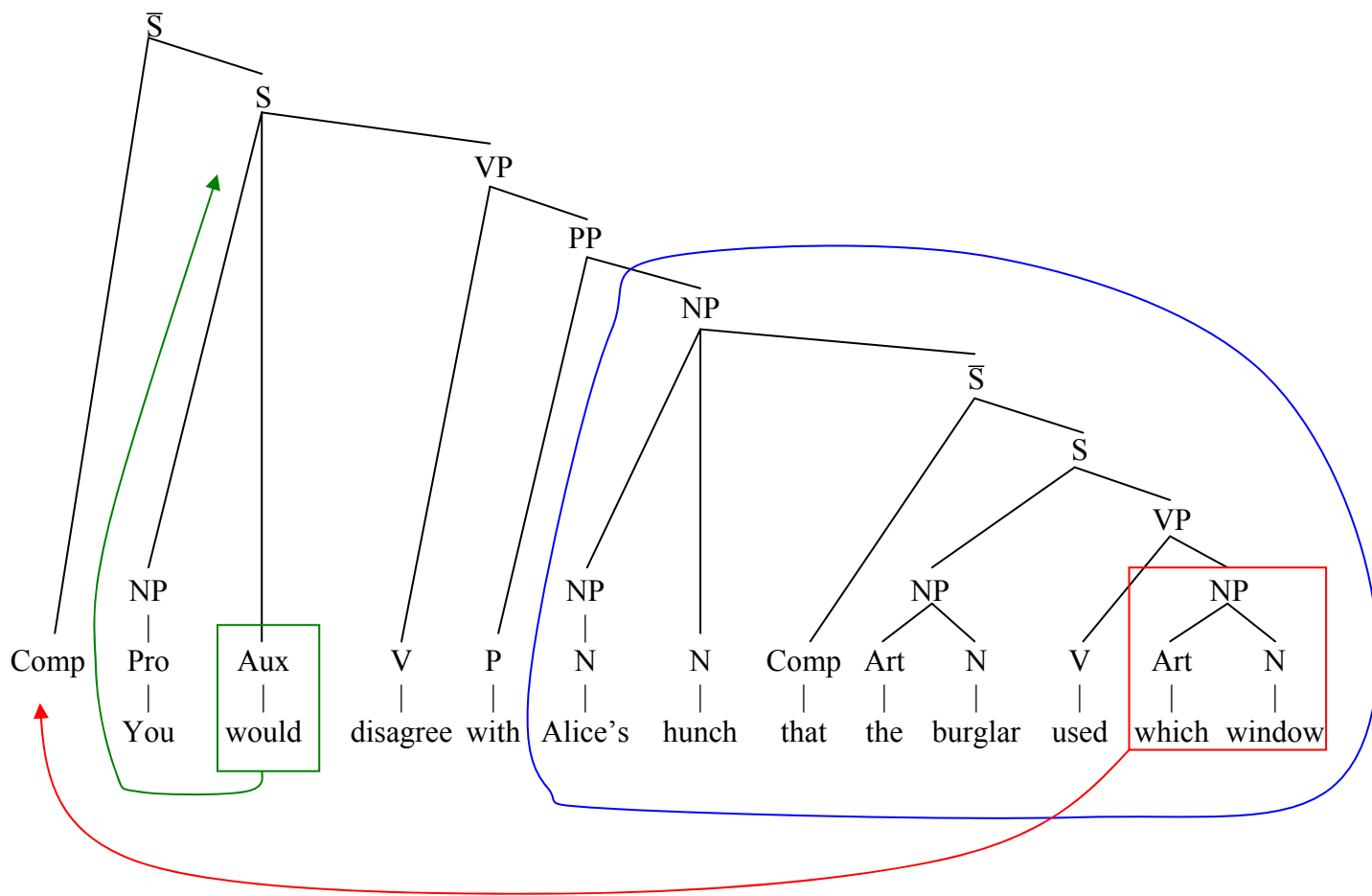
### Study Exercise #26

Give a derivation, with boxes, arrows for movement, and a circled island, for the two sentences just given.

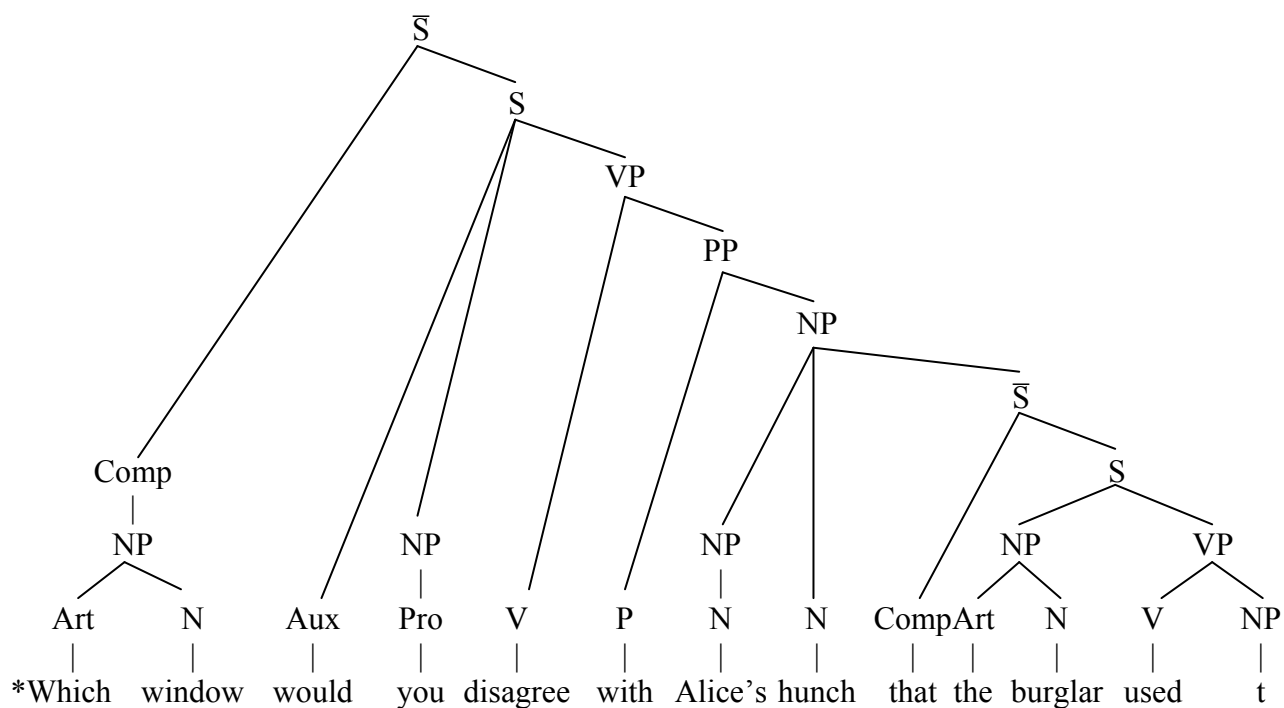
**Answer to Study Exercise #26**

*\*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:

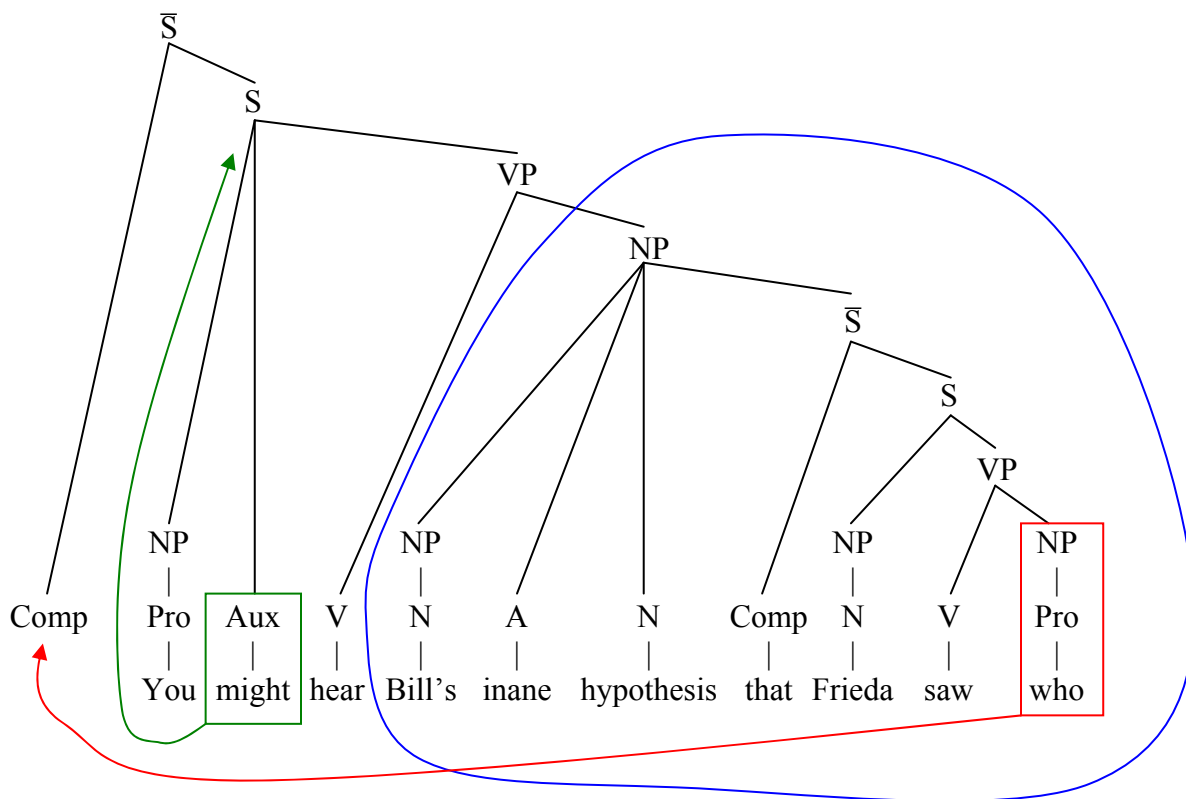


Ungrammatical surface structure:

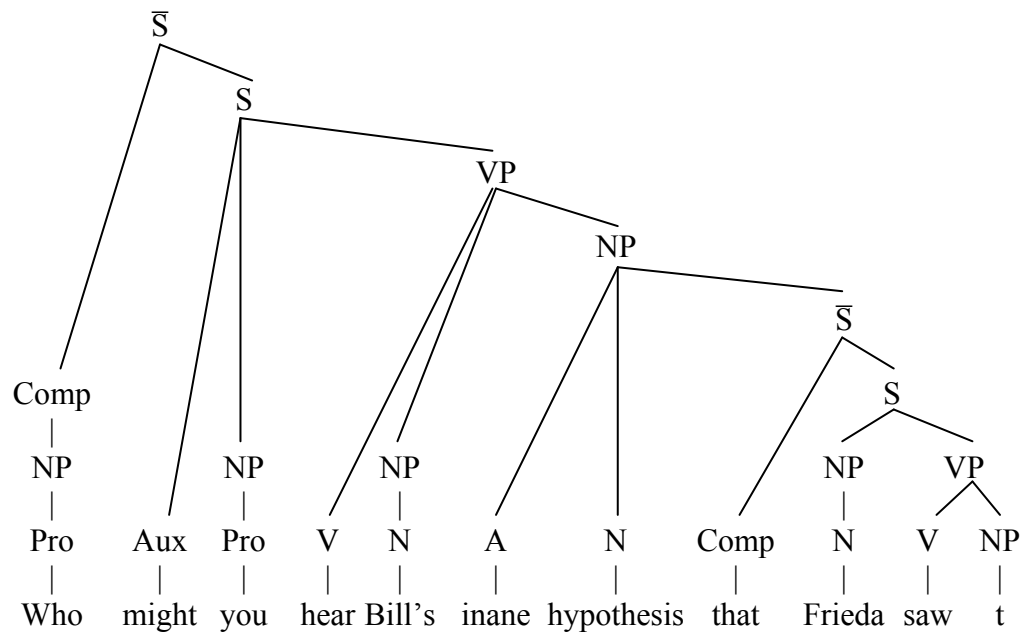


*Who might you hear Bill's inane hypothesis that Frieda saw?*

Deep structure, with Complex NP island, arrows for Subject-Aux Inversion



Ungrammatical surface structure:





**Study Exercise #27**

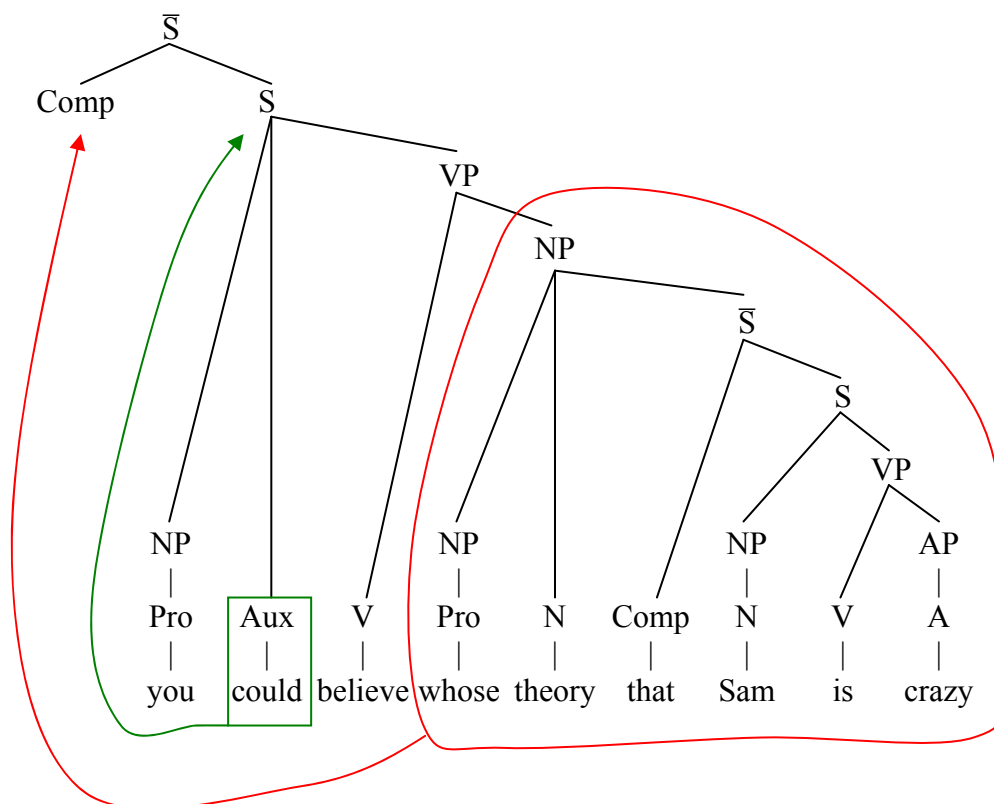
Why is the sentence

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 #27

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.

### 21.3 The Complex NP Constraints 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 \_\_\_\_ ]<sub>NP</sub>.

#### It-Clefting

\*It was [ Kate ] that I discounted [ many rumors that they would elect \_\_\_\_ ]<sub>NP</sub>.

### 21.4 The complex NP constraint is not universal

When it was noticed and first formalized by the linguist 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,<sup>68</sup> 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. ]<sub>NP</sub>  
 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 ]<sub>NP</sub>?  
 Who lived Herod in hope-the of that \_\_\_\_\_ should seduce that man

[ Vem ] levde Herodes i [ hopp-et om att Salome skulle förföra \_\_\_\_\_ ]<sub>NP</sub>?  
 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. ]<sub>NP</sub>  
 Salome lived Herod in hope-the of that \_\_\_\_\_ should seduce that man

[ Den mannen ] levde Herodes i [ hopp-et om att Salome skulle förföra \_\_\_\_\_ ]<sub>NP</sub>.  
 That man lived Herod in hope-the of that Salome should seduce \_\_\_\_\_

This is unusual; most languages that have these rules do respect complex NP's. Thus, here are some French data, very much like English:

\*[ Qui ] as- tu proposé [ l'idée que Marie aime \_\_\_\_\_ ]<sub>NP</sub>?

'Who have you suggested the-idea that Marie loves (gap)?'

<sup>68</sup> The reason for the Biblical subject matter is not clear to me. You can make up example sentences about whatever you like, of course.

## 22. Why these islands?

To review, we have discussed three separate island constraints:

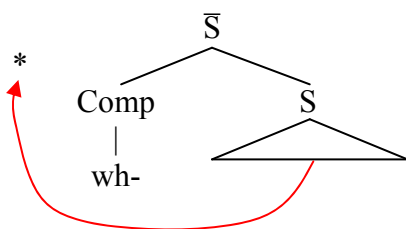
### Coordinate Structure Constraint

Mark as ungrammatical any sentence in which a constituent has been extracted from inside a coordinate structure.



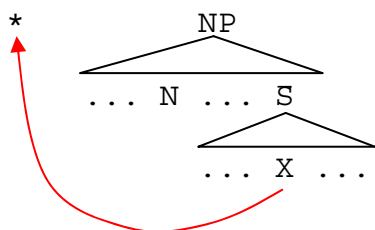
### Wh- Island Constraint

Mark as ungrammatical any sentence in which a constituent has been extracted from inside an  $\bar{S}$  whose Comp contains a wh- phrase.



### Complex NP Constraint

Mark as ungrammatical any sentence in which a constituent has been extracted from inside a complex NP.



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 seems 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. Outline

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*. She does 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.

The basic picture at the present stage of research can be summarized as follows: **children outperform theory**. Kids can be exposed to a language for a few years and 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 property of humans, well worth of study.

The study of how children learn language has two complementary sides:

- **Language acquisition:** actual study of babies and little kids, both by listening to them and having them do experimental tasks
- **Learnability:** developing theories how the kids acquire languages, and (in some cases) computer-implemented models that attempt to learn language in the way that children do

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 <i>the other spoon</i>       |
| 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: Now listen carefully: 'nobody likes me' |  |

C: Oh, nobody doesn't likes me.<sup>69</sup>

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.<sup>70</sup>

Scholars also differ on whether the input to the child is in general grammatical: Noam Chomsky 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 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, clearly there can be no negative evidence available whatsoever.

### 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

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<sup>69</sup> From: McNeill, D. (1966). Developmental psycholinguistics. In Smith, F., and Miller, G. A. (eds.), *The Genesis of Language*, MIT Press, Cambridge, Mass.

<sup>70</sup> I make no claims here on whether or not it is *desirable* to speak Motherese to one's children.



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.<sup>71</sup>

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 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

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<sup>71</sup> 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. A recent reference on imitation in newborns is at <http://email.eva.mpg.de/~rakoczy/texte/auditory-oral-matching.pdf>; original reference is Meltzoff, A.N., & Moore, M.K. (1977). Imitation of facial and manual gestures by human neonates. *Science*, 198, 75–78.

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:<sup>72</sup>

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 Norwegian children, who presumably hear a number of sentences violating this constrain 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.

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<sup>72</sup> *Transformational Grammar as a Theory of Language Acquisition* (1973). Cambridge: Cambridge University Press, pp. 200-201.

## 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 NP's**, 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 NP's”.

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*).<sup>73</sup>

The apparently 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.<sup>74</sup> If a child learns a wrong subcategorization, nothing in the ambient data will tell her it is wrong. Yet in fact, children rather frequently make subcategorization errors—and ultimately, of course, recover from them. Here are a couple of examples:

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<sup>73</sup> For a general review of this and related literature, see <http://lcnl.wisc.edu/people/marks/pubs/SeidenbergMacDonald.1999.CogSci.pdf>

<sup>74</sup> For instance, by C. L. Baker (1979) in “Syntactic Theory and the Projection Problem,” *Linguistic Inquiry* 10.4.

“I filled the salt into the bear.”<sup>75</sup>

“She came it over there”

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 (which means: “She made it come over there”, a causative.)

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.<sup>76</sup> 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

<sup>75</sup> Bowerman, M. (1982). Evaluating competing linguistic models with language acquisition data: Implications of developmental errors with causative verbs. *Quaderni di Semantica*, 3, 5-66.

<sup>76</sup> 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...

particular, we could be highly 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.<sup>77</sup>

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.<sup>78</sup>

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,<sup>79</sup> 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

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<sup>77</sup> For details on this work see <http://neuro.med.harvard.edu/site/dh/b50.htm> (David Hubel).

<sup>78</sup> See <http://www.neuro.duke.edu/faculty/mooney/>.

<sup>79</sup> *Genie: A Psycholinguistic Study of a Modern-Day “Wild Child”* (1977) Academic Press.

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.

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)<sup>80</sup> 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.<sup>81</sup>

## 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

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<sup>80</sup> From the journal *Behavioral and Brain Sciences*; on line at <http://www.bbsonline.org/documents/a/00/00/04/99/>.

<sup>81</sup> P. Lieberman and E. S. Crelin (1971) “On the speech of Neanderthal man,” *Linguistic Inquiry* 2:203-22.

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.

## 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. 161), providing for the following:
- a set of **phrase structure rules**
- a **lexicon**, with words bearing subcategorizations, and a principle of lexical insertion
- 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 **islands**
  - 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.

## MORPHOLOGY

### 2. 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?

### 3. 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’
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naxari	‘that you-sing. not buy’	naxarid	‘that you-plur. not buy’
naxarad	‘that he/she not buy’	naxarand	‘that they not buy’

- Find and gloss the morphemes
- Arrange the morphemes into five position classes.
- 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]
- Show that your rules work by deriving all six third singular forms.
- Which orderings of the rules are needed?

#### 4. English word formation

full	fullness
squeamish	squeamishness
lurid	luridness
profound	profoundness

#### 5. Compounding

Use this rule, from the xxx Readings

**English Compound Formation** (word formation rule)

$[X_1]_{\text{Noun}} + [X_2]_{\text{Noun}} \rightarrow [[X_1]_{\text{Noun}} [X_2]_{\text{Noun}}]_{\text{Noun}}$   
 Meaning: “an  $X_2$  that has something to do with  $X_1$ .”

to derive

*tigerbird, law degree requirements, eggplant plant*

#### 6. Hungarian word formation

Phonetic symbols: [ɔ] = “aw”, with lip rounding; [ɲ] is rather like “ny”; [:] marks a long vowel, ['] goes before the stressed syllable; [ø] is like German “ö” or French “eu”.

'a:ll	‘stand’	'a:llva:ɲ	‘stand, scaffolding’
'igɔzɔl	‘justify’	'igɔzɔlva:ɲ	‘certificate’
kiɔd	‘publish’	'kiɔdva:ɲ	‘publication’
'mutɔt	‘show’	'mutɔtva:ɲ	‘specimen, spectacle’

with a different vowel; ignore the vowel issue for now.

kət	‘tie’	kətveɪn	‘bond, security’
keɪr	‘ask for’	kerveɪn	‘questionnaire’

Write a rule of word formation. The hardest part is specifying the meaning.

## 7. English word formation

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*.

## 8. English word formation

kitchen	kitchenette
pipe	pipette
rose	rosette
statue	statuette

## 9. 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.

ʔu'ma:kinaki	‘your car’	ʔu'ma:tʃa	‘your back’
nu'ma:kinaki	‘my car’	nu'ma:tʃa	‘my back’
ʔu'pa:nki	‘your bread’	ʔu'ka:mi	‘your son’
pu'pa:nki	‘his bread’	pu'ka:mi	‘his son’
nuxar'di:nki	‘my garden’	nu'naʔ	‘my father’
puxar'di:nki	‘his garden’	ʔu'naʔ	‘your father’
nu'no:tki	‘my boss’		
ʔuʂ'ŋa:ki	‘your wife’ <sup>82</sup>		

## 10. Applying Word Formation Rules in Order

Find two meanings for *overfillable* and provide derivations for both.

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<sup>82</sup> To these may be added the somewhat startling *nu'peʃli* ‘my dish’, *pu'peʃli* ‘her dish’; grammar has an arbitrary side...

## 11. Chamorro Infixation

Formalize using the symbols V, C, and numeral subscripts. State in words what your rule does.

liʔiʔ	‘to see’	liniʔi	‘(the) thing seen’
hatsa	‘to lift’	hinatsa	‘(the) thing lifted’
saŋan	‘to tell’	sinanjan	‘(the) thing told’
hasu	‘to think’	hinasu	‘thought’
faisin	‘to ask’	finaisin	‘question’

## 12. Yucatec Reduplication

Symbols:

tʃ as in *church*

ts like *Betsy* but is just one sound, not two

k’ is k with extra oral pressure (“ejective”), t

j is IPA for y

ʔ is glottal stop, heard in the middle of *uh-oh*.

sak	‘white’	sasak	‘very white’
tʃitʃ	‘hard’	tʃitʃitʃ	‘very hard’
tʃak	‘red’	tʃatʃak	‘very red’
k’as	‘bad’	k’ak’as	‘very bad’
nats’	‘near’	nanats’	‘very near’
haj	‘thin’	hahaj	‘very thin’
natʃ	‘far’	nanatʃ	‘very far’
sis	‘cool’	sisis	‘very cool’
suʔuts’	‘sour’	suʔusuʔuts’	‘very sour’
jaʔab	‘many’	jaʔajaʔab	‘very many’

## 13. Obligatory Expression

In

My cat jumped.

specify two cases of obligatory expression (inflectional system of English forces you to communicate particular information)

#### 14. 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’

#### 15. Normative grammar

Briefly describe a matched-guise experiment.

### SYNTAX

#### 16. 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.
- Showing how the various island constraints rule out sentences.

#### 17. Syntax: parsing

English phrase structure rules:

S → NP (Aux) VP  
 NP →  $\left( \left\{ \begin{array}{c} \text{Art} \\ \text{NP} \end{array} \right\} \right) (\text{AP})^* \text{N} (\text{PP})^* (\bar{\text{S}})$   
 NP → Pronoun  
 VP → V (NP) (NP) (PP)\* ( $\bar{\text{S}}$ )  
 VP → V AP  
 PP → P NP  
 $\bar{\text{S}}$  → (Comp) S  
  
 NP → NP (Conj NP)\*  
 VP → VP (Conj VP)\*  
 PP → PP (Conj PP)\*  
 S → S (Conj S)\*  
 $\bar{\text{S}}$  →  $\bar{\text{S}}$  (Conj  $\bar{\text{S}}$ )\*  
 V → 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)

## 18. Syntax: Constituency Testing

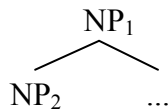
As noted earlier, It-Clefting can be used to show what is an NP or PP, since it “targets” these phrases; that is, it is a potential constituency test. Use this test to justify the constituency of the two meanings of the sentence (b) in question 17.

## 19. Syntax: Case Marking

Apply the case marking rule below to the structure you gave for sentence (a) in question 17 above.

### English Genitive Case Marking

In the configuration shown:



assign the feature [Case:Genitive] to the morphosyntactic representation of the rightmost word in NP<sub>2</sub>.

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].

## 20. Subcategorization

Provide and justify subcategorization frames for:

- a. opinion
- b. transform (as a verb)
- c. expire

## 21. Subcategorization; Under/Overgeneration

- 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?

## 22. 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. On the test, I will probably make up a fictional language, sacrificing realism for gradability.

The language here is Sango, a creole<sup>83</sup> 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   yāma  
      I        eat       some   meat  
      'I eat some meat'
  
2.    mbi    kɛ        tɛ        yāma   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   ateme   ka  
      we        give    some   stones   there  
      'We take some stones there'
  
7.    mbi    mu        na        merenge ti        lo        nginza  
      I        give    to        child   of        him       money

---

<sup>83</sup> 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.

‘I gave money to a child of his.’

8.     mɔ      zia      ngu      na      wa  
        you    put    water   to    fire  
        ‘You put water on the fire’
  
9.     mɔ      zia      mbeni   yāma   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      yāma    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    ateme    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      yāma  
        we      kill    to      meat  
        ‘We kill animals’
  
16.    i        na      mɔ      faa      na      yāma  
        we      to      you    kill      to      meat  
        ‘you and I kill animals’
  
17.    i        na      ala      faa      na      yāma  
        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 kondo mingi  
we kill chicken many  
'We kill many chickens'
20. ala faa woga mingi ti te  
they kill antelope many of eating?  
'They kill many antelope to eat'
21. mbi faa kondo ka na keke  
I kill chicken there to tree  
'I killed a chicken there in the tree'
22. mo wara mbi ka la so  
you find I there day this  
'You found me there today'
23. mbi wara koli 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 koli  
I find sibling of I of man  
'I found my brother'

### 23. Recursiveness

Find a recursive loop in the phrase structure rules you just developed. If there is none, so state.

### 24. Case marking

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.

## 25. Constituency testing

Use the It-Clefting constituency test to determine if the underlined sequences of words are constituents.

- a. I put the key under the mat.
- b. I own the key under the mat.

# Answers

## 26. Answer to #3, 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, -Ø	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/-Ø
				-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]
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**Agreement Rule**

Suffix	-am	when	[Person: 1, Number:Singular]
	-i	when	[Person: 2, Number:Singular]
	-Ø	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.

## 27. Answer to #4, English Word Formation

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

Meaning: “the quality of being Adjective”

## 28. Answer to #5, Compounding

*tigerbird*:

Given the existence of  $[tiger]_{\text{Noun}}$  and  $[bird]_{\text{Noun}}$ , we obtain  $[[tiger]_{\text{Noun}} [bird]_{\text{Noun}}]_{\text{Noun}}$ , which means “a bird having something to do with tigers”

*law degree requirements*:

Step 1: Given the existence of  $[law]_{\text{Noun}}$  and  $[degree]_{\text{Noun}}$ , we obtain  $[[law]_{\text{Noun}} [degree]_{\text{Noun}}]_{\text{Noun}}$ , 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  $[[law]_{\text{Noun}} [degree]_{\text{Noun}}]_{\text{Noun}}$  and  $[requirement]_{\text{Noun}}$ , we obtain  $[[[[law]_{\text{Noun}} [degree]_{\text{Noun}}]_{\text{Noun}}]_{\text{Noun}} [requirement]_{\text{Noun}}]_{\text{Noun}}$ , 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 morphological gives us the plural *law degree requirements*.

## 29. Answer to #6, Hungarian Word Formation

$[X]_{\text{V}} \rightarrow [[X]_{\text{V}} \text{va:n}]_{\text{Noun}}$

Meaning: “the result or instrument of Verbing”

-ve:n is due to phonology, a rule of Vowel Harmony

### 30. Answer to #7, English Word Formation

$[X]_{\text{Verb}} \rightarrow [[X]_{\text{Verb}}]_{\text{Noun}}$

Meaning: “an instance of Verbing”

### 31. Answer to #8, English Word Formation

$[X]_{\text{Noun}} \rightarrow [[X \text{ ette}]_{\text{Noun}}]_{\text{Noun}}$

Meaning: “a little Noun or thing having to do with Noun”

### 32. Answer to #9, 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

$X \rightarrow \text{nu } X$  where morphosyntactic representation contains [Number:Sing, Pers:1]

$X \rightarrow \text{?u } X$  where morphosyntactic representation contains [Number:Sing, Pers:2]

$X \rightarrow \text{pu } X$  where morphosyntactic representation contains [Number:Sing, Pers:3]

#### Inalienability Marking

$X \rightarrow X \text{ ki}$  where morphosyntactic representation contains [Alienable:True]

### 33. Answer to #10, Applying Rules of Word Formation in Order

fill	root	
fillable	$[X]_{\text{Verb}} \rightarrow [[X]_{\text{Verb}} \text{ able}]_{\text{Adj}}$	Meaning: ‘able to be Verbed’
overfillable	$[X]_{\text{Adj}} \rightarrow [\text{over } [X]_{\text{Adj}}]_{\text{Adj}}$	Meaning: ‘excessively A’

‘too fillable’; said perhaps of a conveniently wide-brimmed whiskey flask belonging to a heavy drinker

compare: *dreamable, drinkable; overeager, overproud*

fill	root	
overfill	$[X]_{\text{Verb}} \rightarrow [\text{over } [X]_{\text{Verb}}]_{\text{Verb}}$	Meaning: ‘Verb too much’
overfillable	$[X]_{\text{Verb}} \rightarrow [[X]_{\text{Verb}} \text{ able}]_{\text{Adj}}$	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

compare: *overeate*, *overdress*; (same examples for *-able*)

### 34. Answer to #11, Chamorro Infixation

Assumed to be word formation.

$$\begin{array}{c} [C X]_{Verb} \rightarrow [[C \text{ in } X]_{Verb}]_{Noun} \\ \begin{array}{cc} 1 & 2 \end{array} \qquad \begin{array}{cc} 1 & 2 \end{array} \end{array} \qquad \text{Meaning: "thing that is Verbed"}$$

In other words, “count off the first consonant, and place *-in-* right after it.”

### 35. Answer to #13, Yucatec Reduplication

Assumed to be word formation.

$$\begin{array}{c} [X C]_{Adj} \rightarrow [[X X C]_{Adj}]_{Adj} \\ \begin{array}{cc} 1 & 2 \end{array} \qquad \begin{array}{ccc} 1 & 1 & 2 \end{array} \end{array} \qquad \text{Meaning: "thing that is Verbed"}$$

in other words: “copy all but the last consonant, and put the copy before the original.”

### 36. Answer to #, 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.

### 37. Answer to #14, Organization of the Grammar: Morphology

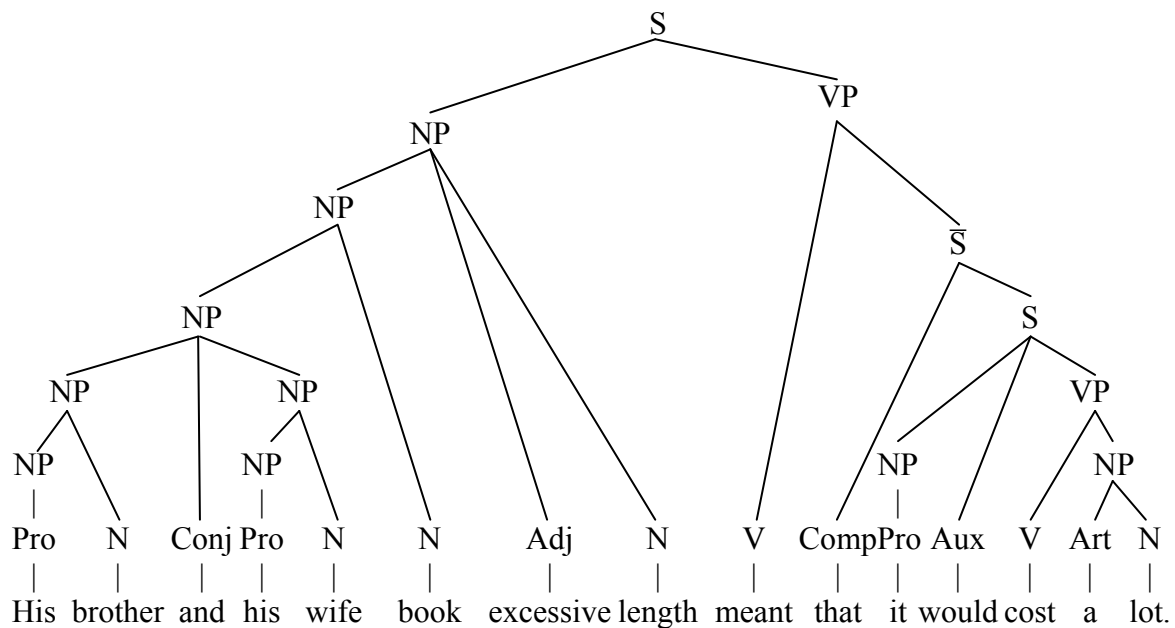
In *\*personsology*, a suffix for word formation, *-ology*, has been added “outside” of (hence, “after”) an inflectional suffix. If word formation precedes lexical insertion and inflection follows it, this should not be possible

### 38. Answer to #15, 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.

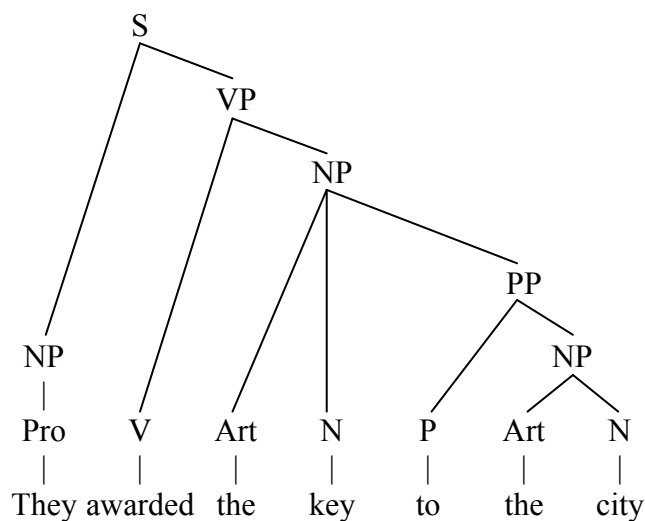
### 39. Answer to #17, Syntax: Parsing

a. Note that since the inflectional suffix -'s is added by rules of morphology, it is not placed in the tree generated by the syntax. See below for how it is added.



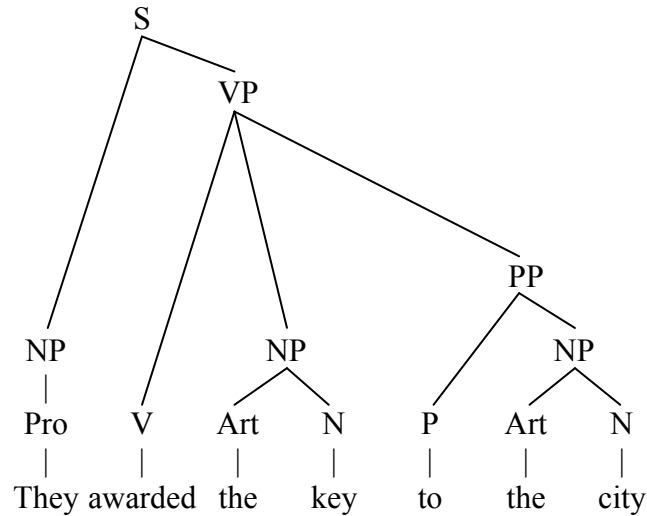
For the -'s, see a later exercise in this section.

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.





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.

#### 40. Answer to #18, Syntax: Constituency Testing

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 ]<sub>NP</sub> 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 ]<sub>NP</sub> that they awarded \_\_\_\_ to the city.

