Examples and Exercises

I-language

An Introduction to Linguistics as Cognitive Science

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1 What is I-language?

(1) Warlpiri plurals

SINGULAR	PLURAL	
kurdu	kurdukurdu	child/children
kamina	kaminakamina	girl/girls

(2) $f(x) = x^\frown x$

(3) $f(x) = x^\frown s$

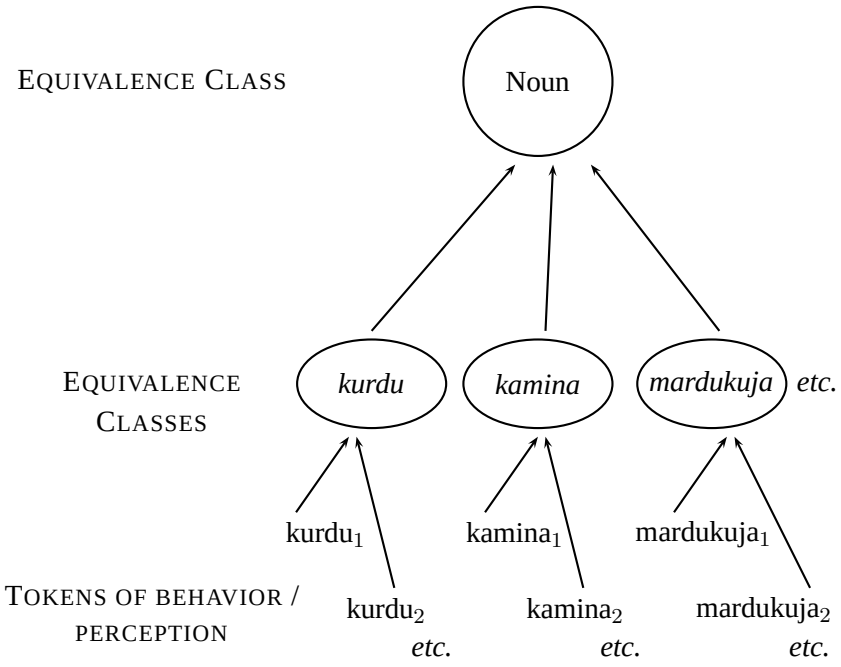


Figure 1: The equivalence class of Nouns is itself an abstraction from equivalence classes abstracted from sets of tokens of individual nouns.

(4) Samoan verbs: sg-pl

nofo	nonofo	'sit'
moe	momoe	'sleep'
alofa	alolofa	'love'
savali	savavali	'walk'
maliu	maliliu	'die'

(5) Representing syllable sequences

a. σ_2-σ_1
b. σ_3-σ_2-σ_1
c. σ_n-...-σ_2-σ_1

(6) If σ_n-...-σ_2-σ_1 is a singular verb, then the plural is σ_n-...-σ_2-σ_2-σ_1

(7) [I]f you believe P, and you believe that P entails Q, then even if Q seems more than a little odd, you have some intellectual obligation to take seriously the possibility that Q may be true, nonetheless. [Zenon Pylyshyn 1984, *Computation and Cognition*:xxii].

1.1 Exercises

Exercise 1.8.1. **Ethnologue:** Throughout the book we refer to languages in the everyday sense of English, Warpiri, Spanish and so on. Find information about where languages are spoken, how many speakers they have and what family they belong to, by consulting the *Ethnologue* at http://www.ethnologue.com. Go to the website and write up a description of the language that immediately follows your family name alphabetically and the language that immediately follows your given name. (If your name is James Jameson, or something else that gives the same language twice, use the language that *precedes* your family name alphabetically.

Exercise 1.8.2. How do you express the meaning *very* in Pocomchí? Fill in the blanks.

adjective		*very* + adjective	
saq	white	saqsaq	very white
raš	green	rašraš	very green
q'eq	black	q'eqq'eq	very black
q'an	ripe		very ripe, rotten
nim	big		very big
kaq	red		very red

Exercise 1.8.3. Can you see how to generate the set of definite nouns (like *the bird*) from the set of bare nouns (like *bird*) in Lyele? Note that vowels in Lyele can bear one of three tones: a = mid tone; á = high tone; à = low tone. These tonal differences are distinctive−they can differentiate meaning.

kúmí	bird	kúmíí	the bird
yálá	millet	yáláá	the millet
kùlí	dog		the dog

Things may be a bit more complex than you thought:

nà	foot	nàá	the foot
yijì	church	yijìí	the church
ya	market	yaá	the market
cèlé	parrot	cèléé	the parrot

To make the definite form (*the* + N) repeat _____ but always use a _____ tone.

What equivalence classes are relevant to a discussion of these Lyele noun forms?

Exercise 1.8.4. **Is it English?** Here are some sentences rendered in Standard orthography that we have heard spoken in various places that are referred to as English-speaking places. Identify differences from your own variety of English, if you can figure out the intended translation into your own dialect. Are these sentences all English? How does the I-language approach bear on the issue?

1. We are allowed running here. (Montreal)
2. We are allowed to run here. (Brooklyn)
3. I did nothing today. (Brooklyn)
4. I didn't do nothing today. (Brooklyn)
5. The government has decided to raise taxes. (Montreal)
6. The government have decided to raise taxes. (London)
7. I'm going to the dep to get some cigarrettes and beer. (Montreal)
8. That's all the faster I can run. (Michigan)
9. That's as fast as I can run. (Brooklyn)
10. I might could go. (Alabama)
11. I might be able to go. (Brooklyn)
12. He been try make me mad. (Cajun English, Lousiana)
13. I ate a egg. (Ypsilanti)
14. I ate an egg. (Brooklyn)

2 I-everything: Triangles, streams, words

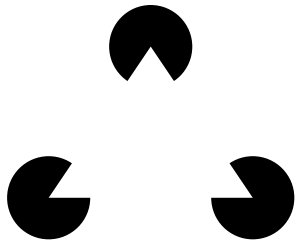


Figure 2: Triangle constructed by visual system.

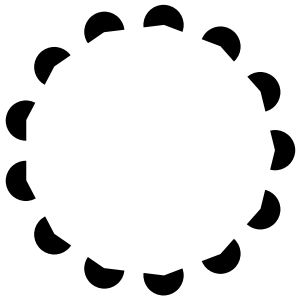


Figure 3: An illusory triskaidecagon

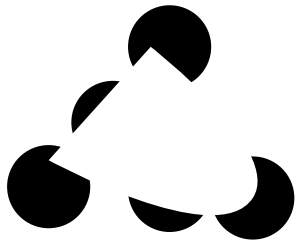


Figure 4: Unnamed form constructed by visual system.

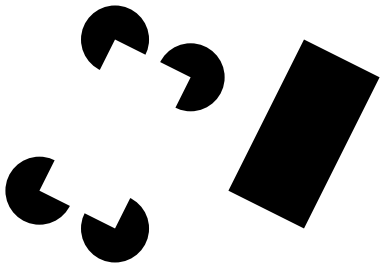


Figure 5: Rectangles constructed by visual system—of humans and bees, who can be trained to treat the two figures as members of an equivalence class in terms of orientation.

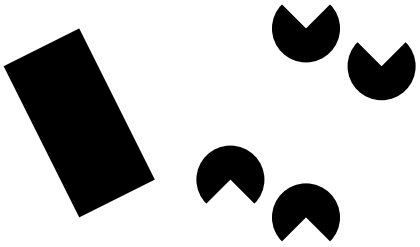


Figure 6: The bees do not treat the illusory rectangle above as the same as either of these two figures

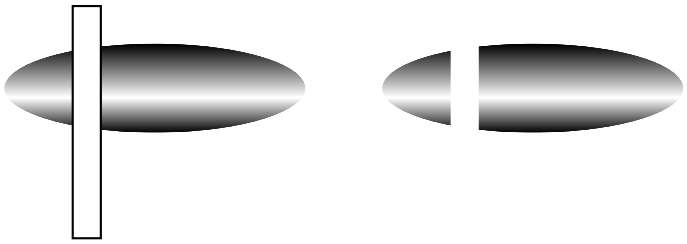


Figure 7: How many objects on the left? How many on the right?

(8) In using the word ‘representations’, we are implying the existence of a two-part system: one part forms the representations and another uses them to do such things as calculate . . . [Albert Bregman 1990, *Auditory Scene Analysis*:3]

(9) After his stroke, Mr. P still had outstanding memory and intelligence. He could read and talk, and mixed well with the other patients on his ward. His vision was in most respects normal—with one notable exception: he couldn’t recognize the faces of people or animals. As he put it himself, “I can see the eyes, nose and mouth quite clearly, but they just don’t add up. They all seem chalked in, like on a blackboard. . . I have to tell by the clothes or by the voice whether it is a man or a woman. . . The hair may help a lot, or if there is a moustache. . . . ” Even his own face, seen in a mirror, looked to him strange and unfamiliar. Mr. P had lost a critical aspect of his visual intelligence. [Preface of Hoffman 1998, *Visual Intelligence*]

Figure 8: Mouths, snouts, lips, eyes and ears or Oonagh and Baby Z?

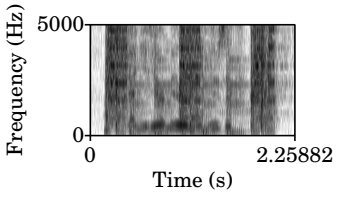


Figure 9: Spectrogram of a complex wave consisting of music and speech

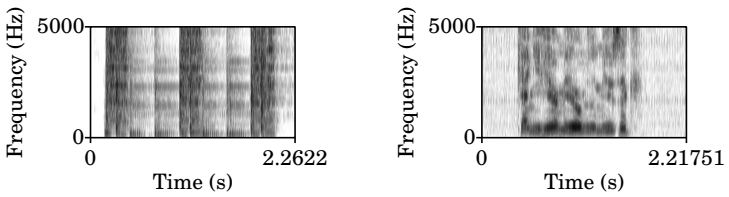


Figure 10: The music (left) and the speech (right)

(10) The perceptual world is one of events with defined beginnings and endings . . . An event becomes defined by its temporal boundary. But this impression is not due to the structure of the acoustic wave; the beginning and ending often are not physically marked by actual silent intervals. [Handel 1989]

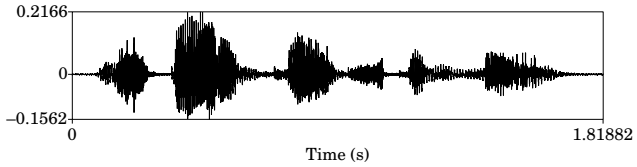


Figure 11: Waveform of a sentence.

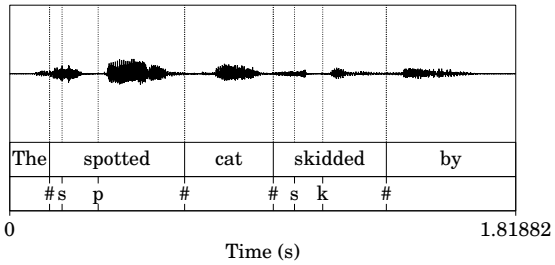


Figure 12: Waveform of *The spotted cat skidded by*.

2.1 Exercises

Exercise 2.6.1. **Word boundaries:** The purpose of this exercise is to give you firsthand experience with the abstractness of linguistic representation. You will see that the word and segment boundaries we perceive are typically not present in the acoustic signal, but instead are imposed by our minds. This is a linguistic example of the construction of experience that we have discussed in relation to vision and hearing.

You will work with a recorded sentence and try to find word boundaries. Using a sound editing program such as Praat (www.praat.org) examine the waveform of the sound file ilang.wav available from the companion website. If you have trouble saving the file from your browser, then download the .zip file containing all the materials you need and unzip it. You'll end up with a folder containing the sound file.

There is also an image of the waveform on the website, but you need a sound editing program to zoom in and play selections. You may find it useful to print this waveform, or one from within Praat, to mark your word boundaries on. In order to complete the exercise you need to be able to see the waveform (a graph of intensity vs. time) and select and play portions of the sound file. You also need to be able to find points in time in the waveform window. This is pretty easy in Praat and most other phonetics programs.

You can also get a manual from the Praat homepage or get a manual written by our former student Tom Erik Stower from the companion page. (This manual contains more detail than you will need.) . Write your answers

down on scrap paper as you proceed, so that you do not lose your work if the computer crashes or if your session is interrupted.

1. Provide an orthographic transcription of the sentence—that is, just write it in normal English writing:
2. For each word of the ten or so words in the sentence, write the ending time of the word in milliseconds. (Count contractions like *can't* as two words, if there are any.) For example:
   End word 1 "the": 136 msec
   End word 2 "cat": 202 msec
   and so on.
3. Are there any cases of silence within a word? Give at least one example and say where the silence occurs–between which sounds? Example: The word "Casper" has silence between the s and the p. This can be heard and also seen because the waveform has almost no amplitude between those two sounds.
4. Is there generally silence or a pause between words? Give an example of two adjacent words where you had difficulty deciding on where to place the boundary. Example: It was hard to decide on the boundary between "the" and "apple".
5. Comment on any difficulties or interesting issues you encountered in any part of this exercise. (Say something coherent and relevant–if you found nothing interesting, fake it.)

Exercise 2.6.2. Take either a prerecorded sentence or record your own and mark the segment boundaries on the waveform. In other words, find the division between adjacent sounds, like the *s* and the *k* of a word like *sky*. Comment on any problems you run into. See how your results compare to those of your classmates. Tom Erik's manual will tell you how to mark the boundaries on a waveform in Praat and print out the results.

Exercise 2.6.3. **More construction:** Visit a website with optical illusions and find examples of illusions that demonstrate your mind's role in the construction of color, motion and shape. Here is one excellent site: http://www.michaelbach.de/ot/index.html

3 Approaches to the study of language

(11) Originally, **thou** was to **you** as in French **tu** is to **vous**. **Thou** signified either close familiarity or social inferiority, while **you**

was the more impersonal and general term. In European languages to this day choosing between the two forms can present a very real social agony. As Jespersen, a Dane who appreciated these things, put it: “ English has thus attained the only manner of address worthy of a nation the respects the elementary rights of each individual.” [Bill Bryson 1990, *Mother Tongue*]

(12) Since language is not, in its essence, a means for transmitting [cognitive] information—though no one denies that we constantly use language for this very purpose—then it is hardly surprising to find in languages much ambiguity and redundancy, as well as other properties that are obviously undesirable in a good communication code. [Morris Halle 1975]

(13) ”To bring out clearly one of these points I select at random, by way of contrast, a passage from the language of Hawaii: ’I kona hiki ana aku ilaila ua hookipa ia mai la oia me ke aloha pumehana loa.’ Thus it goes on, no single word ends in a consonant, and a group of two or more consonants is never found. Can any one be in doubt that even if such a language sound pleasantly and be full of music and harmony the total impression is childlike and effeminate? You do not expect much vigour or energy in a people speaking such a language; it seems adapted only to inhabitants of sunny regions where the soil requires scarcely any labour on the part of man to yield him everything he wants, and where life therefore does not bear the stamp of a hard struggle against nature and against fellow-creatures.” [Otto Jespersen 1911]

(14) The proper conclusion is not that we must abandon concepts of language that can be productively studied, but that the topic of successful communication in the actual world of experience is far too complex and obscure to merit attention in empirical inquiry, except as a guide to intuitions as we pursue research designed to lead to some understanding of the real world, communication included. [Noam Chomsky 2000:68]

(15) Plainly, a naturalistic approach does not exclude other ways of trying to comprehend the world. Someone committed to it can consistently believe (I do) that we learn much more of human

> interest about how people think and feel and act by reading novels or studying history or the activities of ordinary life than from all naturalistic psychology, and perhaps always will; similarly, the arts may offer appreciation of the heavens to which astrophysics does not aspire. [Noam Chomsky 2000:77]

(16) > The beginning of science is the recognition that the simplest phenomena of ordinary life raise quite serious problems: Why are they as they are, instead of some different way? [Chomsky 1988:43, *Language and Problems of Knowledge*].

(17) The boy is singing.

(18) Is the boy singing?

(19) The boy who is dancing is very tall.

(20) The boy is kissing the dog that is whining.

(21) Is the boy who is dancing very tall?

(22) Is the boy kissing the dog that is whining?

(23) The boy whose mother can sing well may chase the puppy that is recovering from an injury that it received from a man who can be quite nasty.

(24) May the boy whose mother can sing well chase the puppy that is recovering from an injury that it received from a man who can be quite nasty?

(25) Rule1. Reverse order of words in a sentence A to form sequence B.

(26) The dog saw a cat.

(27) Cat a saw dog the.

(28) The tall man who is crying can drop the frog that is croaking.

(29) Three blind mice ran across the track.

(30)
1. Bill is perplexed. John kissed himself. (*himself* = *John*, *himself* cannot be *Bill*)
2. Bill is perplexed. *Mary kissed himself. (*himself* cannot be *Mary*, *himself* cannot be *Bill*)

3. Bill is perplexed. John kissed him. (*him* cannot be *John*, *him* can be *Bill*)
4. Bill is perplexed. *Himself kissed John. (*himself* cannot be John, and *himself* cannot be *Bill*)
5. Bill is perplexed. He kissed John. (*he* cannot be *John*, but *he* can be *Bill*)

(31)
1. Bill is perplexed. John didn't kiss anybody.
2. Bill is perplexed. John never kisses anybody.
3. Bill is perplexed. *John kissed anybody.
4. Bill is perplexed. *John always kissed anybody.
5. Bill isn't perplexed. *John kissed anybody.
6. Bill isn't perplexed. *John always kissed anybody.
7. Bill is perplexed. *Anybody didn't kiss John.

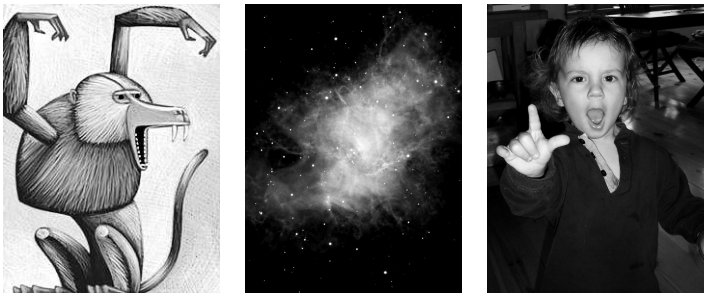


Figure 13: Which two of these look most alike? Baboon image (left) used by permission ©Art Parts.

(32) At one time there was no very profound difference between the two versions. The scientist accepted the familiar story [of the perceiving mind] in its main outline; only he corrected a few facts here and there, and elaborated a few details. But latterly the familiar story and the scientific story have diverged more and more widely—until it has become hard to recognise that they have anything in common. Not content with upsetting fundamentally our ideas of material substance, physics has

played strange pranks with our conceptions of space and time. Even causality has undergone transformations. Physical science now deliberately aims at presenting a new version of the story of our experience from the very beginning, rejecting the familiar story as too erratic a foundation. [Sir Arthur Eddington 1934, *Science and Experience*]

(33) To a remarkable extent, and really out of thin air, philosophers have taken it upon themselves to legislate conditions under which empirical inquiry into the mental must proceed. (Fodor 2000, "It's all in the mind," *Times Literary Supplement* review of Chomsky 2000b)

(34) Explanatory theories of mind have been proposed, notably in the study of language. They have been seriously challenged, not for violating the canons of methodological naturalism (which they seem to observe, reasonably well), but on other grounds: 'philosophical grounds', which are alleged to show that they are dubious, perhaps outrageous, irrespective of success by the normal criteria of science; or perhaps that they are successful, but do not deal with 'the mind' or 'the mental'...[S]uch critiques are commonly a form of methodological dualism, and...advocacy (or tacit acceptance) of that stance has been a leading theme of much of the most interesting work in recent philosophy of language. [Chomsky 2000:77]

(35) I would rather find a single causal law than be the king of Persia [Democritus (5th century BCE)]

3.1 Exercises

Exercise 3.7.1. Ask three friends the following questions:

- What is language?
- Can you characterize language without mentioning what we use it for?
- Can language be studied scientifically, like biology or physics?

Discuss their responses in terms of the approaches introduced in this chapter.

4 I-/E-/P-Language

(36) Weri:

a. àkunèpetál
b. ulùamít

(37) a. akunepetal → àkunèpetál
b. uluamit → ulùamít

(38) An algorithm for Weri stress

- Syllables are grouped into pairs, starting from the end of the word as follows. Each grouped pair is called a “foot”.
  a. a(kune)(petal)
  b. (ulu)(amit)
- Leftover syllables are grouped by themselves:
  a. (a)(kune)(petal)
  b. (ulu)(amit)
- Stress is assigned to the syllable at the right edge of each foot:
  a. (à)(kunè)(petàl)
  b. (ulù)(amìt)
- The rightmost stress in the word is made the primary stress:
  a. (à)(kunè)(petál)
  b. (ulù)(amít)

(39) Maranungku:

- tíralk
- mérepèt
- jángarmàta
- lángkaràtefì
- wélepèlemànta

(40) An algorithm for Maranungku stress

- Label the vowels of each syllables with an index from 1 to n, where n is the number of syllables in the word, *e.g.*:

  - ti_1ra_2lk
  - $me_1re_2pe_3t$
  - ...
- Assign stress to each syllable whose vowel bears an odd numbered index.
- Assign primary stress to the syllable whose vowel bears the lowest index.

(41) Because evidence from Japanese can evidently bear on the correctness of a theory of S_0, it can have indirect−but very powerful−bearing on the choice of the grammar that attempts to characterize the I-language attained by a speaker of English. [Noam Chomsky 1986, *Knowledge of Language*:38]

(42) Here are two words from Warao, a language spoken in Venezuela:

a. yiwàranáe

b. yàpurùkitàneháse

(43) a. $yi_5wà_4ra_3ná_2e_1$
yi(wàra)(náe)

b. $yà_8pu_7rù_6ki_5tà_4ne_3há_2se_1$
(yàpu)(rùki)(tàne)(háse)

(44) Rules in phonology: Pintupi (Australian) stress

páɳa	'earth'
tʲúɽaya	'many'
máɭawàna	'through from behind'
púɭiŋkàlatʲu	'we (sat) on the hill'
tʲámulùmpatʲùŋku	'our relation'
ɽíɭirìŋulàmpatʲu	'the fire for our benefit flared up'

(45) Where are the stressed syllables in the following words?

kuranʲuluimpatʲuɻa	'the first one who is our relation'
yumaɻiŋkamaratʲuɻaka	'because of mother-in-law'

(46) Extensional equivalence—three functions for generating a set of numbers: $\mathcal{S}$={1, 4, 7, 10, 13, 16, 19}.

a. $3x + 1, x \in \{0, 1, 2, 3, 4, 5, 6\}$

b. $3x - 2, x \in \{1, 2, 3, 4, 5, 6, 7\}$

c. $(3x - 4)/2, x \in \{2, 4, 6, 8, 10, 12, 14\}$

(47) Samoan verbs: sg-pl

(**no**fo)	nonofo	'sit'
(**mo**e)	momoe	'sleep'
a(**lo**fa)	alolofa	'love'
sa(**va**li)	savavali	'walk'
ma(**li**u)	maliliu	'die'

(48) Pintupi stress (again)

(páŋa)	$(\sigma'\sigma)$	'earth'
(tʲúʈa)(ya)	$(\sigma'\sigma)\sigma$	'many'
(máɭa)(wàna)	$(\sigma'\sigma)(\sigma\text{'}\sigma)$	'through from behind'
(púɭiŋ)(kàla)(tʲu)	$(\sigma'\sigma)(\sigma\text{'}\sigma)\sigma$	'we (sat) on the hill'
(tʲámu)(lùmpa)(tʲùŋku)	$(\sigma'\sigma)(\sigma\text{'}\sigma)(\sigma\text{'}\sigma)$	'our relation'
(ʈíɭi)(rìŋu)(làmpa)(tʲu)	$(\sigma'\sigma)(\sigma\text{'}\sigma)(\sigma\text{'}\sigma)\sigma$	'the fire for our benefit flared up'

(49) assert that the source for prior support for language acquisition must originate from *inside* the brain, on the unstated assumption that there is no other possible source. But there is another alternative: that the extra support for language learning is vested neither in the brain of the child nor in the brains of parents or teachers, but outside brains, in language itself [Terence Deacon 1997, *The Symbolic Species*:105].

(50) "Language partakes in the world-wide dissemination of similitudes and signatures. It must therefore, be studied itself as a thing in nature. Like animals, plants or stars, its elements have their laws of affinity and convenience, their necessary analogies" [Michel Foucault 1973:35]

(51) It might be that when he listens to Mary speak, Peter proceeds by assuming that she is identical to him, modulo M, some array of modifications that he must work out. Sometimes the task is easy, sometimes hard, sometimes hopeless. . . . Insofar as Peter succeeds in these tasks, he understands what Mary says as being what he means by his comparable expression. The only (virtually) "shared structure" among humans generally is the initial state of the language faculty. Beyond that we expect to

find no more than approximations, as in the case of other natural objects that grow and develop. [Noam Chomsky 2000b *New Horizons*:31]

4.1 Exercises

Exercise 4.5.1. **Stress rules:** Consider the following two made-up words:

(52)
- pakulikamukitakamonisimu
- musinimokatakimukaliku

Imagine that you are (a) a Weri speaker; (b) a Maranungku speaker; (c) a Pintupi speaker; (d) a Waori speaker. What would be the output of your stress assignment rule be in each case?

Exercise 4.5.3. **Kuna verbs:** Concordia undergraduate student Francis Murchison spent his last semester (Winter 2007) in Panama doing fieldwork on the Kuna language. Here is a basic morphology problem adapted from his early field work. Each word in Kuna corresponds to a sentence in English. How much can you break up each Kuna word into morphemes, minimal units of meaning?

(53) Kuna verbs

Kuna	English
anuagunne	I eat fish
beuagunne	You eat fish
weuagunne	She/he eats fish
anmaruagunne	We eat fish
bemaruagunne	You all eat fish
wemaruagunne	They eat fish
anogopgunne	I eat coconut
anuagunnsa	I ate fish

5 A syntactic theory that won't work

(54) *Colorless green ideas sleep furiously.*

(55) *Furiously sleep ideas green colorless.*

(56) Easily interpretable, yet ill-formed strings

a. *The child seems sleeping

b. *John read the book that Mary bought it for him

(57) Equally improbable utterances

- *I saw a fragile whale*
- *I saw a fragile of*

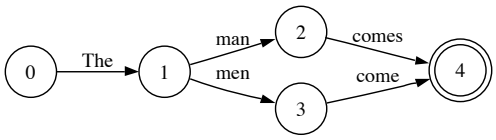
(58) One way to make new sentences

1. The unexamined life is not worth living.
2. I like cheese.
3. I like cheese AND the unexamined life is not worth living.