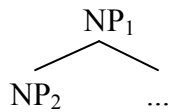
It was [to the city ]<sub>PP</sub> that they awarded the key \_\_\_\_.

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.

#### 41. Answer to #19, Syntax: Case Marking

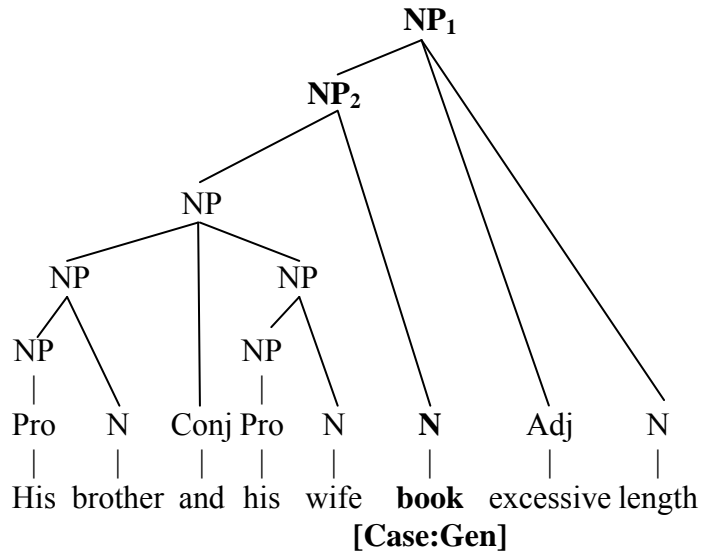
I’ll show just the relevant NP. Items referred to in the rule are shown in boldface.

We are looking for:

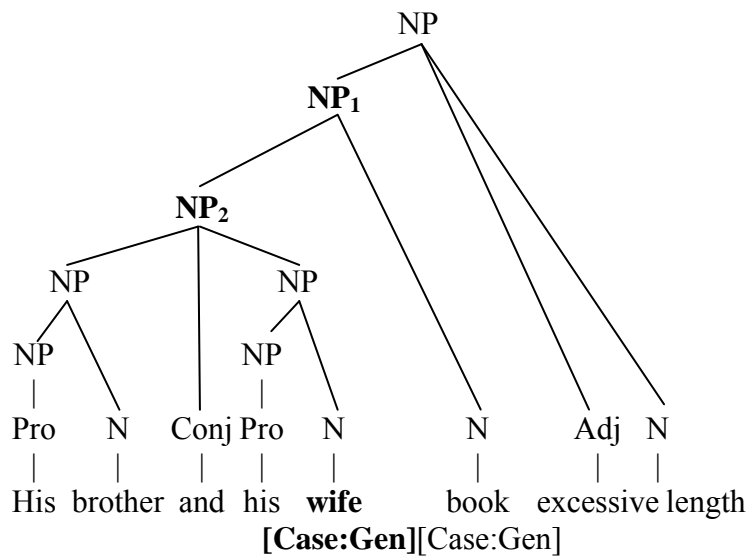


and are putting the feature [Case:Genitive] on the rightmost word of NP<sub>2</sub>.

Here is one application:



Here is the other application:



These are realized later in the morphology as *wife's* and *book's*.

**42. Answer to #20, Subcategorization**

a. opinion

[ \_\_\_\_ (S) ] 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.

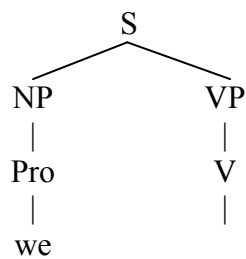
\*Time expired to (or: of, above) the men.

**43. Answer to #21, Syntax: Subcategorization; Under/Overgeneration**

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:



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.

#### 44. Answer to #22, Sango Phrase Structure Rules

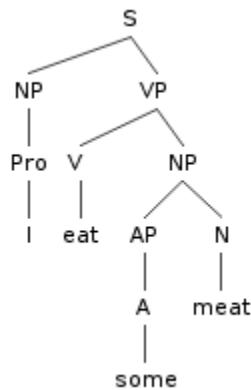
Hoping for a slightly cleaner answer I made a couple of perhaps dubious assumptions:

- *la so* ‘today’ is a fixed expression, i.e. a compound, as in English. I am classifying this as an Adverb.
- I am treating *ke* as an Aux.
- I am treating the pronominal 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        te            mbeni    yāma  
          I        eat        some    meat  
          Pro    V        A        N  
          ‘I eat some meat’



Rules needed:

$S \rightarrow NP VP$

$NP \rightarrow Pro$

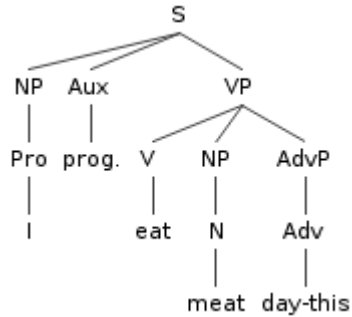
$VP \rightarrow V NP$

$NP \rightarrow AP N$

$AP \rightarrow A$

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'



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

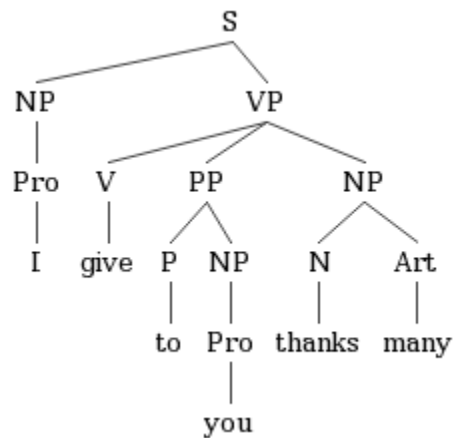
$NP \rightarrow \text{Pro}$  (lots of these, I won't repeat this one)

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

$AdvP \rightarrow Adv$

$NP \rightarrow N$

3.    mbi      mu      na      mɔ      mersi    mingi  
       I        give    to      you      thanks   many  
       Pro    V        P        Pro      N        Art  
       'I give you many thanks'

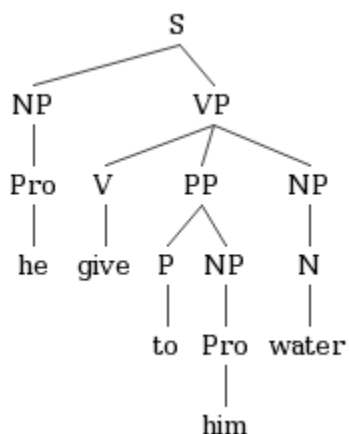


$V \rightarrow V \text{ PP } NP$

$PP \rightarrow P \text{ NP}$

$NP \rightarrow N \text{ Art}$

4.    lo        mu        na        lo        ngu  
       he        give     to        him     water  
       Pro     V        P        Pro     N  
       ‘He gives him water’



VP → V PP NP

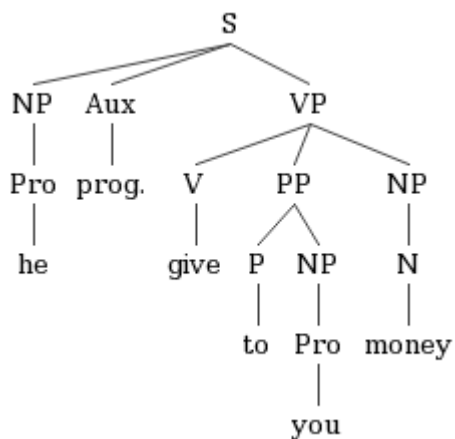
PP → P NP

(many of these, won't repeat)

NP → N

(many of these, won't repeat)

5.    lo        ke        mu        na        mo        nginza  
       he        prog.    give     to        you     money  
       Pro     Aux     V        P        Pro     N  
       ‘He is giving you money’

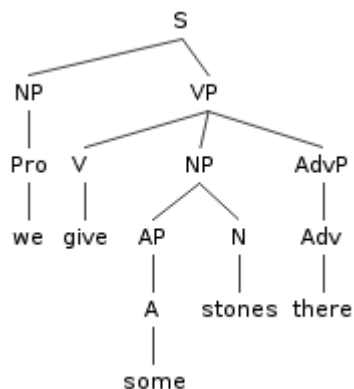


S → NP Aux VP

(many of these, won't repeat)

VP → V PP NP

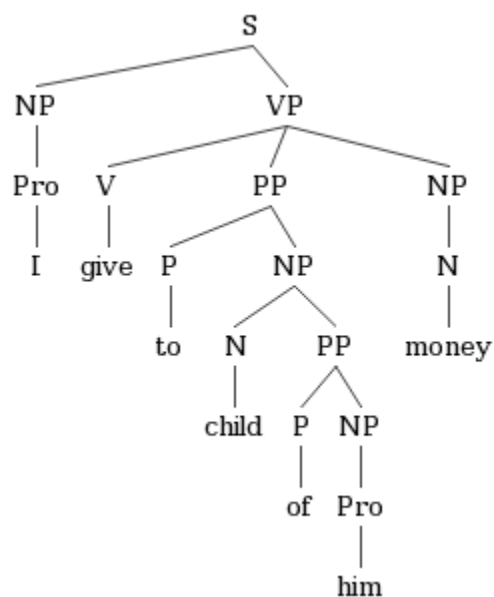
6.     i           mu       mbeni   ateme   ka  
        we       give     some   stones   there  
        Pro     V       Adj    N       Adv  
        ‘We take some stones there’



$V \rightarrow V \text{ NP AdvP}$

$\text{AdvP} \rightarrow \text{Adv}$  (won't repeat)

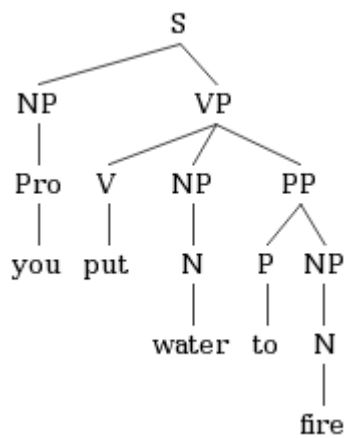
7.     mbi       mu       na       merenge   ti       lo       nginza  
        I       give     to       child    of       him     money  
        Pro     V       P       N       P       Pro     N  
        ‘I gave money to a child of his.’



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

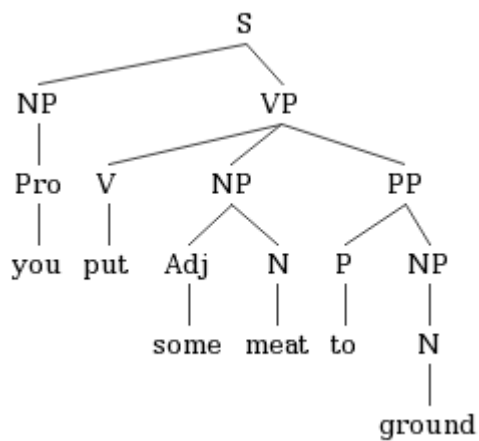
$\text{NP} \rightarrow \text{N PP}$

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

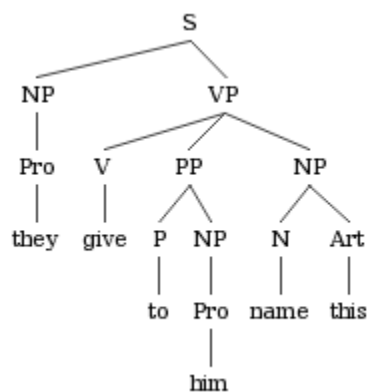
9.    mɔ        zia        mbeni    yāma    na        sese  
       you     put        some     meat    to        ground  
       Pro     V         Adj      N        P        N  
       ‘You put some meat on the ground’



VP → V NP PP



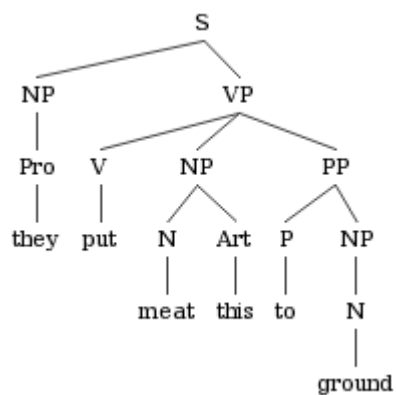
10.    ala        mu        na        lo        ere        so  
       they    give    to        him    name    this  
       Pro     V        P        Pro     N        Art  
       ‘They gave this name to him.’



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

$\text{NP} \rightarrow \text{N Art}$

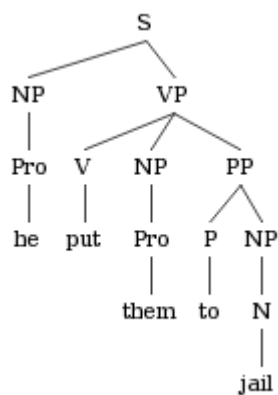
11.    ala        zia        yāma    so        na        sese  
       they    put        meat    this    to        ground  
       Pro     V        N        Art     P        N  
       ‘They put this meat on the ground’



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

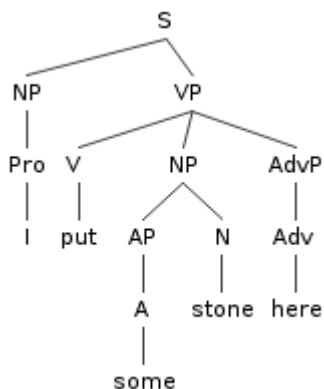
$\text{NP} \rightarrow \text{N Art}$  (won't repeat this one)

12.    lo        zia        ala        na        kanga  
       he        put        them    to        jail  
       Pro      V        Pro      P        N  
       ‘He put them in jail’



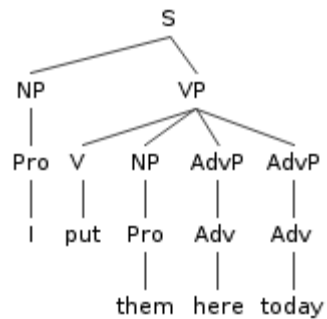
VP → V NP PP

13.    mbi        zia        mbeni    ateme    da  
       I        put        some    stone    here  
       Pro      V        Adj      N        Adv  
       ‘I put some stones here’



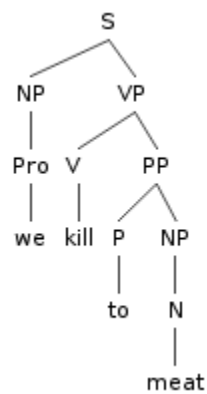
VP → V NP AdvP

14.    mbi        zia        ala        da        la        so  
       I        put        them    here    today.....  
       Pro      V        Pro      Adv    Adv  
       ‘I put them here today’



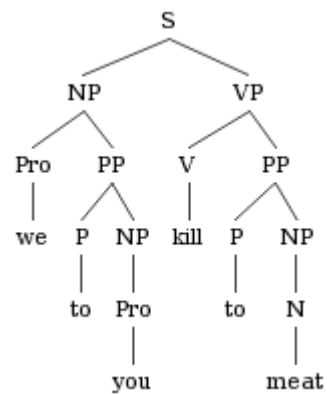
VP → V NP AdvP AdvP

15.    i        faa        na        yāma  
       we        kill        to        meat  
       Pro       V        P        N  
       ‘We kill animals’



VP → V PP

16.    i        na        mo        faa        na        yāma  
       we        to        you        kill        to        meat  
       Pro       P        Pro        V        P        N  
       ‘you and I kill animals’

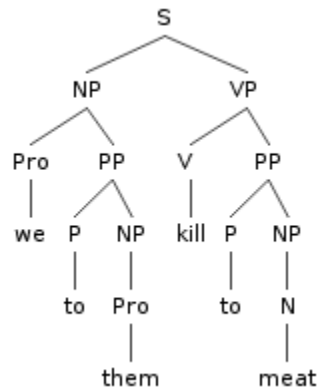


NP → Pro PP

VP → V PP

Note unusual construction, with a PP modifying a Pronoun within NP; not possible in English.

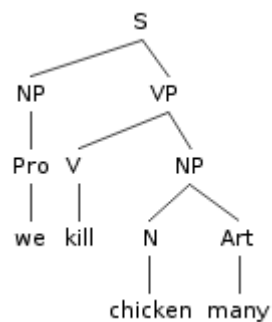
17.    i        na        ala        faa        na        yāma  
       we        to        them    kill        to        meat  
       Pro      P        Pro      V        P        N  
       ‘They and I kill animals’



Nothing new in PS rules.

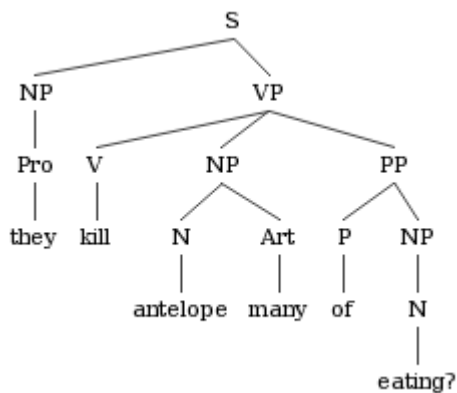
18.    i        na        lo        faa        kondo  
       we        to        him    kill        chicken  
       Pro      P        Pro      V        N  
       ‘He and I kill chickens’  
       Ditto.

19.    i        faa        kondo    mingi  
       Pro      V        N        Art  
       ‘We kill many chickens’



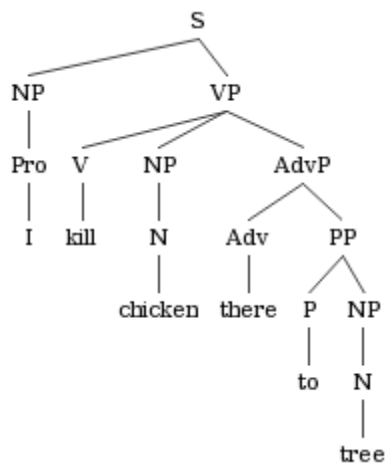
No new rules.

20.   ala       faa       woga   mingi   ti       tɛ  
       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’

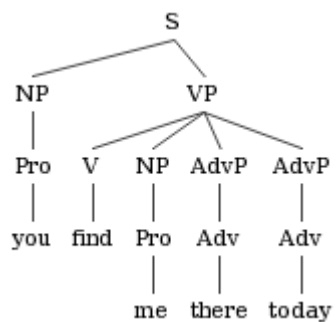


I suggest that the PP *ne keke* is modifying the Adverb *ka*. Thus we need to put our Adverbs inside Adverb Phrases (adjusting the previous rules that used bare Adverbs), and set up an Adverb Phrase rule.

VP → V NP AdvP

AdvP → Adv PP

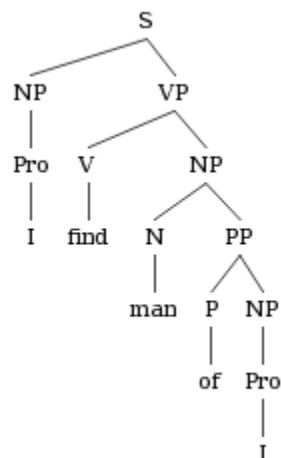
22.    mɔ        wara        mbi        ka        la        so  
       you     find        I        there    today.....  
       Pro     V        Pro     Adv     Adv  
       ‘You found me there today’



A fairly clear case of two Adverbs.

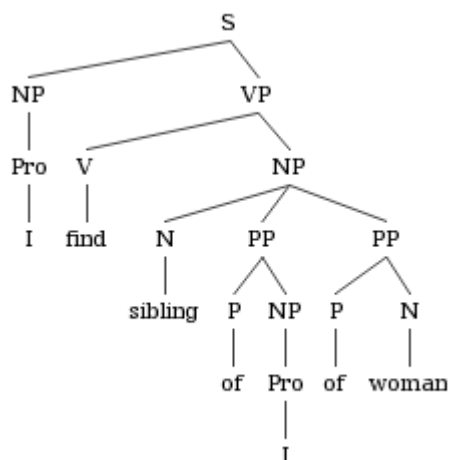
VP → V NP AdvP AdvP

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      koli  
       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

$$VP \rightarrow V PP NP$$

$$AdvP \rightarrow Adv$$

$$AdvP \rightarrow Adv PP$$

$$AP \rightarrow A$$

then we can use the abbreviatory notations, and a little guess work, to produce a more general grammar:

$$S \rightarrow NP (Aux) VP$$

$$NP \rightarrow (AP)^* \begin{Bmatrix} N \\ Pro \end{Bmatrix} (PP)^* (Art)$$

$$PP \rightarrow P NP$$

$$VP \rightarrow V (PP)(NP)(PP)(AdvP)^*$$

$$AdvP \rightarrow Adv (PP)$$

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'

#### 45. Answer to #45, Recursiveness

The one loop appears to be a two-rule case:

$$NP \rightarrow (Adj)^* \begin{Bmatrix} N \\ Pro \end{Bmatrix} (PP)^* (Art)$$

$$PP \rightarrow P NP$$

It's virtually certain that Sango has subordinate clauses, which would produce at least one further loop, as in English.

#### 46. Answer to #24, Case marking

##### 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.

**47. Answer to #25, constituency testing**

a. I put the key under the mat.

\*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 the key under the mat.

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*)

## 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.<sup>84</sup> It also seems clear that we experience thought in ways that are very direct and not linguistic.<sup>85</sup> 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 course I want to cover aspects of semantics that interact most closely with syntax.

### 2. Some aspects of linguistic meaning

We will cover three aspects of linguistic meaning.

- predicate-argument structure

---

<sup>84</sup> 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).

<sup>85</sup> It's probably unnecessary to give an example, but for what it's worth: imagine a parent who sees his toddler put in danger from an unleashed dog: the experience is direct and primal, and depends in no way on an internalized utterance "That dog is a threat to my child" or the like. The dog, the child, the teeth are all part of the thought, but the thought is probably complete before it is ever embodied in NP's, VP's, etc.

- anaphora
- operators and scope

### 3. Predicate-argument structure

A **predicate-argument structure** is a kind of semantic representation that limits itself to depicting “who is doing what to whom.” For example, in a sentence like

*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.<sup>86</sup>

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 NP’s) in syntactic roles, such as subject (daughter of S) or object (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 any sense of 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.

More generally: 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
SOV	Japanese, Korean, Turkish
VSO	Tagalog, Biblical Hebrew, Irish
VOS	Fijian
OSV	Xavante (Brazil)
OVS	Hixkaryana (Brazil) <sup>87</sup>

<sup>86</sup> 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. This kind of generalization is not agreed upon by all linguists and will not be used here.

<sup>87</sup> The last three of these are rare.

The point is that languages do use linear order to convey predicate-argument structure (as we saw in studying phrase structure rules, but that is a matter of grammar, and not of thought).

### 3.1 Variation in how syntax manifests predicate-argument structure

Very often, the grammars of languages offers more than one syntactic means of expressing the same predicate-argument structure. A well-known example of this kind is the **passive** construction, found in many languages:

*The doctor examined John.*

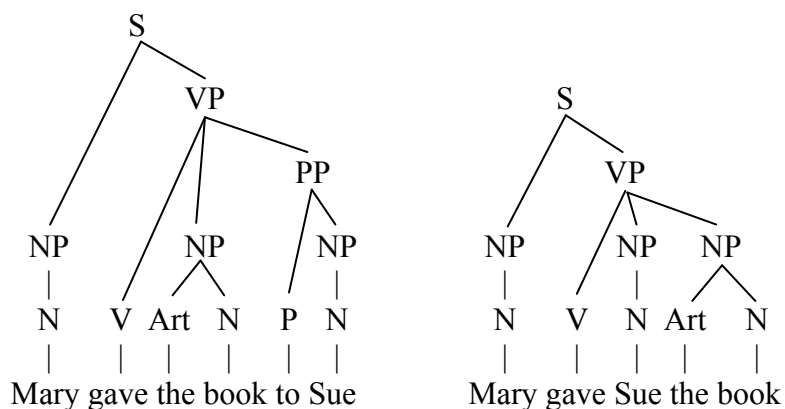
*John was examined by the doctor.*

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:

EXAMINE ( (Examiner Doctor ), (Examinee John ) )

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, 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.

Here is another instance in which the same predicate argument structure has more than one syntactic expression. It and 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 seems to 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 be more natural when one is already talking about *Sue*. As with passive, the new information comes later in the sentence.

### 3.2 Unfilled argument slots

Passive sentences often lack a PP with *by*. Such sentences plausibly involve an argument slot that goes unexpressed, along these lines:

*John was examined.*

EXAMINE ( (Examiner Ø), (Examinee John ) )

Here, zero with a slash means “unspecified”. That is, clearly there was someone who did the examining, but the sentence does not say who. German allows this sort of construction even when the verb is intransitive:

*Es wurde getanzt.*

It was danced

‘There was dancing, people danced.’

DANCE ( (Dancer Ø) )

### 3.3 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 ) ) ) )<sup>88</sup>

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:

---

<sup>88</sup> 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).

Mary thinks that Bill jumped.

THINK ( (Thinker Mary ), (Proposition JUMP ( (Jumper Bill ) ) ) )

### 3.4 Cases of mismatch between syntax and predicate-argument structure

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!).<sup>89</sup> 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*”.

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*.<sup>90</sup>

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.

### 3.5 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-

<sup>89</sup> Observe that this is different from *John was examined* and *Es wurde getanzt*, discussed above. Some really did examine John, and someone really did dance, but no one rains.

<sup>90</sup> “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!)

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 any further here.

**Study Exercise #28**

Give predicate-argument structures for the following sentences. Be brave about labeling the argument slots; in a problem set we would necessarily be flexible about the grading of such labels.

- 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.

**Answer to Study Exercise #28**

- 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  $\emptyset$  ), (Proposition RANT( (Ranter Bill ) ) ) )

---



### Study Exercise #29: 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:

0. We consider him as being eccentric.
1. They regard him as praiseworthy.
2. We judge it as unfortunate that he visited Mary.
3. We regard him as appearing to be sick.

We could accommodate *as* phrases with the following phrase structure rules:

$$VP \rightarrow V (NP) AsP (\bar{S})$$

$$AsP \rightarrow as \begin{Bmatrix} NP \\ PP \\ VP \end{Bmatrix}$$

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  $\bar{S}$ . 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  $\bar{S}$  encoding this proposition.

Assign predicate-argument structures to sentences #1-3 above. Note that the *it* in #2 is pleonastic.

## Answers to Study Exercise #29

Matching up the brackets is tricky; I've used colors to help check.

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

### 4. Defining Anaphora

All languages have pronouns. For example, these are the pronouns of English in their various forms:

<i>Nominative</i>		<i>Objective</i>		<i>Genitive</i>	
I	we	me	us	my	our
you	you	you	you	your	your
he/she/it	they	him/her/it	them	his/her/its	their
<i>Predicative Genitive</i> <sup>91</sup>		<i>Reflexive</i>			
mine	ours	myself		ourselves	
yours	yours	yourself		yourselves	
his/hers/—	theirs	himself/herself/itself		themselves	

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:

I wanted to [ teach Linguistics 865 ]<sub>VP</sub> but was too busy with other courses to [ do so ]<sub>VP</sub>.  
 I had to [ teach Linguistics 497 ]<sub>VP</sub> because no one else would [ do it ]<sub>VP</sub>.

*Thus* is a somewhat archaic proform for Adverb Phrases:

He did it *thus*.

<sup>91</sup> 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.

The term **anaphora** refers, in linguistics, to the process whereby one word or phrase 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*.

## 5. The Pronominalization Hypothesis and why it fails

A tempting analytical option, since we need transformations anyway, is to suppose that pronouns are the result of applying a "Pronominalization" transformation.

Consider a sentence like

*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 is:

*Alice told Sue that Alice was a genius.*

and analogously when *she* means *Sue*, then the deep structure is:

*Alice told Sue that Sue was a genius.*

We can then adopt a transformation that converts the second instance of two identical noun phrases into the appropriate pronoun.

### Pronominalization

X	NP	Y	NP	Z	→	X	NP	Y	Pro	Z
1	2	3	4	5		1	2	3	4	5

where X stands for any sequence of words, and Pro retains its original values for the morphosyntactic features [Number], [Animacy], and [Gender].

It is easy to see that the Pronominalization transformation will convert the two deep structures

*Alice told Sue that Alice was a genius*

and

*Alice told Sue that Sue was a genius*

into the same surface structure, namely

*Alice told Sue that she was a genius*

If this aspect of meaning is read off of deep structure, then we have accounted for the ambiguity of the sentence. Let us call this the Pronominalization Hypothesis.

Although this proposal looks reasonable, 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 obviously means something quite different from the surface structure. We'll return to this problem later on.

A second problem with the Pronominalization Hypothesis is that it can't cover all of the cases at hand. There instances in which one uses a pronoun without even *knowing* the full noun phrase that is its antecedent. 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:

*Well, he's left.*

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.<sup>92</sup> 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 NP's to which they refer. Doing this yields:

---

<sup>92</sup> The problem was noticed in the 1960's by Emmon Bach, of the University of Massachusetts and Stanley Peters of Stanford, and is sometimes called the Bach-Peters paradox.

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 "spelling out" pronouns as their full noun phrases does not seem promising as an account of their semantics.

## 6. Interpretive rules

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 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 are very much dependent 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, are called **interpretive rules**.

We have already covered, informally, an interpretive rule for English, the Each Other Reference rule from Chapter 1. Here, we will cover further rules, with a more serious formalization of them.

## 7. Formal preliminaries

### 7.1 Subscripts and coreference

In what follows, we will use a standard notation for designating what pronouns refer to, namely, subscripting. When I write:

Bill<sub>i</sub> thinks he<sub>i</sub> is a genius.

I will mean: the reading of this sentence in which *it* is understood as referring to *Bill*. This is denoted by the use of identical letters as subscripts.

When I write

Bill<sub>i</sub> thinks he<sub>j</sub> 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 to the Pronoun or Noun node).

Terminology: in the first sentence above, *Bill* and *he* are said to be **coreferent**, meaning that they refer to the same thing. In the second sentence, *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.

### 7.2 Types of noun phrases

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.

### 7.3 C-command

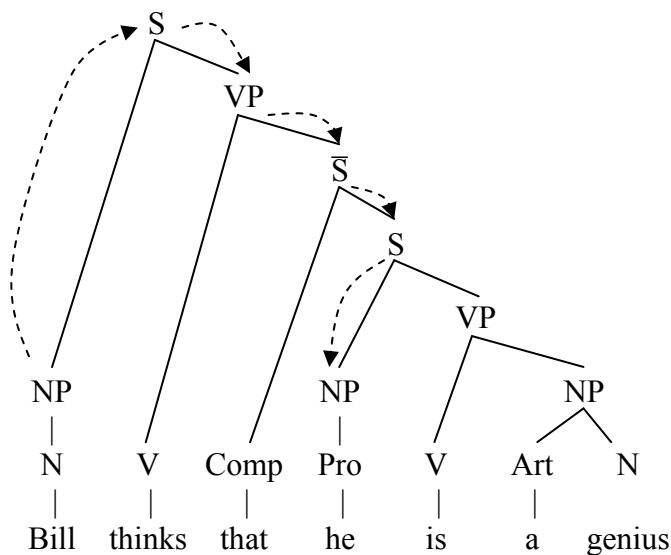
Lastly, a technical definition:

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

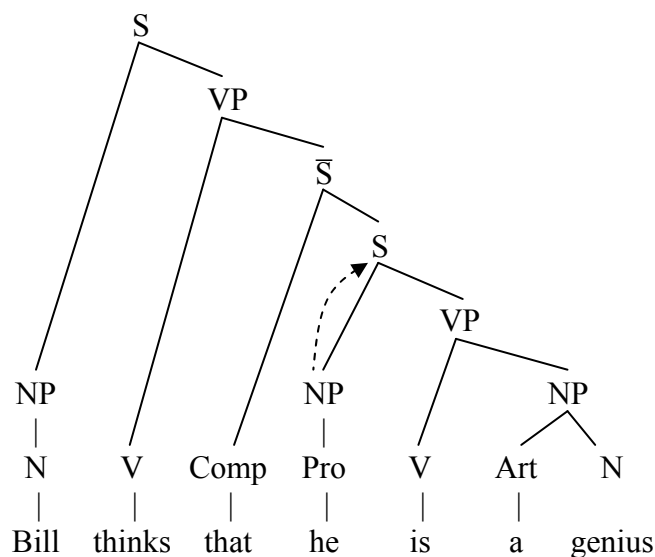
- starts at A
- moves up one node from A to its mother node
- travels exclusively downward through the tree and arrives at B.

Thus in the following example:



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*, *S̄*, *S*, and thence to the NP *he*. See dotted arrows.

But 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:



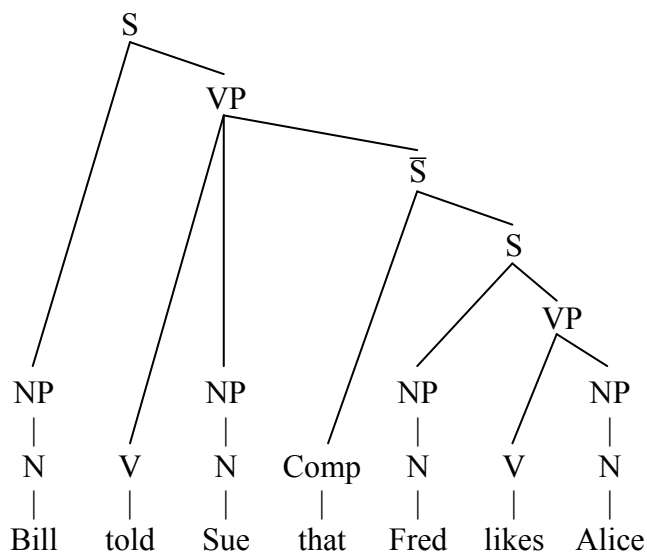
*He* does c-command *genius*, however.

In general, we will speak of c-command only for NP's. 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 to have been both the simplest and most effective. We'll see the relevance of c-command to pronouns shortly.

#### 7.4 Clausemates

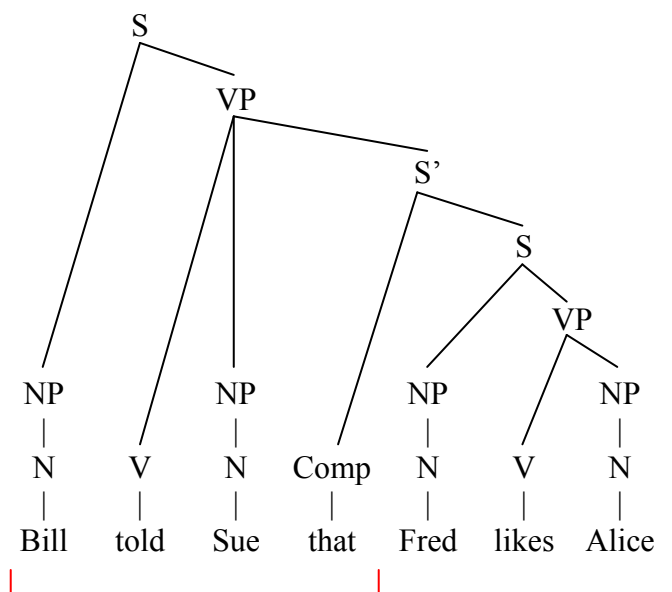
Following up on the discussion in Chapter 1, we will say that constituents X and Y are **clausal mates** if every S node that dominates X also dominates Y, and vice versa. Clausemates are often said to be **in the same clause**, which means the same thing.





Clausemates: *Bill-Sue, Fred-Alice*. Non-clausemates: *Bill-Alice, Bill-Fred, Sue-Alice, Sue-Fred*.

A quick and easy way to show clausemates is to bracket the sentences into domains of clausematehood, like this:



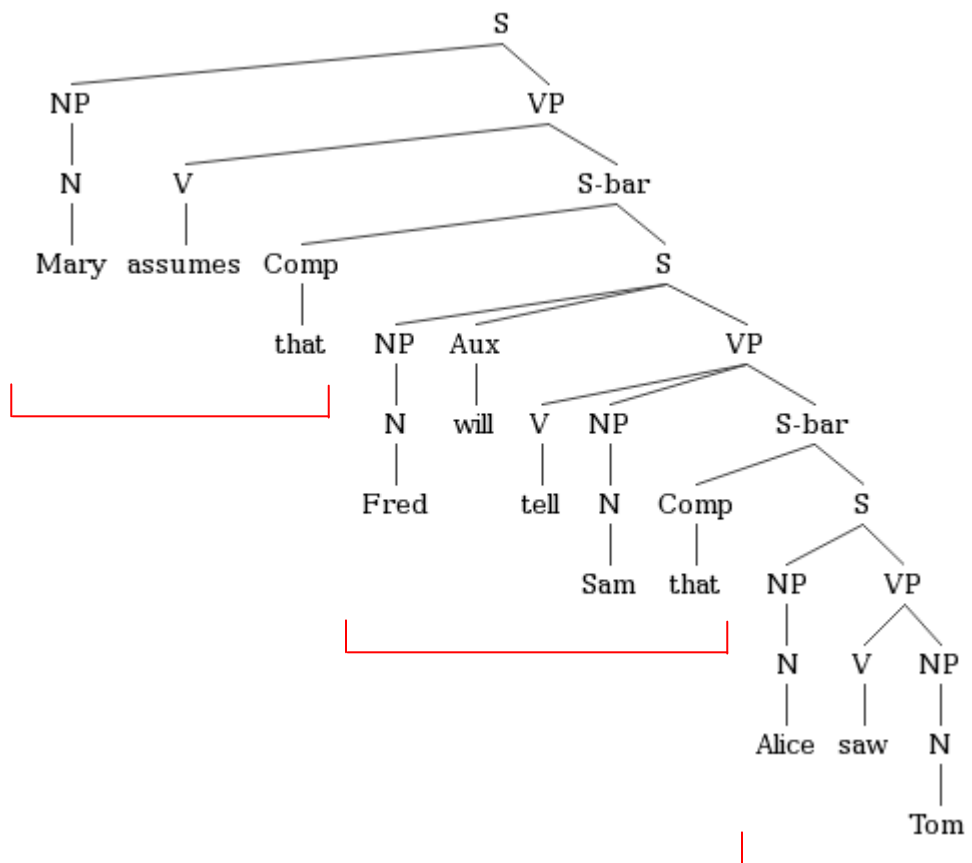
Within brackets, any two NP are clausemates.