(59) a. *I saw a frog dancing down Broadway*

b. *Three all kiss turtles one more*

(60) Simple Finite State Grammar



(61)

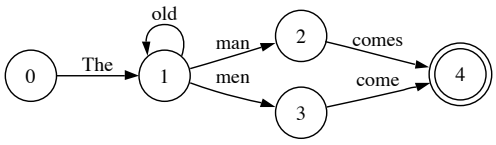
- The man comes
- The men come

(62) There is no longest sentence

- $S_1 =$ *Bill claims that Mary says that Tom claims that Alfred saw Claire bite the frog.*
- $S_2 =$ *I think that Bill claims that Mary says that Tom claims that Alfred saw Claire bite the frog.*

(63) *You suspect that I think that Bill claims that Mary says that Tom claims that Alfred saw Claire bite the frog.*

(64) Finite State Grammar with a loop

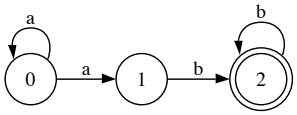


(65)
- The man comes
- The old man comes
- The old, old man comes
- *etc.*
- The men come
- The old men come
- The old, old men come
- *etc.*

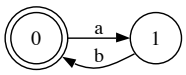
(66) Toy languages not from *Syntactic Structures*

- L_α {ab, aabb, aabbbbbbb ...} = $a^n b^m$
- L_β {ab, abab, abababbab ...} = $(ab)^n$

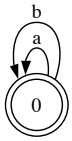
(67) A *fsg* for L_α



(68) A *fsg* for L_β



(69) An uninteresting *fsg*



(70) Toy languages from *Syntactic Structures*

- L_1 = { ab, aabb, aaabbb, ... } = $a^n b^n$
- L_2 = { aa, bb, abba, baab, aaaa, bbbb, aabaa, abbbba, ... } = mirror image

- L_3 = {aa, bb, abab, baba, aaaa, bbbb, aabaab, abbabb, . . . }= XX

(71) Some $a^n b^n$ structures in English

- *If$_a$ John is singing then$_b$ it is raining*
- *If$_a$ either$_a$ John is singing or$_b$ Bill hates Tony then$_b$ it is raining*
- *If$_a$ either$_a$ John either$_a$ loves Mary or$_b$ hates Tony or$_b$ Tom dances well then$_b$ it is raining*

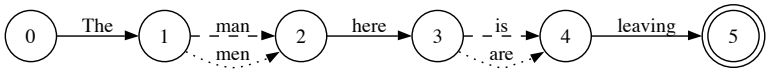
(72) Labeling to show mirror-image structures in English

- *If$_a$ John is singing then$_a$ it is raining*
- *If$_a$ either$_b$ John is singing or$_b$ Bill hates Tony then$_a$ it is raining*
- *If$_a$ either$_b$ John either$_c$ loves Mary or$_c$ hates Tony or$_b$ Tom dances well then$_a$ it is raining*

(73) A language with two sentences

- The **man** here **is** leaving
- The *men* here *are* leaving

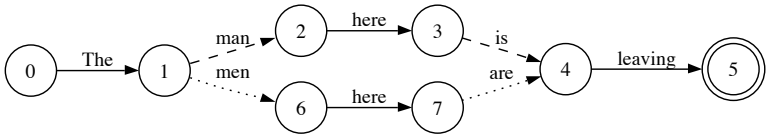
(74) Bad *fsg*



(75) The grammar in (74) overgenerates

- *The man here are leaving
- *The men here is leaving

(76) Good *fsg*



(77) The grammar G_1

- Symbols:
  - Non-terminal symbol: S
  - Terminal symbols: a, b
- Rewrite rules:
  i. $S \rightarrow ab$
  ii. $S \rightarrow aSb$

(78) Sentences of G_1

- $S \rightarrow ab$ (by application of rule i.)
- $S \rightarrow aSb \rightarrow aabb$ (by application of rule ii followed by application of rule i.)
- $S \rightarrow aSb \rightarrow aaSbb \rightarrow aaabbb$ (two applications of rule ii followed by application of rule i.)
- $S \rightarrow aSb \rightarrow aaSbb \rightarrow aaaSbbb \rightarrow \ldots aaaaaaaSbbbbbbb \rightarrow \ldots aaaaaaaaaabbbbbbbbb$ (nine applications of rule ii followed by one application of rule i.)

(79) Some restrictions on a rewrite rule grammar

- rewrite rules can only spell out a single terminal symbol OR
- a single non-terminal symbol OR
- a single terminal, followed by a non-terminal

(80) The grammar G_2

- Symbols:
  - Non-terminal symbols: S, T
  - Terminal symbols: a, b
- Rewrite rules:
  i. $S \rightarrow aT$
  ii. $T \rightarrow b$
  iii. $T \rightarrow bS$

(81) Sentences of G_2

- $S \rightarrow aT \rightarrow ab$ (by application of rule i and then rule ii.)

- $S \rightarrow aT \rightarrow abS \rightarrow abaT \rightarrow abab$ (by application of rule i followed by application of rule iii followed by application of rule i followed by application of rule ii.)
- $S \rightarrow aT \rightarrow abS \rightarrow abaT \rightarrow \ldots ababababababS \rightarrow abababababababaT \ldots ababababababababab$ (The sequence *rule i-rule iii* applies nine times, then rule i applies followed by rule ii.)

5.1 Exercises

In the following exercises assume these conventions for Finite State Machines:

- Start states are numbered 0
- Other numbers are meaningless
- End states use double circles
- Each transition can only write out a single 'word' a, b or c

Exercise 5.5.1. Make a finite state machine that will generate all and only strings of the form (abc)^n—that is *abc* repeated any number of times greater than or equal to 1: $L = \{abc, abcabc, abcabcabc \ldots\}$.

Exercise 5.5.2. Can you make a finite state machine that generates a language whose sentences consist of any nonnull string of a's and b's followed by a single c followed by any string of a's and b's of the same length as the first such string. For example $baabacbabbb$ is a sentence in this language but $baabacbbbb$ is not. Explain why there is no such machine or show the machine if you can.

Exercise 5.5.3. Can you make a finite state machine that generates a language whose sentences consist of any nonnull string of a's and b's followed by a single c followed by any nonnull string of a's and b's followed by three c's. For example $baabacbabbbccc$ is a sentence in this language and so is $baabacbbbbccc$ but $cbabccc$ is not. Explain why there is no such machine or show the machine if you can.

Exercise 5.5.4. Can you make a finite state machine that generates a language whose sentences consist of any (possibly null) string of a's and b's followed by four c's followed by any nonnull string of a's and b's. Explain why there is no such machine or show the machine if you can.

Exercise 5.5.5. Can you make a finite state machine that generates a language whose sentences consist of any nonnull string of a's and b's followed by between one and four c's followed by any (possibly null) string of a's and b's. Explain why there is no such machine or show the machine if you can.

Exercise 5.5.6. Make a rewrite rule grammar that obeys the restrictions in (79) that can generate L_α. In other words, turn the *fsg* in (67) into a rewrite rule grammar. (Hint: You need two non-terminal symbols.)

Exercise 5.5.7. Try to develop a *fsg* to generate all and only the sentence in the following list. Ideally you should build up your grammar, for example, by making one for the first sentence, then the first two, then the first three, and so on.

1. The boy is washing
2. The boy with blue eyes is washing
3. The boys are washing
4. The boys with blue eyes are washing
5. The boy is washing himself
6. The boys are washing themselves
7. The boy with blue eyes is washing himself
8. The boys with blue eyes are washing themselves
9. Both the boys with blue eyes are washing themselves

6 Abstract Representations

(82) Some "simple phenomena"

1. *Do you know if anyone is here yet?*
   I know Mary is here.
2. *Do you know if anyone is here yet?*
   I know Mary's here.
3. *Do you know if anyone is here yet?*
   I know Mary is.
4. *Do you know if anyone is here yet?*
   ***I know Mary's.**

(83) Do you know anyone's mother?
I know Mary's.

(84) Do you know if anyone is here yet?
***I know Mary's and Bill's coming soon.**

(85) Do you know if anyone is here yet?
***I know Mary's but she has to leave soon.**

(86) The contracted form of the copula cannot be

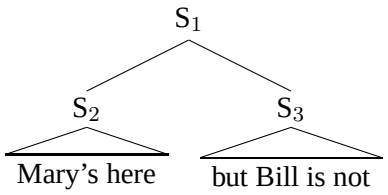
1. followed by a connector, or
2. followed by a pause

(87) Connectors

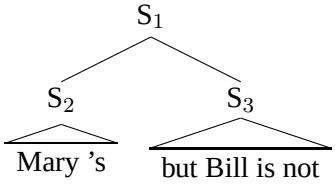
1. Mary **and** Peter are here.
2. Mary opened the window **and** Peter closed it back again.

(88) The contracted form of the copula must be followed by another word in the same sentence (inside the smallest S that contains the copula).

(89)



(90)



(91) That cat, Atom, didn't want to stare at the two thin rats at ease atop the atomic pot.

(92) **T**ha**t** ca**t**, A**t**om, didn'**t** wan**t** **t**o s**t**are a**t** **t**he **t**wo **t**hin ra**t**s a**t** ease a**t**op **t**he a**t**omic po**t**.

(93) 1. *I saw a cat* —a glottal stop [ʔ], the sound in the middle of *uh-uh* 'no'.

2. *The cat is on the mat*-–a flap, [ɾ], the sound in the middle of *butter* and *ladder*.
3. *I saw three cats*–plain old *t*, [t], without a puff of air

(94) 1. *My tie is clean*—an aspirated *t*, [t^h] followed by a puff of air
2. *My sty is clean*—another plain old [t], although it actually sounds like a *d* if you cut off the *s*, something you can do with a simple, free computer program like *Praat*, mentioned in Chapter 2.

(95) What is a joot?

(96) Oh, a joot is a fruit?

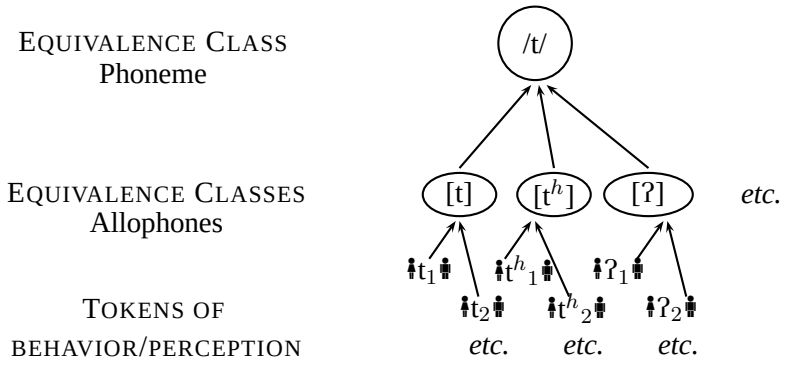


Figure 14: The equivalence class of the phoneme /t/ is itself an abstraction from equivalence classes of allophones abstracted from individual utterances.

(97) Why does perception of *t* show Construction of Experience?

- Things that are different physically perceived as the same
  - t/t^h/ʔ/ɾ/∅
- Things that are physically the same perceived as different:
  - *wetting* ⇝ [wɛrɪŋ]
  - *wedding* ⇝ [wɛrɪŋ]

(98) Turkish vowel harmony data[1]

	nom. sg.	*nom. pl.*	*gen. sg.*	*gen. pl.*	
a.	ip	ip-ler	ip-in	ip-ler-in	‘rope’
b.	kıl	kıl-lar	kıl- ın	kıl-lar- ın	‘body hair’
c.	sap	sap-lar	sap-ın	sap-lar-ın	‘stalk’
d.	uç	uç-lar	uç-un	uç-lar-ın	‘tip’
e.	son	son-lar	son-un	son-lar-ın	‘end’
f.	öç	öç-ler	öç-ün	öç-ler-in	‘revenge”
g.	gül	gül-ler	gül-ün	gül-ler-in	‘rose’
h.	ek	ek-ler	ek-in	ek-ler-in	‘joint’

(99)

	NON-BACK		BACK	
HIGH	i	ü	ı	u
NON-HIGH	e	ö	a	o
	NON-ROUND	ROUND	NON-ROUND	ROUND

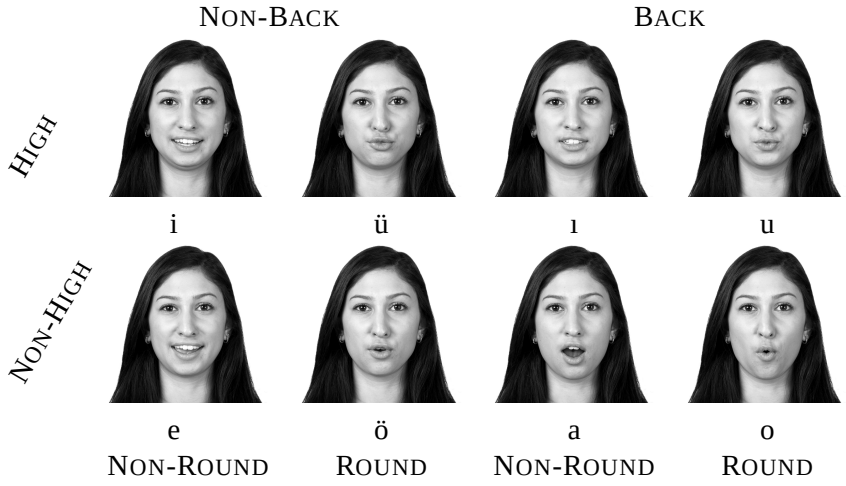


Figure 15: A native speaker pronouncing the eight Turkish vowels. See companion website for side views and sound files. The photographer, Sabina Matyiku and the model, Ezgi Özdemir are both Concordia undergraduate linguistics students.

(100) Turkish singular / plural pairs

[1]The symbol *ç* represents the sound written *ch* in English. The vowel symbols will be explained in the main text.

singular	plural	meaning
dev	devler	giant
kek	kekler	cake
can	canlar	soul
cep	cepler	pocket
tarz	tarzlar	type
kap	kaplar	recipient
çek	çekler	check
saç	saçlar	hair
şey	şeyler	thing
ters	tersler	contrary
aşk	aşklar	love

1. What are the two forms of the plural suffix?
2. What determines where you find each suffiix?
    - Suffix (1) occurs . . .
    - Suffix (2) occurs . . .

(101) More Turkish singular / plural pairs

singular	plural	meaning
ip	ipler	rope
kıl	kıllar	body hair
sap	saplar	stalk
uç	uçlar	edge
son	sonlar	end
öç	öçler	vengeance
gül	güller	rose
ek	ekler	junction

1. What are the two forms of the plural suffix? 1. 2.
2. What determines where you find each suffiix?
    - Suffix (1) occurs . . .
    - Suffix (2) occurs . . .

(102) $\begin{bmatrix} \text{V} \\ \text{NON-ROUND} \\ \text{NON-HIGH} \end{bmatrix}$

(103) $l \begin{bmatrix} \text{V} \\ \text{NON-ROUND} \\ \text{NON-HIGH} \end{bmatrix} r$

(104) Turkish nominative and genitive singular pairs

nom. singular	genitive singular	meaning
ip	ipin	rope
kıl	kılın	body hair
sap	sapın	stalk
uç	uçun	edge
son	sonun	end
öç	öçün	vengeance
gül	gülün	rose
ek	ekin	junction

1. What are the four forms of the genitive suffix?
   i. ii. iii. iv.
2. What determines where you find each suffiix?
   - Suffix (i) occurs . . .
   - Suffix (ii) occurs . . .
   - Suffix (iii) occurs . . .
   - Suffix (iv) occurs . . .

(105) $\begin{bmatrix} \text{V} \\ \text{HIGH} \end{bmatrix}$ n

(106) Turkish nominative singular / genitive plural pairs

nom. singular	genitive plural	meaning
ip	iplerin	rope
kıl	kılların	body hair
sap	sapların	cue
uç	uçların	edge
son	sonların	end
öç	öçlerin	vengeance
gül	güllerin	rose
ek	eklerin	junction

1. What are the two forms of the genitive suffix in this data?
   1. 2.
2. What determines where you find each suffiix?
   - Suffix (1) occurs . . .
   - Suffix (2) occurs . . .

(107) Input to the phonology for *öçler*

INPUT: [V, NON-BACK, ROUND, NON-HIGH] ç-l [V, NON-ROUND, NON-HIGH] r

(108) Output of the phonology for *öçler*

OUTPUT: [V, NON-BACK, ROUND, NON-HIGH] çl [V, NON-BACK, NON-ROUND, NON-HIGH] r

(109) Derivation of *öçün*

INPUT: [V, NON-BACK, ROUND, NON-HIGH] ç- [V, HIGH] n

OUTPUT: [V, NON-BACK, ROUND, NON-HIGH] ç [V, NON-BACK, ROUND, HIGH] n

(110) Input representation of *öçlerin*

INPUT: [V, NON-BACK, ROUND, NON-HIGH] ç-l [V, NON-ROUND, NON-HIGH] r [V, HIGH] n

(111) Output representation of *öçlerin* with features for the vowels

OUTPUT: [V, NON-BACK, ROUND, NON-HIGH] çl [V, NON-BACK, NON-ROUND, NON-HIGH] r [V, NON-BACK, NON-ROUND, HIGH] n

(112) Harmonic Turkish Roots

BACK	boru	‘pipe’
	arı	‘bee’
	oda	‘room’
NON-BACK	inek	‘cow’
	dere	‘river’
	güzel	‘beautiful’

(113) Swahili singular-plural pairs

SINGULAR	PLURAL	meaning
mtoto	watoto	child/children
mtu	watu	person/people
mpiši	wapiši	cook/cooks
mgeni	wageni	stranger/strangers

(114)
- SINGULAR = m⌢ROOT
- PLURAL = wa⌢ROOT

(115)
- One function of ROOT = m⌢ROOT
- Another function of ROOT = wa⌢ROOT

(116)
a. $f(x)$= m⌢x
b. $g(x)$ = wa⌢x

(117)
a. $f(x) = 2x - 3$
b. $g(x) = 4x$

(118)
- Sami wasn't wearing clothes
- Sami wasn't wearing footwear
- Sami wasn't wearing socks
- Sami wasn't wearing white socks

(119)
- Sami wasn't wearing any clothes
- Sami wasn't wearing any footwear
- Sami wasn't wearing any socks
- Sami wasn't wearing any white socks

(120)
- *Sami was wearing any clothes
- *Sami was wearing any footwear
- *Sami was wearing any socks
- *Sami was wearing any white socks

(121)
- Sami was wearing clothes
- Sami was wearing footwear
- Sami was wearing socks

- Sami was wearing white socks

(122)
1. Sami wasn't *ever* wearing clothes.
2. Sami wasn't wearing clothes *yet*.
3. Sami wasn't wearing clothes *at all*.
4. Sami wasn't wearing *anything*.

(123)
1. *Sami was *ever* wearing clothes.
2. *Sami was wearing clothes *yet*.
3. *Sami was wearing clothes *at all*.
4. *Sami was wearing *anything*.

(124)
- Sami wasn't wearing clothes $\Rightarrow$
- Sami wasn't wearing footwear $\Rightarrow$
- Sami wasn't wearing socks $\Rightarrow$
- Sami wasn't wearing white socks

(125)
- Sami was wearing clothes $\Leftarrow$
- Sami was wearing footwear $\Leftarrow$
- Sami was wearing socks $\Leftarrow$
- Sami was wearing white socks

(126) More entailment switches

*any	any
*Sami *always* wears any socks	Sami *never* wears any socks
*Sami *often* wears any socks	Sami *hardly* wears any socks
*Sami left *with* any socks	Sami left *without* any socks
**Many* cats wear any socks	*Few* cats wear any socks
*Sami smiles *after* he puts on any socks	Sami smiles *before* he puts on any socks

(127)

	English	French
Negation:	He won't eat anything.	Il ne mange rien.
Free Choice:	He'll eat anything.	Il mange n'importe quoi.

(128) NPIs in questions

- Did you kick anyone?
- Have you ever been to Timbuktu?
- Has anybody seen my girl?

6.1 Exercises

Exercise 6.8.1. **Do grammars avoid ambiguity?** When we present the *Mary's* data in class, we have found that there are always some students who insist that the unacceptability of ***I know Mary's*** in the sense intended in (82d) must be somehow connected to the fact that the string has another, acceptable reading. In other words, these students suggest that we, or our grammars, somehow refuse to allow strings that are ambiguous.

There are several problems with such a view, the most obvious being that it is trivial to find examples of ambiguity, of all types. The string *I saw the man with a telescope* has two obvious readings, one in which the man who was seen had a telescope and one in which the device used for seeing was a telescope. Of course, there is also another pair of readings that can be paraphrased as *I regularly use a telescope to cut (to saw) the man* and *I regularly cut the man who has a telescope*. The second problem with the explanation that appeals to ambiguity is that grammars, which are just computational systems, have no way to avoid generating ambiguous structures—they just produce outputs from inputs mechanically, and furthermore, grammars have no reason to care about ambiguity. People communicate, grammars do not.

In any case, it is still useful to come up with examples where the issue of ambiguity does not arise. We can find such cases by making our subject plural as in (129a). In spoken English, there is also a reduced or contracted form of the plural copula, although there is no standard orthographic convention for writing this—we have used *'er*. We see that the patterns of grammaticality are exactly the same as in the previous sentences.

(129) *Do you know if anyone is here yet?*

1. **I know Sami and Bill are here.**
2. **I know Sami and Bill 'er here.**
3. **I know Sami and Bill are.**
4. ***I know Sami and Bill 'er.**
5. ***I know Sami and Bill 'er, but Mary's not.**

Explain how these examples help to show that avoidance of ambiguity is irrelevant to an explanation of the distribution of the contracted copula forms that we developed in this chapter.

Exercise 6.8.2. **English allophones:** Using *Praat* record the following sets of words, making a separate file for each set. The *Praat* manual or our mini-manual will tell you how to do this.

- *leaf, feel*
- *bead, bean*
- *pit, spit, bit*

1. Using the symbols of the International Phonetic Alphabet, one might transcribe the first set as [lif] and [fil]. In *Praat*, open (using READ) the first file, select it in the object list and then choose EDIT. Play the file. Then select the file in your *Praat* object list and choose **Modify** > **Reverse**. Play the waveform again. Based on the transcription, one would expect the reverse of *leaf, feel* to sound like the original. Does it? Record other examples of words that begin with *l* and words that end with *l*. Try to select the part corresponding to *l* in the waveforms. Is there a consistent difference between the initial and final pronunciation of this letter?
2. Open the file containing *bead, bean*. One might expect that two words contain the same vowel since one might transcribe the words [bid] and [bin]. Isolate the vowel part of each word in the waveform and play it. Do they sound the same? Try to find other examples of each of these two types of vowel. Try to find other vowel pairs that differ in the same way, such as those in these words: *lode, loam, lone, lobe*. Does English have twice as many vowels as you thought? Hint: It depends on what you mean by "a vowel". Think of equivalence classes.
3. Like /t/, the phoneme /p/ has a plain and aspirated variant. Open and play the file containing *pit, spit, bit*, then select and play the aspirated and unaspirated allophones of /p/ by selecting parts of the waveform. Then select all of *spit* except the /s/. Play what remains—how does it sound?

Exercise 6.8.3. **Guaymí:** This language is spoken in Panama and Costa Rica by about 128,000 people. Use the notation we developed for Swahili to express Guaymí verbs as a function of two variables, based on the following table:

present	past	meaning
kuge	kugaba	burns/burned
blite	blitaba	speaks/spoke
kite	kitaba	throws/threw
mete	metaba	hits/hit

Exercise 6.8.4. **Nahuatl:** An expression like $z = 5w - 2x + 3y - 6$ represents z as a function of three independent variables. Come up with a function of three variables to generate the form of possessed nouns in Nahuatl, spoken by about 1.5 million people in Mexico. List the full set of possibilities for each variable.

nokali	my house	nokalimes	my houses
mokali	your house	mokalimes	your houses
ikali	his house	ikalimes	his houses
nopelo	my dog	nopelomes	my dogs
mopelo	your dog	mopelomes	your dogs
ipelo	his dog	ipelomes	his dogs
nokwahmili	my cornfield	nokwahmilimes	my cornfields
mokwahmili	your cornfield	mokwahmilimes	your cornfields
ikwahmili	his cornfield	ikwahmilimes	his cornfields

7 Some details of sentence structure

(130)
1. This fat cat is red with white spots
2. This fat chicken is red with white spots
3. This fat pencil is red with white spots
4. *This fat goes is red with white spots

(131) This fat ___ is

(132)
1. This fat cat is red with white spots
2. That fat cat is red with white spots
3. The fat cat is red with white spots
4. A fat cat is red with white spots
5. *Away fat cat is red with white spots

(133) . . . fat chicken

(134) *This*$_D$ *fat*$_A$ *cat*$_N$ *is*$_V$ *red*$_A$ *with*$_P$ *white*$_A$ *spots*$_N$.

(135) *This*$_D$ *fat*$_A$ *chicken*$_N$ *is*$_V$ *red*$_A$ *with*$_P$ *white*$_A$ *spots*$_N$.

(136) *This*$_D$ *fat*$_A$ *pencil*$_N$ *is*$_V$ *red*$_A$ *with*$_P$ *white*$_A$ *spots*$_N$.

(137) That blue fish got skinny despite strong warnings.

(138) *That*$_D$ *blue*$_A$ *fish*$_N$ *got*$_V$ *skinny*$_A$ *despite*$_P$ *strong*$_A$ *warnings*$_N$.