### Study Exercise #30: in

*Mary assumes that Fred will tell Sam that Alice saw Tom.*

Parse the sentence, draw the informal brackets to show the clausemate domains (answer on next page).

## Answer to Study Exercise #30



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

---

## 8. An interpretive analysis for reflexive pronouns

For reflexives, we can write the following rule of interpretation:

### Reflexive Interpretation<sup>93</sup>

A reflexive pronoun must be coreferent with an NP that

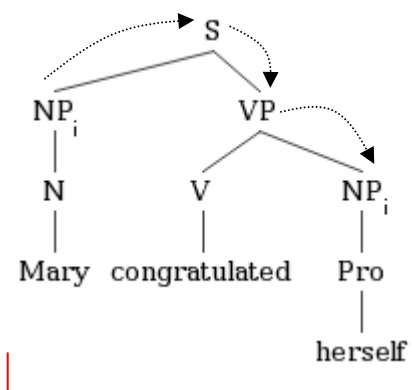
- (a) is its clausemate; and
- (b) c-commands it.

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 is that a sentence with an uninterpretable pronoun is ungrammatical.

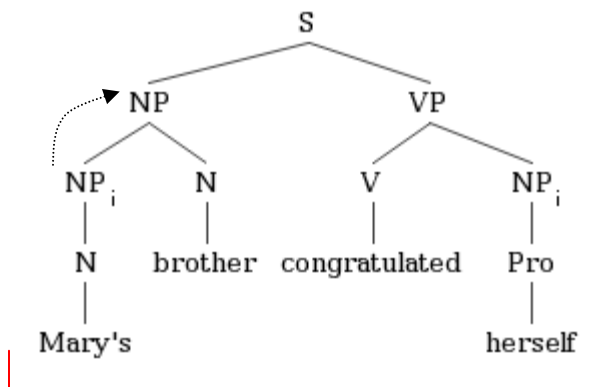
*Mary<sub>i</sub> congratulated herself<sub>i</sub>.*



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 NP's, not lower down) is shown in the tree above.

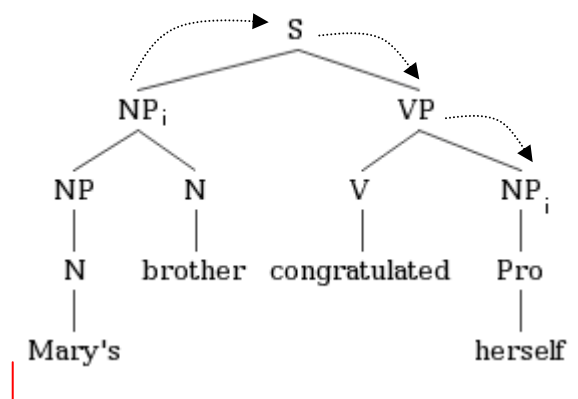
*\*[Mary<sub>i</sub>'s brother] congratulated herself<sub>i</sub>.*

<sup>93</sup> In the linguistics literature this rule, in a slightly generalized version, is called "Principle A." I'm deviating from standard terminology here, taking the view that rules should be given names that correspond to their function.



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*.

\*[*Mary's brother*]<sub>i</sub> congratulated *herself*<sub>i</sub>.

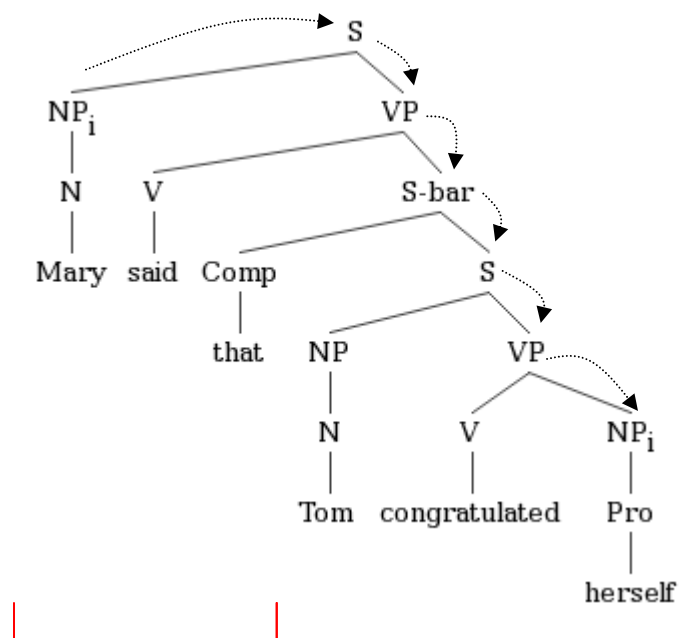


Same tree, but different indices. Here, the NP *Mary's brother* does c-command the NP *herself*, and is a clausemate, but there's a gender mismatch (brothers are always male, and *herself* is [Gender:feminine]), so the sentence is still ungrammatical.

[*Mary's brother*]<sub>i</sub> congratulated *himself*<sub>i</sub>.

This one matches all requirements (gender match, c-command, clausemate condition), and is fine.

Mary<sub>i</sub> said that Tom congratulated *herself*<sub>i</sub>.



Bad: *Mary* is not the clausemate of *herself* (*herself* is in the lower S, *Mary* is not).

Mary said that Tom<sub>i</sub> congratulated herself<sub>i</sub>.

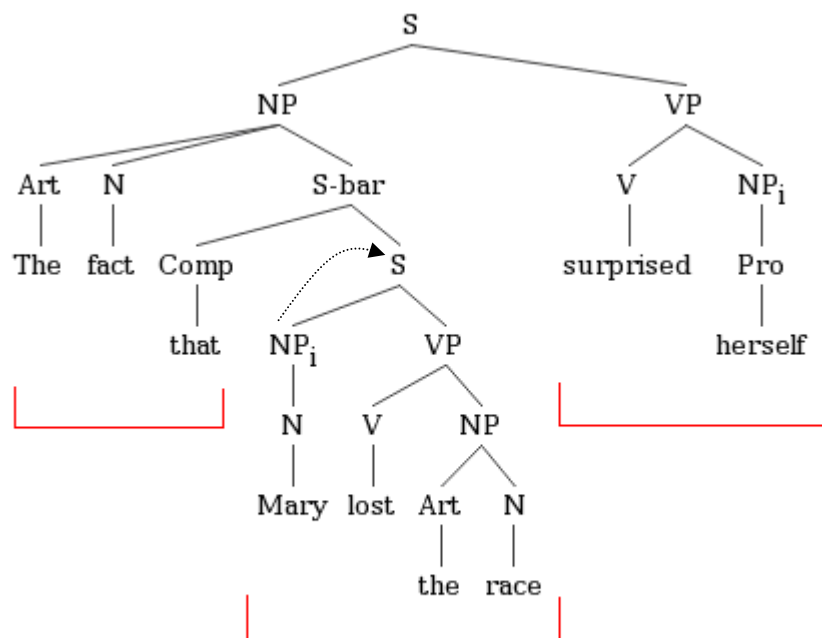
Bad: gender mismatch (unless, of course, *Tom* designates a female person; who knows...)

### Study Exercise #31

The fact that Mary<sub>i</sub> lost the race surprised herself<sub>i</sub>.

This one is bad; you give the explanation. Answer on next page.

### Answer to Study Exercise #31



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*.

### 8.1 Each other

The phrase *each other* is a **reciprocal** pronoun, not a reflexive, but it works essentially like a reflexive and is normally analyzed using the same sort of rule. Thus:

- |  |                                    |
|--|------------------------------------|
| [ John and Mary ] <sub>i</sub> like [each other] <sub>i</sub> .          | Ok.                                |
| *[ Each other ] <sub>i</sub> like [ John and Mary ] <sub>i</sub> .       | Bad: c-command condition violated  |
| *[ John and Mary ] <sub>i</sub> think I like [each other] <sub>i</sub> . | Bad: clausemate condition violated |

For further relevant data see Chapter 1.

## 9. 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 “He left” example on p. 244 above.

The key to these pronouns, in the view of many linguists, is that you to specify not what they *can* refer to, but rather what they *cannot* refer to. Here is a version of the rule commonly proposed:

## Regular Pronoun Interpretation<sup>94</sup>

A regular pronoun cannot be coreferent with a c-commanding clausemate.

Some examples follow.

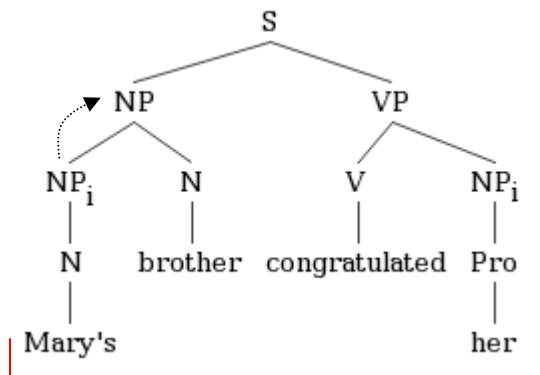
### 9.1 Pronouns alone

*He<sub>i</sub> sings.*

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.

### 9.2 No c-command, coreference ok

[Mary<sub>i</sub>'s brother] congratulated her<sub>i</sub>.



This is fine, because *Mary* doesn't c-command *her*.

### 9.3 No coreference — always ok

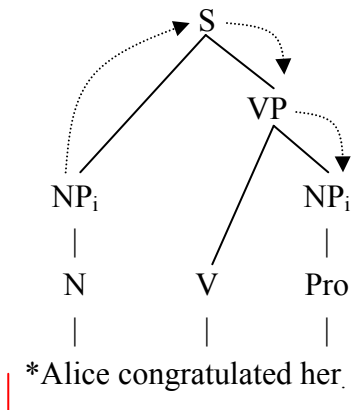
[Mary<sub>i</sub>'s brother] congratulated her<sub>i</sub>.

<sup>94</sup> In the linguistics literature this rule is called “Principle B.”

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.*

#### 9.4 C-commanding clausemate: coreference impossible

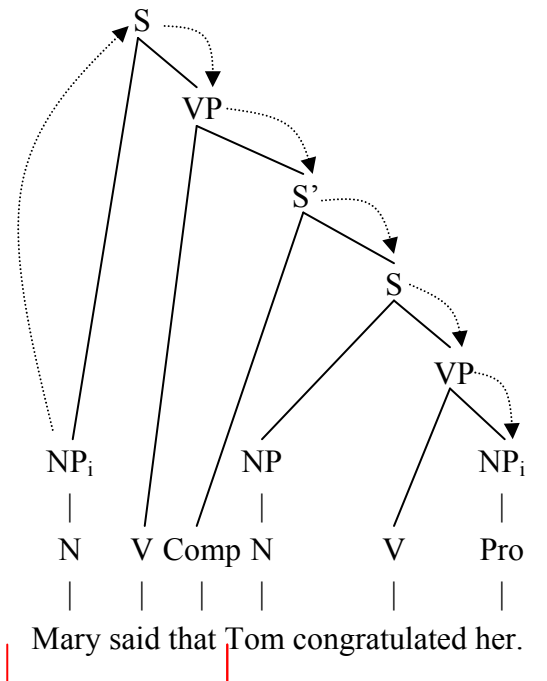


This one is no good: *Alice* is the clausemate of *her*, and also c-commands *her*, so it can't be coreferent. However, with distinct reference, the following reading is ok:

Alice<sub>i</sub> congratulated her<sub>j</sub>.



### 9.5 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.

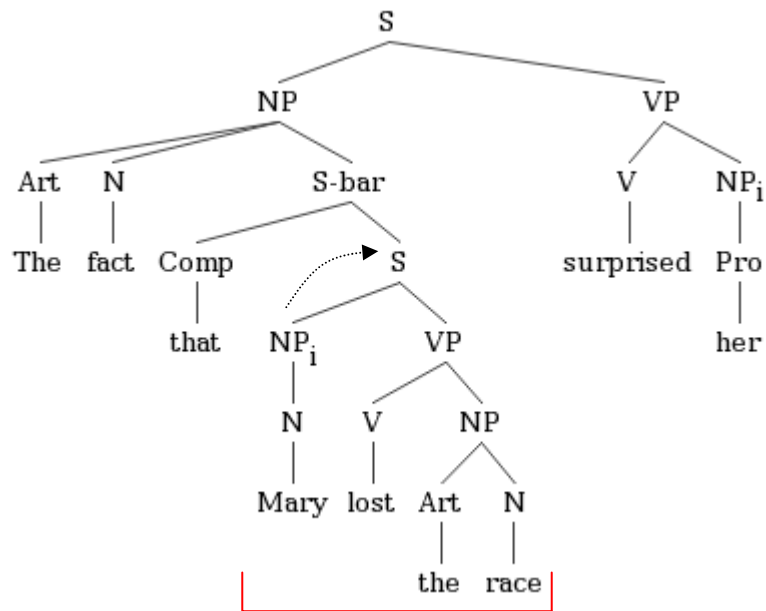
### 9.6 C-command but not clausemate: non-coreference ok

Mary<sub>i</sub> said that Tom congratulated her<sub>j</sub>.

This is likewise fine, *her<sub>j</sub>* refers to some female person mentioned earlier or physically present.

### 9.7 No c-command, not clausemate: coreference ok

The fact that Mary<sub>i</sub> lost the race surprised her<sub>i</sub>.

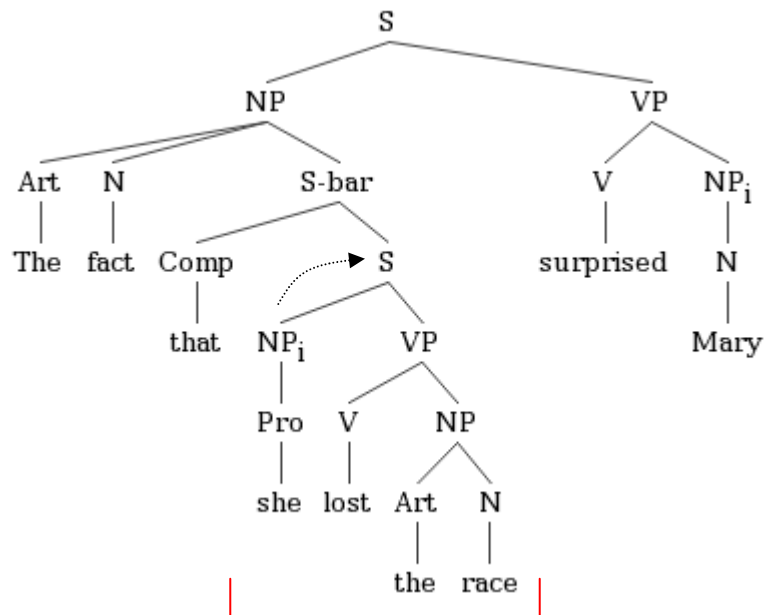


Ok, *Mary* is neither a clausemate of *her*, nor does *her* c-command *Mary*, so the coreference is allowed.

### 9.8 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<sub>i</sub> lost the race surprised Mary<sub>i</sub>.



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<sub>i</sub> lost the race SURPRISED Mary<sub>i</sub>.

Of course, since Regular Pronoun Interpretation only forbids coreference, the following reading is also acceptable:

The fact that she<sub>j</sub> lost the race surprised Mary<sub>i</sub>.

## 10. 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<sub>i</sub> thinks Bill<sub>i</sub> is a genius.

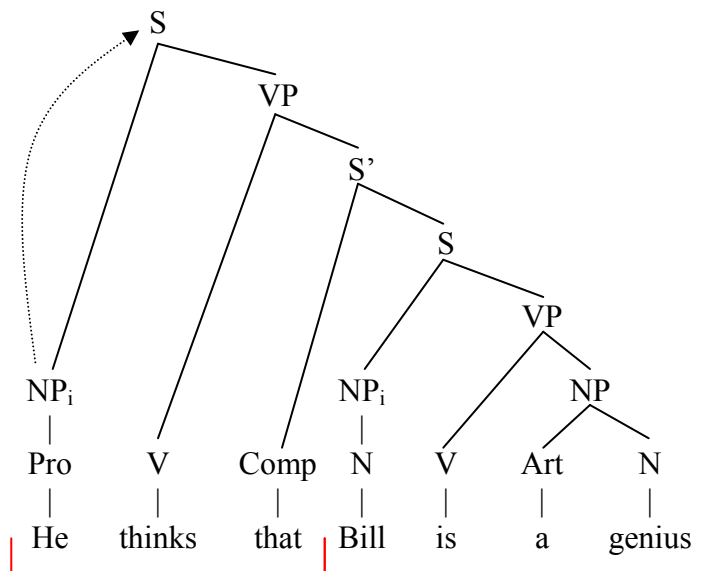
The coreference shown is impossible, even though nothing we've said so far rules it out. The rule commonly used is this one:

### Full Noun Phrase Interpretation<sup>95</sup>

A full noun phrase cannot be coreferent with a c-commanding Noun Phrase.

<sup>95</sup> In the linguistics literature this rule is often called "Principle C."

This rules out *\*He<sub>i</sub> thinks that Bill<sub>i</sub> 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.

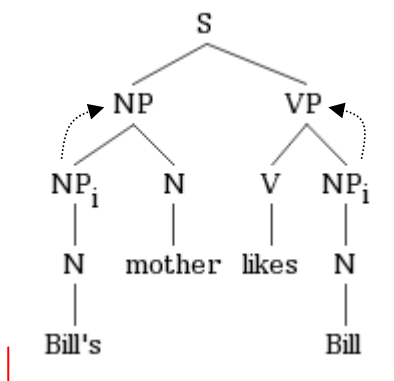
we must interpret the two *Bill*'s as being different people; that is, these sentences must be interpreted:

Bill<sub>i</sub> thinks Bill<sub>j</sub> is a genius.

Bill<sub>i</sub> saw Bill<sub>j</sub>.

If neither copy of *Bill* c-commands the other, then coreference becomes more or less ok:

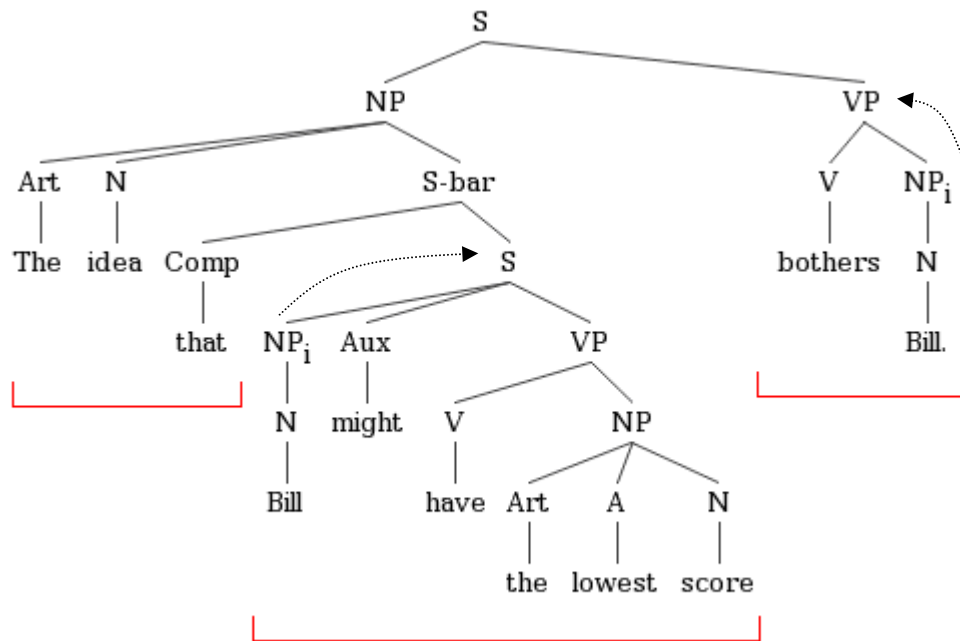
[ well, at least ] Bill<sub>i</sub>'s mother likes Bill<sub>i</sub>.



**Study Exercise #32:** in the following, why can the two *Bill*'s be the same person?

The idea that Bill might have the lowest score bothers Bill.

### Answer to Study Exercise #32



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*.

## 11. Summary

We've now done a particular corner of English semantics, setting out rules of semantic interpretation for anaphoric elements. Dividing all NP's into the categories of Reflexive Pronouns, Regular Pronouns, and Full NP's, we developed three rules, one of which requires coreference in certain contexts, the other two of which forbid it:

### Reflexive Interpretation

A reflexive pronoun must be coreferent with an NP that (a) is its clausemate; and (b) c-commands it.

### Regular Pronoun Interpretation

A regular pronoun cannot be coreferent with a c-commanding clausemate.

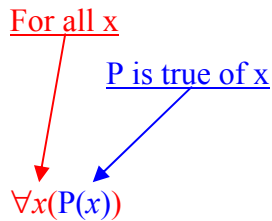
### Full Noun Phrase Interpretation

A full noun phrase cannot be coreferent with a c-commanding Noun Phrase.

## OPERATORS AND SCOPE

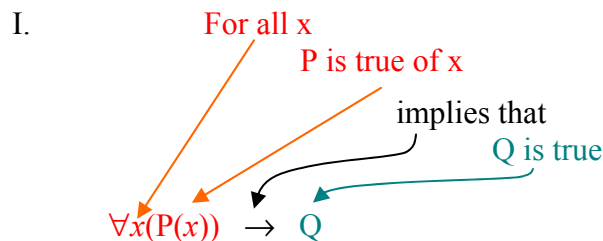
### 12. Operators and scope in formal logic

The idea of operators and scope was incorporated into linguistics from the field of formal logic, a branch of philosophy.<sup>96</sup> Logicians express (certain aspects of) meaning with formulas like the following.



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 imagine a universe in which  $x$  represents only 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.

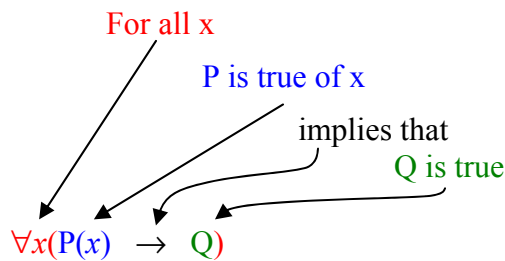


Pursuing our real-life interpretation, we might suppose that  $Q$  means “the professor postpones the exam”. The symbol  $\rightarrow$  means “if ... then”. The interpretation would then be “If every one of the students in Linguistics 20 has the flu, then the professor will postpone the exam.”

Now consider a similar formula, with a different location for the right parenthesis.

<sup>96</sup> You can study the basics of this field in UCLA’s Philosophy 31.

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.” — in other words, 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  $P(x) \rightarrow Q$  (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  $\sim \forall x(P(x)) \rightarrow \exists y(\sim P(y))$  (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.

### 13. 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*  
*x sang*

a kind of (restricted) universal quantifier ( $\forall x$ ,  $x$  a boy)  
a predicate



Putting these together, we get something like:

$(\forall x, x \text{ a boy}) (x \text{ sang})$

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 convention. So, for instance, a sentence like:

*Jane taught every student.*

would be expressed as:

$(\forall x, x \text{ a student}) (\text{Jane taught } x)$

In principle, we could integrate such expressions with the predicate-argument structure developed above, so that the meaning would appear like this:

$(\forall x, x \text{ a student}) (\text{TEACH } ((\text{Teacher Jane}) (\text{Teachee } x)))$

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.

### 13.1 Pronouns as variables

So far, we have treated pronouns as NP's that refer to things. When a pronoun is coindexed with another NP, (*Bill<sub>i</sub> thinks he<sub>i</sub> 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<sub>i</sub>'s gone*), 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.*

The interesting reading here is the one where 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. Rather, we can give it a sensible interpretation provided we set up a structure that has *two* variables, as follows.

<i>Every boy</i>	is the quantifier ( $\forall x, x \text{ a boy}$ )
<i>he</i>	is a bound variable ( $x$ )
<i>x thinks x is smarter than average</i>	is a complex predicate, with two variables

Putting these together, we get the following structure:

$(\forall x, x \text{ a boy}) (x \text{ thinks } x \text{ is smarter than average})$

Thus, the pronoun is not referential but rather is the linguistic means for expressing the second instances of the variable. (The first variable simply occurs in the syntactic location of the quantifier phrase; see rules below for how this can be derived).

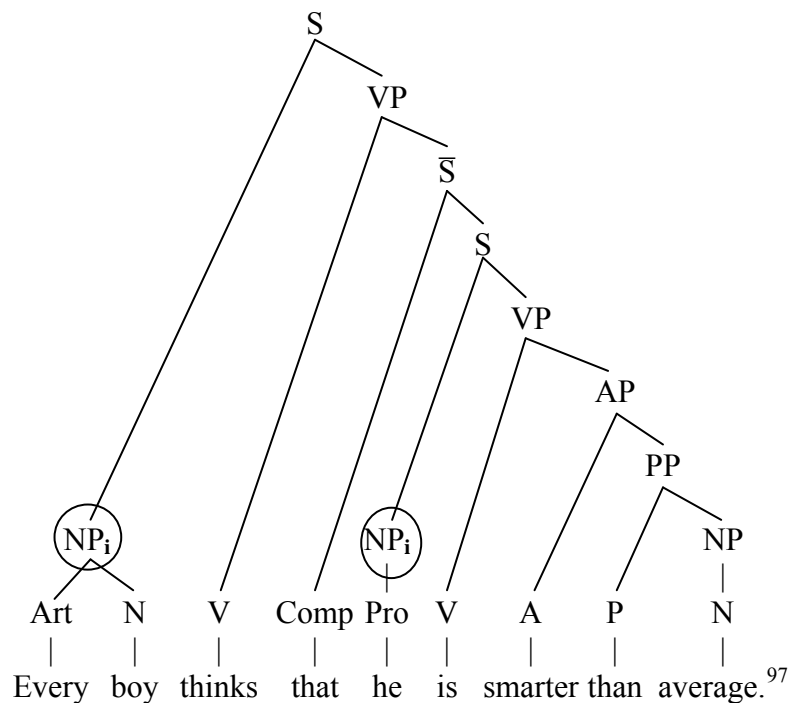
Observe now that the sentence under discussion, *Every boy thinks that he is smarter than average*, is ambiguous, because the pronoun *he* does not **have to** act as a bound variable. It can also be an ordinary pronoun, which can refer to some male person who happens to be under discussion. Thus, the other reading is as follows:

$\forall (x, x \text{ a boy}) (x \text{ thinks } he_i \text{ is smarter than average})$

where  $he_i$  is an ordinary pronoun referring to someone 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 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 NP's in the sentence we are working with (*he* is not the clausemate of *every boy*, so Regular Pronoun Interpretation is satisfied; and *he* does not c-command *every boy*, so Full Noun Phrase Interpretation is satisfied).



Because *every boy* is a quantified NP, this must be further translated to

$(\forall x, x \text{ a boy}) (x \text{ thinks } x \text{ is smarter than average})$

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:

$$\begin{array}{c}
 [ \text{Every boy} ]_i \text{ thinks that } [ \text{he} ]_i \text{ is smarter than average.} \\
 \swarrow \quad \searrow \\
 (\forall x, x \text{ a boy}) (x \text{ thinks } x \text{ is smarter than average})
 \end{array}$$

## 14. 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 code idea is that the rules of the semantics create from syntactic representation<sup>98</sup> a separate representation of the sentence's meaning (or, in cases of ambiguity, more than one

<sup>97</sup> This tree is not compliant with our phrase structure rules. The additional rule needed is pretty straightforward:  $AP \rightarrow A (PP)$ . All comparative adjectives ("X-er") can take a PP with *than*.

<sup>98</sup> 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.

representation). Such a semantic representation is often called the **logical form** of a sentence. 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 NP’s into operator-variable pairs, to indicate scope, as described in the previous section. 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 ]<sub>i</sub> thinks [ he ]<sub>i</sub> 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 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:

$\forall(x, x \text{ a boy})((\text{THINK}((\text{Thinker } x), (\text{Proposition SMART}((\text{Assessee } x))))))$

For the sentence *Mary seems to like every boy*, the same processes would yield:

$\text{SEEM}(\text{Proposition } \forall(x, x \text{ a boy})(\text{LIKE}((\text{Liker Mary})(\text{Lik-ee } x))))$

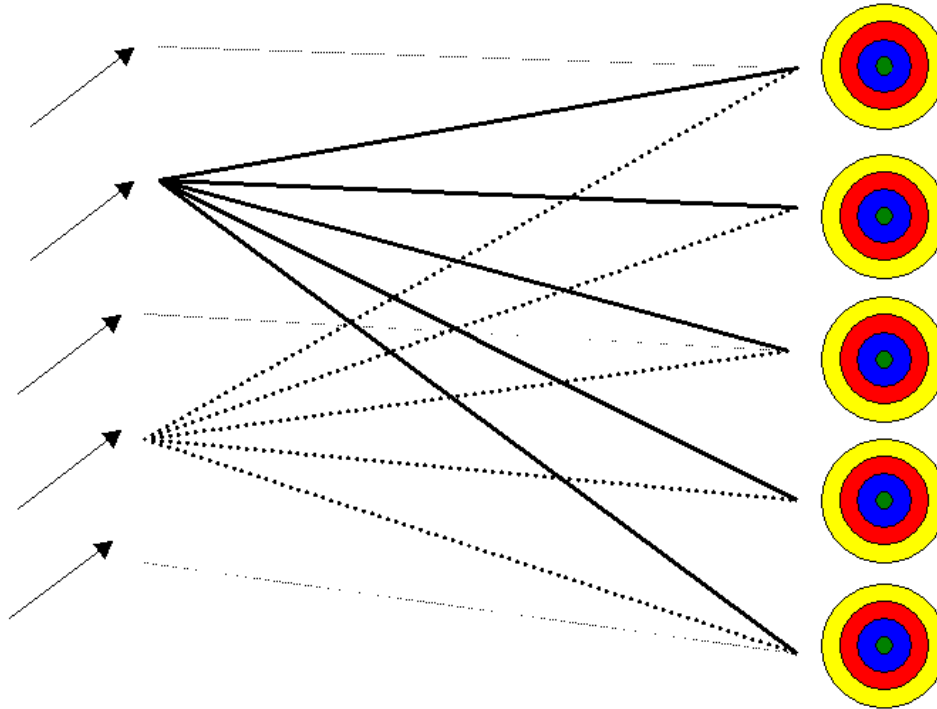
This is, of course, only an outline scheme. In the pages below, I’ll discuss briefly the rules for converting quantified NP’s into operator-variable pairs, which will flesh out the scheme a bit. However, we will henceforth skip the step of creating predicate-argument structure from syntax.

## 15. Sentences with two operators

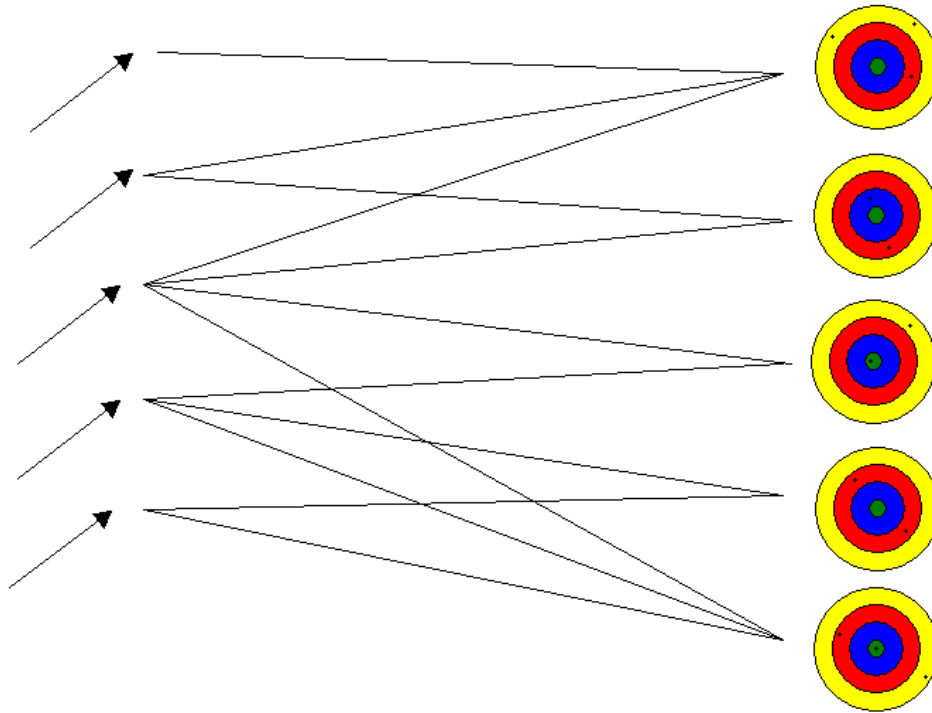
Many sentences contain two operators. When this happens, the two operators often interact with each other. For example, speaking of an archery tournament, we could say:

*At least two arrows hit every target.*

This sentence is ambiguous, in the following way. Suppose that the archers present 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: at least 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.



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.



The two readings of *At least two arrows hit every target* can be summarized as follows:

*'There were at least two arrows such that they hit every target.'*

True only of the first diagram.

*'For every target, it is the case that at least two arrows hit it.'*

True of both diagrams.

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  $\forall x$ . The phrase *at least 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.

- a. ( For at least two  $x$ ,  $x$  an arrow ) ( ( for every  $y$ ,  $y$  a target ) (  $x$  hit  $y$  ) )  
*'There were at least two arrows such that they hit every target.'*
- b. ( For every  $y$ ,  $y$  a target ) ( ( for at least two  $x$ ,  $x$  an arrow ) (  $x$  hit  $y$  ) )  
*'For every target, it is the case that at least two arrows hit it.'*

This is an example of a **scope ambiguity**. In (a), the scope of the operator ( For at least two  $x$ ,  $x$  an arrow ) is ( ( for every  $y$ ,  $y$  a target ) (  $x$  hit  $y$  ) ). In (b), the scope of the operator ( For every  $y$ ,  $y$  a target ) is ( ( for at least two  $x$ ,  $x$  an arrow ) (  $x$  hit  $y$  ) ).

Another way of saying that same thing is that in (a), ( For at least 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

at least two  $x$ ,  $x$  an arrow ). In (b), ( for every  $y$ ,  $y$  a target ) takes scope over ( For at least two  $x$ ,  $x$  an arrow ).

### 15.1 The local “universe of discourse”

As you can see above, in language operators often consist of two parts, one the quantifying expression itself (*at least 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.

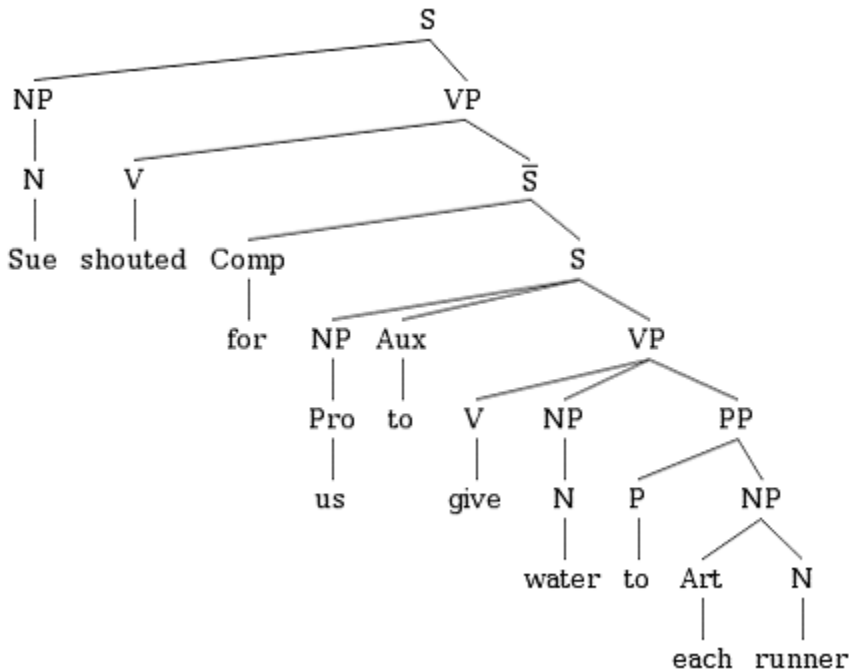
## 16. Operator scope in multiclausal sentences

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:

Sue shouted [ for us to give water to each runner ]

We need briefly to cover the syntax here. In one commonly-used analysis, *for us to give water to each runner* is an  $\bar{S}$ , *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  $\bar{S}$  (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 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:

Sue shouted ( ( for each  $x$ ,  $x$  a runner ) ( for us to give water to  $x$  ) )

In the other reading, which is a bit harder to get, Sue is a more hands-on manager, who drives around monitoring the individual water stations. Here is a context:

*We were covering the water station at Mile 23. By this point, the runners were fairly far apart from one another. Sue, watching continuously, shouted for us to give water to each runner, and every time we heard this shout, we complied..*

I believe this could fairly be given the reading:

( 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.

Some terminology: we can say that in the first reading, that is

Sue shouted ( ( for each  $x$ ,  $x$  a runner ) ( for us to give water to  $x$  ) )



the operator *each* has **narrow scope**, namely the embedded clause; whereas in the second reading

( For each *x*, *x* a runner ) (Sue shouted ( for us to give water to *x* ) )

the operator *each* has **wide scope**—here, scope over the whole sentence.

The general point 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.

## 17. Creating operator-variable pairs from quantifiers in logical form

We can now consider what is needed to derive the logical form of quantified sentences. We know, up front, that the rules need to have some flexibility, because of sentences like *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 NP's into operators.

### Quantifier Translation

Replace

[ every N ] <sub>NP</sub>	with	[ for every <i>x</i> , <i>x</i> an N ] <sub>NP</sub>
[ some N ] <sub>NP</sub>	with	[ for some <i>x</i> , <i>x</i> an N ] <sub>NP</sub>

...

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.

### Quantifier Raising

Left-adjoin a quantified NP to S, leaving behind a variable in its original location.

This rule has an undefined term in it, **adjunction**, which is defined as follows:

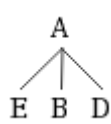
### Left-Adjunction

Given a constituent A, containing a B, and (optionally) C, the mother of A:

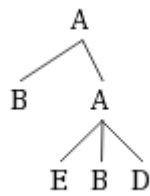
Form a new constituent, which is:

- 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

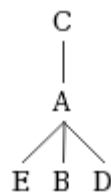
Here are two simple cases of left adjunction.