(139) *I spotted that rodent with a telescope.*

(140) a. I$_N$ [spotted$_V$ [that $_D$ rodent$_N$ with$_P$ a$_D$ telescope$_N$]]

b. I$_N$ [[spotted$_V$ that$_D$ rodent$_N$] with$_P$ a$_D$ telescope$_N$]

(141) *I spotted [that rodent with a telescope], and Mary spotted [it], too*
([it]=[that rodent with a telescope])

(142) *I spotted [that rodent] with a telescope* and Mary spotted [it] with a magnifying glass. ([it]=[that rodent])

(143) *I [spotted that rodent] with a telescope and Mary [did] with a magnifying glass* ([did]=[spotted that rodent])

(144) *I [spotted [that rodent with a telescope]] and Mary [did], too.*
([did]=[spotted that rodent with a telescope])

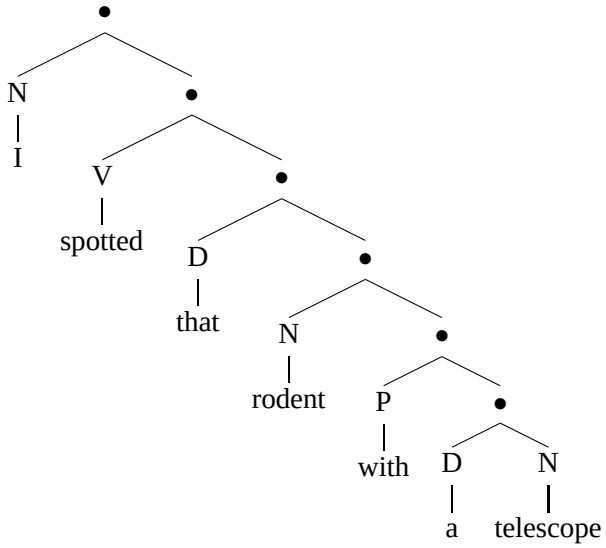
(145)
- [*that* [*rodent with a telescope*]].
- [*that* [*one*]].

(146)
- [*that* [*rodent* [*with a telescope*]]].
- [*that* [*rodent* [*there*]]].

(147)
- [*that* [*rodent* [*with a telescope*]]].
- [*that* [*rodent* [*with* [*it*]]]].

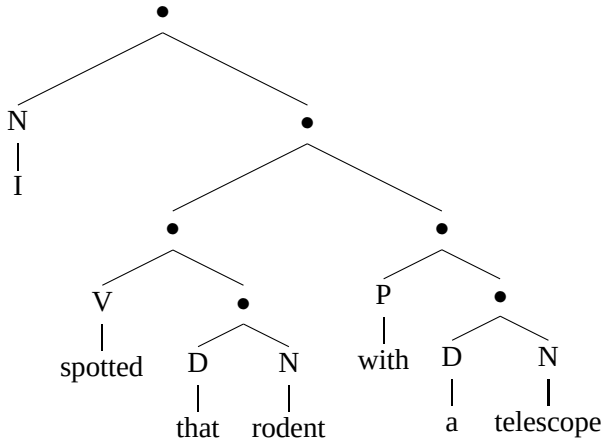
(148) Tree structure for (140a):

[*I* [*spotted* [*that* [*rodent* [*with* [*a telescope*]]]]]]



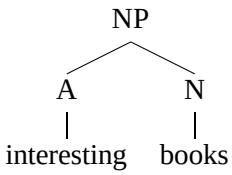
(149) Tree structure for (140b):

[*I* [*spotted* [*that rodent*]] [*with* [*a telescope*]]]

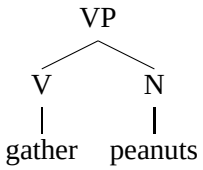


(150)
- He has many [interesting books].
- He has many [books].
- *He has many [interesting].

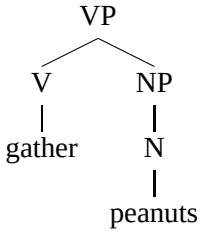
(151)



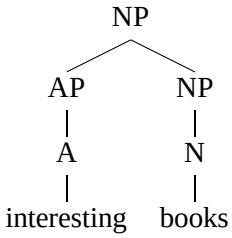
(152)



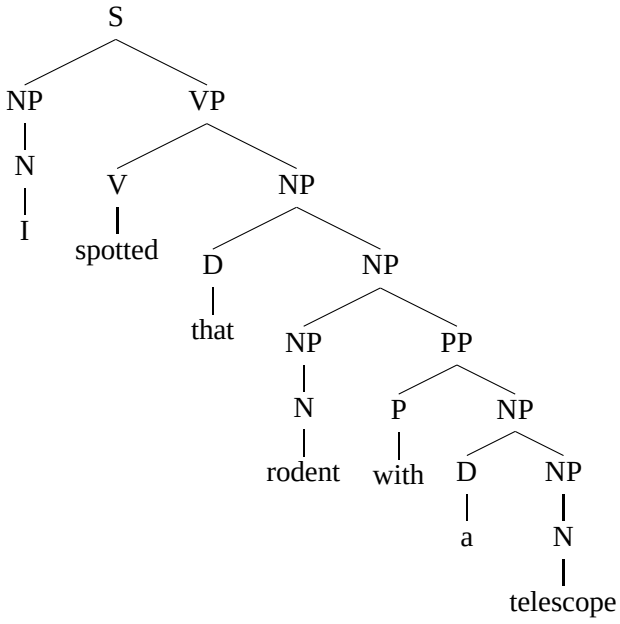
(153)



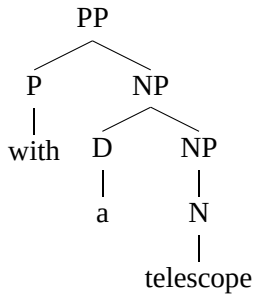
(154)



(155)



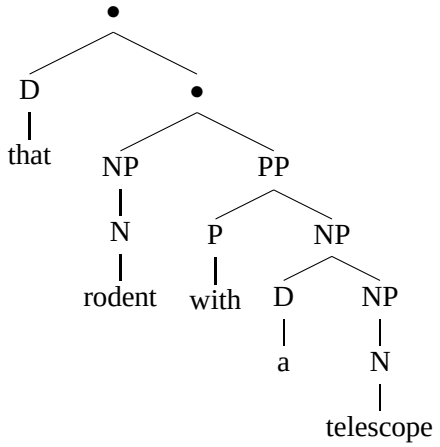
(156)



(157) a. that rodent with a telescope

b. that inquisitive rodent with a telescope

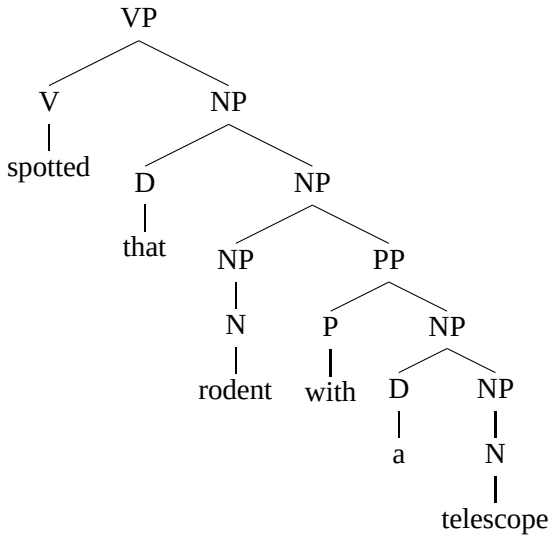
(158)



(159) a. [A rodent with a telescope] is all we need in this house.

b. [A rodent] is all we need in this house.

(160)



(161) a. [Under the table] is Oonagh's favorite place.

b. [Fortunate] is what we consider ourselves to be.

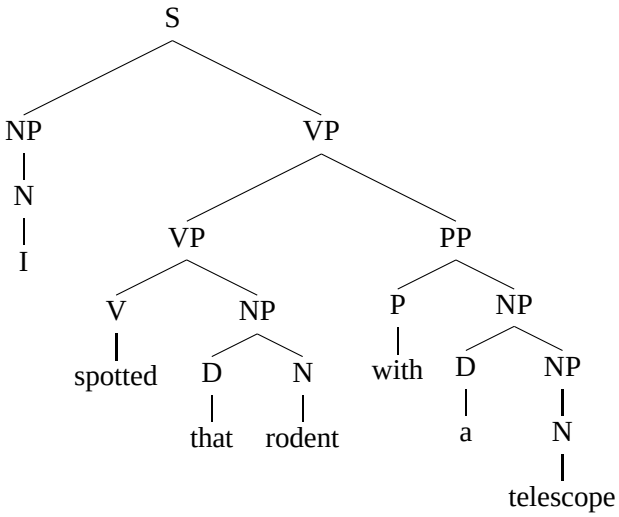
c. [That Davey always talks about Sami] is something we all got used to.

(162) a. Mary thought [I spotted that rodent with a telescope].

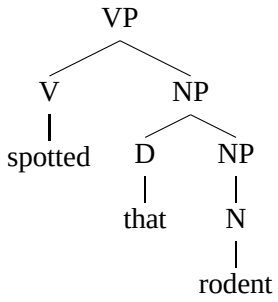
b. I believe [Mary thought [I spotted that rodent with a telescope]].

c. I scorn the man [who thought [I spotted that rodent with a telescope]].

(163)

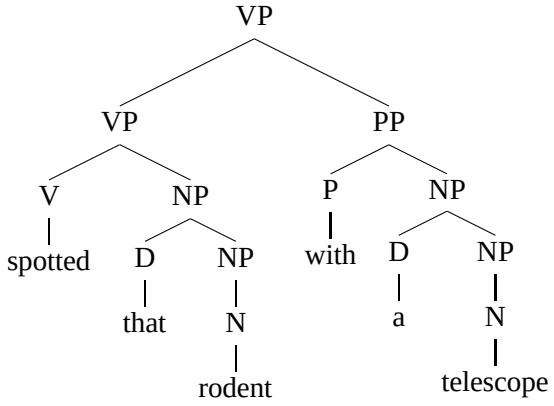


(164)



(165) I [spotted that rodent] with a telescope, and Mary [did] with a magnifying glass.

(166)

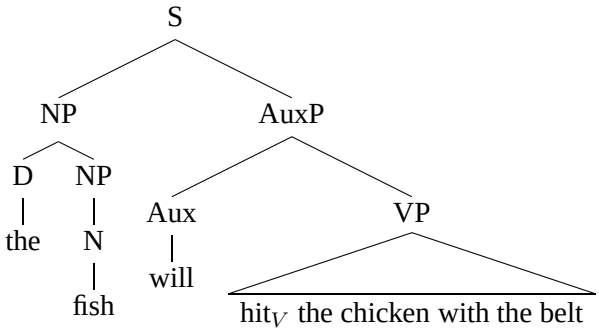


(167) a. I spotted that rodent with a telescope.

b. I spotted that rodent.

(168) The$_D$ fish$_N$ will$_{Aux}$ hit$_V$ the $_D$ chicken$_N$ with$_P$ the$_D$ belt$_N$

(169)



(170) **The fish will hit the chicken with.*

(171) 1. The$_D$ fish$_N$ [will$_{Aux}$[hit$_V$ [the $_D$ chicken$_N$ [with$_P$ the$_D$ belt$_N$]]]]

2. The$_D$ fish$_N$ [will$_{Aux}$ [[hit$_V$ the$_D$ chicken$_N$] [with$_P$ the$_D$ belt$_N$]]]

(172) *What will the fish hit the chicken with?*

(173) Asking about the chicken

1. *The fish will hit the chicken with what?.*
2. *What was the chicken that the fish will hit wearing?*
3. *For what x is it the case that the fish will hit the chicken and the chicken was with x?*

(174) What$_i$ will the fish who kissed the rat who bit the kitty who licked the turtle who scratched the pony's eyes out hit the chicken with ~~what~~$_i$?

(175) Two simple sentences

a. *You will see John.*

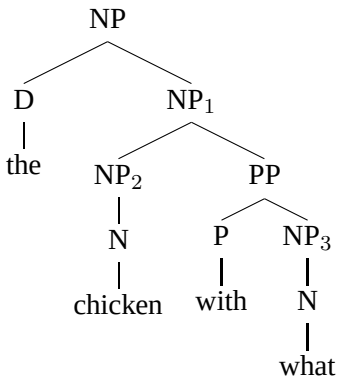
b. *You will see Bill and John.*

(176) Only one *wh*-question possible

a. *Who will you see?*

b. **Who will you see Bill and?*

(177)

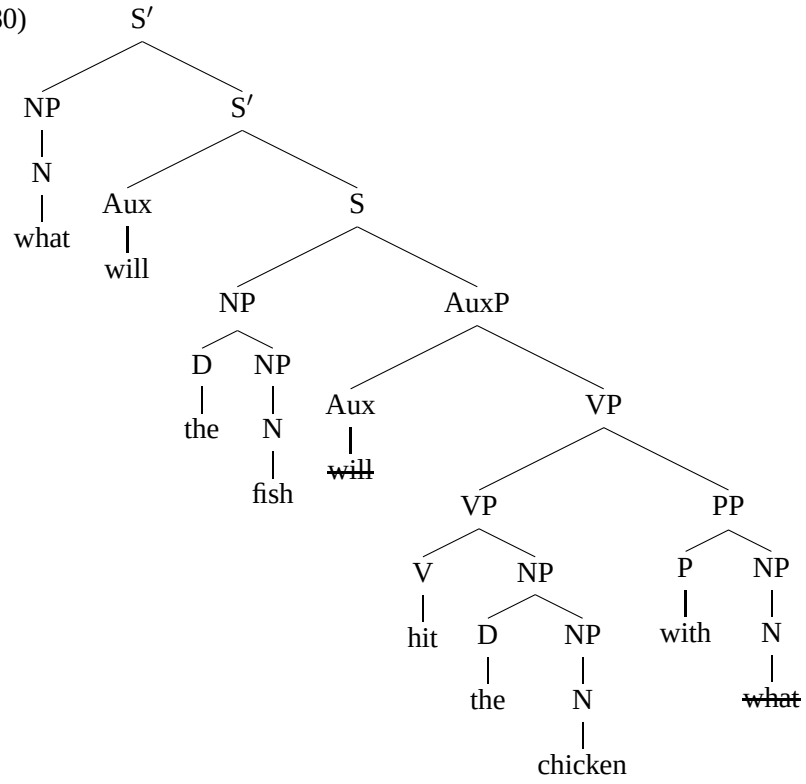


(178)

(179) a. What will the fish ~~will~~ hit the chicken with ~~what~~?

b. *Will what the fish ~~will~~ hit the chicken with ~~what~~?