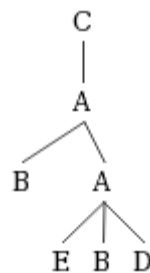
left adjoin B  
to A  
→



(A is not the  
daughter of any  
node)



left adjoin B  
to A  
→

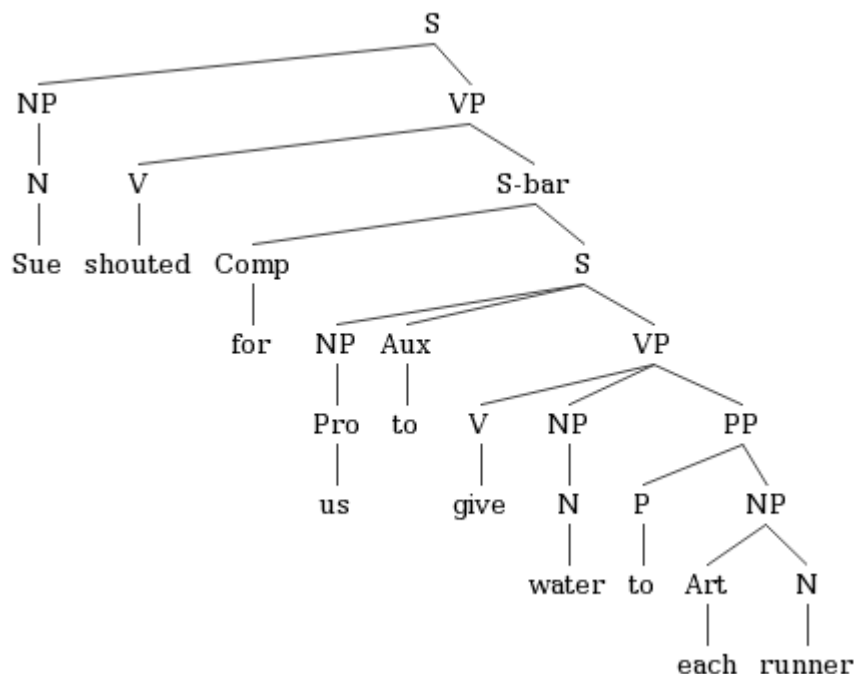


(A is daughter  
of C)

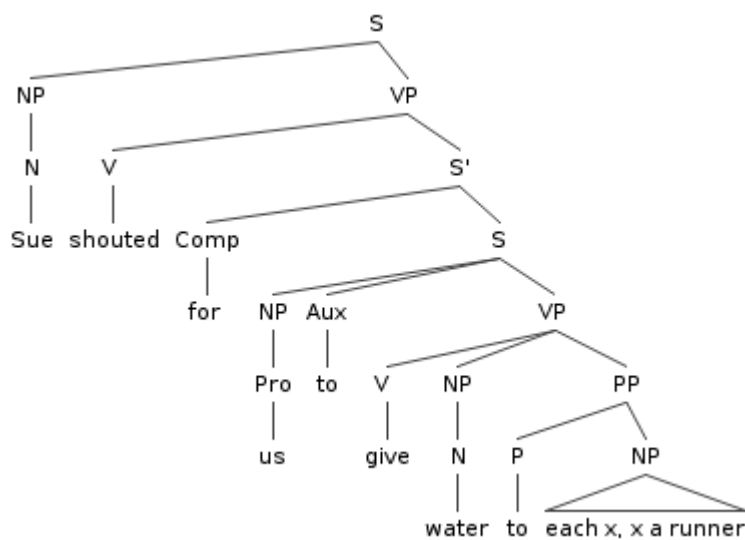
The purpose of left adjunction here is simply to provide a slot in which the logical operator can reside.

## 18. Deriving distinct meanings with Quantifier Raising

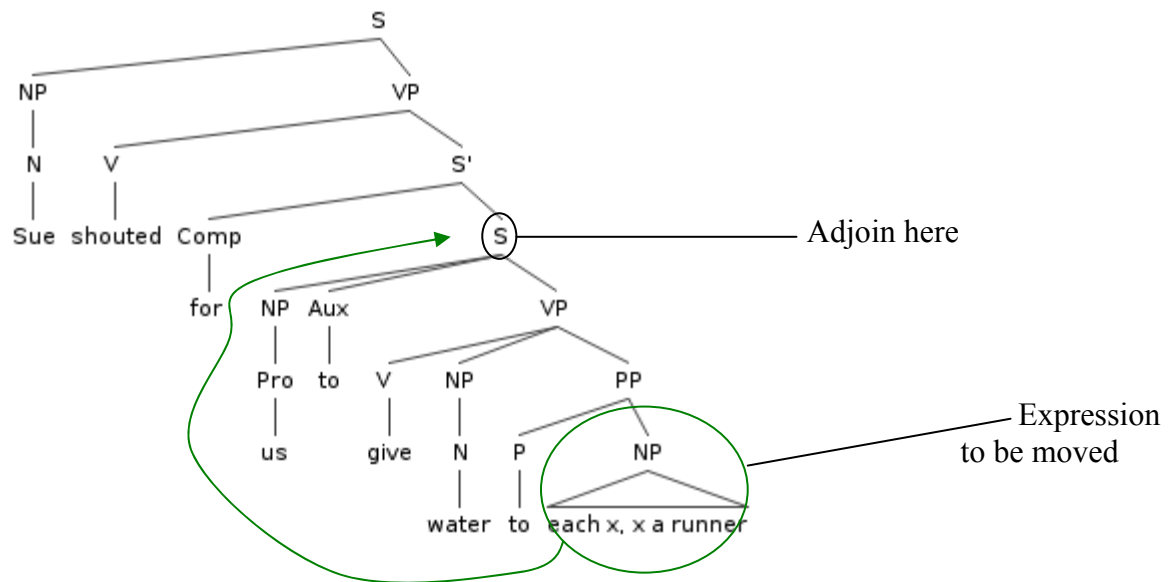
Let us return to *Sue shouted for us to give water to each runner*, whose surface structure is repeated below.



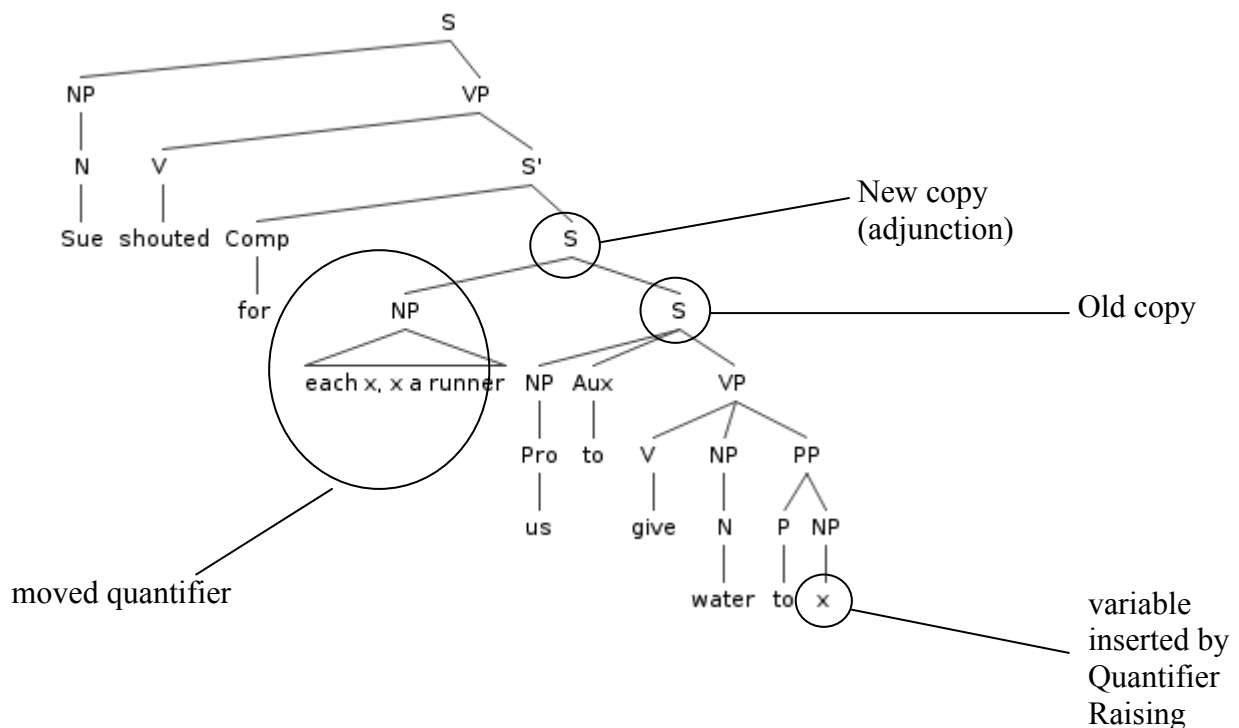
First applying Quantifier Translation to *each runner*, we get the following. A triangle is used to avoid worrying about the inner details of the quantifiers.



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:

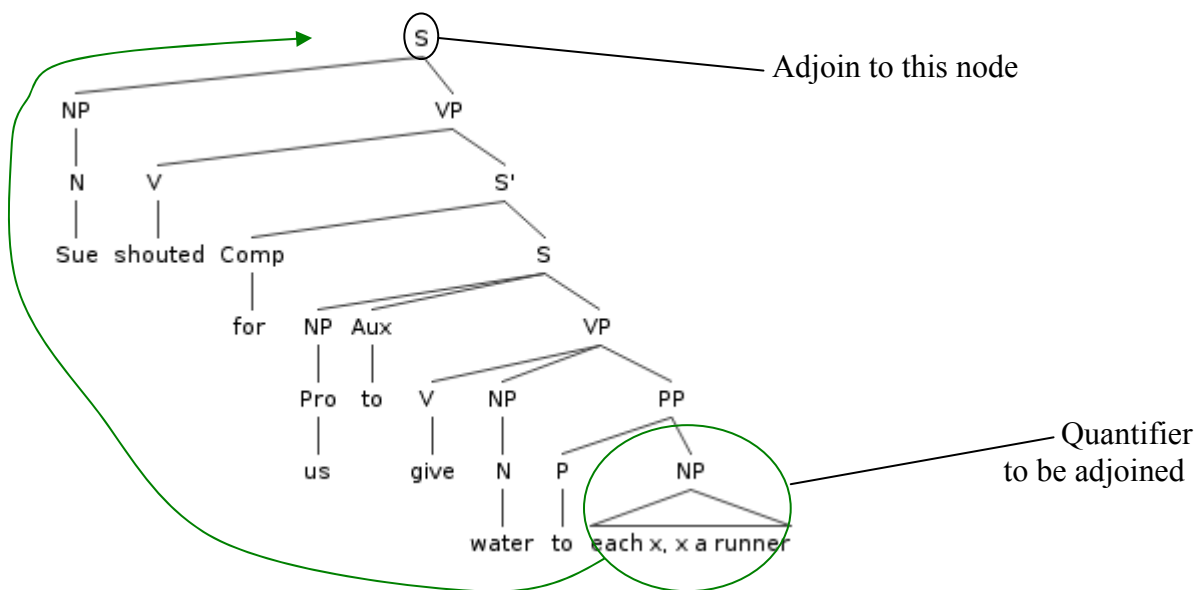


Inserting the new S node, and rearranging the tree in the way required, we get the following:



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 reading of (11)-(12) above.

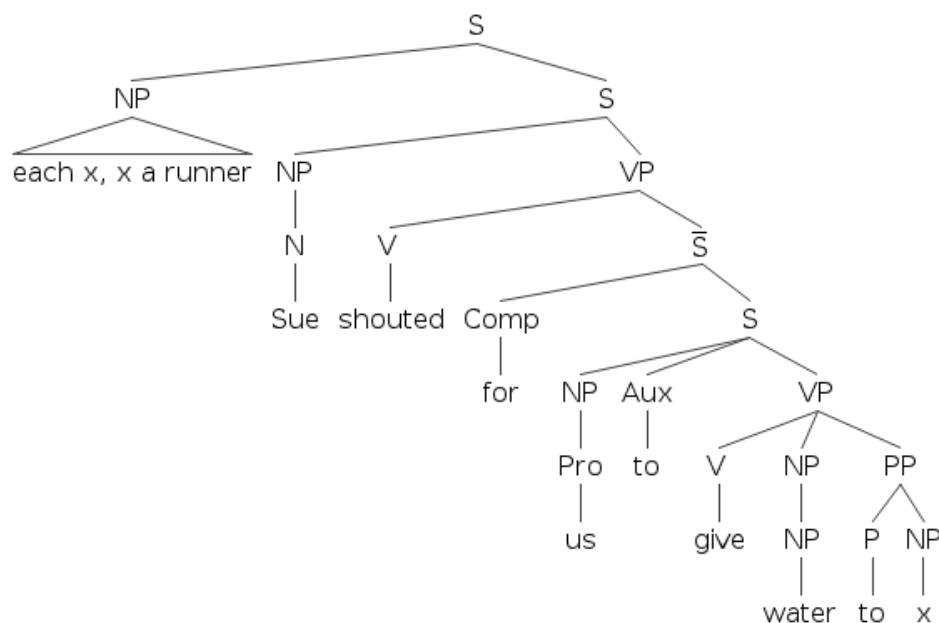
If we pick the upper clause, adjunction will look like this:



### Study Exercise #33

Show the final output of the derivation.

### Answer to Study Exercise #33



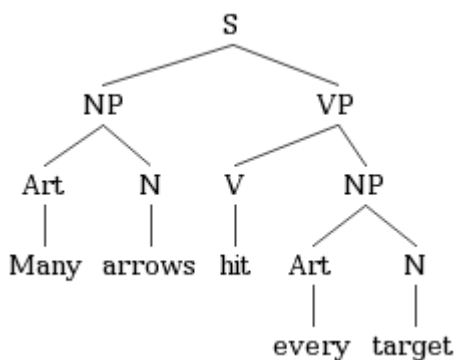
### 19. Logical form in sentences with two quantifiers

Let us now return to the topic of section 15, namely sentences that include two quantifiers. Suppose we start with a simplified version of our arrow-target sentence:

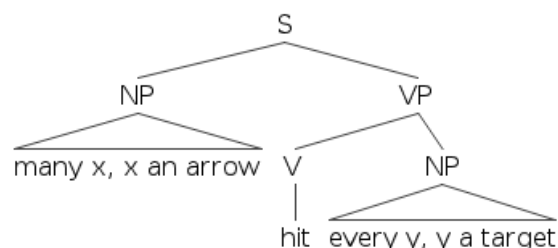
*Many arrows hit every target.*

This sentence is ambiguous, and could mean either “Many were the arrows that hit every target”; or “For every target, many arrows hit it.”

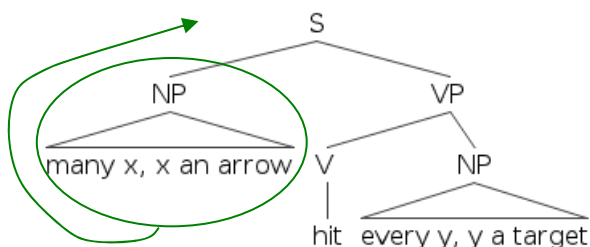
The syntactic surface structure (as well as deep structure) would be as shown:



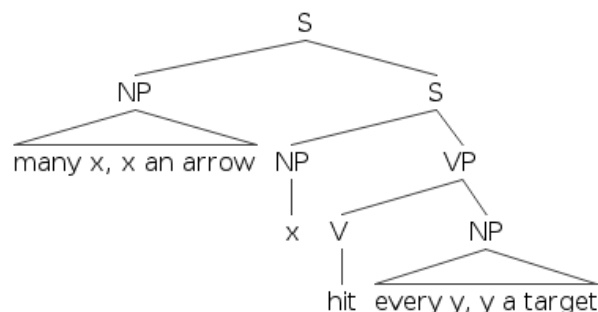
We first translate the NP with quantifiers into appropriate operators, with the rule of Quantifier Translation. Note that it is crucial to use different variables (here,  $x$  and  $y$ ) for the different noun phrases.



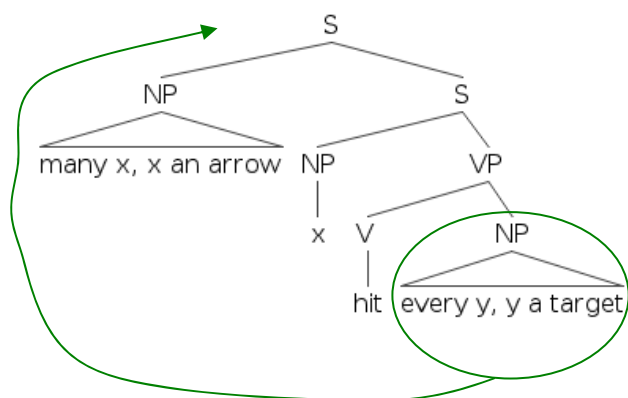
Although the order in which we perform the operations turns out not to matter here, we can arbitrarily choose first to left-adjoin *many x, x an arrow* to the sentence, as follows:



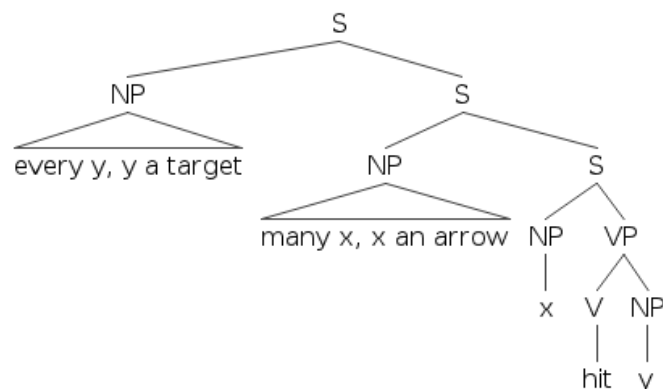
The result has a new S node, copying the original one, and the moved quantifier is the sister of the original S:



In the next step, we need to apply the same rule of Quantifier Raising again, this time to the quantified expression *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”.

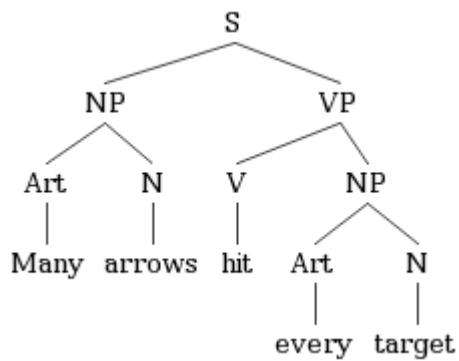
### Study Exercise #34

Derive the other reading.

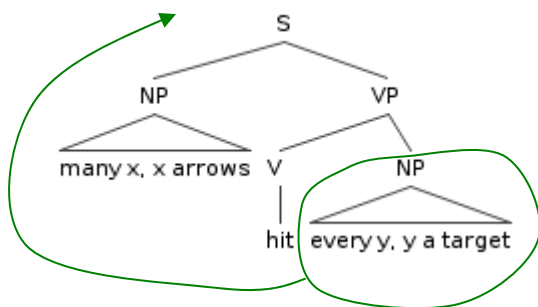


### Answer to Study Exercise #34

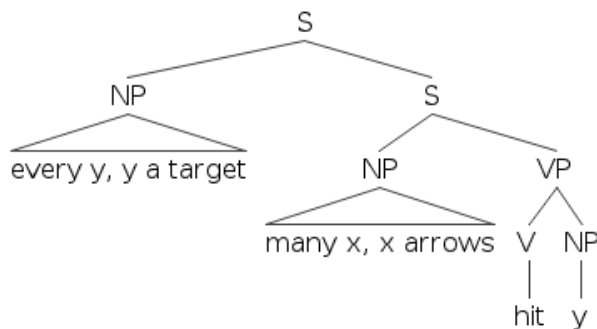
Syntactic structure:



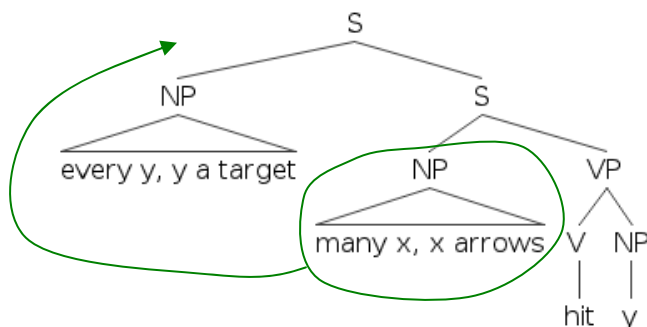
Output of Quantified Translation. I also show an arrow that indicates the application of Quantifier Raising to the quantified expression *every y, y a target*.



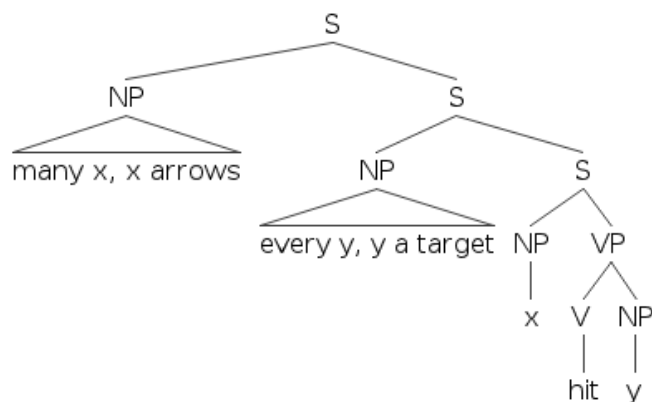
The structure that results is given below.



Next, we apply Quantifier Raising to *many x, x arrows*. This is shown with the arrow below:



The final structure that results is shown below:

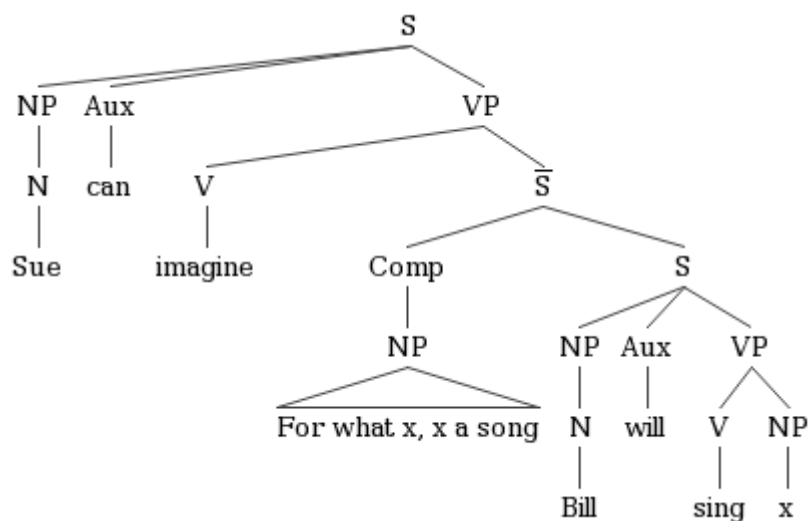
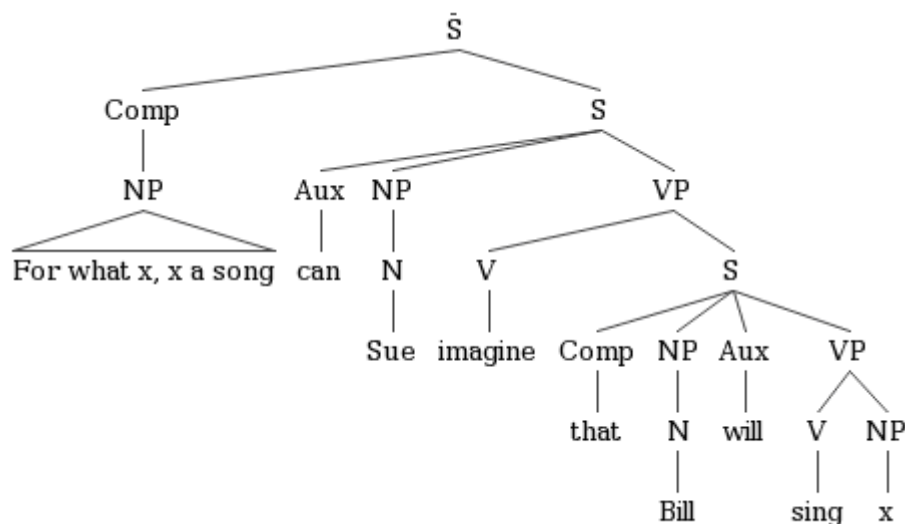


## 20. Wh-phrases are operators

Earlier in these readings, I mentioned 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 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:



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.

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:

[s	tʂaŋsán	tsʰái	[s	lìsû	çihwán	ʂěi	]
	Zhangsan	guess		Lisi	like	who	
	1	1	1	3	4	3	1
	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. It can also mean “Zhangsan guessed who Lisi likes.” This meaning involves raising the Wh- phrase only to the lower S in logical form.<sup>99</sup>

We saw above another area where syntax mimics semantics: the use of pronouns as bound variables, as in section 13.1. Here, interpretive rules must convert these pronouns to variables in logical form. These rules are usually optional, resulting the ambiguity of sentences like *Every boy thinks that he is smarter than average*. For completeness, here is the interpretive rule that could perform this function.

### **Pronoun-to-Variable Conversion**

When a NP is converted to an quantifier by Quantifier Translation (p. 273), convert any pronoun coindexed with the NP to the same variable that the quantifier specifies.

## **21. Summary of operators, variables, and scope**

- Constructions with operators and variables are perhaps 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 NP's 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 does move to the appropriate scope location in surface structure.

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<sup>99</sup> Thanks to UCLA graduate students Kristine Yu and Grace Kuo for constructing this example for me.

## Chapter 10: Phonetics

### 1. Phonetic description

Linguists who take on a never-studied language seldom start with quantifier scope! The first task is to be able to hear the language and take down utterances. It's a familiar experience for everyone to have heard a foreign language as mere sound—it seems to go by very fast, and is hard to imitate and remember. Indeed, it will typically be the case that a language will contain crucial distinctions between sounds that escape the linguist entirely in his first few efforts.

Thus, it's a fundamental skill of linguists to be able to listen to other languages with a trained ear; to take down what is said accurately in a phonetic transcription. Such transcription is taught to beginning linguists all over the world, including in a full one-quarter course at UCLA.<sup>100</sup>

Here is an example of transcription:

[ˈðɪs ɪz ə fəˈnɛtɪk trænˈskrɪpʃən əv ən ˈɪŋɡlɪʃ ˈsɛntɪs prəˈnaʊnst ɪn maɪ ˈoʊn ˈdaɪəlɛkt]  
(This is a phonetic transcription of an English sentence pronounced in my own dialect.)

### 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”). This is the form of transcription that will be taught in this course. The Association offers much information, either free or inexpensive, on its Alphabet and how to use it:

- Their printed guide, *Handbook of the International Phonetic Association : A Guide to the Use of the International Phonetic Alphabet* (Cambridge University Press, and UCLA libraries)
- The IPA website: <http://www.langsci.ucl.ac.uk/ipa/>
- The IPA's free sound files from many languages: <http://web.uvic.ca/ling/resources/ipa/handbook.htm>
- 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.

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<sup>100</sup> Linguistics 103, offered every quarter.

## THE INTERNATIONAL PHONETIC ALPHABET (revised to 2005)

## CONSONANTS (PULMONIC)

© 2005 IPA

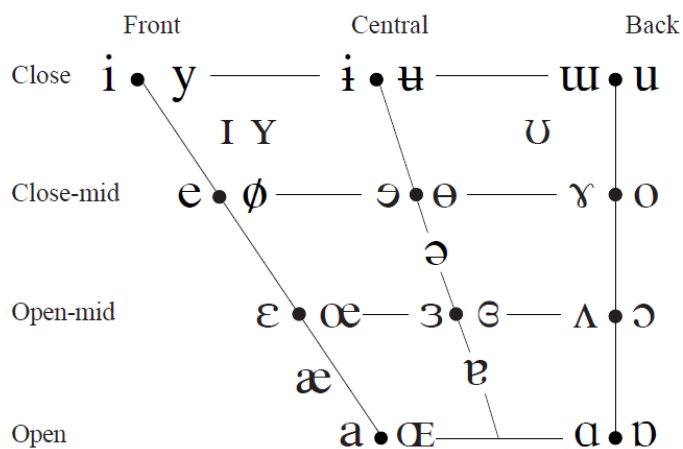
	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k ɡ	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	ɴ		
Trill	ʙ			r					ʀ		
Tap or Flap		ⱱ		ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

## CONSONANTS (NON-PULMONIC)

Clicks	Voiced implosives	Ejectives
ɔ Bilabial   Dental ! (Post)alveolar ≠ Palatoalveolar    Alveolar lateral	ɓ Bilabial ɗ Dental/alveolar ɟ Palatal ɠ Velar ʄ Uvular	ʼ Examples: pʼ Bilabial tʼ Dental/alveolar kʼ Velar 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	ç ʒ	Alveolo-palatal fricatives
w	Voiced labial-velar approximant	ɺ	Voiced alveolar lateral flap
ɥ	Voiced labial-palatal approximant	ɧ	Simultaneous ʃ and x
ħ	Voiceless epiglottal fricative	Affricates and double articulations can be represented by two symbols joined by a tie bar if necessary.	
ʕ	Voiced epiglottal fricative		
ʡ	Epiglottal plosive		

kp̚ ts̚

DIACRITICS    Diacritics may be placed above a symbol with a descender, e.g. ŋ̥

o	Voiceless	n̥ d̥	..	Breathy voiced	b̤ a̤	ɳ	Dental	t̪ d̪
˘	Voiced	s̚ t̚	˜	Creaky voiced	b̰ a̰	ɿ	Apical	t̺ d̺
h	Aspirated	tʰ dʰ	˚	Linguolabial	t̼ d̼	ɽ	Laminal	t̻ d̻
ɔ̹	More rounded	ɔ̹	ʷ	Labialized	tʷ dʷ	ẽ	Nasalized	ẽ
ɔ̜	Less rounded	ɔ̜	j	Palatalized	tʲ dʲ	n̥	Nasal release	d̥ⁿ
ɹ̥	Advanced	u̟	ʲ	Velarized	tˠ dˠ	ˡ	Lateral release	d̥ˡ
̠	Retracted	e̠	ˠ	Pharyngealized	tˤ dˤ	ˠ	No audible release	d̥ˠ
̠̠	Centralized	ẽ̠̠	ˠ	Velarized or pharyngealized	ɫ			
̠̠̠	Mid-centralized	ẽ̠̠̠	̠̠̠	Raised	e̠̠̠ (ɹ̠̠̠ = voiced alveolar fricative)			
̠̠̠̠	Syllabic	n̠̠̠̠	̠̠̠̠	Lowered	e̠̠̠̠ (β̠̠̠̠ = voiced bilabial approximant)			
̠̠̠̠̠	Non-syllabic	e̠̠̠̠̠	̠̠̠̠̠	Advanced Tongue Root	e̠̠̠̠̠			
̠̠̠̠̠̠	Rhoticity	ə̠̠̠̠̠̠ a̠̠̠̠̠̠	̠̠̠̠̠̠̠	Retracted Tongue Root	e̠̠̠̠̠̠̠			

## SUPRASEGMENTALS

'	Primary stress
ˈ	Secondary stress
ˌ	ˌfounəˈtɪʃən
ː	Long eː
ˑ	Half-long eˑ
◌̥	Extra-short ĕ
	Minor (foot) group
	Major (intonation) group
·	Syllable break ˌɪ.ækt
◌̣	Linking (absence of a break)

## TONES AND WORD ACCENTS

LEVEL		CONTOUR	
é or ˥	Extra high	ě or ˧	Rising
é	High	ê	Falling
ē	Mid	ẽ	High rising
è	Low	ẽ	Low rising
è	Extra low	ẽ	Rising-falling
↓	Downstep	↗	Global rise
↑	Upstep	↘	Global fall

It would not be reasonable to ask you to learn the entire IPA chart in an introductory linguistics course, but I've included it just to show what is needed to cover (most of) the world's languages.<sup>101</sup> Given the very brief time available, the only language that we will cover will be American English. This is 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:

<sup>101</sup> 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.



## Consonants

		Bilabial	Labio-dental	Dental	Alveolar	Palato-alveolar	Palatal	Velar	Glottal
Stops	voiceless	/p/ <u>p</u> in			/t/ <u>t</u> in			/k/ <u>k</u> in	
	voiced	/b/ <u>b</u> in			/d/ <u>d</u> in			/g/ <u>g</u> ill	
Affricates	voiceless					/tʃ/ <u>ch</u> in			
	voiced					/dʒ/ <u>g</u> in			
Fricatives	voiceless		/f/ <u>f</u> in	/θ/ <u>th</u> in	/s/ <u>s</u> in	/ʃ/ <u>sh</u> in			/h/ <u>h</u> ymn
	voiced		/v/ <u>v</u> im	/ð/ <u>th</u> is	/z/ <u>z</u> ip	/ʒ/ vi <u>si</u> on			
Nasals		/m/ <u>m</u> itt			/n/ <u>n</u> ip			/ŋ/ <u>si</u> ng	
Approximants	lateral				/l/ <u>L</u> ynn				
	central	/w/ <u>w</u> in				/ɹ/ <u>r</u> im	/j/ <u>y</u> ing		

## Vowels and diphthongs

	Front Unrounded	Central Unrounded	Back		Diphthongs
			Unrounded	Rounded	
Upper high	/i/ <u>b</u> eat			/u/ <u>b</u> oot	/aɪ/, /aʊ/, /ɔɪ/ b <u>i</u> te, b <u>o</u> ut, C <u>oi</u> t
Lower high	/ɪ/ b <u>i</u> t			/ʊ/ f <u>oo</u> t	
Upper mid	/eɪ/ b <u>a</u> it	/ə/ abb <u>o</u> t		/oʊ/ b <u>oa</u> t	Rhotacized upper mid central unrounded  /əʔ/ B <u>e</u> rt
Lower mid	/ɛ/ b <u>e</u> t		/ʌ/ b <u>u</u> t		
Low	/æ/ b <u>a</u> t		/ɑ/ f <u>a</u> ther		

To get you up and running fast, I propose first to just run through the sounds, and only then go into phonetic theory and discuss the basis on which they are made.

Consonant symbols are not particularly hard; most have their expected values, with the following exceptions:

- [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 in *church*. If you listen carefully, you’ll hear that the choice of “t” + “ʃ” is a sensible one here.<sup>102</sup>
- [dʒ] is the “j” sound, heard in *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 [r] is a tongue-tip trill in IPA.)
- [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 are trickier:

- [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 *cook*, *kook* [ˈkʊk, 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]
- [ɹ̥] (“rhotacized schwa” is much like [ɪ], only it acts as a vowel rather than consonant. Compare *furry* [ˈfɹ̥i] with *free* [ˈfɹ̥i]

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]?<sup>103</sup> You can also hear the diphthongal character of

<sup>102</sup> 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: [tʃ̥].

<sup>103</sup> 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 [a:] instead.

[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*      [ˈdɪfə]

*defer*      [dɪˈfə]

*permit*      [pəˈmɪt]      verb: ‘to allow’

*permit*      [ˈpə.mɪt]      noun: ‘a kind of document giving permission’,<sup>104</sup>

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<sup>104</sup> The example works for the majority of Americans, though there are many who say [pəˈmɪt] for both.

## 5. Transcription technique

There are various ways to become a skilled phonetic transcriber. This section covers a number of them.

### 5.1 The keyword method

One of the most effective ways to become a more accurate transcriber is to use what I will be calling 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 read page 289 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*: “[bɪt]”

*Linguist*: “Now say the word we are working on.”

*Native speaker*: “[mɪt]”

*Linguist*: “Now say all three words in a row.”

*Native speaker*: “[bɪt] ... [bɪt] ... [mɪt]”

The idea should be plain: it’s much easier for your ear to compare a new word to known words than it is to transcribe “out of the blue”.

When I do English phonetic dictations in class, I encourage students to raise their hand ask me to pronounce keywords. If you want to use keywords in doing a homework, you can find them (with sound files) at:

<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* [guːs] with *lose* [luːz].

The sequence *ng* in spelling can spell either one sound or two (for most dialects). For example, *finger* is ['fɪŋgə], but *singer* is ['sɪŋə].

It is difficult to hear schwa; often people transcribe a full vowel that corresponds to the spelling. For example: *tenacious* = [tə'neɪʃəs], not \*[tɛ'neɪʃəs]; *connection* = [kə'nekʃən], not \*[kou'nekʃən]; *childless* = ['tʃaɪdləs], not \*[tʃaɪdlɛs].

The letter *u* often represents a sequence of [j]+[u]: *use* = ['juːz]; *fugue* = ['fjuːg]; *spectacular* = [spek'tækjʊlə] or [spek'tækjələ].

The letter *x* can represent [ks] (*Texas* = ['tɛksəs]) or [gz] (*exact* = [əg'zækt]).

The sequence *th* can represent either [θ] (*ether* = ['iθə]) or [ð] (*brother* = ['brʌðə]).

In cases where I have provided more than one way of transcribing the same sound, either way is acceptable. We are not requiring that you memorize the symbols; we will provide phonetic charts for the final exam.