(180)



(181) a. The fish will hit the chicken with the belt.

b. What will the fish ~~will~~ hit the chicken with ~~what~~?

c. Will the fish ~~will~~ hit the chicken with the belt?

d. I wonder who the chicken will hit ~~who~~.

(182) The boy who can dance will kiss the dog that should whine.

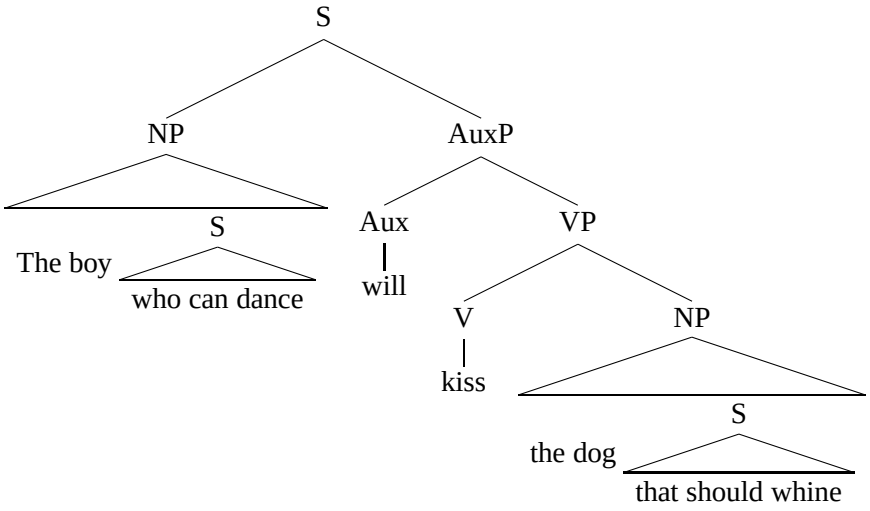
(183) Which Aux gets fronted?

a. *Can the boy who ~~can~~ dance will kiss the dog that should whine?

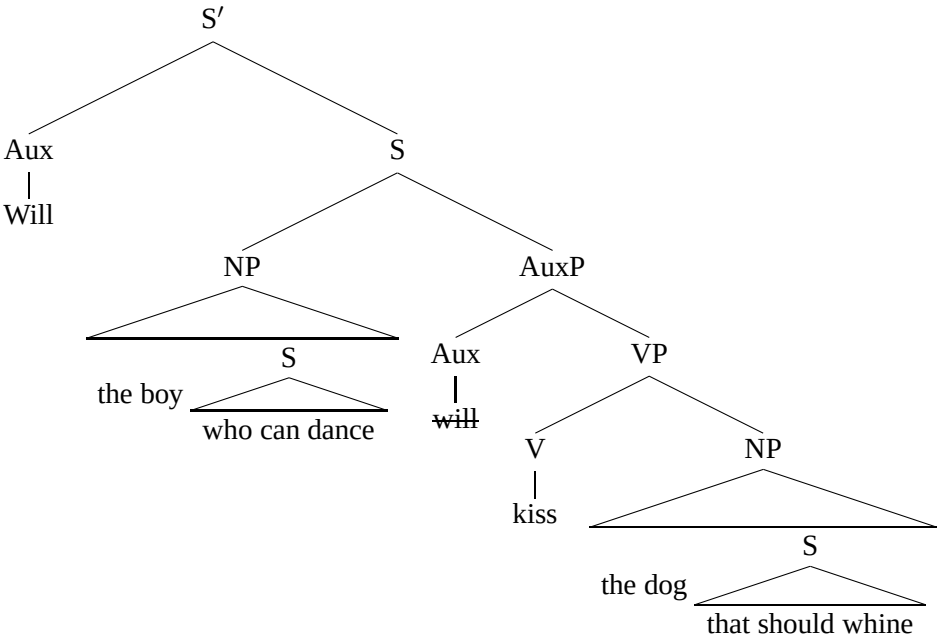
b. Will the boy who can dance ~~will~~ kiss the dog that should whine?

c. *Should the boy who can dance will kiss the dog that ~~should~~ whine.

(184) Tree for (182)



(185) Tree for (183b)

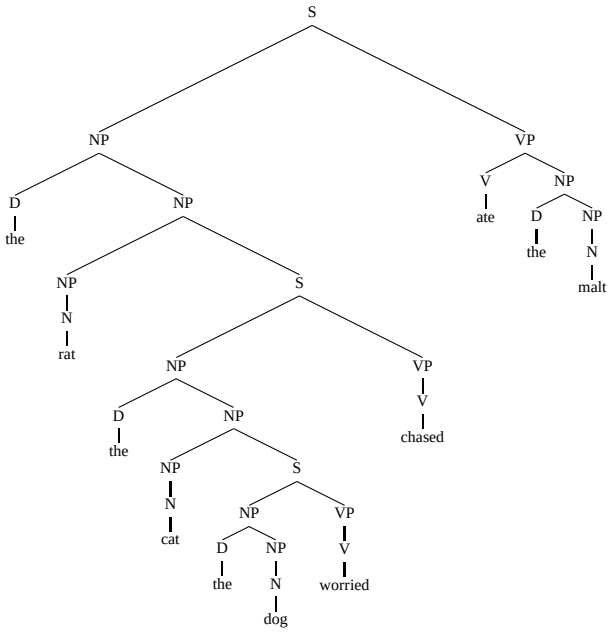


(186) a. *The rat the cat the dog worried chased ate the malt*

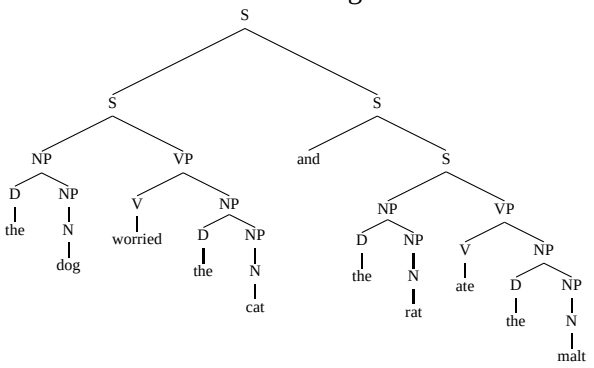
b. *The dog worried the cat and the rat ate the malt*

(187) *The rat that the cat that the dog worried chased ate the malt*

(188) Structure with a lot of embedding



(189) Structure with less embedding



7.1 Exercises

Exercise 7.7.1. **Tree Practice:** For more practice of how words are grouped together into constituents, and for the labeling of these constituents, consider the following string.

(190) *The fish with the hat hit the chicken with the belt.*

Draw the tree for the meaning in which the chicken's pants won't fall down. What is *with a belt* modifying? What does this PP attach to? What does

with a hat modify? What does this PP attach to?

Now draw the tree for the reading in which the fish uses a fashion accessory as a chicken-hitting implement. How does this tree differ from the previous one?

Exercise 7.7.2. **Aux movement:** In the tree in (184) there are three distinct Auxiliaries, and it is the one whose base position is second that is fronted.

i. Give a YES/NO question which also contains three Auxiliaries, but in which the Aux whose base position is first undergoes Aux movement. Draw the tree showing base and derived positions.

ii. Give another YES/NO question in which the Aux whose base position is last of the three is fronted. Draw the tree showing base and derived positions.

iii. Without drawing a tree, give a YES/NO question in which there are nine Auxiliaries (you can reuse them—for example, you can use *should* more than once) and the one that is moved is the seventh in base position.

iv. What do these examples tell us about linear order and structure?

8 Binding

(191) Mary$_i$ saw her$_j$

(192) *Mary$_i$ saw her$_i$

(193) Mary$_i$ saw her$_{*i/j}$

(194) Mary$_j$ saw her$_{i/*j}$

(195) Mary$_i$ saw herself$_{i/*j}$

(196)
1. You saw Bob Dylan at the wax museum.
2. Bob Dylan$_i$ saw himself$_i$ at the wax museum.

(197)
1. *Mary$_i$ sees herself$_j$.
2. Mary$_i$ sees herself$_i$.
3. *Herself$_i$ sees Mary$_i$.

(198) Hypothesis I: *herself* must appear in a sentence that contains a coindexed nominal expression, a phrase bearing the same index as *herself*.

(199) Hypothesis II: *herself* must be preceded by a coindexed nominal expression, a phrase bearing the same index as *herself*.

(200)
1. *Mary$_i$ knows that Jane$_j$ loves herself$_i$.
2. Mary$_i$ knows that Jane$_j$ loves herself$_j$.

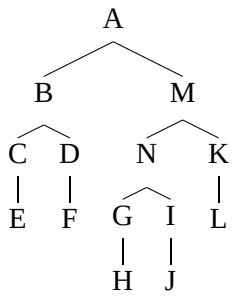
(201) Hypothesis III: *herself* must be preceded by a coindexed nominal expression, and no other nominal expression may intervene between *herself* and the coindexed preceding nominal expression.

(202)
1. *A friend$_j$ of Mary's$_i$ flogs herself$_i$.
2. A friend$_j$ of Mary's$_i$ flogs herself$_j$.
3. *I flog herself$_i$.
4. *Mary$_i$ knows that I/we/they/you flog herself$_i$.

(203) Mary$_i$ told Sue$_j$ that Jane$_k$ likes her$_{i,j,*k,l}$.

(204) Hypothesis IV: an anaphor, like *herself*, must be bound in its minimal clause.

(205) What are the c-command relations in this tree?

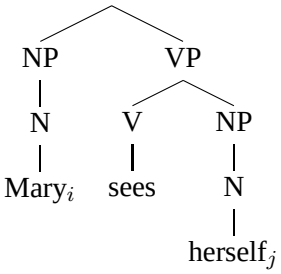


(206) Three conditions in Hypothesis IV

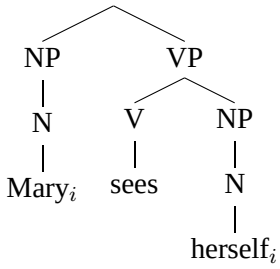
- Is there a nominal constituent that is coindexed with *herself*?
- Does that nominal constituent c-command *herself*?

(207) Trees for (197ab)

1. *S

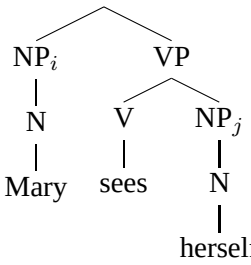


2. S

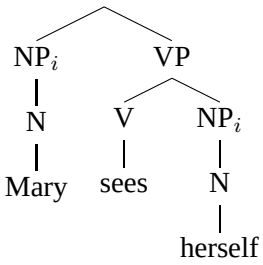


(208) Revised trees for (197ab)

a. *S

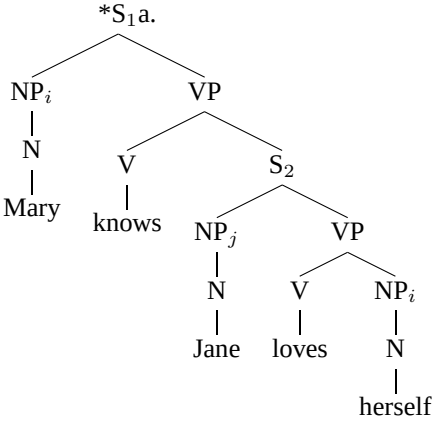


b. S

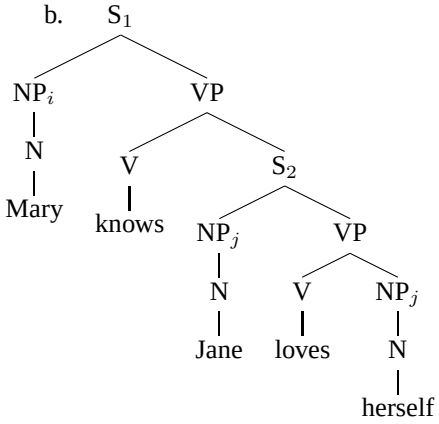


(209) Trees of (200a,b) with correct labeling

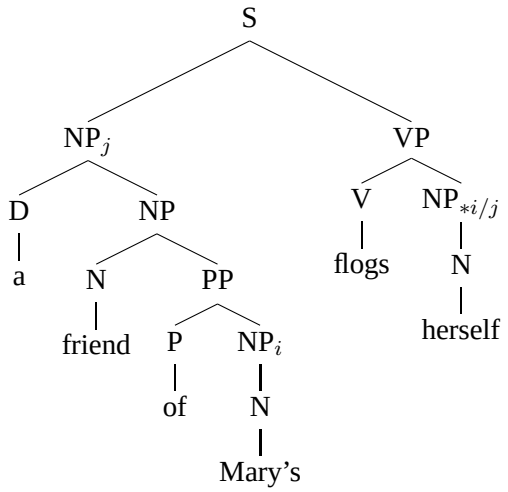
*S$_1$a.



b. S$_1$



(210) Trees for (202ab) NP within NP



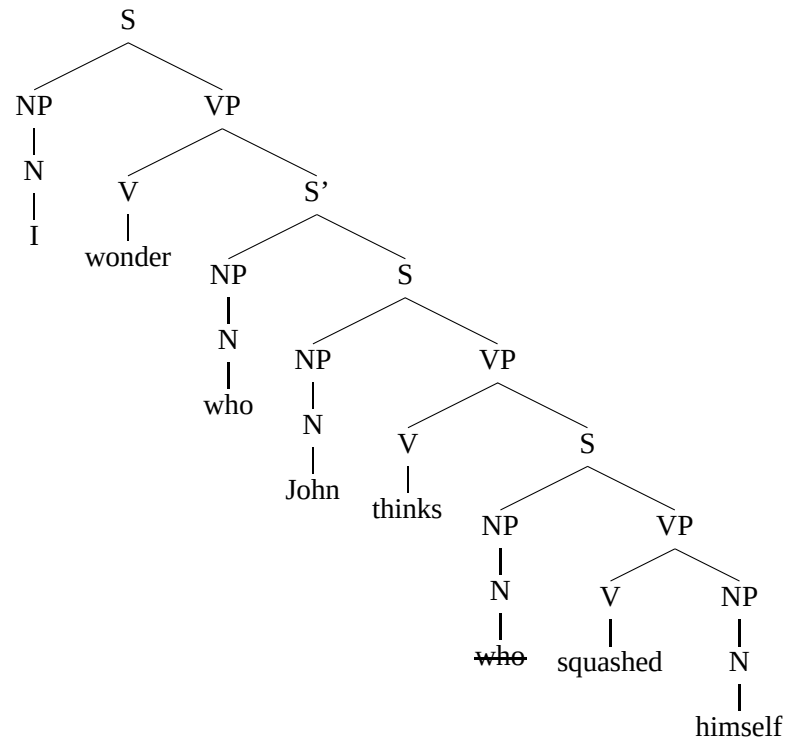
(211) I wonder who$_i$ John$_j$ thinks squashed himself$_{i,*j,*k}$

(212) 1. [Peter]$_{SU}$ [squashed]$_V$ [the squirrel]$_{OBJ}$.
2. [Peter]$_{SU}$ [squashed]$_V$ [himself]$_{OBJ}$.

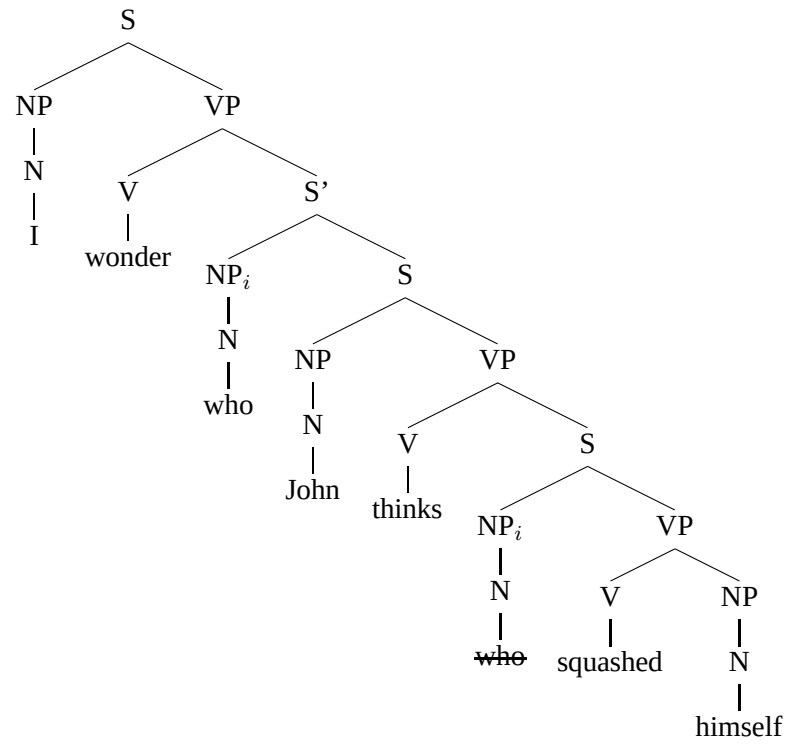
(213) a. John thinks Peter squashed the squirrel
b. I wonder who John thinks squashed the squirrel?

(214) 1. John squashed Mike.
2. Who did John squash?

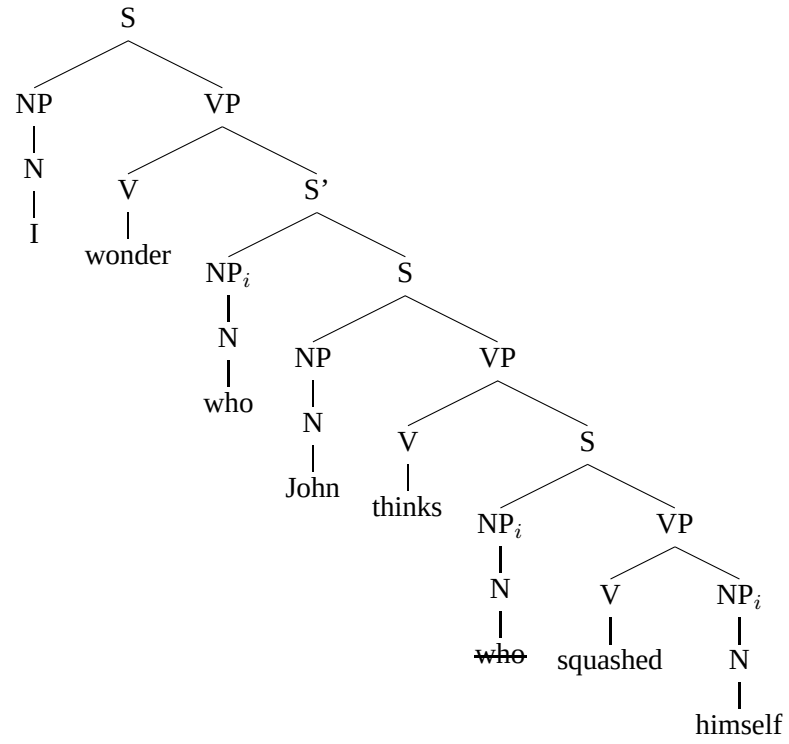
(215)


S
NP
VP
N
V
S’
I
wonder
NP
S
N
NP
VP
who
N
V
S
John
thinks
NP
VP
N
V
NP
~~who~~
squashed
N
himself

(216)


S
NP
VP
N
V
S’
I
wonder
NP$_i$
S
N
NP
VP
who
N
V
S
John
thinks
NP$_i$
VP
N
V
NP
~~who~~
squashed
N
himself

(217)



(218) Parallelism in interpretation

1. Janie$_i$ asked Loretta$_j$ to fix her$_{i,j}$ bicycle—*at least two readings.*
2. Rayette$_k$ asked Eve$_l$ to fix her$_{k,l}$ bicycle—*at least two readings.*
3. Janie$_i$ asked Loretta$_j$ to fix her$_{i,j}$ bicycle and Rayette$_k$ asked Eve$_l$ to fix her$_{k,l}$ bicycle.—*how many of the following readings are possible:* i *&* k*;* i *&* l*;* j *&* k*;* j *&* l *?*

(219) The pilot called the flight attendant into the cabin because she needed his help.

8.1 Exercises

Exercise 8.7.1. Show with trees that the following examples a. and b. show exactly the same problems for **Hypothesis III** as (202a) and (202b), respectively.

(220) a. *The teacher$_j$ who Mary$_i$ likes flogs herself$_i$.
b. The teacher$_j$ who Mary$_i$ likes flogs herself$_j$.

Exercise 8.7.2. **R-expressions and binding theory:** Consider the following data and confirm that these examples are compatible with the claim that R-expressions cannot be bound at all, even at a distance. The opposite of bound is 'free', so we can say "R-expressions must be free".

a. She$_i$ loves Mary$_{*i/j}$.

b. She$_i$ says that John loves Mary$_{*i/j}$.

c. John says that Jim thinks that she$_i$ promises to tell Bill to beg Sam to force Mary$_{*i/j}$ to eat better.

d. The woman$_i$ who loves her$_{j/k}$, told Mary$_j$ to leave immediately.

Draw a tree for each example and explain why each indexed R-expression is or is not bound by other indexed NPs.

Exercise 8.7.3. **Pronouns and binding theory:** The point of this exercise is to reinforce the idea that syntactic phenomena are structure dependent. In the text we examined the conditions on the appearance of anaphors (like *himself* and *herself*), and in the previous exercise the conditions on regular referring expressions. You will now go through similar steps of reasoning to discover conditions on the distribution of non-reflexive pronouns like **him** and **her**. Some data:

a. Tom$_i$ sees him$_j$.

b. *Tom$_i$ sees him$_i$.

1. Propose a Hypothesis I that relies exclusively on linear order to account for the grammatical *vs*. ungrammatical indexing of *him* and *Tom* in (l) and (m):

More data:

c. Tom$_i$ knows that Fred$_j$ loves him$_i$.

d. *Tom$_i$ knows that Fred$_j$ loves him$_j$.

Explain:

2. Why is (c.) a problem for Hypothesis I?

3. Is (d.) a problem for Hypothesis I? Explain.

4. Propose another linear order Hypothesis II using the notion of intervention (*x* comes between between *a* and *b*) to account for just (a.b.c.d.):

More data:

e. The aromatherapist$_j$ Tom$_i$ likes flogs him$_i$.
f. *The aromatherapist$_j$ Tom$_i$ likes flogs him$_j$.
g. A friend$_j$ of Tom's$_i$ flogs him$_i$.
h. *A friend$_j$ of Tom's$_i$ flogs him$_j$.
i. He$_i$ flogs him$_j$.

Explain:

5. Why is (e.) a problem for Hypothesis II?

6. Why is (f.) a problem for Hypothesis II?

7. Why is (g.) a problem for Hypothesis II?

8. Why is (h.) a problem for Hypothesis II?

9. Is (i.) a problem for Hypothesis II?

10. Draw trees and show indexing on the Noun Phrases for the five sentences e-i. Use the trees in the chapter to help you.

11. Fill in the correct responses. A constituent α of a sentence ***binds*** another constituent β just in case these two conditions are satisfied:
    i.
    ii.

12. Give the letter of an example from the sentences above in which *him* is bound, and the sentence is grammatical:
13. Give the letter of an example from the sentences above in which *him* is not bound, and the sentence is grammatical:

14. Formulate a Hypothesis III for the distribution of *him* that uses binding and accounts for all of (a.-i.):

Consider the grammaticality of the three sentences represented by the following string and indexation: Who$_i$ does Annie$_j$ think loves her$_{*i/j/k}$.

15. Explain only the reason why the following reading is ungrammatical. Your answer should include a tree and one sentence.

Who$_i$ does Annie$_j$ think loves her$_{*i}$

9 Ergativity

(221) He kicked the frog.