**Study Exercise #35**

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 #35**

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 [sɪŋ] instead)
22. [ˈlɪn]
23. [ˈwɪn]
24. [ˈɪm]
25. [ˈjɪŋ] (many speakers say [jɪŋ] instead)
26. [ˈbʊt]
27. [ˈbʊk]
28. [ˈbaʊt]
29. [ˈbɪt]
30. [ˈkæt]
31. [ˈbɪt]
32. [ˈbʊt]
33. [ˈkæt]

34. ['bæt]
35. ['bɪt]
36. ['fʊt]
37. ['beɪt]
38. ['æbət]
39. ['baʊt]
40. ['bet]
41. ['bʌt]
42. ['bɒt]
43. ['bæt]
44. ['faðə]
45. ['baɪt]
46. ['baʊt]
47. ['kɔɪt]
48. ['bɜːt]
49. ['dɪfə]
50. [dɪˈfə]
51. [pəˈmɪt]
52. ['pəˌmɪt] (some speakers have initial stress for this word)
53. ['pɑp]
54. ['tʌt]
55. ['kɪk]
56. ['bʌb]
57. ['dæd]
58. ['gæg]
59. ['faɪf]
60. ['θɪn]
61. ['sɪs]
62. ['ʃu]
63. ['hi]
64. ['væt]
65. ['ðau]
66. ['zu]
67. ['eɪzə]
68. ['tʃəʃ]



69. ['dʒʌdʒ]
70. ['mʌm]
71. ['nʌn]
72. ['jʌŋ]
73. ['juθ]
74. ['wɪtʃ]
75. ['tɔɪ]
76. ['dʒʊnəpəʃ]
77. ['wɪʃ]
78. ['pəʒən]
79. ['θætʃə]
80. ['jʌt]
81. ['kwɛstʃən]
82. ['tɛnθ]
83. ['ʌðə]
84. ['fæloʊ]
85. ['bɛltʃ]
86. ['mjuzɪk]
87. ['lætʃt]
88. ['bleɪdz]
89. ['fɪŋgə] (some speakers have ['fɪŋgəʃ])
90. ['sɪŋə] (some speakers have ['sɪŋgəʃ])
91. ['juʒ]
92. ['fjuʒ]
93. [spɛk'tækjʊlə]
94. [spɛk'tækjələ]
95. ['tɛksəs]
96. [ɪg'zækt]
97. ['iθə]
98. ['bɪʌðə]
99. ['fɪt]
100. ['fɪt]
101. ['fiət]
102. ['lʊk]
103. ['lʊk]

104. ['lʊək]  
105. ['ðaɪ]  
106. ['θaɪ]  
107. ['ɪaɪrə]  
108. ['ɪaɪrə]  
109. ['kət]  
110. ['kɑt]  
111. ['ʔʌʔou]  
112. (misnumbered, no word here)  
113. (misnumbered, no word here)  
114. ['ɪɔɪ]  
115. ['deɪrə]  
116. ['θɪn]  
117. ['ðɛn] (some speakers have [ðɪn])  
118. ['ʃu]  
119. ['vɪʃən]  
120. ['tʃəʃ]  
121. ['dʒʌdʒ]  
122. ['jɪɪ] (some speakers have ['jiɪ])  
123. ['lɔ] (some speakers have ['lɑ] for this word)  
124. ['lɑ]  
125. ['kət] (some speakers have ['kɑt] for this word)  
126. ['kɑt]  
127. ['pəli] (some speakers have ['pali] for this word)  
128. ['pali]  
129. ['bɔɪ]  
130. [tə'meɪrou]  
131. [ə'meɪəkə] (some speakers have [ə'meɪɪkə] for this word)  
132. [kə'nɛrəkət]  
133. ['bæd]  
134. ['ɪaɪd]  
135. ['bɔɪ]  
136. ['haʊ]  
137. ['tɪkəl]  
138. ['bʌtɪ]

## 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>

You'll get some practice transcribing words in this week's sections. 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 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.

<i>feet</i>	[fit]	
<i>fit</i>	[fɪt]	Clues: [ɪ] shorter than [i]. Spoken slowly, [ɪ] becomes [ɪə].
<i>Luke</i>	[luke]	
<i>look</i>	[lʊk]	Clues: [ʊ] shorter than [u]. Spoken slowly, [ʊ] becomes [ʊə].
<i>thy</i>	[ðai]	
<i>die</i>	[daɪ]	Clue: sit up close and lip-read. [ð] usually has tongue protrusion.
<i>writer</i>	[ɹaɪtə]	
<i>rider</i>	[ɹaɪdə]	Clue: [aɪ] has more jaw lowering.

*caught* [kɒt]

*cot* [kɑt]

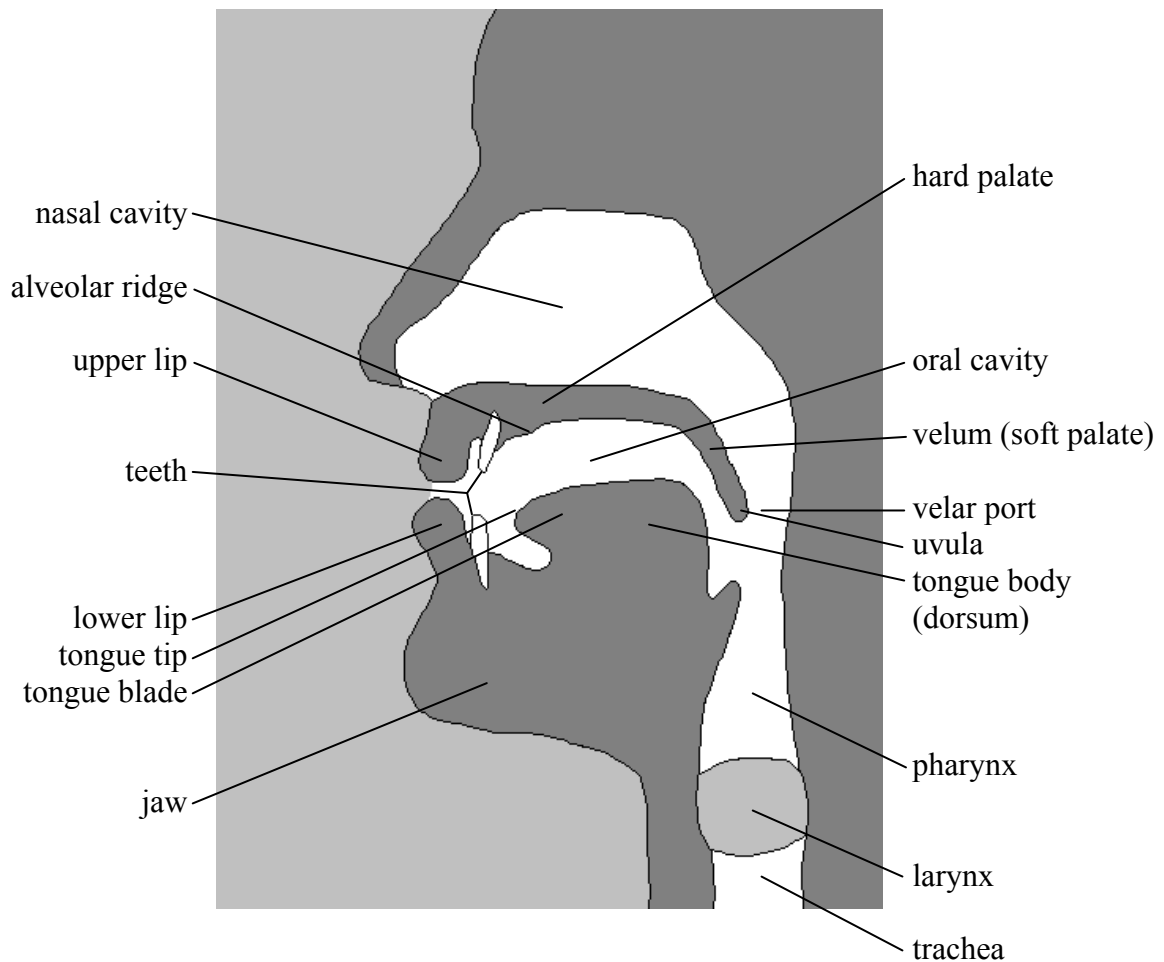
Clue: [ɑ] has a fish-like lip-rounding gesture.

## 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 retroflex click or a bilabial trill (demonstrations). Any one language uses only a fairly small inventory of speech sounds.


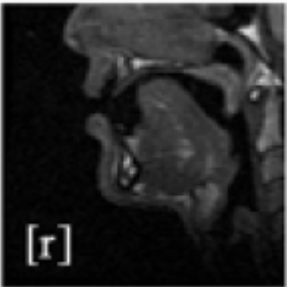
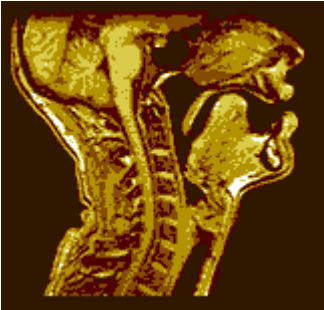
### 8. Vocal tract anatomy

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:



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 fully safe examination of living subjects, with images like the following:

	American English [l]
	American English [ɹ]
	A evidently nasalized [ɪ̃], showing more of the head and neck <sup>105</sup>

<sup>105</sup> First two images: from [www.linguistics.ubc.ca/isrl/Gick\\_Whalen\\_Kang\(SPS5\)](http://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 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 highly visible flange up front. The round main section is extremely mobile and flexible, and can move in all directions. The parts of the tongue that we will refer to are the **tip** (or **apex**), the **blade** (= the forward flange), and the **body** (the main rounded part).

I will now discuss 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 off 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 sound 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.

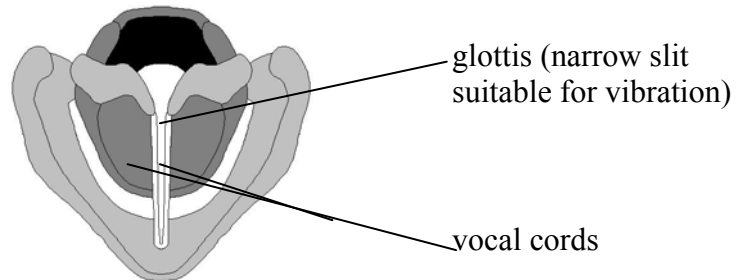
### 8.2 *The larynx*

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**.<sup>106</sup> 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**.

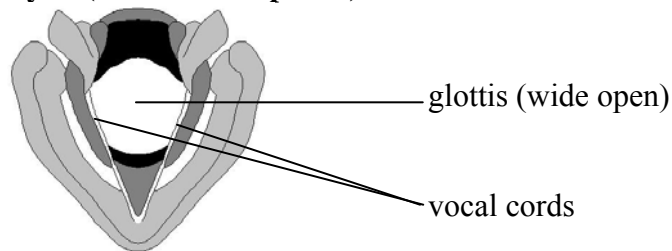
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<sup>106</sup> Not: chords.

**Larynx with vocal cords in position to vibrate:**



**Open larynx (vocal cords spread):**



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**. This is the sound that begins each syllable of the expression “uh-oh” [ʔʌʔou]; its IPA symbol is [ʔ]. (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.<sup>107</sup> 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.

<sup>107</sup> For a moving image of the vocal tract, consult [http://www.speech.kth.se/~olov/Bilder/MRIs\\_2D.gif](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.

### 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

(Keywords:)	[p] <i>pop</i>	[t] <i>tot</i>	[k] <i>kick</i>
	[b] <i>Bob</i>	[d] <i>Dad</i>	[g] <i>gag</i>

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] <i>fife</i>	[θ] <i>thin</i>	[s] <i>Sis</i>	[ʃ] <i>shoe</i>	[h] <i>he</i>
[v] <i>vat</i>	[ð] <i>thou</i>	[z] <i>zoo</i>	[ʒ] <i>Asia</i>	

(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*<sup>108</sup>
- [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.

(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 very 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 nasal [n], and an alveolar lateral liquid [l]. All these phonetic symbols correspond to English spelling.

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<sup>108</sup> A small number of American English speakers have an additional central approximant, [ɻ], which is a voiceless version of [w]. It occurs in words spelled with *wh*, like *which*.

(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 Consonant chart

The consonants can be depicted arranged by place, manner, and voicing, as follows:

		Bilabial	Labio-dental	Dental	Alveolar	Palato-alveolar	Palatal	Velar	Glottal
Stops	voiceless	/p/ <u>p</u> in			/t/ <u>t</u> in			/k/ <u>k</u> in	
		/b/ <u>b</u> in			/d/ <u>d</u> in			/g/ <u>g</u> ill	
	voiced								
Affricates	voiceless					/tʃ/ <u>ch</u> in			
						/dʒ/ <u>g</u> in			
	voiced								
Fricatives	voiceless		/f/ <u>f</u> in	/θ/ <u>th</u> in	/s/ <u>s</u> in	/ʃ/ <u>sh</u> in			/h/ <u>h</u> ymn
			/v/ <u>v</u> im	/ð/ <u>th</u> is	/z/ <u>z</u> ip	/ʒ/ vi <u>si</u> on			
	voiced								
Tap					[ɾ] da <u>t</u> a				
Nasals		/m/ <u>m</u> itt			/n/ <u>n</u> ip			/ŋ/ <u>ng</u>	
Approximants	lateral				/l/ <u>L</u> ynn				
	central	/w/ <u>w</u> in			/ɹ/ <u>r</u> im		/j/ <u>y</u> ing		

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).

## 10. Describing vowels

Vowels differ from consonants in that they do not have real “places of articulation”, that is to say, points of severe 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 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.<sup>109</sup> 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 forward than the high back vowels, owing to the space available for tongue movement. Because

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<sup>109</sup> A more refined classification recognizes **central** vowels; neither front nor back. Here it will suffice to have just two degrees of backness.

of this, the chart should be interpreted as saying “relatively more front” or “relatively more high” rather than specifying actual physical tongue positions.

	Front Unrounded	Back		Diphthongs
		Unrounded	Rounded	
Upper tense	/i/ b <u>e</u> at		/u/ b <u>oo</u> t	/aɪ/, /aʊ/, /ɔɪ/ b <u>i</u> te, b <u>ou</u> t, C <u>oi</u> t
Lower nontense	/ɪ/ b <u>i</u> t		/ʊ/ f <u>oo</u> t	
Upper tense	/eɪ/ b <u>a</u> it	/ə/ abb <u>o</u> t	/oʊ/ b <u>oa</u> t	Rhotacized upper mid back unrounded: /ɝ/ B <u>er</u> t
Lower nontense	/ɛ/ b <u>e</u> t	/ʌ/ b <u>u</u> t	/ɔ/ b <u>ou</u> ght	
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 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

law    ['lɔ]    la    ['lɑ]  
 caught    ['kɔt]    cot    ['kat]  
 Pauley    ['pɔli]    Polly    ['pali]

#### New dialect<sup>110</sup>

law, la    ['lɑ]  
 caught, cot    ['kat]  
 Pauley, Polly    ['pali]

Speakers who don’t have an [ɔ] as a separate sound do usually have it as part of diphthong, as in [ɔɪ] *boy*; see section 310 below.

(2) Many Americans have a high central rounded vowel, IPA [ɯ], instead of [u].

<sup>110</sup> 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:

tom <u>a</u> to	[tə'meɪrou]
Amer <u>i</u> ca	[ə'meɪəkə]
Connect <u>i</u> cut	[kə'neɪəkət]

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 [ɜ̃]

[ɜ̃], 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 [ɜ̃] is classified as a rhotacized upper mid central unrounded vowel.

### 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 [ɜ̃].

### 10.9 Diphthongs

A *diphthong* (note the spelling) is a sequence of the form *vowel+glide* that functions as a single sound. English has numerous diphthongs. The three most obvious ones are [aɪ], which appears in *ride*; [ɔɪ], which appears in *boy*; and [aʊ], 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 [̩] underneath the symbol for the appropriate consonant. The following transcriptions illustrate this:

tickle    ['tɪkəl]  
 button    ['bʌtn̩]

## FEATURES

### 11. Features

We will shortly shift from phonetics to phonology. This involves writing rules; and to write rules, it is useful to have a compact and clear formalism. The formalism used to refer to speech sounds in phonology is to use **phonetic features**. These are rather like the morphosyntactic features we used for inflectional morphology (for example, [Case:Accusative]), but they refer here to phonetic rather than grammatical properties. Informally, 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. The features jointly define this sound.

Phonetic 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].<sup>111</sup> As with morphological features, brackets are normally placed around the feature names.

### 12. A feature set

We will use the following features in doing phonology; each should be assumed to take the values plus or minus:

[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]

Some comments on these features:

**[syllabic]** distinguishes vowels (and syllabic consonants like [l] and [ŋ]; see above) from consonants; the vowels are [+syllabic], the consonants [–syllabic].

---

<sup>111</sup> If we were to be consistent, we would write [High:Plus, Tense:Plus, Round:Minus, Nasal:Minus, Back:Minus], but no linguist ever writes phonological features in this way.

[tense] is a feature of vowels, corresponding to what is sometimes taught in school as “long”. The vowels [i], [e], [æ] [ʌ], [u] 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 logical impossibility.)

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]: see p. 316 below.
- [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.



## Consonants

		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]
p	-	+	-	-	-	-	-		-				-				+	-	-	-	-	-	-	-	
t	-	+	-	-	-	-	-		-				-				-	-	+	-	-	-	-	-	
k	-	+	-	-	-	-	-		-				-				-	-	-	-	+	-	-	-	
b	-	+	-	-	-	-	+		-				-				+	-	-	-	-	-	-	-	
d	-	+	-	-	-	-	+		-				-				-	-	+	-	-	-	-	-	
g	-	+	-	-	-	-	+		-				-				-	-	-	-	-	+	-	-	
tʃ	-	-	+	-	-	-	-		-				-				-	-	-	+	-	-	-	-	
dʒ	-	-	+	-	-	-	+		-				-				-	-	-	+	-	-	-	-	
f	-	-	-	+	-	-	-		-				-				-	+	-	-	-	-	-	-	
θ	-	-	-	+	-	-	-		-				-				-	-	+	-	-	-	-	-	
s	-	-	-	+	-	-	-		-				-				-	-	+	-	-	-	-	-	
ʃ	-	-	-	+	-	-	-		-				-				-	-	-	+	-	-	-	-	
h	-	-	-	+	-	-	-		-				-				-	-	-	-	-	+	-	-	
v	-	-	-	+	-	-	+		-				-				-	+	-	-	-	-	-	-	
ð	-	-	-	+	-	-	+		-				-				-	+	-	-	-	-	-	-	
z	-	-	-	+	-	-	+		-				-				-	-	+	-	-	-	-	-	
ʒ	-	-	-	+	-	-	+		-				-				-	-	-	+	-	-	-	-	
m	-	-	-	-	-	-	+		+				-				+	-	-	-	-	-	-	-	
n	-	-	-	-	-	-	+		+				-				-	-	+	-	-	-	-	-	
ŋ	-	-	-	-	-	-	+		+				-				-	-	-	-	+	-	-	-	
l	-	-	-	-	+	-	+		-				-				-	-	+	-	-	-	-	+	
ɹ	-	-	-	-	+	-	+		-				-				-	-	-	+	-	-	-	-	
j	-	-	-	-	-	+	+		-				-				-	-	-	-	+	-	-	-	
w	-	-	-	-	-	+	+		-				+				-	-	-	-	-	-	-	-	

## Vowels

	Manner of articulation features						Laryngeal features		Features mostly for vowels						Place of articulation features									
	[stop]	[affricate]	[fricative]	[liquid]	[glide]	[voiced]			[aspirated]	[nasal]	[high]	[low]	[back]	[round]	[tense]	[stressed]	[bilabial]	[labiodental]	[dental]	[alveolar]	[palato-alveolar]	[palatal]	[velar]	[glottal]
i	+	-	-	-	-	+		-	+	-	-	-	+		-	-	-	-	-	-	-	-	-	
ɪ	+	-	-	-	-	+		-	+	-	-	-	-		-	-	-	-	-	-	-	-	-	
eɪ	+	-	-	-	-	+		-	-	-	-	-	+		-	-	-	-	-	-	-	-	-	
ɛ	+	-	-	-	-	+		-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	
æ	+	-	-	-	-	+		-	-	+	-	-	-		-	-	-	-	-	-	-	-	-	
u	+	-	-	-	-	+		-	+	-	+	+	+		-	-	-	-	-	-	-	-	-	
ʊ	+	-	-	-	-	+		-	+	-	+	+	-		-	-	-	-	-	-	-	-	-	
oʊ	+	-	-	-	-	+		-	-	-	+	+	+		-	-	-	-	-	-	-	-	-	
ɔ	+	-	-	-	-	+		-	-	-	+	+	+		-	-	-	-	-	-	-	-	-	
ʌ	+	-	-	-	-	+		-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	
ə	+	-	-	-	-	+		-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	
ø	+	-	-	-	-	+		-	-	-	+	-	+		-	-	-	-	+	-	-	-	-	
ɑ	+	-	-	-	-	+		-	-	-	+	-	+		-	-	-	-	-	-	-	-	-	

### 13.1 Description of sounds using their features

The features allow us to describe a segment phonetically in a compact notation, called a **feature matrix**. For example, the vowel [i] is expressed in features as follows:

+	syllabic
-	back
+	high
-	low
+	tense
-	round
-	nasal

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

[-back +high +tense]
----------------------------

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 has no front rounded vowels. [-nasal] is not needed, since English has no nasalized vowels.

**Study Exercise #36**

Using the features above, describe the sounds [tʃ] and [ŋ] in the same way that [i] was described, that is, enough to distinguish them from other sounds of English.

**Answer to Study Exercise #36**

[tʃ]:	$\begin{bmatrix} -\text{voiced} \\ +\text{affricate} \end{bmatrix}$
[n]:	$\begin{bmatrix} +\text{nasal} \\ +\text{alveolar} \end{bmatrix}$

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,l,r] 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.

Why does this matter? It will matter when we move on to phonology—the phonological rules treat whole classes of sound in parallel. To give an example, English aspirates (adds puff of breath) to the sound [p] when it is in word-initial position: *pin* is [p<sup>h</sup>m], whereas *spin*, with medial [p], has unaspirated [p]: [spɪn].<sup>112</sup> This pattern is replicated with the other voiceless stops: *till* is [t<sup>h</sup>ɪl], *still* is [stɪl]; *kin* is [k<sup>h</sup>ɪn], *skin* is [skɪn]. Thus, the overall pattern is to aspirate the entire class of voiceless stops, or in features [+stop, −voice]. This use of features will appear repeatedly in the next chapter.

**Study Exercise #37**

If you wanted to characterize the following set of sounds in English:

- a. [u,ɪ] b. [i,ɪ,eɪ,ɛ,æ] c. [v, ð, z, ʒ] d. [w, u, ʊ, ou, 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.

<sup>112</sup> An easy way to detect this is to pronounce *pin* and *spin* with fingertips in front of your lips, thus detecting the aspiration.

**Answer to Study Exercise #37**

a. [u,i]	[+high +tense]
b. [i, ɪ, eɪ, ε, æ]	[−back]
c. [v, ð, z, ʒ]	[+voiced +fricative]
d. [w, u, ʊ, ou, 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 #38**

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 starting on p. 313 above.

- a. [d, n, z, l]
- b. [l]
- c. [w]
- d. [h]
- e. [æ, ɑ]
- f. [eɪ, ε, ou, ɔ, ʌ, ə]
- g. [ε, ʌ, æ]
- h. [ε, ʌ]
- i. [æ, ɪ, ʊ, eɪ, ε, ou, ɔ, ə, 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 #38**

- 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]

## 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.”

There are two basic phenomena that arise in such a grammar. First, the speech sounds of a language all vary by their context; in phonology we find the pattern of this variation (which is generally quite systematic) and characterize it with rules. Second, in morphological paradigms (Chapter 2), we often find that one sound is replaced by another in a particular context; such replacements are also describable with rules.

We will first cover the contextual variation of speech sounds.

### 2. Phonemes

The most basic and obvious principle of phonology is the following:

#### **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:

## 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/ <sup>113</sup> Lynn				
						/ɹ/ rip			
[+glide]	[+voice]	/w/ <sup>114</sup> win					/j/ yet		

<sup>113</sup> /l/ is also distinct from /ɹ/ in being [+lateral]; air moves around sides of tongue.

<sup>114</sup> “bilabial” is an approximation for /w/; the feature chart from last time uses the vowel features [+round, +high, +back].



## Vowels

		[−back −round]	[+back −round]	[+back +round]
[+high −low]	[+tense]	/i/ beat		/u/ boot
	[−tense]	/ɪ/ bit		/ʊ/ foot
[−high −low]	[+tense]	/eɪ/ bait	/ə/ abb <u>o</u> t	/oʊ/ boat
	[−tense]	/ɛ/ bet	/ʌ/ but	/ɔ/ <sup>115</sup> bought
[−high +low]	[+tense]		/ɑ/ father	
	[−tense]	/æ/ bat		

Can't fit on chart: rhotacized schwa /ɝ/<sup>116</sup>

Three diphthongs: /aɪ/, /aʊ/, /ɔɪ/<sup>117</sup>

All the words of English (in the relevant dialect) are made up of *these sounds and no others*. Thus you can recognize that ['bɹɪk] could be English and that ['q'əʃɹɪ] could not, even if you have never heard either word before. In analysis, we seek a phoneme inventory that is large enough to encompass the target language, and 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, 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.)

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

<sup>115</sup> Dialectal; many speakers use /ɑ/ in all of the words that (for speakers who have this vowel) have /ɔ/.

<sup>116</sup> Treated as bearing a consonant feature, [+palato-alveolar] (tongue blade is up, unlike in any other vowel).

<sup>117</sup> Features for diphthongs: one approach is to treat them as vowel sequences, assigning features to each vowel.

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.<sup>118</sup>

### 3. Allophones, phonemes, and rules

A second principle, which will be the basis of much of the analyses to follow, is the Allophonic Principle:

#### **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.<sup>119</sup> One variant is simply the plain alveolar central approximant [ɹ], already discussed. However, many instances of this phoneme are pronounced as [ɹ<sup>w</sup>], 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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<sup>118</sup> 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.

<sup>119</sup> 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.

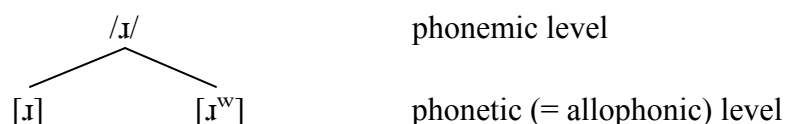
<i>real</i>	[ <sup>l</sup> ɪ <sup>w</sup> ɪl]	<i>par</i>	[ <sup>l</sup> pɑr]
<i>write</i>	[ <sup>l</sup> ɪ <sup>w</sup> aɪt]	<i>core</i>	[ <sup>l</sup> koɪ]
<i>rope</i>	[ <sup>l</sup> ɪ <sup>w</sup> oʊp]	<i>ear</i>	[ <sup>l</sup> iɪ]
<i>reveal</i>	[ɪ <sup>w</sup> ə <sup>l</sup> vil]	<i>part</i>	[ <sup>l</sup> pɑrt]
<i>arrange</i>	[ə <sup>l</sup> ɪ <sup>w</sup> eɪndʒ]	<i>bear</i>	[ <sup>l</sup> bɛɪ]
<i>apparition</i>	[æpə <sup>l</sup> ɪ <sup>w</sup> ɪʃən]	<i>lure</i>	[ <sup>l</sup> luɪ]
<i>carry</i>	[ <sup>l</sup> keɪ <sup>w</sup> i]	<i>forming</i>	[ <sup>l</sup> fɔɪmɪŋ]
<i>era</i>	[ <sup>l</sup> eɪ <sup>w</sup> ə]	<i>tornado</i>	[toɪ <sup>l</sup> neɪrou]
<i>Erie</i>	[ <sup>l</sup> iɪ <sup>w</sup> i]		

Plainly, some words have [ɪ<sup>w</sup>] and some have [ɪ], but the data are not haphazard. Looking at the examples, it should be apparent that

[ɪ<sup>w</sup>] occurs only before a vowel

[ɪ] occurs elsewhere; that is, before a consonant or pause

The idea, then, is that at some abstract level, [ɪ<sup>w</sup>] and [ɪ] belong to the *same category*—they are predictable variants of the same fundamental sound. A diagram suggesting this idea is:



This fundamental sound designated as /ɪ/ is a **phoneme** of English. Phonemes are normally placed in slant brackets to distinguish them from ordinary phonetic transcription. The sounds [ɪ] and [ɪ<sup>w</sup>] are said to be the **allophones** of /ɪ/.

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 [ɪ<sup>w</sup>] and [ɪ] in this list of sounds. The distinction between the two is redundant (predictable)—thus it is far more sensible to include just /ɪ/ in our list of sounds, and let the distinction between [ɪ<sup>w</sup>] and [ɪ] 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

We can produce a systematic phonological analysis of languages by using the same method of **rules** and **derivations** we have been using for morphology, syntax and semantics.

The idea is to begin the derivation with each word consisting solely of its phonemes, then use phonological rules to derive the details; that is, the particular allophones in particular environments. The phonological rules most often 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 word has a **phonemic representation**, defined as follows:

The **phonemic representation** of a word is the string of phonemes from which it is formed.

For example, the phonemic representation of *real* (phonetically [ˈɹiːl]) is /ˈɹiːl/. The phonemic representation of *par* (phonetically [ˈpɑːr]) is /ˈpɑːr/.

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:

##### /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

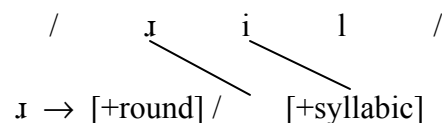
“If the sound ɹ occurs in the environment before a [+syllabic] sound, change its features so that it is [+round].”

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*.

/ɪl/	underlying representation
ɪ <sup>w</sup>	/ɪ/ Rounding
[ɪ <sup>w</sup> il]	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: /ɪ/ Rounding matches up to /ɪl/ as follows:



That is, the position where /ɪ/ occurs is immediately followed in the form /ɪl/ by the phoneme /i/, which, being a vowel, is [+syllabic]. When we change the feature values of /ɪ/ so that its former value of [−round] is altered to [+round], that is the formal way of indicating that the plain /ɪ/ has been converted to a labialized [ɪ<sup>w</sup>].

The word *par* has a quite trivial derivation, since /ɪ/ Rounding cannot apply to it (there is no following [+syllabic] sound). The non-effect of inapplicable rules is shown in a derivation with a long dash:

/paɪ/	underlying representation
—	/ɪ/ Rounding
[paɪ]	surface representation

Such cases *should* be shown, because it is assumed that all words are submitted to all rules, like objects passing down an assembly line.

The allophone [ɪ] 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 /ɪ/, you get [ɪ<sup>w</sup>] before a vowel and [ɪ] elsewhere.

The analysis just given makes an important claim: although English has two [ɪ]-like sounds at the phonetic level, there is a more abstract analytical level at which it has just one, namely the phoneme /ɪ/: we don’t need both [ɪ] and [ɪ<sup>w</sup>] to characterize the pronunciation of English words; having /ɪ/ plus the rule of /ɪ/ Rounding suffices.

## 5. Practical uses of phonemes

Here are practical uses of phonemes.

First, ambitious 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.<sup>120</sup>

**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 it possible for the spelling to specify, in principle, all aspects of the pronunciation of a word, without including any additional redundant information. Alphabet design is in fact 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

<i>real</i>	*[ <sup>l</sup> .ɹil]
<i>write</i>	*[ <sup>l</sup> .ɹaɪt]
<i>rope</i>	*[ <sup>l</sup> .ɹoʊp]

leaving out the labialization, it doesn't right (intuitively: “not enough like an r”); and likewise if I say

<i>par</i>	*[ <sup>l</sup> pɑɹ <sup>w</sup> ]
<i>core</i>	*[ <sup>l</sup> kɔɹ <sup>w</sup> ]
<i>ear</i>	*[ <sup>l</sup> iɹ <sup>w</sup> ]

it sounds quite peculiar indeed (intuitively: “adding a *w* where it doesn't belong”).

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<sup>120</sup> 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.

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. \*['ɪɪl] is ungrammatical because the speaker has neglected to apply /ɪ/ Rounding where it should be applied; \*['pɑɪ<sup>w</sup>] is ungrammatical because (one might say) /ɪ/ Rounding has been applied in the wrong context.<sup>121</sup>

## 7. Features and natural classes

The rule of /ɪ/ Rounding just covered 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**:

- A **natural class** is the complete set of speech sounds from a particular language characterized by a set of one or more features.

Here are examples of allophonic rules of English that apply to natural classes.

### Aspiration

$$\left[ \begin{array}{l} +\text{stop} \\ -\text{voice} \end{array} \right] \rightarrow [+ \text{aspirated}] / [\text{word} \text{ \_\_\_\_\_\_}]$$

“Voiceless stops become aspirated word-initially.”

Derivations:

<i>pit</i>	<i>spit</i>	<i>top</i>	<i>stop</i>	<i>kick</i>	<i>Scot</i>	
/pɪt/	/spɪt/	/tɒp/	/stɒp/	/kɪk/	/skɒt/	underlying representation
p <sup>h</sup>	—	t <sup>h</sup>	—	k <sup>h</sup>	—	Aspiration
[p <sup>h</sup> ɪt]	[spɪt]	[t <sup>h</sup> ɒp]	[stɒp]	[k <sup>h</sup> ɪk]	[skɒt]	surface representation

Note the parallel shift, /p t k/ → [p<sup>h</sup> t<sup>h</sup> k<sup>h</sup>]. 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 chart on p. 313).

<sup>121</sup> There are other aspects to “sayability” in phonology—notably legal phoneme orders—that we won’t have time to cover.

### Vowel Nasalization

[+syllabic] → [+nasal] / \_\_\_\_ [+nasal]

“A vowel becomes nasalized when it precedes a nasal sound.”

<i>bun</i>	<i>bud</i>	<i>doom</i>	<i>do</i>	<i>sing</i>	<i>sit</i>	
/bʌn/	/bʌd/	/dum/	/du/	/sɪŋ/	/sɪt/	underlying representation
ã	—	ũ	—	ĩ	—	Vowel Nasalization
[bãn]	[bʌd]	[dũm]	[du]	[sĩŋ]	[sɪt]	surface representation

Examples are given here for three vowels only, but all the others would work the same.

#### Study Exercise #39

Demonstrate that Vowel Nasalization can apply to /ə/, using a close pair similar to *bun* / *bud*. Include a derivation in the same format as above.



**Answer to Study Exercise #39**

Possible cases are *burn/bird*, *turn/turd*, *kern/curd*. If you don't insist on near-identity, there are many more. Derivations for *burn/bird*:

<i>burn</i>	<i>bird</i>	
/bɜ̃n/	/bɜ̃d/	underlying representation
ɜ̃	—	Vowel Nasalization
[bɜ̃n]	[bʌd]	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  $i\ u\ ɪ\ ʊ \rightarrow \tilde{i}\ \tilde{u}\ \tilde{i}\ \tilde{u}$ . The left side of the rule can be just [+high], because in the feature system we’re using there are no [+high] consonants.<sup>122</sup> The right side of the rule need only mention [+nasal], since that is all that changes; hence, [+high]  $\rightarrow$  [+nasal].

**Example 2:** suppose in English we want  $k\ g\ ŋ \rightarrow p\ b\ m$ . 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  $[\widehat{kp}\ \widehat{gb}\ \widehat{\eta m}]$ .<sup>123</sup> If we didn’t change [+velar] to [–velar], we’d end up with one of the “labial-velar” sounds as the incorrect output.

**Example 3:** suppose in English we want  $p\ t\ k \rightarrow m\ n\ ŋ$ . The left side is  $\begin{bmatrix} +\text{stop} \\ -\text{voice} \end{bmatrix}$ , since we don’t want  $b\ d\ g$  to undergo the rule. The right side is  $\begin{bmatrix} +\text{nasal} \\ -\text{stop} \\ +\text{voice} \end{bmatrix}$ , since nasals are nasal, and they aren’t stops, and they are voiced (look at the feature chart, p. 313, to see that these are indeed exactly the three features that need to change).

**Example 4:** suppose in English we want  $ɪ\ ʊ \rightarrow i\ u$ . Let’s do the change first: this clearly has to be  $X \rightarrow [+tense]$ . Now, what is the simplest characterization for X? The answer is

<sup>122</sup> A caution: you may elsewhere encounter feature systems in which certain consonants, such as [j w], are [+high].

<sup>123</sup> 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 /ɪ/ Rounding, p. 324. There is no /ɪ<sup>w</sup>/ phoneme in English, and the closest phoneme compatible with adding [+round] to /ɪ/ is /w/. This works great for describing the phonology of little kids and Elmer Fudd ([ˈkweɪzi ˈwæbrɪ]), but not ordinary adult English.

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.

### Study Exercise #40

Formulate these rules using the features on p. 313. Assume that the inventory of sounds is as in English.

- a. t, d become tʃ, dʒ before j, w.<sup>124</sup>
- b. l becomes ɫ when another l comes before it, separated by a vowel.<sup>125</sup>
- c. i, ɪ become u, ʊ after w.
- d. tʃ, dʒ become ʃ, ʒ between vowels.<sup>126</sup>
- e. v, ð, z, ʒ become f, θ, s, ʃ at the end of a word.<sup>127</sup>
- f. ɪ, ɛ, æ are deleted at the end of a word.
- g. 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}.<sup>128</sup>
- h. u, ʊ become i, ɪ everywhere<sup>129</sup>

<sup>124</sup> This one is more or less real: *get you* ['getʃju], *said you would go* ['sedʒjuwʊd'gou], *twin* [tʃwɪn], *dwelt* [dʒwɜl]. A later rule normally deletes [j] after palato-alveolars, yielding ['getʃu], ['sedʒuʊd'gou].

<sup>125</sup> Based on Latin phonology. This is why we say *nav-al*, but *sol-ar* (words borrowed into English from Latin).

<sup>126</sup> More or less real, as a rule of the vernacular dialect of Italian spoken in Florence.

<sup>127</sup> This is close to being true of English, though it really happens only at the ends of phrases, and the devoicing is sometimes partial.

<sup>128</sup> Not unlike a phonological rule of Japanese.

<sup>129</sup> A change that was once a phonological rule in Yiddish.

**Answers to Study Exercise #40**

$$a. \begin{bmatrix} +\text{stop} \\ +\text{alveolar} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{affricate} \\ -\text{stop} \\ +\text{palato-alveolar} \\ -\text{alveolar} \end{bmatrix} / \text{ \_\_\_\_\_\_ } [+ \text{glide}]$$

$$b. [+ \text{lateral}] \rightarrow \begin{bmatrix} -\text{lateral} \\ +\text{palato-alveolar} \\ -\text{alveolar} \end{bmatrix} / [+ \text{lateral}][+ \text{syllabic}] \text{ \_\_\_\_\_\_ }$$

$$c. [+ \text{high}] \rightarrow \begin{bmatrix} +\text{back} \\ +\text{round} \end{bmatrix} / \begin{bmatrix} +\text{glide} \\ +\text{round} \end{bmatrix} \text{ \_\_\_\_\_\_ }$$

$$d. [+ \text{affricate}] \rightarrow \begin{bmatrix} +\text{fricative} \\ -\text{affricate} \end{bmatrix} / [+ \text{syllabic}] \text{ \_\_\_\_\_\_ } [+ \text{syllabic}]$$

$$e. [+ \text{fricative}] \rightarrow [- \text{voice}] / \text{ \_\_\_\_\_\_ } ]_{\text{word}} \quad \text{Note the use of vacuous application (to [f, \theta, s, \text{ʃ}]) to simplify the rule.}$$

$$f. \begin{bmatrix} +\text{syllabic} \\ -\text{back} \\ -\text{tense} \end{bmatrix} \rightarrow \emptyset / \text{ \_\_\_\_\_\_ } ]_{\text{word}}$$

$$g. \begin{bmatrix} +\text{high} \\ -\text{tense} \end{bmatrix} \rightarrow [- \text{voice}] / [- \text{voice}] \text{ \_\_\_\_\_\_ } [- \text{voice}]$$

$$h. [+ \text{high}] \rightarrow \begin{bmatrix} +\text{back} \\ +\text{round} \end{bmatrix} \quad \text{Note the use of vacuous application (to [f, \theta, s, \text{ʃ}]) to simplify the rule.}$$

## 9. Phonemic analysis by the method of local environments

English phonemic analysis 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, the crucial point being that sounds that are mere allophones in English are phonemes in other languages, and vice versa. The important analytic procedure is the working out of each language's phonemic system in its own terms.

There is a fairly well-worked out method (about 80 years old) for working out phonemes from data; it doesn't cover all cases, but is effective in quite a few, assuming the transcriptions you feed it are accurate. The method has no official name, but I will call it the “method of local environments” here.

I'll work through the method with some data from an Australian aboriginal language, Yidjɪn ([ɲ] is IPA for the palatal nasal, like Spanish “ñ”). Yidjɪn is probably no longer spoken, though there may be a few aborigines alive today who remember a few words. The fieldwork on Yidjɪn was done in the 1960's and 70's by Prof. Robert M. W. Dixon of the Australian National University.

The data below are somewhat idealized, constructed from Dixon's lexicon following his description of the facts.

First, the non-English IPA symbols needed:

- [ɲ] is a voiced palatal stop —same place of articulation as [j], but full closure.
- [ɲ] is a palatal nasal, as noted above
- [:] indicates that the preceding vowel is long
- [ɭ] is an [l] with the tongue body backed—in IPA terminology, **velarized**. English in fact uses such an [l] at the end of words, as in *call* ['kɔɭ]. In English, [ɭ] is an allophone of /l/.
- [r] is a trilled r
- [ɻ] is a retroflex central approximant, with tongue tip curled up and back<sup>130</sup>

The following are consonant and vowel charts for Yidjɪn. These are not just a casual review—consulting the chart is actually a good procedure to follow when you are discovering the rule environments.

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<sup>130</sup> Many English speakers use this kind of r, rather than the (more common) /ɹ/.

**Consonants**

	Bilabial	Alveolar	Retroflex	Palatal	Velar
Stops (voiced)	b	d		ʃ	g
Nasals	m	n		ɲ	ŋ
Liquids nonlateral		r	ɭ		
Lateral		l			
Lateral velarized		ɭ			
Glides	w			j	

**Vowels**

	Front Unrounded	Back Unrounded	Back Rounded
High tense	i, i:		u, u:
High lax	ɪ		ʊ, ʊ:
Low		a, a:	

We won't approach the language from scratch (as Dixon had to!), but will focus our efforts on some particular target sounds. Here are the data:

1. [ʃumba:ɡɪ] 'tobacco'
2. [ɲawu:ʃɔ] 'salt-water turtle'
3. [ɡuʔa:ɭ] 'big-leafed fig tree'
4. [ɲuɲɔ:r] 'initiated man'
5. [dugu:biɭ] 'bark bag'
6. [muɲʃɔ:ɭ] 'plenty'
7. [wigilwigil] 'sweet'
8. [ʃambu:ʔ] 'two'
9. [ʃɔʔɲu:ʔ] 'waterfall'
10. [ɡabu:ʔ] 'stick for carrying fish'
11. [wurgu:ʔ] 'pelican'
12. [babu:ʃɔ] (can't find gloss)
13. [ɡuʔɡɪ] 'sand, sugar'
14. [magu:ʔ] 'a root vegetable'
15. [muʔpa:rɪ] 'blanket'
16. [ɲumbu:bu] 'new-born baby'

17. [ʃoʃoʃuŋguɬ] 'noise of snake sliding through grass'
18. [ʃuga:bal] 'house frame'
19. [ʃuwar] 'wattle tree'
20. [ʃodu:ɬu] 'brown pigeon'
21. [duɬnbi:laj] 'white cedar'
22. [ʃimu:r] 'large house'
23. [gunbu:ɬ] 'billy-can'
24. [guɬa:n] 'walnut tree'
25. [ʃuŋgu:ɬ] 'Torres Straits pigeon'
26. [muga:ɬu] 'fish net'
27. [wi:ɬu:ɬ] 'shellfish species'
28. [wuɬmbu:ɬ] 'leafy broom'
29. [ʃori:n] 'leech'
30. [ʃundu:ba] 'you-nom. sing'
31. [guʃu] 'tree vine species'
32. [wuɬmbu:ɬ] 'leafy broom'
33. [ʃuɬugunu] 'black myrtle tree'
34. [buɬu:ɬ] 'storytime person'
35. [ɲu:ɬu:ɬ] 'just now'
36. [gugu:ɬu] 'recitative mourning style used by men'
37. [wubu:ɬ] 'lucky'
38. [dalɲudalɲu] 'sound of bell ringing'
39. [dalɔ] 'forehead'
40. [ʃuma:l] 'straight woomera'<sup>131</sup>
41. [ʃilɲgu] 'down'
42. [baŋga:mu] 'English potato'
43. [muɬa:ri] 'initiated man'
44. [gangu:ɬ] 'grey wallaby'
45. [guʃu:n] 'wind'
46. [gaʃu:ɬ] 'dirty (e.g. water)'
47. [buɬgu:ɬ] 'swamp'
48. [ʃuŋgu:m] 'worm'
49. [ʃuɬ] 'sharp, pointed'

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<sup>131</sup> Spear-thrower (<http://www.geocities.com/Athens/Delphi/2970/woomera.htm>)

- 50. [gawu:t] 'blue gum tree'
- 51. [bawu:] 'backbone'
- 52. [gawu:] 'tree species'
- 53. [galbr:] 'catfish'
- 54. [diwr:] 'small ground bee'

Consider first the two sounds [l] and [ɫ]. We **collect local environments** for them by looking up each one in the data, and recording (a) the example number; (b) the preceding sound; (c) the following sound. Here is such a chart for [l]

- 5. i \_\_\_\_
- 7. i \_\_\_\_
- 7. i \_\_\_\_
- 18. a \_\_\_\_
- 21. i: \_\_\_\_ a
- 38. a \_\_\_\_ ŋ
- 38. a \_\_\_\_ ŋ
- 39. a \_\_\_\_ ʊ
- 40. a: \_\_\_\_
- 41. i \_\_\_\_ ŋ

The first item on this chart was obtained by taking the l-containing form

5. [du<sup>l</sup>gu:bi]

replacing l with \_\_\_\_,

5. [du<sup>l</sup>gu:bi \_\_\_\_]

and removing all the material not next to the l:

5. [~~du~~<sup>l</sup>~~gu:bi~~ \_\_\_\_]

The resulting entry, 5. i \_\_\_\_, means “an [l] occurred after [i] and at the end of a word.”

The same procedure yields this list for [ɫ]:



3. u\_\_a
8. u:\_\_\_]
9. ʊ\_\_n
10. u:\_\_\_]
11. u:\_\_\_]
13. u\_\_g
14. u:\_\_\_]
15. u\_\_n
17. u\_\_\_]

20. u:\_\_\_ʊ
21. u\_\_n
23. u:\_\_\_]
24. u\_\_a
25. u:\_\_\_]
27. u:\_\_\_]
28. u\_\_m
32. u\_\_m
33. ʊ\_\_u
34. u\_\_u

35. u:\_\_\_]
36. u:\_\_\_ʊ
37. u:\_\_\_]
43. u\_\_a:
44. u:\_\_\_]
46. ʊ:\_\_\_]
47. u\_\_g
50. u:\_\_\_]

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 [t], which, shown alone, look like this:

3. u\_\_
8. u:\_\_\_
9. ʊ\_\_
10. u:\_\_\_
11. u:\_\_\_
13. u\_\_
14. u:\_\_\_
15. u\_\_
17. u\_\_
20. u:\_\_\_
21. u\_\_
23. u:\_\_\_
24. u\_\_
25. u:\_\_\_
27. u:\_\_\_
28. u\_\_
32. u\_\_
33. ʊ\_\_
34. u\_\_
35. u:\_\_\_
36. u:\_\_\_
37. u:\_\_\_
43. u\_\_
44. u:\_\_\_
46. ʊ:\_\_\_
47. u\_\_

50. u:\_\_\_

which in turn reduces to four cases:

u \_\_\_\_, u: \_\_\_\_, ʊ \_\_\_\_, ʊ: \_\_\_\_

These four cases occupy a specific region of the vowel chart, repeated below:

	Front Unrounded	Back Unrounded	Back Rounded
High tense	i, i:		u, u:
High lax	ɪ		ʊ, ʊ:
Low		a, a:	

This can be characterized very simply as the round vowels.<sup>132</sup> Thus, in our notation, “in the environment, after a round vowel” is stated:

/  $\left[ \begin{array}{c} +\text{syllabic} \\ +\text{round} \end{array} \right]$  \_\_\_\_

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 [ɫ] sound relate to this environment? Combing through the data, we find that there are no cases of [ɫ] in the environment  $\left[ \begin{array}{c} +\text{syllabic} \\ +\text{round} \end{array} \right]$  \_\_\_\_ . Assuming that the data are representative,<sup>133</sup> this gap likewise is something we need to explain.

The phonemic analysis, therefore, would work like this. We assume the phoneme /ɫ/, and write the following rule:

### **/ɫ/ Velarization**

ɫ → [+back] /  $\left[ \begin{array}{c} +\text{syllabic} \\ +\text{round} \end{array} \right]$  \_\_\_\_

*“Realize the /ɫ/ phoneme as back (velarized) when it follows a round vowel.”*

This rule can be illustrated with derivations. To make the illustration clear, we pick one form that is eligible for the rule and one that isn’t:

<sup>132</sup> It’s true that these four vowels are also [+round] and [+high]; we’re going for a terse characterization here; there’s no point in using more features than necessary. Note that [a] and [a:] are central, not back.

<sup>133</sup> And in a teaching context, you should *always* assume this; why would we be trying to deceive you?

10. /ga'bu:l/	5. /du'gu:bi/	phonemic form
ɫ	—	/l/ Velarization
[ga'bu:ɫ]	[du'gu:bi]	phonetic form

As before, the horizontal dash bears the meaning “rule is inapplicable.”

### 9.1 Why does the local-environment method work?

Collecting local environments is, of course, tedious, and some people find they can solve phoneme problems at sight, rather than slogging through all this data processing by hand. However, collecting local environments can certainly 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.

### 9.2 Complementary distribution

Where Yidjɪ [l] occurs, [ɫ] cannot occur. Where Yidjɪ [ɫ] occurs, [l] cannot occur. This pattern is known as **complementary distribution** (one set of environments is the complement of the other). Complementary distribution is a pattern that strongly suggests<sup>134</sup> membership in the same phoneme.

## 10. Demonstrating separate phonemehood: minimal pairs

In many languages (for instance, Italian and Swahili), long vowels are allophones of the their short counterparts. This *might* be true of Yidjɪ, in principle, but the following data show that we needn't pursue this hypothesis very far:

[malan]	‘flat rock’
[mala:n]	‘right hand’
[wuɹu]	‘spear handle’
[wuɹu:]	‘river’ or ‘snake species’ <sup>135</sup>
[guɹil]	‘smell-present tense’

<sup>134</sup> But does not prove it; if we have time I hope to cover cases of complementary distribution that do not prove membership in the same phoneme.

<sup>135</sup> Thus like English *bank*.

[guʃi:l] ‘smell-past tense’

These are so-called **minimal pairs**, defined as two words that differ in just one sound, in the same location. Minimal pairs generally show the existence of separate phonemes.

The idea of a phoneme inventory is that it is the minimal set needed to represent all the words of a language. Yidiñ *malan* and *mala:n* are distinct words, and are identical in the parts *mal...n*, *mal...n*. If /a/ and /a:/ are not separate phonemes, then we can’t represent the difference between these different words; and it follows that /a/ and /a:/ must be separate phonemes.

Generally, phonemic analysis involves the application of both the method of local environments, plus the collection of minimal pairs — together, the two methods will gradually make clear the inventory of phonemes.

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* ‘hand-dative’), in syntax (“Fred stole/killed the chicken from Greeley”), and in semantics (“Alice congratulated her/herself”). Throughout, the idea is to compare utterances that have just one single difference, in order to learn the contribution made by that difference.

## 11. More Yidiñ allophones

The local-environment method for detection of allophones is applied below to [u], [ʊ], [u:], and [u:]:

### 11.1 Environments for [ʊ]

1. j\_\_m
9. j\_\_t
12. j\_\_]
18. j\_\_g
19. j\_\_w
20. j\_\_d
29. j\_\_r
33. j\_\_t
40. j\_\_m
48. j\_\_ŋ
49. j\_\_ɬ
30. ɲ\_\_n
2. j\_\_]
17. j\_\_j

- 17. j\_\_\_ɹ
- 31. j\_\_\_]
- 16. b\_\_\_]
- 20. t\_\_\_]
- 26. ɹ\_\_\_]
- 33. n\_\_\_]
- 36. t\_\_\_]
- 38. ŋ\_\_\_]
- 39. l\_\_\_]
- 41. g\_\_\_]
- 42. m\_\_\_]

### 11.2 Environments for [u]

- 11. w\_\_r
- 13. g\_\_t
- 15. m\_\_t
- 16. ŋ\_\_m
- 17. ɹ\_\_ŋ
- 17. g\_\_t
- 21. d\_\_t
- 23. g\_\_n
- 24. g\_\_t
- 26. m\_\_g
- 28. w\_\_t
- 3. g\_\_t
- 31. g\_\_j
- 32. w\_\_t
- 33. t\_\_g
- 33. g\_\_n
- 34. b\_\_t
- 35. ŋ\_\_ɹ
- 36. g\_\_g
- 37. w\_\_b
- 38. ŋ\_\_d
- 4. ŋ\_\_'n
- 43. m\_\_t
- 45. g\_\_t
- 47. b\_\_t
- 5. d\_\_g
- 6. m\_\_n

This one is a bit harder: you have to notice that there are two environments for [u]: 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.

**Postpalatal Laxing (preliminary)**

$u \rightarrow [-\text{tense}] / \begin{bmatrix} -\text{syllabic} \\ +\text{palatal} \end{bmatrix} \_\_\_$

*“/u/ becomes lax when it follows a palatal consonant.”*

**Final Laxing (preliminary)**

$u \rightarrow [-\text{tense}] / \_\_\_ ]_{\text{word}}$

*“/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.	/jɪlŋgu/	9.	/jʊtŋgu:l/	4.	/bulu:ɫ/	phonemic form
	—		ʊ		—	Postpalatal Laxing
	ɪ		—		—	Final Laxing
	—		ɫ		ɫ	/l/ Velarization
	[jɪlŋɡʊ]		[jʊtŋɡu:ɫ]		[buɫu:ɫ]	phonetic form

**11.3 Environments for [ʊ:] and [u:]**

4.    p\_\_r  
 45   t\_\_n  
 46.   t\_\_t  
 6.    t\_\_ɫ  
 51.   w\_\_]  
 52.   w\_\_]

and

10.   b\_\_t  
 11.   g\_\_t  
 12    b\_\_t  
 14.   g\_\_t  
 16.   b\_\_b  
 2.    w\_\_j  
 20.   d\_\_t  
 22.   m\_\_r  
 23.   b\_\_t

25. g\_\_t  
 27. ɹ\_\_t  
 28. b\_\_ɹ  
 30. d\_\_b  
 32. b\_\_ɹ  
 34. t\_\_ɹ  
 35. ɹ\_\_t  
 36. g\_\_t  
 37. b\_\_t  
 44. g\_\_t  
 47. g\_\_ɹ  
 48. g\_\_m  
 5. g\_\_b  
 50. w\_\_t  
 8. b\_\_t  
 9. g\_\_t

It should be clear that the situation is quite parallel to what we saw with short [u] and [ʊ]: the lax 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, ʊ }. This is another instance of phonological rules applying to natural classes (see section 7 above). Using features to handle this, we restate the rules as follows:

#### Postpalatal Laxing (final version)

$$\begin{bmatrix} +\text{syllabic} \\ +\text{round} \end{bmatrix} \rightarrow [-\text{tense}] / \begin{bmatrix} -\text{syllabic} \\ +\text{palatal} \end{bmatrix} \_\_\_$$

*“Any rounded vowel becomes lax after a palatal consonant.”*

#### Final Laxing (still preliminary)

$$\begin{bmatrix} +\text{syllabic} \\ +\text{round} \end{bmatrix} \rightarrow [-\text{tense}] / \_\_\_ ]_{\text{word}}$$

*“Any rounded vowel becomes lax in final position.”*



The designation  $\begin{bmatrix} +\text{syllabic} \\ +\text{round} \end{bmatrix}$  suffices, in a language like Yidj with a tiny vowel inventory, to designate all and only the vowels of the set { u, u: }. The idea behind the rule is that it changes only the feature [tense], with all other features remaining the same. As a result, /u:/ becomes [u:] and /u/ becomes [u], each retaining their value of the feature [long]—again, 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 #41**

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 on page 343 as your model.

**Answer to Study Exercise #41**

52. /bawu:/	6. /mupɰʊ:l/	11. /wurgu:l/	phonemic form
—	ʊ	—	Postpalatal Laxing
u:	—	—	Final Laxing
—	—	ɫ	/l/ Velarization
[bawu:]	[mupɰʊ:l]	[wurgu:ɫ]	phonetic form

*11.4 Environments for [i] and [ɪ]*

[ɪ]:

- 1. g\_\_
- 13. g\_\_
- 15. r\_\_
- 43. r\_\_
- 49. ɫ\_\_

[i]:

- 22. j\_\_m
- 27. w\_\_ɫ
- 41. j\_\_l
- 5. b\_\_l
- 7. w\_\_g
- 7. g\_\_l
- 7. w\_\_g
- 7. g\_\_l

These data also suggest complementary distribution: all of the [ɪ]'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.

*11.5 Environments for [i], [ɪ], [i:], [ɪ:]*

If Final Laxing applies to long /u:/, to short /u/, and to short /i/, then it have better apply to long /i:/ as well. Data are few, but apparently conform to the prediction:

[ɪ]:

53. b\_\_\_\_]

54. w\_\_\_\_]

[i:]

21. b\_\_\_\_l

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, ʊ, i, i: }, but not [a, a:]. This can be done if we formulate it to affect only non-low vowels:

**Final Laxing** (final version)

$$\begin{bmatrix} +\text{syllabic} \\ -\text{low} \end{bmatrix} \rightarrow [-\text{tense}] / \_\_\_\_\_\_ ]_{\text{word}}$$

*“Non-low vowels are made lax in word-final position.”*

### Study Exercise #42

Review the completed Yidj analysis 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.

## Answer to Study Exercise #42

Postpalatal Laxing is triggered by the natural class of palatal consonants, which in Yidjɪn is { ʃ, ɲ, j }. Postpalatal Laxing applies to the class of round vowels, which in Yidjɪn is { u, uː }. Final Laxing applies to the natural class of nonlow vowels, which in Yidjɪn is { i, iː, u, uː }.

---

### 11.6 The Yidjɪn phoneme inventory

We've now succeeded in showing that several of the sounds of the Yidjɪn phonetic chart above are not independent phonemes, but merely allophones. These are placed in parentheses in the revised charts below:

#### Consonants

	Bilabial	Alveolar	Retroflex	Palatal	Velar
Stops (voiced)	b	d		ʃ	g
Nasals	m	n		ɲ	ŋ
Liquids		r	ɭ		
Glides:	w			j	

#### 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.

### 11.7 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 Yidjn.

**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 [k̟, g̟, ŋ̟] before front vowels, as in *keel* ['k̟il], *gale* ['g̟eɪl], or *dinghy* ['dɪŋ̟i]. This is an assimilation, which can be expressed by:

### Velar Fronting

$$[+velar] \rightarrow [-back] / \text{---} \begin{bmatrix} +syllabic \\ -back \end{bmatrix}$$

*“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  $p \rightarrow [+voice]$  rather than  $p \rightarrow b$ , 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.

##### **Preglottalization**

$$\left[ \begin{array}{c} +\text{stop} \\ -\text{voiced} \end{array} \right] \rightarrow [+glottal] / \_\_\_\_\_\_ ]_{\text{word}} \quad (\text{optional})$$

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*:     [<sup>1</sup>kæt] or [<sup>1</sup>kæ<sup>2</sup>t]  
*hat*:     [<sup>1</sup>hæt] or [<sup>1</sup>hæ<sup>2</sup>t]  
*cut*:     [<sup>1</sup>kΛt] or [<sup>1</sup>kΛ<sup>2</sup>t]

Additional data with other places of articulation are as follows:

*cup*:     [<sup>1</sup>kΛp] or [<sup>1</sup>kΛ<sup>2</sup>p]  
*hack*:    [<sup>1</sup>hæk] or [<sup>1</sup>hæ<sup>2</sup>k]

#### 1.2 Tapping

Another optional rule (of North American English<sup>136</sup>) is Tapping, which derives [ɾ] as an allophone of /t/.<sup>137</sup> The data look like this:

<sup>136</sup> Tapping is unusual outside North America. It occurs natively in some Irish speech and is said to be appearing in other foreign dialects as a cultural import. Non-tapping dialects often have Glottaling instead: *butter* [<sup>1</sup>bʌʔə], [<sup>1</sup>bʊʔə].

<sup>137</sup> And, as we'll see later on, of /d/.

### Forms that can be tapped

<i>butter</i>	[ˈbʌɾə]
<i>attic</i>	[ˈæɾɪk]
<i>heritability</i>	[hɛ.ɾəɾəˈbɪləɾɪ]
<i>motto</i>	[ˈmɑrou]

### Forms that cannot be tapped

<i>attain</i>	[əˈteɪn]	(*[əˈreɪn])
<i>Tommy</i>	[ˈtɑmi]	(*[ˈɾɑmi])
<i>cat</i>	[ˈkæt]	(*[ˈkæɾ])
<i>actor</i>	[ˈæktə]	(*[ˈækrə])
<i>Atkins</i>	[ˈætɪnz]	(*[ˈæɾɪnz])

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 be stressless:

### Tapping (preliminary version)<sup>138</sup>

$$t \rightarrow \text{ɾ} / [+syllabic] \text{ \_\_\_ } \begin{bmatrix} +syllabic \\ -stress \end{bmatrix}$$

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:

<i>butter</i>	[ˈbʌɾə], [ˈbʌtə]
<i>attic</i>	[ˈæɾɪk], [ˈætɪk]
<i>heritability</i>	[hɛ.ɾəɾəˈbɪləɾɪ], [hɛ.ɾəɾəˈbɪlətɪ]
<i>motto</i>	[ˈmɑrou], [ˈmatou]

### 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:

---

<sup>138</sup> To be generalized below.

**No diphthongization:**

<i>cat</i>	[ <sup>1</sup> kæt]
<i>pack</i>	[ <sup>1</sup> pæk]
<i>lap</i>	[ <sup>1</sup> læp]
<i>lab</i>	[ <sup>1</sup> læb]
<i>pal</i>	[ <sup>1</sup> pæl]

**Diphthongization:**

<i>can</i>	[ <sup>1</sup> kɛən]
<i>man</i>	[ <sup>1</sup> mɛən]
<i>Spanish</i>	[ <sup>1</sup> spɛənɪʃ]
<i>dance</i>	[ <sup>1</sup> dɛəns]
<i>spam</i>	[ <sup>1</sup> spɛəm]
<i>tram</i>	[ <sup>1</sup> tɛəm]

Setting up the basic phoneme as /æ/, we can write the rule as follows:

**/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 [<sup>1</sup>kæn], [<sup>1</sup>mæn], [<sup>1</sup>spænɪʃ], [<sup>1</sup>dæns], [<sup>1</sup>tɹæm]. 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 [<sup>h</sup>]) heard on word-initial voiceless stops.

**Initial Aspiration**

$\left[ \begin{array}{c} +\text{stop} \\ -\text{voiced} \end{array} \right] \rightarrow [+aspirated] / [\text{word } \_\_\_]$

Data:

<i>pie</i>	[ <sup>1</sup> p <sup>h</sup> aɪ]
<i>tie</i>	[ <sup>1</sup> t <sup>h</sup> aɪ]



*cat*            [ˈkʰæt]  
*police*        [pʰəˈlis]  
*collect*       [kʰəˈlekt]

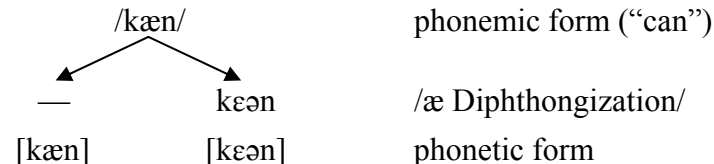
but not

*spy*            [ˈspaɪ]  
*sty*             [ˈstaɪ]  
*scat*            [ˈskæt]  
*upper*         [ˈʌpəː]  
*tickle*         [ˈtɪkl̩]

This rule 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 for clarity and gradability for the TA's I'd like you to follow the format given here, which 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:



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 /au/ to [æ] (try for instance: *Get out of here!* [ɡerˈæ̥rəhiː].)

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,<sup>139</sup> 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 (p. 339) 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.

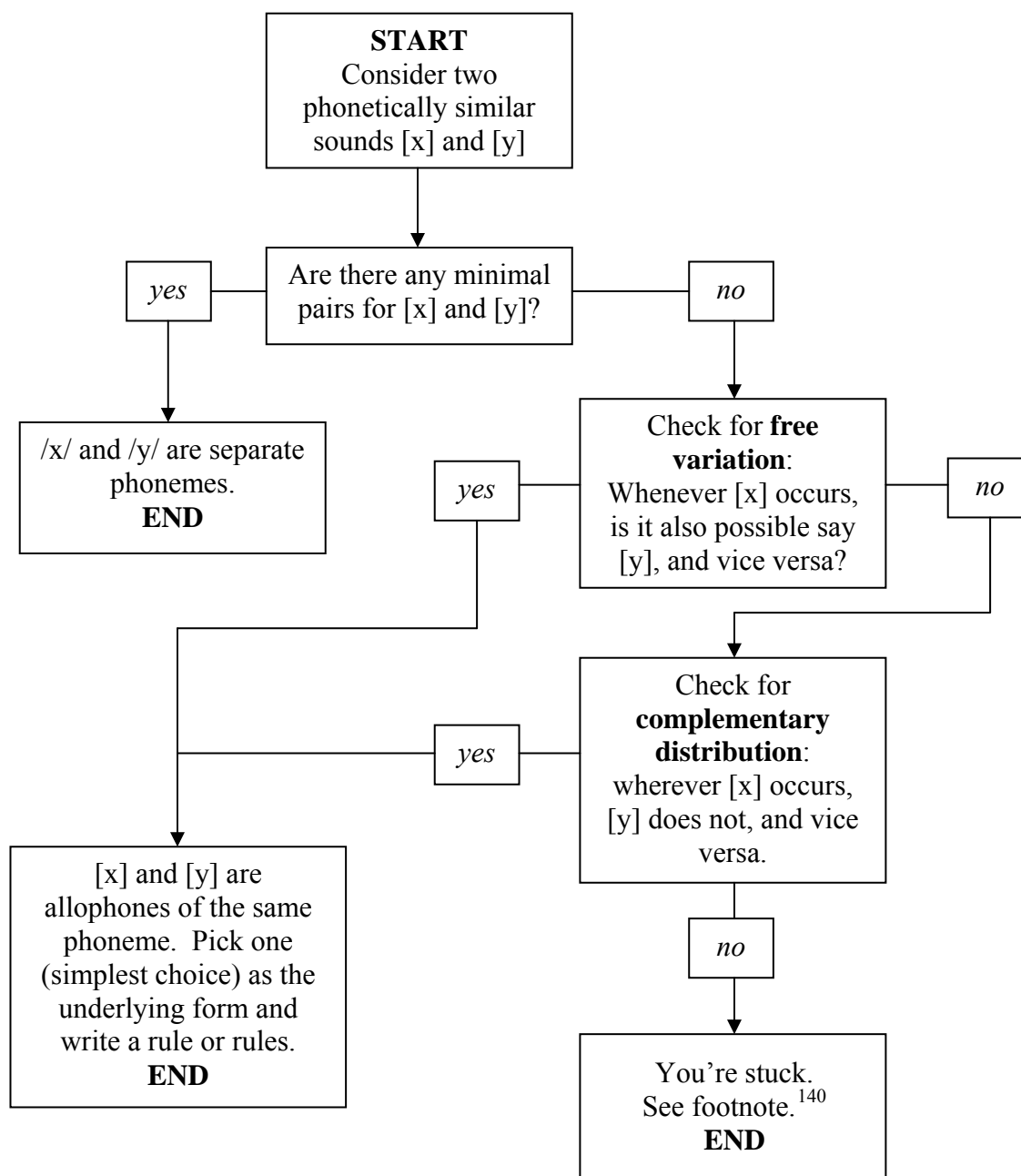
The method of local environments can be adapted for free variation. The trick is to make separate columns for each variation pattern. Thus, for instance, if you were working on the data for /æ/ Diphthongization above, you would make a column headed “[æ] or [ɛə]”, like this:

[æ] or [ɛə]		[æ] only	
<i>can</i>	/ k ____ n	<i>cat</i>	/ k ____ t
<i>Sam</i>	/ s ____ m	<i>lass</i>	/ l ____ s
etc.		etc.	

Phonemic analysis including free variation can be described as a “flow chart” of options, in the following way.

---

<sup>139</sup> 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.



<sup>140</sup> 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, like English /ð/ and /z/. 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.

### Study Exercise #43

Target sounds: [s], [ts̩]. One phoneme or two?

- Collect local environments.
- Give the appropriate underlying forms and rules.
- Give phonemic forms 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.
- Sorting local environments: make a list for “just [s]”, a list for “[s] and [ts̩] in free variation, and for “just [ts̩]”.

<i>dance</i>	[ˈdænts̩]
<i>Clarence</i>	[ˈkleɪ.ənts̩]
<i>mince</i>	[ˈmɪnts̩]
<i>hence</i>	[ˈhɛnts̩]
<i>concert</i>	[ˈkɑnsət̩], [ˈkɑnts̩ət̩],
<i>cancer</i>	[ˈkænsə̃], [ˈkænts̩ə̃]
<i>cancel</i>	[ˈkænsəl], [ˈkænts̩əl]
<i>cancellation</i>	[kænsəˈleɪʃən], [kænts̩əˈleɪʃən]
<i>tonsil</i>	[ˈtɑnsəl], [ˈtɑnts̩əl]
<i>fancy</i>	[ˈfænsi], [ˈfænts̩i]
<i>insert</i>	[ɪnˈsət̩]
<i>concede</i>	[kənˈsɪd]
<i>coincide</i>	[kɔɪnˈsaɪd]
<i>soup</i>	[ˈsup]
<i>false</i>	[ˈfals]
<i>farce</i>	[ˈfɑːs]
<i>miss</i>	[ˈmɪs]
<i>fussy</i>	[ˈfʌsi]

### 3. Answer to Study Exercise #43

Local environments:

[ts] only

*dance* /n \_\_\_\_]

*Clarence* /n \_\_\_\_]

*mince* /n \_\_\_\_]

*hence* /n \_\_\_\_]

Environments for either [s] or [ts] in free variation

*concert* /n \_\_\_\_ ə

*cancer* /n \_\_\_\_ ə

*cancel* /n \_\_\_\_ ə

*cancel* /n \_\_\_\_ ə

*tonsil* /n \_\_\_\_ ə

*fancy* /n \_\_\_\_ i

Environments with only [s]

*insert* /n \_\_\_\_ 'ə

*concede* /n \_\_\_\_ 'i

*coincide* /n \_\_\_\_ 'aɪ

*soup* / [ \_\_\_\_ 'u

*false* /l \_\_\_\_ ]

*farce* /ɹ \_\_\_\_ ]

*miss* / 'ɪ \_\_\_\_ ]

*fussy* / 'ʌ \_\_\_\_ i

[s] and [ts] are sometimes in complementary distribution, sometimes in free variation.

[ts] 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

$$s \rightarrow \begin{bmatrix} -\text{fricative} \\ +\text{affricate} \end{bmatrix} / n \text{ \_\_\_\_ } ]_{\text{word}}$$

“An s becomes [ts̩] if it comes between [n] and the end of a word.”

### Optional /s/ Affrication

$$s \rightarrow \begin{bmatrix} -\text{fricative} \\ +\text{affricate} \end{bmatrix} / n \text{ \_\_\_\_ } \begin{bmatrix} +\text{syllabic} \\ -\text{stress} \end{bmatrix} \quad (\text{optional})$$

“An s may become [ts̩] if it comes between [n] and a stressless vowel.”

Derivations:

<i>dance</i>	<i>concert</i>	<i>false</i>	
/ˈdæns/	/ˈkɑnsəɾt/	/fals/	phonemic forms
ts̩	—	—	Obligatory /s/ Affrication
	↙ ↘		
—	ˈkɑntsəɾt	—	Optional /s/ Affrication
[ˈdænts̩]	[ˈkɑnts̩əɾt]	[kɑnsəɾt]	phonetic forms
		[fals]	

## 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 it is tied to other components of the grammar, notably morphology. In what follows we will examine some of the phenomena involving in this relationship.

### 5. Alternation

**Alternation** is the appearance of a single morpheme in different phonetic forms in different contexts. It is found in all languages of the world. It normally results from an interaction of morphological and phonological rules. To show how alternation arises, I will first have to present some background material on the morphology and phonology of American English.

For morphology, we can very briefly review the format used here for derivational rules:

### **-able Attachment**

$[X]_{\text{Verb}} \rightarrow [[X]_{\text{Verb}} \text{əbəl}]_{\text{Adj}}$   
 meaning: “able to be Verbed”

This derives, for instance, *lovable* and *wearable*.

### **-ation Attachment**

$[X]_{\text{Verb}} \rightarrow [[X]_{\text{Verb}} \text{'eɪʃən}]_{\text{Noun}}$   
 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:

### **Pre-Stress Aspiration**

$\begin{bmatrix} +\text{stop} \\ -\text{voice} \end{bmatrix} \rightarrow [+ \text{aspirated}] / [+ \text{syllabic}] \text{ — } \begin{bmatrix} +\text{syllabic} \\ +\text{stressed} \end{bmatrix}$

This is part of family of rules assigning aspiration; see also Initial Aspiration above.<sup>141</sup> This one is needed to cover that cases of aspiration that occur other than at the beginning of the word. Here are examples:

*appeal* [ə'p<sup>h</sup>il]  
*attend* [ə't<sup>h</sup>end]  
*account* [ə'k<sup>h</sup>aʊnt]

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* ['k<sup>h</sup>eɪpə]  
*tickle* ['t<sup>h</sup>ɪkəl]<sup>142</sup>

<sup>141</sup> It's odd to need two aspiration rules (one initial, the other pre-stress). Various proposals have been made to unify them.

<sup>142</sup> We can't check /t/ here because it would undergo Tapping, which makes it not a stop at all and hence ineligible for aspiration.

The remaining phonological rules we'll need were justified in the pages above; they are repeated below for convenience:

### Tapping

$$t \rightarrow \tau / [+syllabic] \text{ \_\_\_\_ } \begin{bmatrix} +syllabic \\ -stress \end{bmatrix}$$

as in *butter*, *motto*, *vanity*, etc.

### Preglottalization

$$\begin{bmatrix} +stop \\ -voiced \end{bmatrix} \rightarrow [+glottal] / \text{ \_\_\_\_ } ]_{\text{word}} \quad (\text{optional})$$

as in *cat*, *cap*, *lack*, etc.

Both of these rules are optional, but for simplicity we will assume below 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 this example in mind, we can now cover the crucial data:

<i>note</i>	<i>notable</i>	<i>notation</i>
[ <sup>2</sup> nou <sup>1</sup> t]	[ <sup>2</sup> nou <sup>1</sup> rəbəl]	[ <sup>2</sup> nou <sup>1</sup> t <sup>h</sup> eɪʃən]

<i>quote</i>	<i>quotable</i>	<i>quotation</i>
[ <sup>2</sup> kwou <sup>1</sup> t]	[ <sup>2</sup> kwou <sup>1</sup> rəbəl]	[ <sup>2</sup> kwou <sup>1</sup> t <sup>h</sup> eɪʃən]

The first three forms are, or are derived from, the stem *note* and the last three from *quote*. 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:

<i>note</i>	<i>notable</i>	<i>notation</i>
[ <sup>2</sup> nou <sup>1</sup> t]	[ <sup>2</sup> nou <sup>1</sup> r]	[ <sup>2</sup> nou <sup>1</sup> t <sup>h</sup> ]
<i>quote</i>	<i>quotable</i>	<i>quotation</i>
[ <sup>2</sup> kwou <sup>1</sup> t]	[ <sup>2</sup> kwou <sup>1</sup> r]	[ <sup>2</sup> kwou <sup>1</sup> t <sup>h</sup> ]

These variant forms of the stems are called **allomorphs**. It can be seen that, following the definition given above of “alternation” (“**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 taught here as follows:

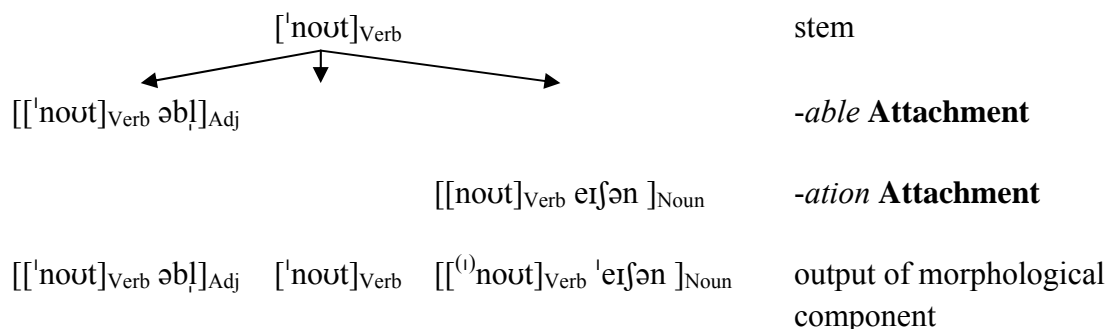


*Morphological rules precede phonological rules.*

or to put it more specifically, the morphological component of grammar occupies 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 grand derivation showing how the scheme works for the words and rules given so far. I'll go through the derivations for the stem *note*; *quote* works identically.

The first phase takes place in the morphological component, where rules of derivational morphology are applied. As noted a few weeks ago, derivational rules 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:



The resulting forms [['nout]Verb əbɪ]Adj, ['nout]Verb, and [[nout]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:

'noutəbɪ                  'nout                  nou'teɪʃən<sup>143</sup>

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 “deepest” (most abstract) level of representations; they are actually output (“surface”) representations when considered from the viewpoint of morphology.

<sup>143</sup> I did a hand-waving 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.

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 I picked one order arbitrarily.

/noutəb/	/nout/	/nou <sup>h</sup> teɪʃən/	underlying representations
—	—	t <sup>h</sup>	Pre-Stress Aspiration
ɾ	—	—	Tapping
—	ʔt	—	Preglottalization
[ <sup>h</sup> nourəb]	[ <sup>h</sup> nou <sup>h</sup> t]	[nou <sup>h</sup> teɪʃən]	phonetic forms

We have now produced an explanation for alternation: *-able* Attachment placed the /t/ of /nout/ in an environment where Tapping could apply to it; *-ation* Attachment placed the /t/ of /nout/ 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, [nour], [nou<sup>h</sup>t], and [nout<sup>h</sup>].

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.<sup>144</sup>

## 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.

**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. Phonological rules apply to these underlying representations to create the actually observed pronunciations. Such 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.

<sup>144</sup> 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.

**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,<sup>145</sup> 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.

## 8. The ordering of syntax and phonology

Last time, we covered the principle reviewed in the last paragraph above: that because morphology puts phonemes in different environments, we get phonological alternation. At the theoretical level, the conclusion we drew was a very general one: in the architecture of linguistic theory, we must arrange the components so that the output of the morphological component feeds into the phonological component. This will guarantee that morphological rules always apply before phonological rules.

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

$$t \rightarrow \text{ɾ} / [+syllabic] \text{ \_\_\_ } \begin{bmatrix} +syllabic \\ -stress \end{bmatrix}$$

*utter* [ˈʌtə] *batting* [ˈbætɪŋ]

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.

---

<sup>145</sup> 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.

Here are Tapping examples across word boundary, shown here with the brackets ]<sub>w</sub> [

	Phonemic	Phonetic
<i>at Ed</i>	[ æt ] <sub>w</sub> [ 'ɛd ]	[ æɾ ] <sub>w</sub> [ 'ɛd ]
<i>get Alice</i>	[ gɛt ] <sub>w</sub> [ 'æɪɪs ] <sub>w</sub>	[ gɛɾ ] <sub>w</sub> [ 'æɪɪs ] <sub>w</sub>
<i>not Adam</i>	[ nɒt ] <sub>w</sub> [ 'ædəm ] <sub>w</sub>	[ nɒɾ ] <sub>w</sub> [ 'æɾəm ] <sub>w</sub>

To handle these facts, we need to adopt an additional Tapping rule, which could be written like this:

### Phrasal Tapping

$t \rightarrow \text{ɾ} / [+syllabic] \text{ \_\_\_\_ } ]_w [+syllabic]$

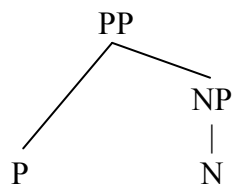
In words, this says “make /t/ a flap when it is immediately preceded by a vowel and immediately followed by a vowel which is in the next word.” Phrasal Tapping has been a source of puzzlement to phonologists: why should stress matter for tapping within a word, but not across word boundaries? Various theories have been proposed, which we will lack time for...

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 rules; others could be used as well.

PP → P NP  
 NP → (Art) (AP)\* N (PP) ( $\bar{S}$ )  
 (plus: lexical insertion)

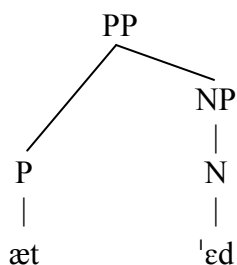
Consider now the pronunciation of the PP *at Ed*. If the syntactic rules apply first, then we will derive the correct output as follows:

SYNTACTIC COMPONENT:



PP → P NP  
 NP → (**Art**) (A)\* N (PP) ( $\bar{S}$ )

Lexical insertion



## PHONOLOGICAL COMPONENT:

[ æt ]<sub>word</sub> [ 'ɛd ] (same as above, but tree omitted, and word boundaries made explicit)

[ æɾ ]<sub>word</sub> [ 'ɛd ] Phrasal Tapping

[æɾ'ɛd] 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.<sup>146</sup>

## 9. Neutralization

“Neutralization” is defined as the phonetically identical realization of distinct phoneme 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/

*write* /'ɹaɪt/ [ 'ɹaɪ<sup>2</sup>t ]

*writer* /'ɹaɪt+ə/ [ 'ɹaɪɾə ]

*white* /'waɪt/ [ 'waɪ<sup>2</sup>t ]

*whiter* /'waɪt+ə/ [ 'waɪɾə ]

*pat* /'pæt/ [ 'pæ<sup>2</sup>t ]

*patting* /'pætɪŋ/ [ 'pæɾɪŋ ]

### Cases of Tapping with /d/

*ride* /'ɹaɪd/ [ 'ɹaɪd ]

*rider* /'ɹaɪd+ə/ [ 'ɹaɪɾə ]

*wide* /'waɪd/ [ 'waɪd ]

*wider* /'waɪd+ə/ [ 'waɪɾə ]

*pad* /'pæd/ [ 'pæd ]

*padding* /'pæd+ɪŋ/ [ 'pæɾɪŋ ]

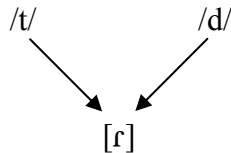
Reformalizing the rule with features, it now reads:

<sup>146</sup> In fact, the issue gets pretty complicated; there's good reason to believe that some phonological rules apply in tandem with the morphology, so each new affixation triggers another cascade of phonological rule application. Again, this is something we'll have to skip in an intro course.

### Tapping

$$\begin{bmatrix} +\text{alveolar} \\ +\text{stop} \end{bmatrix} \rightarrow \text{ɾ} / [+syllabic] \text{ — } \begin{bmatrix} +\text{syllabic} \\ -\text{stress} \end{bmatrix}$$

The neutralization here takes the form



Neutralization is a source of ambiguity that is purely phonological. In the dialect under description here, the listener hearing ['ɹaɪɾə] must infer from context, or just guess, whether the speaker meant /'ɹaɪtə/ *writer* or /'ɹaɪtə/ *rider*. Usually, context suffices, but the particular ambiguity *kitty/kiddie* does seem to create some real-life confusion.

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:

<i>We live in Pittsburgh</i>	[ɪm pɪtsbəɹg]
<i>Wouldja hand me the phone book?</i>	[foum buk]
<i>I gotta make a phone call.</i>	[fouŋ kəl]
<i>It's all a con game.</i>	[kaŋ 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

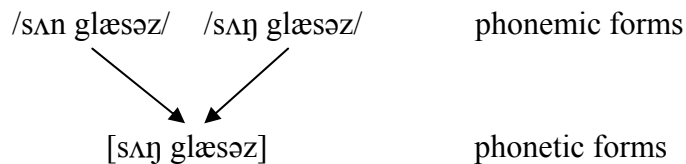
$$n \rightarrow [\text{same place}] / \text{ — } [-\text{syllabic}]$$

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”.<sup>147</sup>



## 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”.

<i>cat</i>	[kæ̃t]	<i>cad</i>	[ˈkæd]
<i>pot</i>	[pɑ̃t]	<i>pod</i>	[ˈpɑd]
<i>cop</i>	[kɑ̃p]	<i>cob</i>	[ˈkɑb]
<i>cup</i>	[kʌ̃p]	<i>cub</i>	[ˈkʌb]
<i>batch</i>	[bæ̃tʃ]	<i>badge</i>	[ˈbædʒ]
<i>pasta</i>	[ˈpɑ̃stə]	<i>Mazda</i>	[ˈmæzdə]
<i>beat</i>	[ˈbɪ̃t]	<i>bead</i>	[ˈbɪd]
<i>Bruce</i>	[ˈbrʊ̃s]	<i>bruise</i>	[ˈbrʊz]

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 occur before voiced consonants, and the short vowels occur before voiceless consonants.

<sup>147</sup> Context: magical world in which singing by trained experts gives the lenses a bluish tint; speaking, in contrast, makes them slightly pinker.

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* [pa], *bee* [bi], and *brew* ['bɹu] indicate that the longer versions of the vowels are the elsewhere allophones, 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:

<i>Bruce</i>	<i>bruise</i>	<i>brew</i>	
/ˈbɹʊs/	/ˈbɹʊz/	/ˈbɹu/	phonemic forms
ǔ	—	—	Vowel Shortening
[ˈbɹʊs]	[ˈbɹʊz]	[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

$\left[ \begin{array}{c} +\text{alveolar} \\ +\text{stop} \end{array} \right] \rightarrow r / [+syllabic] \text{ } \_\_\_ \left[ \begin{array}{c} +\text{syllabic} \\ -\text{stress} \end{array} \right]$

Here, it will be useful to use a fully formalized version of the rule, using features instead of the symbol [r]. We need to know, then, just what features must be changed in order to turn both /t/ and /d/ into [r].

First of all, a flap 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/. Flap 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

$\left[ \begin{array}{c} +\text{alveolar} \\ +\text{stop} \end{array} \right] \rightarrow \left[ \begin{array}{c} +\text{voiced} \\ -\text{stop} \\ +\text{tap} \end{array} \right] / [+syllabic] \text{ } \_\_\_ \left[ \begin{array}{c} +\text{syllabic} \\ -\text{stress} \end{array} \right]$



With these two rules in hand, we can now see how they might interact. The crux of the matter is this:

- 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*

<i>patting</i>	<i>padding</i>	
/ˈpætɪŋ/	/ˈpædɪŋ/	Phonemic forms
ˈpæɾɪŋ	ˈpæɾɪŋ	Tapping
—	—	Vowel Shortening
[ˈpæɾɪŋ]	[ˈpæɾɪŋ]	Phonetic forms

B. *Vowel Shortening precedes Tapping*

<i>patting</i>	<i>padding</i>	
/ˈpætɪŋ/	/ˈpædɪŋ/	Phonemic forms
æ	—	Vowel Shortening
ɾ	ɾ	Tapping
[ˈpæɾɪŋ]	[ˈpæɾɪŋ]	Phonetic forms

The predictions that the derivations make are clear: if Tapping precedes Lengthening, then *patting* and *padding* should be pronounced identically. If Lengthening precedes Tapping, then *patting* and *padding* should be pronounced differently; that is, *padding* should have the longer vowel. These observations should hold 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. 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. There are Here is an example description, for the example in the preceding section: "In the dialect where *patting* is [ˈpæɾɪŋ] 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 #44

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.

[:] means that the preceding vowel is long.

[ø] mid front rounded, as in German *Goethe* or French *Chartreuse*.

[y] high front rounded, as in German *Führer* or French *tu*

- What stems alternate, and what are their allomorphs?
- State a phonological rule that correctly derives the alternation, in both formalism and words. Give your rule a name.
- Give underlying forms and derivations for pəd, pədnək, and pətto:l.

d. Is your rule neutralizing? Explain your answer.

### Hungarian Data

<i>Nominative</i>	<i>Dative</i>	<i>Ablative</i> <sup>148</sup>	<i>Essive</i> <sup>149</sup>	<i>Allative</i> <sup>150</sup>	<i>Gloss</i>
røgbi	røgbinøk	røgbitø:l	røgbike:nt	røgbihez	‘rugby’
ipʃe	ipʃenek	ipʃetø:l	ipʃeke:nt	ipʃehéz	‘fellow’
kølöp	kølöpnök	kølöptø:l	kølöpke:nt	kølöphez	‘hat’
ku:t	ku:tnøk	ku:ttø:l	ku:tke:nt	ku:thoz	‘well’
juk	juknök	jukto:l	jukke:nt	jukhoz	‘hole’
sēm	sēmnek	sēmto:l	sēmke:nt	sēmhez	‘eye’
røb	røbnøk	røptø:l	røpke:nt	røphoz	‘prisoner’
ʒeb	ʒebnek	ʒeptø:l	ʒepke:nt	ʒephéz	‘pocket’
ka:d	ka:dnøk	ka:ttø:l	ka:tke:nt	ka:thoz	‘bathtub’
pød	pødnök	pøttø:l	pøtke:nt	pøthoz	‘bench’
a:ʒ	a:ʒnök	a:cto:l	a:cke:nt	a:choz	‘bed’
mēlēg	mēlēgnek	mēlēktø:l	mēlēkke:nt	mēlēkhez	‘heat’
hertseg	hertsegnøk	hertsektø:l	hertsekke:nt	hertsekhez	‘duke’
templom	templomnök	templomto:l	templomke:nt	templomhoz	‘house of worship’
by:n	by:nnek	by:ntø:l	by:nke:nt	by:nhöz	‘sin’
toroŋ	toroŋnök	toroŋto:l	toroŋke:nt	toroŋhoz	‘tower’
fāl	fálnøk	fältø:l	fälke:nt	fälhoz	‘wall’
ø:r	ø:rnøk	ø:rtø:l	ø:rke:nt	ø:rhez	‘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 [smørøktke:nt].

<i>Nominative</i>	<i>Dative</i>	<i>Ablative</i>	<i>Essive</i>	<i>Allative</i>	<i>Gloss</i>
smørøgd	smørøgdnök	smørøktto:l	smørøktke:nt	smørøkthez	‘emerald’

<sup>148</sup> Ablative case means, roughly, “from”.

<sup>149</sup> More accurately: essive formal. Essive case means, roughly, “as”.

<sup>150</sup> 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).

## 11. Answer to Study Exercise #44

- a. What stems alternate, and what are their allomorphs?

Stem	Allomorph 1	Allomorph 2
rɔb	rɔb	rɔp
ʒɛb	ʒɛb	ʒɛp
ka:d	ka:d	ka:t
pɔd	pɔd	pɔt
aɹ	aɹ	a:c
mɛɛg	mɛɛg	mɛɛk
hɛrtɛg	hɛrtɛg	hɛrtɛk

- b. State a phonological rule that correctly derives the alternation, in both formalism and words. Give your rule a name.

### Voicing Assimilation

$[+stop] \rightarrow [-voice] / \_\_\_ [-voice]$

‘A stop becomes voiceless when it precedes a voiceless sound.’

- c. Give underlying forms and derivations for pɔd, pɔdnɔk, and pɔtto:l.

/pɔd/	/pɔdnɔk/	/pɔtto:l/	underlying forms
—	—	t	Voicing Assimilation
[pɔd]	[pɔdnɔk]	[pɔtto:l]	underlying forms

- d. Is your rule neutralizing? Explain your answer.

Yes. Look at this quadruplet, focusing on the underlined sounds:

ku: <u>t</u>	ku: <u>tt</u> o:l
pɔ <u>d</u>	pɔ <u>tt</u> o:l

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 [smərɔktke:nt]. 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 [smərɔktke:nt].

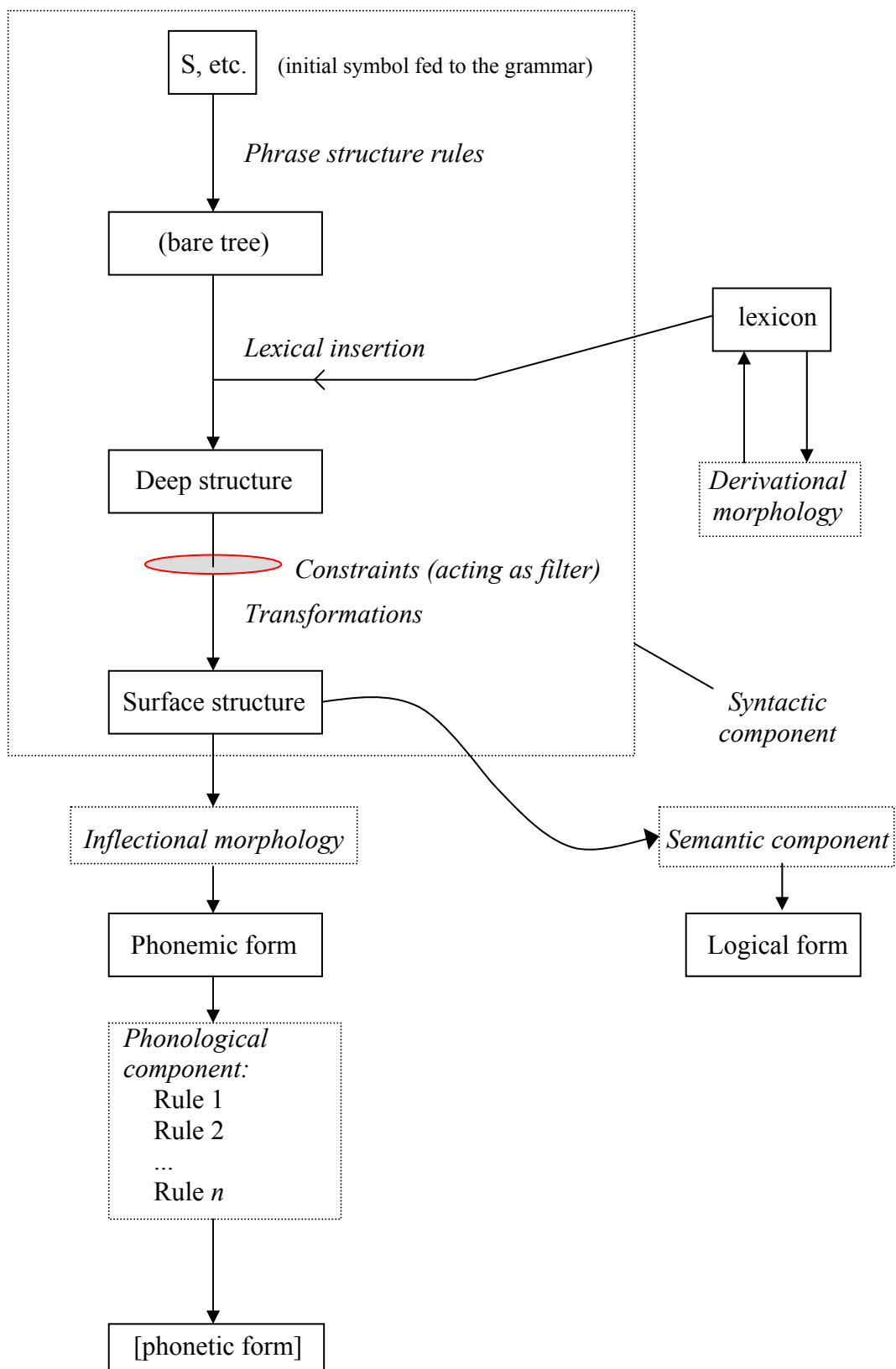
/smərɔgdke:nt/	underlying form
t	Voicing Assimilation: first time
k	Voicing Assimilation: second time
[smərɔktke:nt]	surface form

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## 12. 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 (p. 161).

How do these different theories fit together into a coherent whole? This is very much an open question, one that linguists continue to debate. For concreteness, I will give one particular view here. I hope this will at least help you integrate the material of the course and get a sense of the breadth of the system. 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.



The **syntax** is the primary generative component, creating an infinite number of possible sentences.<sup>151</sup> 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.

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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<sup>151</sup> Derivational morphology is also generative, and in most languages can likewise create an infinite variety of structures (recall: *eggplant plant plant...*), though typically less elaborate.

## 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 gedæghwamlīcan hlaf syle us to dæg*  
 ['urne gɛ'dæɣwamlīkan 'lɑf 'syle us to 'dæɣ]  
 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*, ['lɑf] = *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 ɛtʃə dæɪəs brɛd]  
 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.



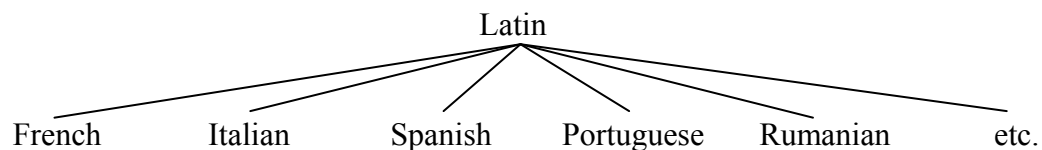
For linguists, descent is the gold standard for language identity—descent has a completely clear meaning and can be diagnosed with near certainty if enough data are available. Descent is not always used as the criterion of language identity in popular culture, however. For instance, in the real world you will hear people say things like:

“Modern English is a mixture of Old English, French, and Latin.”

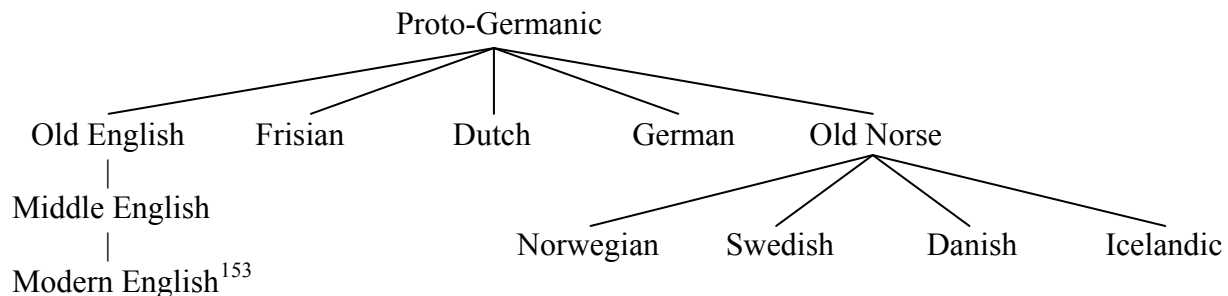
This statement is perfectly true as a description of the *vocabulary* of Modern English, since over the centuries English has borrowed thousands of words from French and Latin. But English is *descended* from Old English;<sup>152</sup> there was no continuous transmission of language from generation 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.



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*.

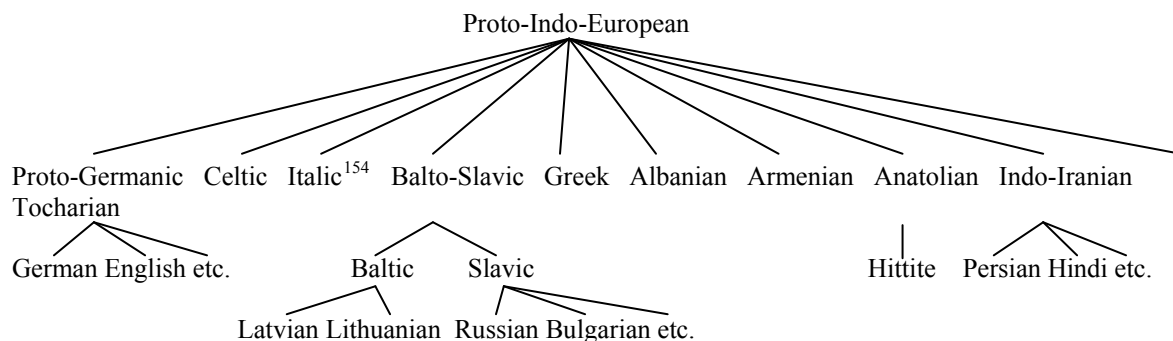


<sup>152</sup> ... and, at a deeper level, the earlier languages from which Old English is descended; more on this immediately below.

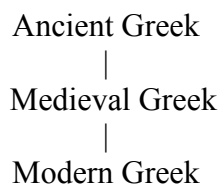
<sup>153</sup> Only English is shown with stages (following the custom, three of them: Old, Middle, Modern). But the same could be done for all of the languages shown.

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:



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:



“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.

[dʒom'hur]	‘republic’
[ʼelm]	‘science’
[mohæn'des]	‘engineer’
[velɑ'jæt]	‘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

<sup>154</sup> 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.

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:

[pe'dær]	‘father’
[bæra'dær]	‘brother’
[seta're]	‘star’
[gav]	‘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 sophisticated 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

“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 scholars 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 [ɫ] in Old English [ɫaf] ‘bread’ has become voiced [l] in Modern English. This change happened to all the voiceless [ɫ]’s of Old English; for example, the words *lady*, *lot*, and *lean* originally began with voiceless [ɫ]’s.<sup>155</sup>

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.

<sup>155</sup> The Old English for “lady” was *hlæfdige*, literally “kneader of bread”. “Lot” was *hlot*, and “lean” was *hlæne*. All three forms are from the *Oxford English Dictionary*, available online (if you are logged into UCLA) 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 [t] are pronounced with voiced [d] in 1500, then we say that the language has undergone a sound change taking [t] to [d]. 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
<i>cot</i>	[ˈkɑt]	[ˈkɑt]
<i>caught</i>	[ˈkɔt]	[ˈkɑt]
<i>la</i>	[ˈlɑ]	[ˈlɑ]
<i>law</i>	[ˈlɔ]	[ˈlɑ]
<i>hock</i>	[ˈhɑk]	[ˈhɑk]
<i>hawk</i>	[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]-[a] distinction reflects the earlier state of the language is that all the old written documents through the centuries spell out the distinction.<sup>156</sup> 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:

	<b>Dialect A</b>	<b>Dialect B</b>	<b>Dialect C</b>
<i>cot</i>	[ˈkɑt]	[ˈkɑt]	[ˈkɑt]
<i>caught</i>	[ˈkɔt]	[ˈkɔt] ~ [ˈkɑt]	[ˈkɑt]
<i>la</i>	[ˈlɑ]	[ˈlɑ]	[ˈlɑ]
<i>law</i>	[ˈlɔ]	[ˈlɔ] ~ [ˈlɑ]	[ˈlɑ]
<i>hock</i>	[ˈhɑk]	[ˈhɑk]	[ˈhɑk]
<i>hawk</i>	[ˈhɔk]	[ˈhɔk] ~ [ˈhɑk]	[ˈhɑk]
generally:	[ɑ] [ɔ]	[ɑ] [ɑ] ~ [ɔ]	[ɑ] [ɑ]

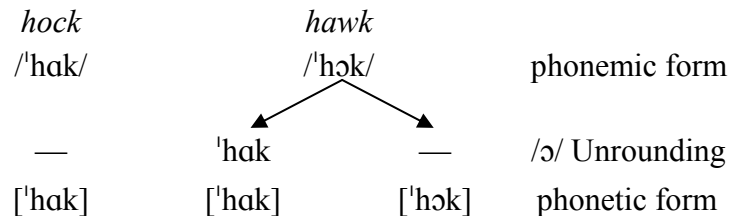
It is in Dialect B that we can see sound change in progress. Evidently, B speakers have a rule of neutralization, which applies optionally—in other words, they *have* a distinction, but sometimes wipe it out phonologically. Here would be the phonological analysis of Dialect B:

### /ɔ/ Unrounding

ɔ → [−round] in all environments, optionally

<sup>156</sup> A 1440 Latin glossary: “Hawke, *falco*”. A 1398 source: þe hocke is a nesche herbe (as in *hollyhock*).

Example derivations:



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*:

**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 signs 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 /ɪ/.<sup>157</sup> Here again, the conservative dialect still exists alongside the innovating dialect.

æ > e / \_\_\_\_ ɪ

Conservative dialect:	<i>marry</i>	[ <sup>1</sup> mæ.ɪ]	<i>Mary</i>	[ <sup>1</sup> mæ.ɪ]
	<i>carry</i>	[ <sup>1</sup> kæ.ɪ]	<i>Cary</i>	[ <sup>1</sup> ke.ɪ]
	<i>arable</i>	[ <sup>1</sup> æ.ɪəbəl]	<i>airable</i>	[ <sup>1</sup> e.ɪəbəl]
	<i>Harry</i>	[ <sup>1</sup> hæ.ɪ]	<i>hairry</i>	[ <sup>1</sup> he.ɪ]
Innovating dialect:	<i>marry</i>	[ <sup>1</sup> me.ɪ]	<i>Mary</i>	[ <sup>1</sup> me.ɪ]
	<i>carry</i>	[ <sup>1</sup> ke.ɪ]	<i>Cary</i>	[ <sup>1</sup> ke.ɪ]
	<i>arable</i>	[ <sup>1</sup> e.ɪəbəl]	<i>airable</i>	[ <sup>1</sup> e.ɪəbəl]
	<i>Harry</i>	[ <sup>1</sup> he.ɪ]	<i>hairry</i>	[ <sup>1</sup> he.ɪ]

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 /ɪ/; 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.<sup>158</sup> 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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<sup>157</sup> A detail here: the phoneme /eɪ/ has the allophone [e] for most speakers before [ɪ]—it's monophthongal in this context.

<sup>158</sup> 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 #45**

Let's add in "Dialect BR" — standard British English, and do some comparisons with American Dialect A.

Word	BR	A
<i>sore</i>	[sɔ]	[sɔɪ]
<i>saw</i>	[sɔ]	[sɔ]
<i>door</i>	[dɔ]	[dɔɪ]
<i>daw</i> <sup>159</sup>	[dɔ]	[dsɔ]
<i>lore</i>	[lɔ]	[lɔɪ]
<i>law</i>	[lɔ]	[lɔ]
<i>pore</i>	[pɔ]	[pɔɪ]
<i>paw</i>	[pɔ]	[pɔ]
<i>roar</i>	[ɹɔ]	[ɹɔɪ]
<i>raw</i>	[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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<sup>159</sup> A kind of bird.

### Answer to Study Exercise #45

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 /ɪ/ in them. This would be very hard to explain if the /ɪ/'s were innovated. Second, the spelling of the words, established long before British and American English split, indicates the early presence of /ɪ/ in *sore*, *door*, *lore*, *pore*, and *raw*.

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The answer just given can be based on very little background knowledge. Looking up these words in the *Oxford English Dictionary*,<sup>160</sup> 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 /ɪ/ to this day.

- 1300: þe touche of senewes hap no feling of **soore** and of smerte.
- 1340: File **sawe** and spindelle
- 1000: Seo **duru** wæs belocen<sup>161</sup>
- 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.<sup>162</sup>
- 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** oper a-roste!<sup>163</sup>

One other fact: the *geography* of deleted /ɪ/ 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 /ɪ/.

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<sup>160</sup> This costs a ton of money but is free to UCLA faculty and students: <http://dictionary.oed.com>, when you are linked to a University web server.

<sup>161</sup> "The door was shut", from an English version of the Bible, Matthew 25:10.

<sup>162</sup> Shakespeare, *The Merchant of Venice* IV.1.178.

<sup>163</sup> 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:  $\text{ɔ} > \text{ɑ}$  eliminated the /ɔ/ phoneme, and  $\text{æ} > \text{e} / \_\_\_\text{ɪ}$  eliminated the /æ/ - /eɪ/ distinction before /ɪ/. 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]?<sup>164</sup>

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.<sup>164</sup>

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.

	<i>OHG</i>	<i>MHG</i>
'high'	'hox	'hox
'higher'	'hox-iro	'høx-ərø
'highest'	'hox-isto	'høx-əstø
'high (adv.)'	'hox-o	'hox-ø

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 change. The evolution of the forms above is the result of the following two sound changes, applying in the (historical) order given:

<sup>164</sup> More precisely, Japanese uses the sound [ɸ], a voiceless bilabial fricative, to render English the phonetically similar /f/, as in [ɸaito] 'fight'; [ɸesutibarū] 'festival'.

I. **Umlaut:**       $o > \emptyset / \_\_\_ [-\text{syllabic}] i$

II. **Vowel Reduction:**       $\begin{bmatrix} +\text{syllabic} \\ -\text{stress} \end{bmatrix} > \emptyset$

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.<sup>165</sup>

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

<sup>165</sup> 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*.

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.<sup>166</sup>

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:<sup>167</sup>

	<i>English</i>	<i>German</i>	<i>Swedish</i>
A. <i>good</i>	<sup>1</sup> gud	<sup>1</sup> gu:t	<sup>1</sup> gu:d
<i>drive</i>	<sup>1</sup> draɪv	<sup>1</sup> traɪb-ən	<sup>1</sup> dri:v-a <sup>168</sup>
<i>ride</i>	<sup>1</sup> raɪd	<sup>1</sup> raɪt-ən	<sup>1</sup> ri:d-a
<i>wide</i>	<sup>1</sup> waɪd	<sup>1</sup> vaɪt	<sup>1</sup> vi:d
<i>deed</i>	<sup>1</sup> di:d	<sup>1</sup> ta:t	<sup>1</sup> do:d

<sup>166</sup> 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.

<sup>167</sup> 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.*

<sup>168</sup> For simplicity I'll ignore the phonetic differences between English, German, and Swedish *r*, which are actually [ɹ], [ʀ] (voiced uvular approximant), and [r].

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:

<i>English</i>	<i>German</i>	<i>Swedish</i>
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:

<i>English</i>	<i>German</i>	<i>Swedish</i>	<i>Proto-Germanic</i>
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:

	<i>English</i>	<i>German</i>	<i>Swedish</i>
B. <i>good</i>	<sup>1</sup> gud	<sup>1</sup> gu:t	<sup>1</sup> gu:d
<i>green</i>	<sup>1</sup> grin	<sup>1</sup> gry:n	<sup>1</sup> grø:n
<i>go</i>	<sup>1</sup> gou	<sup>1</sup> ge:-ən	<sup>1</sup> go:
<i>give</i>	<sup>1</sup> giv	<sup>1</sup> ge:b-ən	<sup>1</sup> gi:va
<i>goose</i>	<sup>1</sup> gus	<sup>1</sup> gans	<sup>1</sup> go:s

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:

<i>English</i>	<i>German</i>	<i>Swedish</i>	<i>Proto-Germanic</i>
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/:

	<i>English</i>	<i>German</i>	<i>Swedish</i>
C. <i>bind</i>	<sup>1</sup> baɪnd	<sup>1</sup> bind-ən	<sup>1</sup> bind-a
<i>round</i>	<sup>1</sup> raʊnd	<sup>1</sup> rund-ə	<sup>1</sup> rund
<i>land</i>	<sup>1</sup> lænd	<sup>1</sup> land-əs	<sup>1</sup> land
<i>hound</i>	<sup>1</sup> haʊnd	<sup>1</sup> hund-ə	<sup>1</sup> hund
<i>linden</i>	<sup>1</sup> lɪndən	<sup>1</sup> lind-ə	<sup>1</sup> lind

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:

<i>English</i>	<i>German</i>	<i>Swedish</i>	<i>Proto-Germanic</i>
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:

	<i>English</i>	<i>German</i>	<i>Swedish</i>
D(i)	<i>stool</i>	<sup>1</sup> stul	<sup>1</sup> stu:l
	<i>stone</i>	<sup>1</sup> stoun	<sup>1</sup> ste:n
	<i>best</i>	<sup>1</sup> bɛst	<sup>1</sup> bɛst
	<i>list</i>	<sup>1</sup> lɪst	<sup>1</sup> lɪsta
(ii)	<i>white</i>	<sup>1</sup> waɪt	<sup>1</sup> vi:t
	<i>foot</i>	<sup>1</sup> fʊt	<sup>1</sup> fu:t
	<i>sweet</i>	<sup>1</sup> swɪt	<sup>1</sup> sø:t
	<i>out</i>	<sup>1</sup> aut	<sup>1</sup> ʊ:t <sup>169</sup>
(iii)	<i>token</i>	<sup>1</sup> toʊkən	<sup>1</sup> tɛkən
	<i>salt</i>	<sup>1</sup> sɒlt	<sup>1</sup> salt
	<i>smart</i> <sup>170</sup>	<sup>1</sup> smɜrt	<sup>1</sup> smɛrtə
	<i>Lent</i>	<sup>1</sup> lɛnt	?

The correspondences are as follows:

<sup>169</sup> [ʊ] is a high central rounded vowel.

<sup>170</sup> In the sense of pain, as in “that smarts”.



		<i>English</i>	<i>German</i>	<i>Swedish</i>
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:

		<i>English</i>	<i>German</i>	<i>Swedish</i>	<i>Proto-Germanic</i>
D.	i.	t	t	t	*t
	ii.	t	s	t	*t
	iii.	t	ts	t	*t

Sound Changes in German:

t > [+fricative] / [+syllabic] \_\_\_\_

t > [+affricate] /  $\begin{bmatrix} -\text{syllabic} \\ -\text{fricative} \end{bmatrix}$  \_\_\_\_

One more set of data suggests a slight revision of the analysis:

	<i>English</i>	<i>German</i>	<i>Swedish</i>
E. <i>spin</i>	<sup>1</sup> spɪn	<sup>1</sup> ʃpɪn-ən	<sup>1</sup> spɪna
<i>spade</i>	<sup>1</sup> speɪd	<sup>1</sup> ʃpa:tən	<sup>1</sup> spa:de
<i>leap</i>	<sup>1</sup> lɪp	<sup>1</sup> laʊf-ən	<sup>1</sup> lø:pa
<i>heap</i>	<sup>1</sup> hɪp	<sup>1</sup> haʊfən	<sup>1</sup> hu:p
<i>pound</i>	<sup>1</sup> paʊnd	<sup>1</sup> pʊnd-əs	<sup>1</sup> pʊnd
<i>pipe</i>	<sup>1</sup> paɪp	<sup>1</sup> pfaɪf	<sup>1</sup> pi:pa

Here the correspondences are as follows:

<i>English</i>	<i>German</i>	<i>Swedish</i>
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:

<i>English</i>	<i>German</i>	<i>Swedish</i>	<i>Proto-Germanic</i>
p	p	p	*p
p	f	p	*p
p	pf	p	*p

Sound Changes in German:

$$\begin{bmatrix} +\text{stop} \\ -\text{voiced} \end{bmatrix} > [+ \text{fricative}] / [+ \text{syllabic}] \_\_\_$$

$$\begin{bmatrix} +\text{stop} \\ -\text{voiced} \end{bmatrix} > [+ \text{affricate}] / \begin{bmatrix} -\text{syllabic} \\ -\text{fricative} \end{bmatrix} \_\_\_$$

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 particularly 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* = *tsaixən*, *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 *god*, German *gut*, Swedish *gu:d*) has been reconstructed as \**gu:d*. 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 #46: Proto-Germanic $\theta$

The following correspondence sets illustrate the fate of Proto-Germanic  $\theta$  in English, German, and Swedish. The German data are slightly fudged, as *bad*, *klaid*, *tod*, and *laid* are actually pronounced [bat], [klart], [tot], and [lart]. The pronunciations shown are used whenever an ending is added to the word. For purposes of the problem, assume the pronunciations given.

	<i>English</i>	<i>German</i>	<i>Swedish</i>
1. <i>bath</i>	[bæθ]	bad	bad
2. <i>brother</i>	[brʌðə]	bruder	bruder
3. <i>cloth</i>	[klɒθ]	klaid	kled
4. <i>death</i>	[deθ]	tod	dod
5. <i>further</i>	[fəðə]	(be)fordərn	(be)furdra
6. <i>loath</i>	[louθ]	laid	led
7. <i>thank</i>	[θɪŋk]	dan̩k	takk
8. <i>thing</i>	[θɪŋ]	dɪŋ	tiŋ
9. <i>three</i>	[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  $\theta$  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. <i>bathe</i>	[beɪð]	baden	bada
11. <i>clothe</i>	[klouð]	klarden	kleda
12. <i>loathe</i>	[louð]	larden	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 #46****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 #47: 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 <sup>171</sup>
1	kaku	kaku	kaku	‘snow’
2	kapo	kabo	kaba	‘daughter-in-law’
3	kawi	gawi	gawi	‘lamb’
4	kene	gene	dzana	‘salmon’
5	kepi	gebi	dzabi	‘victory’
6	keta	geda	dzada	‘cow’
7	kiko	giko	dzika	‘grass’
8	kiko	giko	dzika	‘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’

<sup>171</sup> 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 #47, 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 #47, 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 #47, 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 #47, Question (c)**

Find the correspondence series for bilabial stops and reconstruct the ancestor sounds.

**Answer to Study Exercise #47, question (c)**

There are two series:

<i>A</i>	<i>B</i>	<i>C</i>	
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 #47, Question (d)**

Find the correspondence series for alveolar stops and reconstruct the ancestor sounds.

**Answer to Study Exercise #47, 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 #47, 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 #47, 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 #47, Question (f)**

Generalize your findings of the last three sections using features.

**Answer to Study Exercise #47, question (f)****Stop Devoicing**

\*[+stop] > [−voice] in A

---

**Study Exercise #47, 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 #47, question (g)**

[ieaou], [ieaou], and [iaɪu], 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 #47, 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 #47, 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:

$$*\begin{bmatrix} +\text{syllabic} \\ -\text{high} \end{bmatrix} > [+low, +back]$$
**Study Exercise #47, 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 #47, 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 #47, 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 #47, question (k)**

Cases where \*k evolved into [tʃ]:

*Environment**Example*

- |   |                               |
|---|-------------------------------|
| • followed by an [i]                        | 9 [tʃɪda]                     |
| • 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 [ka <u>k</u> u]; compare B [ka <u>k</u> u] |
| • followed by an [a] that used to be an [o] | 11 [ka <u>p</u> a]; 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.

**Palatalization**<sup>172</sup>

$$* \begin{bmatrix} +\text{velar} \\ +\text{stop} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{velar} \\ +\text{palato-alveolar} \\ -\text{stop} \\ +\text{affricate} \end{bmatrix} / \text{ — } \begin{bmatrix} +\text{syllabic} \\ -\text{back} \end{bmatrix}$$

“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].

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**Study Exercise #47, Question (I)**

Provide historical derivations for 15, 3, 4, 8, 9, and 33, in each language.

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<sup>172</sup> 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 #47, question (I)**

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 bɖg], 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.

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.

	<i>PIE</i>
English <i>father</i>	* <i>pāter</i>
Latin <i>pater</i> (cf. <i>paternal</i> )	
Greek <i>pater</i> (cf. <i>patriarch</i> )	
Persian <i>padār</i>	
English <i>heart</i>	* <i>kerd</i>
Greek <i>kardia</i> (cf. <i>cardiac</i> )	
Latin <i>kord</i> (cf. <i>cordial</i> )	
English <i>bear</i>	
Latin <i>fer</i> (cf. <i>transfer</i> )	* <i>bher</i>
Greek <i>pherein</i> (cf. <i>amphora</i> ) ‘vessel to carry things in’	
English <i>two</i>	
Latin <i>duo</i> (cf. <i>dual</i> )	* <i>dwo</i>
Greek <i>dis</i> (cf. <i>disyllabic</i> )	
Armenian <i>erku</i>	

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:

<i>Proto-Indo-European</i>		<i>Proto-Germanic</i>
p t k	>	f θ h <sup>173</sup>
b d g	>	p t k
b <sup>h</sup> d <sup>h</sup> g <sup>h</sup>	>	b d g

Here are examples:

---

<sup>173</sup> 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].

<i>father</i> , Latin <i>pater</i>	<i>three</i> , Greek <i>treis</i>	<i>heart</i> , Greek <i>kardia</i> :
<i>hemp</i> , Greek <i>kannabis</i>	<i>two</i> , Latin <i>duo</i>	<i>knee</i> , Latin <i>genu</i> : <sup>174</sup>
<i>brother</i> , Latin <i>frater</i> <sup>175</sup>	<i>do</i> , Sanskrit <i>d<sup>h</sup>a:-</i> <sup>176</sup>	<i>guest</i> , Latin <i>hostis</i> <sup>177</sup>

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 the original roots for these correspondences in their Indo-European appendix:

*pater	*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  $k > tʃ \text{ } dʒ$  in C.

Proto-ABC is modeled on a real-life case, namely the history of Sanskrit, of which the following data are representative.

<i>Latin</i>	<i>Old English</i>	<i>Greek</i>	<i>Sanskrit</i>	<i>gloss</i>
-kwe	—	-te	-tʃa	‘and’
kwis	hwa:	tis	tʃid	‘who’
kwod	hwæt	—	-kas	‘what’
—	hwæθer	poteros	kataras	‘which of the two’
kwando	hwanne	—	kada:	‘when’

<sup>174</sup> [kni], until about 1700

<sup>175</sup> The Proto-Indo-European  $b^h$ , preserved in Sanskrit  $b^h a:tar$ , became  $f$  in Latin.

<sup>176</sup> Meaning “to set”.

<sup>177</sup> The Proto-Indo-European  $g^h$  became  $h$  in Latin.



The correspondence series here are these:

<i>Latin</i>	<i>Old English</i>	<i>Greek</i>	<i>Sanskrit</i>	
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 [tʃ], 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:

### 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	—	ka <u>s</u>	ka <u>ta</u> ra <u>s</u>	*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.<sup>178</sup>

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

<sup>178</sup> 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.

typically phoneme inventories 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 ancestor 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.<sup>179</sup> 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	
*'gastiz	*'gastiz	*'gastiz	*'gastiz	Proto-Germanic
—	'gestiz	—	'gæstiz	vowel assimilation
—	'gestir	—	—	weakening of z to r
'gastz	'gestr	'gastz	'gæstz	loss of stressless vowel
—	—	'gast	'gæst	cluster simplification
'gasts	—	'gast	'gæst	voicing assimilation
'gasts	'gestr	'gast	'gæst	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 w a g a s t i z | h o l t i j a z | h o r n a | t a w i d o

<sup>179</sup> 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<sup>h</sup>ostis ‘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<sup>180</sup> 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.<sup>181</sup>

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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<sup>180</sup> Candidates include Uralic (Finnish, Hungarian, Estonian, etc.), Altaic (Turkish, Mongolian, etc), Basque, and others.

<sup>181</sup> The Middle Persian form is recorded as *vat*, more distant already...

**Study Exercise #48**

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 #48

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. /pfartsɪ/. 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 /pfartsɪ/ 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 #49

Consider the following correspondences:

<i>English</i>	<i>German</i>	<i>Swedish</i>	<i>Proto-Germanic</i>
fish	fɪʃ	fɪʃ	*fisk
shoe	ʃu	ʃu:	*sku:
flesh	fleʃ	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 #49

*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 \*skurtjo:n.

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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*:

<i>foot</i> /fʊt/
<i>feet</i> /fi:t/[Number:plural]
‘appendage at end of leg’

The theory of lexical insertion must state 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.):

<i>foot</i>	<i>feet</i>	<i>mouse</i>	<i>mice</i>
*'fot	*'fot-i	*'mus	*'mus-i

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

$$* \begin{bmatrix} +\text{syllabic} \\ +\text{round} \end{bmatrix} > [-\text{back}] / \_\_\_ [-\text{syllabic}] i$$

This change produced the following forms:

<i>foot</i>	<i>feet</i>	<i>mouse</i>	<i>mice</i>
'fot	'føt-i	'mus	'mys-i

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

$$* \begin{bmatrix} +\text{syllabic} \\ -\text{stress} \end{bmatrix} > \text{ə}$$

<i>foot</i>	<i>feet</i>	<i>mouse</i>	<i>mice</i>
<sup>1</sup> fot	<sup>1</sup> føtə	<sup>1</sup> mus	<sup>1</sup> mysə

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 > Ø / \_\_\_\_ ]<sub>word</sub>

<i>foot</i>	<i>feet</i>	<i>mouse</i>	<i>mice</i>
<sup>1</sup> fot	<sup>1</sup> føt	<sup>1</sup> mus	<sup>1</sup> mys

Then the vowel /ø/ lost its rounding, and became the corresponding unrounded vowel /e/:

### ø Unrounding

\*ø > [–round]

<i>foot</i>	<i>feet</i>	<i>mouse</i>	<i>mice</i>
<sup>1</sup> fot	<sup>1</sup> fet	<sup>1</sup> mus	<sup>1</sup> mys

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 unlifzendes eal zefeormod **fet** and folma*  
‘swiftly thus the lifeless corse was clear devoured, even feet and hands.’
- 1297 *He vel of is palefrey, & brec is **fo**t.*  
‘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]

<i>foot</i>	<i>feet</i>	<i>mouse</i>	<i>mice</i>
<sup>1</sup> fot	<sup>1</sup> fet	<sup>1</sup> mus	<sup>1</sup> mis

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 > ai	u > au
e > i	o > u
æ > e	ɔ > o

<i>foot</i>	<i>feet</i>	<i>mouse</i>	<i>mice</i>
<sup>1</sup> fut	<sup>1</sup> fit	<sup>1</sup> maus	<sup>1</sup> mais

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:

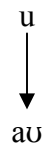
### /u/ Laxing

\*u > [–tense] in certain environments

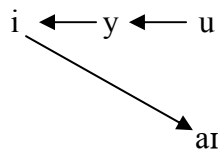
<i>foot</i>	<i>feet</i>	<i>mouse</i>	<i>mice</i>
<sup>1</sup> fut	<sup>1</sup> fit	<sup>1</sup> maus	<sup>1</sup> mais

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*:



The vowel of *musi*:



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*.<sup>182</sup>

### 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 *oversimplifying* 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 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.

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<sup>182</sup> 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].)

## 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.

## Chapter 14: Applications and Outlook

### 1. This course and linguistics in general

This course has taken a particular tack concerning the problem of how to teach basic linguistics in just ten weeks. For every areas we've discussed, 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, I've mostly picked theories on the basis of being able to teach them 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 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.

#### 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 proceed steadily onward to become fluent native speakers. Moreover, they don't get stuck: there are a number of Bantu tone languages that have resisted being completely reduced to rule, but that hasn't stopped the human children who learn these languages from apprehending the pattern and using it fluently.

The problem of acquisition in syntax is perhaps even more baffling, because there, what children do is learn the ungrammaticality of sentences in the absence of negative evidence (see Chapter 7).

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<sup>183</sup> when asked for the past tense of "*splung*", guesses as follows:

<i>splung</i>	first choice
<i>splinged</i>	close second
<i>splang</i>	third choice

This roughly matches the preference of people. 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

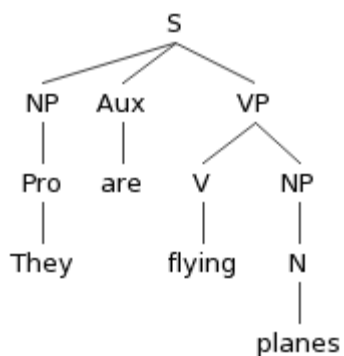
A parser is a procedure (usually a computer program) that, given a grammar and a sentence, can figure out the phrase structure tree that the grammar assigns to the sentence. One problem in parsing is that sentences often have many more parses than we as linguists think they do. To give one example, the sentence:

They are flying planes.

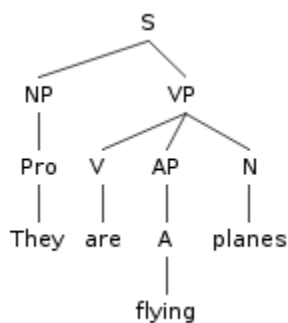
has two obvious parses:

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<sup>183</sup> 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>]



(They are acting as pilots)



(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:

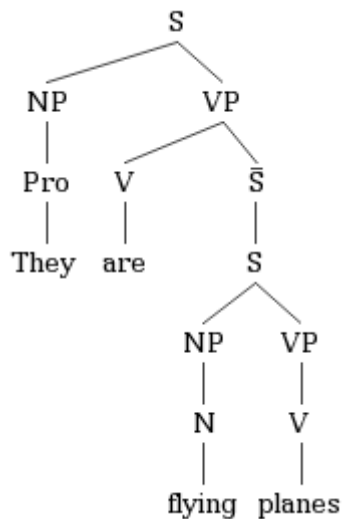
Smoking kills.

What are the facts? The facts are, smoking kills.

They are, smoking kills.

They are, flying planes.





(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, construed generally, 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?

To go out on a limb: I think 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.

#### 3.1 Teaching reading and writing

Children learn to read, at least in part, by establish correspondences between the phonemes they learned in toddlerhood and the letters used to spell the language. Teachers who teach children to read can, at least in principle, make faster progress by being aware of the phonemic system of their students. Thus, if a student makes no distinction between [ɪ] and [ɛ] before nasals (saying, as millions do, both *pin* and *pen* as [pɪn]), then a reading teacher should not

correct the student who reads *pen* as [pɪn]—this can only undermine the student’s confidence, given that she correctly interpreted the letters within her phonemic system.<sup>184</sup>

In later years, children are taught to write in a standardized, normatively-defined style. 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.

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”.<sup>185</sup> The concepts of clause, implicit subject, and coreference—all taught in this course—are clearly relevant here.

### 3.2 Teaching foreign languages

Language instruction can be either intuitive or structural—in 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 text include training in basic phonetics and the IPA, and use IPA transcriptions to make 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.

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<sup>184</sup> Far more tricky is the case of a child who has learned a theta-less dialect like Cockney or Black 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.

<sup>185</sup> Strunk and White’s *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/e/estyle\\_1.htm](http://orwell.ru/library/others/style/e/estyle_1.htm).

### 3.3 Alphabet design

Many of the world's people 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 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 and 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 2007):

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 Linguistics 20 student could tell Bill Gates 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.<sup>186</sup>

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.

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.

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<sup>186</sup> To be fair, it is possible that the Microsoft staff are aware of this problem, but have yet to find a reliable way to “undo” Wh- Movement.

## Chapter 15: More review problems

### **Study Exercise #50: Phonetic Dictations**

*southern*  
*myrrh*  
*corpulent*  
*whether*  
*multiple*  
*coinage*  
*parameter*  
*ostentatious*  
*turmoil*  
*trapezium*

**Answer to Study Exercise #50**

<i>southern</i>	[ˈsʌðə̃n]
<i>myrrh</i>	[ˈmɜ̃]
<i>corpulent</i>	[ˈk{ou,o,ɔ}ɪpj{u,u,ə}lənt]
<i>whether</i>	[ˈwɛðə̃]
<i>multiple</i>	[ˈmʌlt{ɪ, ə}p{l, əl}]
<i>coinage</i>	[ˈkɔɪn{ə,ɪ}dʒ]
<i>parameter</i>	[pəˈɪæməɾə̃] [ə̃] for first [ə] or [əɪ] ok
<i>turmoil</i>	[ˈtɜ̃mɔɪl]
<i>ostentatious</i>	[ɔstɛnˈteɪʃəs]
<i>trapezium</i>	[tɹəˈpɪziəm]

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**Study Exercise #51: 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: [juɪ, uɪ, oɪ].

	<i>Dialect A</i>	<i>Dialect B</i>	<i>Dialect C</i>
1. <i>Muir</i>	[ˈmjuɪ]	[ˈmjuɪ]	[ˈmjoɪ]
2. <i>moor</i>	[ˈmuɪ]	[ˈmuɪ]	[ˈmoɪ]
3. <i>more</i>	[ˈmoɪ]	[ˈmoɪ]	[ˈmoɪ]
4. <i>cure</i>	[ˈkjuɪ]	[ˈkjuɪ]	[ˈkjoɪ]
5. <i>Coors</i>	[ˈkuɪz]	[ˈkuɪz]	[ˈkoɪz]
6. <i>core</i>	[ˈkoɪ]	[ˈkoɪ]	[ˈkoɪ]
7. <i>Buhr</i>	[ˈbjuɪ]	[ˈbjuɪ]	[ˈbjoɪ]
8. <i>boor</i>	[ˈbuɪ]	[ˈbuɪ]	[ˈboɪ]
9. <i>bore</i>	[ˈboɪ]	[ˈboɪ]	[ˈboɪ]
10. <i>endure</i>	[ɛnˈdjuɪ]	[ɛnˈduɪ]	[ɛnˈdoɪ]
11. <i>dour</i>	[ˈduɪ]	[ˈduɪ]	[ˈdoɪ]
12. <i>door</i>	[ˈdoɪ]	[ˈdoɪ]	[ˈdoɪ]
13. <i>Turing</i>	[ˈtjuɪɪŋ]	[ˈtuɪɪŋ]	[ˈtoɪɪŋ]
14. <i>tour</i>	[ˈtuɪ]	[ˈtuɪ]	[ˈtoɪ]
15. <i>tore</i>	[ˈtoɪ]	[ˈtoɪ]	[ˈtoɪ]

- |     |                                  |             |             |             |
|-----|----------------------------------|-------------|-------------|-------------|
| 16. | <i>inure</i>                     | [ɪˈnjuː]    | [ɪˈnuː]     | [ɪˈnoː]     |
| 17. | <i>Koh-i-noor</i> <sup>187</sup> | [ˈkoʊhɪnuː] | [ˈkoʊhɪnuː] | [ˈkoʊhɪnoː] |
| 18. | <i>nor</i>                       | [ˈnoː]      | [ˈnoː]      | [ˈnoː]      |

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<sup>187</sup> A famous diamond, from the Persian for “mountain of light”.

**Answer to Study Exercise #51**

Correspondence sets:

Proto	A	B	C	Examples
*juɪ	juɪ	juɪ	joɪ	1, 4, 7
*jʊɪ	juɪ	uɪ	oɪ	10, 13, 16
*uɪ	uɪ	uɪ	oɪ	2, 5, 8, 11, 14, 17
*or	oɪ	oɪ	oɪ	3, 6, 9, 12, 15, 18

The proto-language is identical to Dialect A.

B and C have both undergone:

\*j > Ø / [+alveolar] \_\_\_\_

See *endure*, *Turing*, and *inure*

C has also undergone:

\*u > o / \_\_\_\_ ɪ

which has merged *moor* with *more*, *boor* with *bore*, and so on.

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**Study Exercise #52: Wh- Movement and islands**

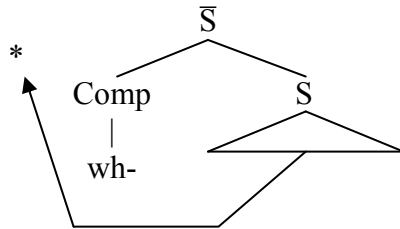
Show why

*\*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.

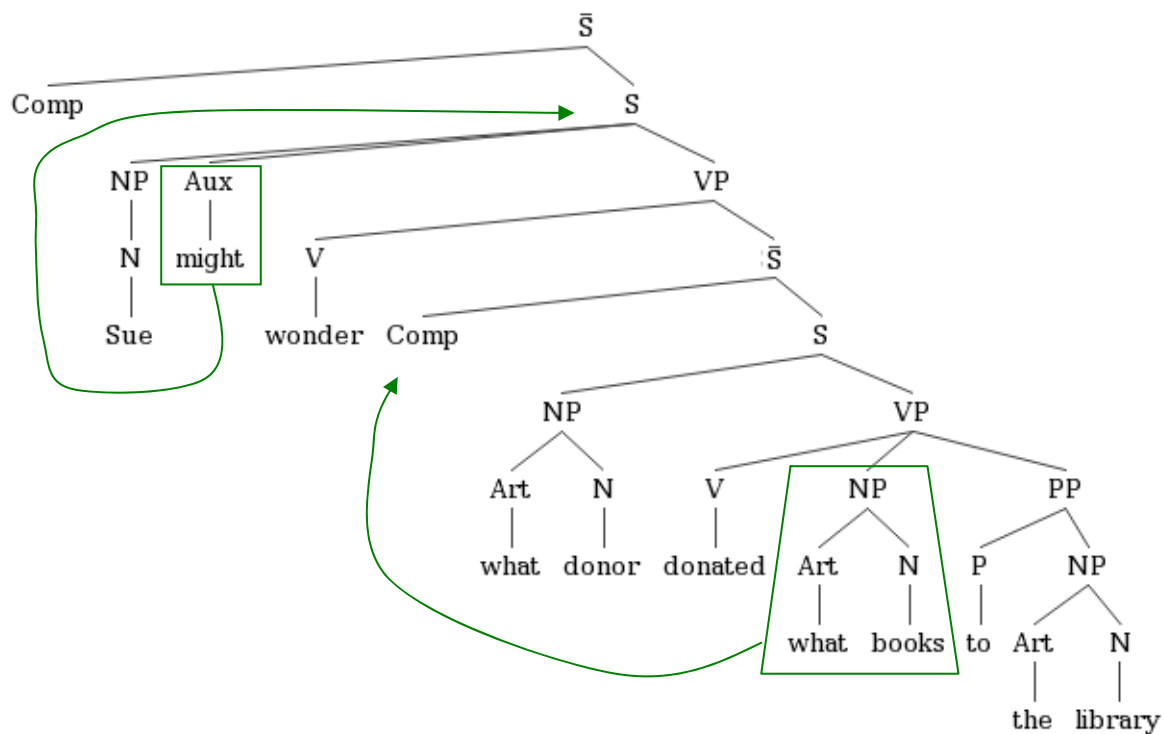
**Wh- Island Constraint**

Mark as ungrammatical any sentence in which a constituent has been extracted from inside an  $\bar{S}$  whose Comp contains a wh- phrase.

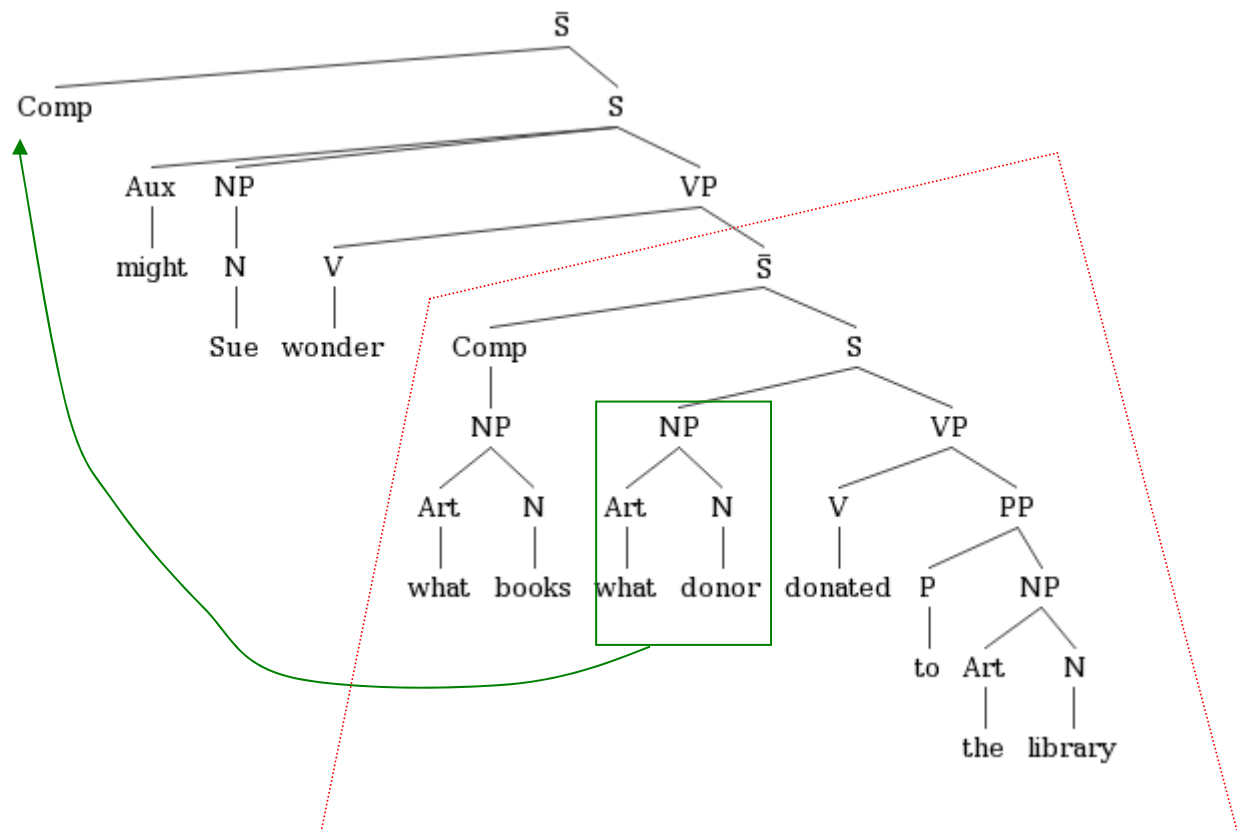


**Answer to Study Exercise #52**

Deep structure (all wh- phrases *in situ*), with lower instance of Wh-Movement; also Subject-Aux Inversion in upper clause:



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 #53: 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). [t, ɖ, ɳ] are dental.

	<i>'Noun'</i>	<i>'the Noun'</i>	<i>'two Nouns'</i>	<i>'five Nouns'</i>	
1.	[pama]	[la bama]	[ɖue bamas]	[kwɪɳɖo bamas]	'tuna'
2.	[peli]	[la beli]	[ɖue belis]	[kwɪɳɖo belis]	'swordfish'
3.	[tʉbe]	[la ɖube]	[ɖue ɖube]	[kwɪɳɖo ɖube]	'mackerel'
4.	[tʉazo]	[la ɖazo]	[ɖue ɖazo]	[kwɪɳɖo ɖazo]	'cod'
5.	[kame]	[la game]	[ɖue game]	[kwɪɳɖo game]	'mahi mahi'
6.	[koli]	[la goli]	[ɖue goli]	[kwɪɳɖo goli]	'carp'
7.	[bafi]	[la βafi]	[ɖue βafi]	[kwɪɳɖo βafi]	'catfish'
8.	[belu]	[la βelu]	[ɖue βelu]	[kwɪɳɖo βelu]	'pollock'
9.	[ɖaba]	[la ðaba]	[ɖue ðaba]	[kwɪɳɖo ðaba]	'yellowtail'
10.	[ɖazo]	[la ðazo]	[ɖue ðazo]	[kwɪɳɖo ðazo]	'sturgeon'
11.	[gele]	[la ɣele]	[ɖue ɣele]	[kwɪɳɖo ɣele]	'halibut'
12.	[gova]	[la ɣova]	[ɖue ɣova]	[kwɪɳɖo ɣova]	'salmon'

- Produce consonant and vowel charts, labeling the rows and columns with features. You may assume [+dental] is a feature.
- Do the stems alternate? Explain
- Give rules, naming them.
- Is any rule ordering required?
- Give right order/wrong order derivations for *la dazo* and *la ðazo*.

**Answer to Study Exercise #53**

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]	β	v	ð	z	ɣ
[+nasal]		m		n		
[+liquid]					l	
[+glide]		w				

	[−back −round]	[+back −round]	[+back −round]
[+high −low]	i		u
[−high −low]	e		o
[−high +low]		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<sup>188</sup>**

[+stop  
+voice] → [−stop  
+fricative] / [+syllabic] \_\_\_\_ [+syllabic]

This turns any voiced stop between vowels to its fricative counterpart, thus [b, d, g] → [β, ð, ɣ].

<sup>188</sup> 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/	phonemic forms
—	ð	Intervocalic Spirantization
d	—	Intervocalic Voicing
[la dazo]	[la ðazo]	phonetic forms

Incorrect:

/la tazo/	/la dazo/	phonemic forms
d	—	Intervocalic Voicing
ð	ð	Intervocalic Spirantization
*[la ðazo]	[la ðazo]	phonetic forms

### Study Exercise #54: Semantics; anaphora

*The wizards believe that the witches turned the girls into copies of each other.*

- Produce the phrase structure tree.
- Show clausemates with brackets, as in xxx the readings, show c-command with arrows.
- Explain with reference to rule given below the possible reference of *each other*.

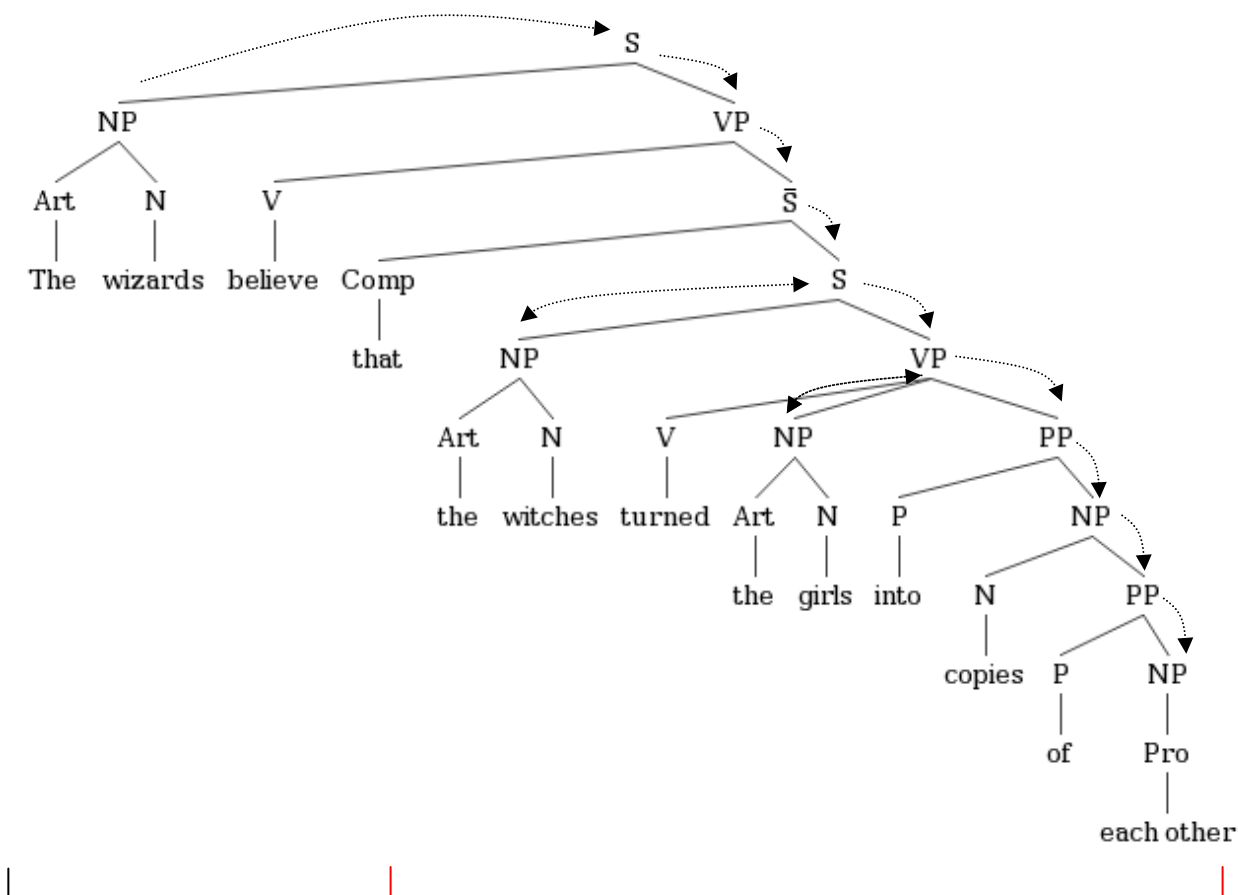
#### Each Other Reference

*Each other* may refer only to a c-commanding clausemate.

### Answer to Study Exercise #54

*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 NP's, we see the following relations of c-command:<sup>189</sup>

*the wizards* c-commands the other three NP's

*the witches* c-command *the girls* and *each other*

*the girls* c-commands *each other*

<sup>189</sup> 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 #55: Semantics: scope

This sentence has a scope-based ambiguity.

*Many people visit two islands.*

- Describe clearly in words the two meanings of these sentence.
- Make up a scenario of which it could hold true.
- Using Quantifier Translation and Quantifier Raising, derive the logical forms for each meaning.

#### Quantifier Translation

Replace

[ every N ] <sub>NP</sub>	with	[ for every x, x an N ] <sub>NP</sub>
[ some N ] <sub>NP</sub>	with	[ for some x, x an N ] <sub>NP</sub>
...		

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 #55

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. Give scenarios.

(The possibilities are infinite, but here is one:)

(a): A travel agency offering tours of the Hawaiian Islands offers a great number of package tours:

One-Island tours: just Oahu, or Big Island, or Maui, or Molokai, etc.

Two-Island tours: Oahu and Big Island, or Oahu and Maui, or Big Island and Kauai, etc.

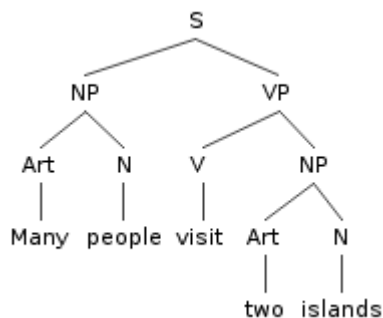
Three-Island tours: Oahu, Big Island, and Maui; or Kauai, Oahu, and Maui; etc.

Many customers select a Two-Island Tour.

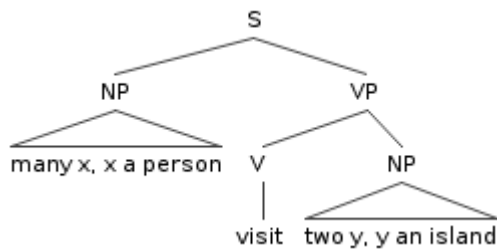
(b) In this scenario: many people visit Oahu, many people visit the Big Island, but hardly anyone ever visits Kauai, Maui, Molokai, or any of the other islands.

iii. Derivation of logical forms

Surface structure:



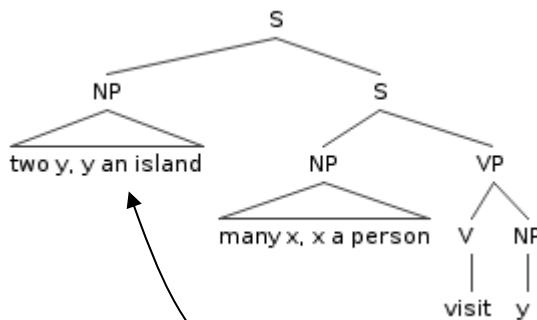
## Quantifier Conversion:



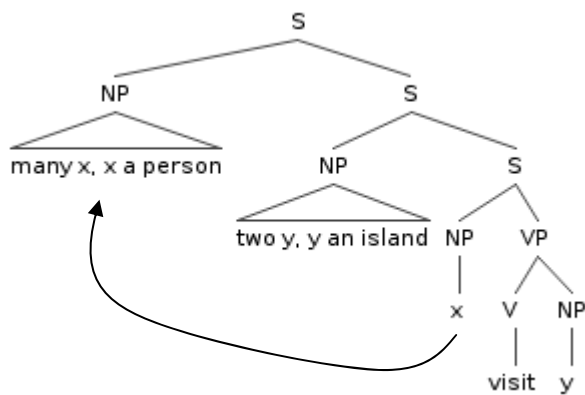
At this point, the meanings depend on the order in which the quantifier operators are raised.

(a)

## Quantifier Raising I



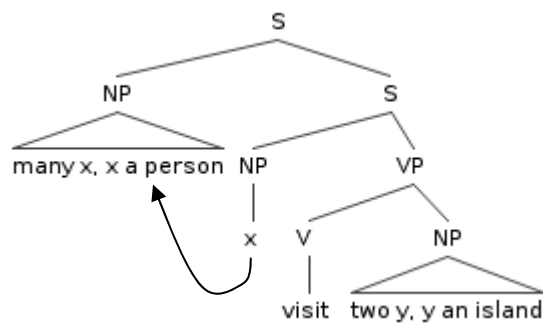
## Quantifier Raising II



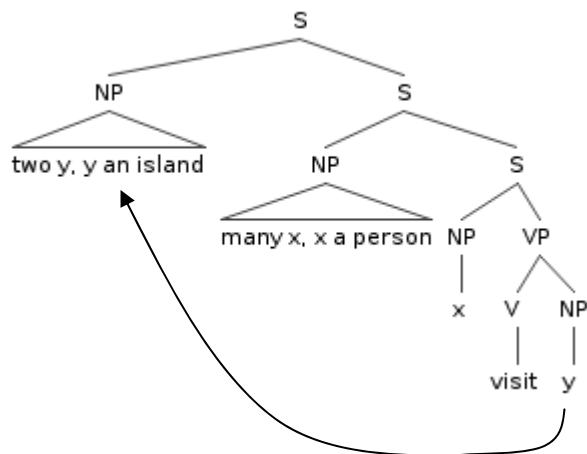
"It is true of many people that they visit two islands"

(b)

## Quantifier Raising I



## Quantifier Raising II



“It is true of two islands that many people visit them.”