(222) Describing a constituent like *he*

- it is a PRONOUN, which is a kind of NP
- it is the SUBJECT of the sentence
- it is the AGENT of the action described
- it is in the NOMINATIVE CASE, as opposed to a form like *him*

(223) Transitivity

- *Mary yawned* (no arguments within the VP)=Intransitive
- *Mary kicked him* (one argument within the VP)=Transitive
- *Mary gave him the cold shoulder* (two arguments within the VP)=Ditransitive

(224) Agreement in English

	PRESENT	PAST
SINGULAR	*He sees John*	*He saw John*
PLURAL	*They see John*	*They saw John*

(225) Subject-verb agreement in two Latin tenses

	PRESENT		FUTURE	
	SG	PL	SG	PL
1^{st}	am$\bar{o}$	am$\bar{a}$mus	amab$\bar{o}$	amabimus
2^{nd}	am$\bar{a}$s	am$\bar{a}$tis	amabis	amabitis
3^{rd}	amat	amant	amabit	amabunt

(226) First person, non-singular forms in three languages

	Mohawk	Tok Pisin	English
1, DU, EXC	iakenihiá:tons	mitupela raitim	we write
1, PL, EXC	iakwahiá:tons	mipela raitim	〃
1, DU, INC	tenihiá:tons	yumitupela raitim	〃
1, PL, INC	tewahiá:tons	yumipela raitim	〃

(227) Hungarian has some nice suffixes on verbs:

Verb	*I V an X*	*I V the X*	*I V you*
send	küldök	küldöm	küldelek
watch	lesek	lesem	leslek
await	várok	várom	várlak

(228) Latin nominative-accusative system

a. dominu**s** venit ‘the master is coming’
b. servu**s** venit ‘the slave is coming’
c. dominu**s** servu**m** audit ‘the master hears the slave’
d. servu**s** dominu**m** audit ‘the slave hears the master’

(229) English pronoun case

a. **I** am coming
b. **She** is coming
c. **I** hear **her**
d. **She** hears **me**

(230) Ergative-absolutive system

Yup’ik Eskimo (Alaska)

a.	Doris-aq ayallruuq	‘Doris travelled’
b.	Tom-am Doris-aq cingallura	‘Tom greeted Doris’
c.	Tom-aq ayallruuq	‘Tom travelled’
d.	Doris-am Tom-aq cingallura	‘Doris greeted Tom ’
e.	Ayallruu-nga	‘I travelled’
f.	Ayallruu-q	‘He travelled’
g.	Cingallru-a-nga	‘He greeted me’

(231) Two case marking patterns

	Yup’ik	Latin
Subject of transitive (ST)	*-am*	*-s*
Subject of intransitive (SI)	*-aq*	*-s*
Object (O)	*-aq*	*-m*

(232) Two case marking patterns

<table>
<tr><th>Yup’ik</th><th></th><th>Latin</th></tr>
<tr><td rowspan="2">ERGATIVE</td><td>ST</td><td rowspan="2">NOMINATIVE</td></tr>
<tr><td rowspan="2">ABSOLUTIVE</td><td>SI</td></tr>
<tr><td>O</td><td>ACCUSATIVE</td></tr>
</table>

(233) English transitive alternation

TRANSITIVE	INTRANSITIVE
a. Davey and Sami grow pansies there	Pansies grow there
b. They grow *them* there	*They* grow there

(234) Hypothetical English′ transitive alternation

TRANSITIVE	INTRANSITIVE
a. Davey and Sami grow pansies there	Pansies grow there
b. They grow *them* there	*Them* grow there

(235) Tense-split system in Georgian

a.	student-i midis student-NOM goes	‘The student goes’
b.	student-i ceril-s cers student-NOM letter-ACC writes	‘The student writes the letter’
c.	student-i mivida student-ABS went	‘The student went’
d.	student-ma ceril-i dacera student-ERG letter-ABS wrote	‘The student wrote the letter’

(236) NP vs. V marking split in Managalasi (Papua New Guinea)

a. a vaʔ-ena — ‘you will go’
   2SG go-FUT:2SG

b. na vaʔ-ejo — ‘I will go’
   1SG go-FUT:1SG

c. nara a an-aʔ-ejo — ‘I will hit you’
   1SG 2SG hit-2SG-FUT:1SG

d. ara na an-iʔ-ena — ‘you will hit me’
   2SG 1SG hit-1SG-FUT:2SG

(237) Two patterns in a single language—Managalasi 1st singular

Pronouns		Verb Markers
nara	ST	*ejo*
na	SI	
	O	*iʔ*

(238) Some simple Dyirbal sentences

English	Dyirbal	gloss
a. **he** saw *her*	*yabu* **ɲumaŋgu** buran	‘**father** saw *mother*’
b. *she* returned	*yabu* banagan^{y}u	‘*mother* returned’
c. **she** saw *him*	*ɲuma* **yabuŋgu** buran	‘**mother** saw *father*’

(239) Ergative-Absolutive Case Pattern

ɲuma	**yabuŋgu**	buran	‘**mother** saw *father*’
father	**mother**	saw	
ABSOLUTIVE	ERGATIVE		
yabu		banagan	‘*mother* returned’
mother		returned	
ABSOLUTIVE			

(240) Case patterns for English pronoun and Dyirbal noun

	English	Dyirbal
Transitive subject	**she**	**yabuŋgu**
Intransitive subject	*she*	*yabu*
Object	her	*yabu*

(241) Dyirbal pronouns

a.	ŋana banagan^{y}u we-all returned.NON-FUT	‘we returned’
b.	n^{y}urra banagan^{y} you-all returned.NON-FUT	‘you returned’
c.	n^{y}urra ŋanana buran you-all we-all see.NON-FUT	‘you saw us’
d.	ŋana n^{y}urrana buran we-all you-all see-NON-FUT	‘we saw you’

(242) Lexical NPs *vs.* pronouns in Dyirbal

ROOT	‘mother’	‘father’	‘we all’	‘you all’
ST	yabuŋgu	ɲumaŋgu	ŋana	n^{y}urra
SI O	yabu	ɲuma	ŋanana	n^{y}urrana

9.1 Exercises

Exercise 9.8.1. **Managalasi 2nd person:** Go back to the discussion of Managalasi and create a table like that in (231) for the 2nd person singular forms from the data in (236).

Exercise 9.8.2. **Iyinû-Aimûn verbs:** This exercise was prepared by our student Kevin Brousseau who is a speaker of this Algonquian language, a dialect of Cree spoken in Québec, Canada.

Consider the following sentences:

1. *nicî* *tahcishkuwâu* *atimw*
   I-PAST kick dog
   ‘I kicked the dog’
2. *nicî* *tahcishken* *tehtapûn*
   I-PAST kick chair
   ‘I kicked the chair’
3. *cî* *pahcishin* *an* *atimw*
   PAST fall that dog
   ‘That dog fell’
4. *cî* *pahchihtin* *an* *tehtapûn*
   PAST fall that chair
   ‘That chair fell’

What seems to condition the form of the verb in the two transitive sentences (i) and (ii)? What seems to condition the form of the verb in the two intransitive sentences (iii) and (iv)? What do these facts together remind you of?

The words for ‘girl, woman, man, boy, moose’ can all replace the word for ‘dog’ in the sentences above; and the words for ‘sock, shoe, canoe’ can all replace the word for ‘chair’, but if we replace, say, ‘dog’ with ‘canoe’ or ‘chair’ with ‘man’, the sequences become ungrammatical. Note that the form *mishtikw* can mean both ‘tree’ and ‘stick’, but it is clear in each of the following which meaning is intended:

1. *nicî* *tahcishkuwâu* *mishtikw*
   I-PAST kick tree/stick
   ‘I kicked the tree’
2. *nicî* *tahcishken* *mishtikw*
   I-PAST kick tree/stick
   ‘I kicked the stick’
3. *cî* *pahcishin* *an* *mishtikw*
   PAST fall that tree/stick
   ‘That tree fell’
4. *cî* *pahchihtin* *an* *mishtikw*
   PAST fall that tree/stick
   ‘That stick fell’

Do the nouns in Iyinû-Aimûn appear to fall into different groups? How might you label those groups? Do you think it is plausible that a mental grammar, which we have been characterizing as a symbol-processing computational system, is sensitive to the kind of information you appealed to in characterizing the noun classes? How does the following bear on this issue?

1. *nicî* *muwâu* *âihkunâu*
   I-PAST eat bread
   ‘I ate the bread’
2. *nicî* *mîcham* *mîcim*
   I-PAST eat food
   ‘I ate the food’

3. *cî* *pahcishin* *an* *asinî*
   PAST fall that stone
   'That stone fell'

What determines the nature of Iyinû-Aimûn noun equivalence classes—what the nouns mean or an abstract and arbitrary feature?

Exercise 9.8.3. **Guugu Yimidhirr cases:** Assume that *you* in a translation always refers to 2nd person singular. Assume that word order is completely free in this language. Ignore any variation between long (double) and short (single) vowels.

1. Nyundu ganaa? Are you well?
2. Nyulu galmba ganaa. She is also fine.

⋆ What is the word for *well, fine*? a._____

⇒ The first two sentences have no verb–it need not be expressed in such sentences. You can also think of the adjective as serving as a verb.

⋆ What is the word for *you*? b._____

⋆ For *she*? c._____

3. Nyundu dhadaa? Are you going to go?

⋆ What is the verb in this sentence (in Guugu Yimidhirr)? d._____

4. Yuu, ngayu dhadaa. Yes, I am going to go.
5. Ngayu galmba dhadaa. I too am going to go.

⋆ What is the word for *also, too*? e._____

⋆ For *yes*? f._____

⋆ For *I*? g._____

⋆ For *she*? h._____

6. Ngali dhadaa gulbuuygu. You and I will go together.

⋆ If *gulbuuygu* means together, what does *ngali* mean? i._____

7. Nyundu ganaa. You are OK.

⇒ Note that a question does not have different word order from a statement—sentences 7 and 1 are the same in Guugu Yimidhirr.

8. Nyundu Billy nhaadhi. You saw Billy.

- ⋆ What is the word for *Billy*? j._____
- ⋆ For *saw*? k._____

9. Ngayu Billy nhaadhi. I saw Billy.
10. Nyundu nganhi nhaadhi. You saw me.

- ⋆ What does *nganhi* mean? l._____

11. Ngayu nhina nhaadhi. I saw you.

- ⋆ What does *nhina* mean? m._____
- ⋆ Using only the sentences above, find a transitive sentence (one with a subject and an object) with *you* (sg) as the subject. n.# _____
- ⋆ Then find an intransitive sentence (no object) with *you* as the subject. o.# _____
- ⋆ Then find one with *you* as an object. p.# _____. This gives us *you* as an ST, an SI and an O.
- ⋆ Fill in the following table:

	2 sg.
ST	q._____
SI	r._____
O	s._____

- ⋆ Base on the entries in your table, does the 2 sg pronoun follow the nominative/accusative pattern, the ergative absolutive pattern, or some other pattern?
  t._____

12. Nyulu nganhi nhaadhi. He saw me.
13. Ngayu nhangu daamay. I speared him.
14. Nyundu nhangu nhaadhi. You saw him.
15. Nyulu nhina nhaadhi. He saw you.

- ⋆ How do you think you say *She saw you*?
  u. _____
- ⋆ Now fill in the table below:

	1sg.	2sg.	3sg.
ST	v.		y.
SI	w.		z.
O	x.		aa.

- ⋆ Do the first and third person forms show the same pattern as the second person form? bb._____
  Consider the further data below.

16. Billy ngayu nhaadhi. I saw Billy.
17. Nhina nhaadhi ngayu. I saw you.
18. Nhaadhi nhangu nyundu. You saw him.
19. Ngayu ganaa. I am well.
20. Wanhu dhadaara? Who is going?
21. Wanhdhu Billy nhaadhi? Who saw Billy?
22. Nyundu wanhu nhaadhi? Who did you see?
23. Nyundu buli? Did you fall down?
24. Wanhdhu nhina dhuurrngay? Who pushed you?
25. Billy-ngun nganhi dhuurrngay. Billy pushed me.
26. Nganhi dhuurrngay. I was pushed. / Someone pushed me.
27. Billy dhadaa. Billy is going to go.
28. Ngayu Billy nhaadhi. I saw Billy.
29. Billy-ngun nganhi nhadhi. Billy saw me.
30. Yarrga-ngun nganhi gunday. The boy hit me.
31. Yugu-ngun bayan dumbi. The tree crushed the house.
32. Yarraman-ngun nhina dhuurrngay. The horse pushed you.
33. Yugu buli. The tree fell.
34. Ngayu yugu bulii-mani. I made the tree fall.
35. Nambal duday. The rock rolled away.

⋆ How do names pattern? Ergative/absolutive or nominative/accusative?
ff._____

⋆ Complete the table:

	PERSONAL PRONOUNS			wh-PRONOUN	Name	Common NP
	1sg.	2sg.	3sg.	who	Billy	the boy, etc.
ST				dd.	gg.	jj.
SI				ee.	hh.	kk.
O				ff.	ii.	ll.

⋆ How do regular noun phrases pattern?
gg._____

⋆ How does the Guugu Yimidhirr word for *who* pattern?
hh._____

36. Yarrga-ngun nambal duday-mani. The boy rolled the rock away.
    - ⋆ How do you think you say *The boy rolled the rock away.*?
      ii. _____
    - ⋆ How do you think you say *The boy got pushed.*?
      jj._____
    - ⋆ Which sentence best shows that a ST need not be a volitional, conscious agent, but rather just be the subject of a transitive sentence?
      kk.# _____

Exercise 9.8.4. **Lakhota:** Do the agreement markers on the Lakhota verbs in the following data show a NOMINATIVE/ACCUSATIVE pattern, an ERGATIVE-ABSOLUTIVE pattern, or something else? What seems to determine the forms of a marker agreeing with an intransitive subject? What categories do we need to refer to to predict the forms of a SI? Do you think it is consistent with our discussion thus far that the grammar should be sensitive to such issues? Can you propose any alternative accounts based only on structure?

a-ma-ya-phe ‘you hit me’
DIR-1SG-2SG-hit

wa-0-ktékte ‘I kill him’
1SG-3SG-kill

0-ma- ktékte ‘He kills me’
3SG-1SG-kill

ma-hîxpaye ‘I fall’
1SG-fall

ma-t’e’ ‘I die’
1SG-die

ma-čǎča ‘I shiver’
1SG-shiver

wa-škate ‘I play’
1SG-play

wa-nûwe ‘I swim’
1SG-swim

wa-lowă ‘I sing’
1SG-sing

10 Approaches to UG: Empirical evidence

Figure 16: Oonagh and Baby Z are raised in a very similar environment.

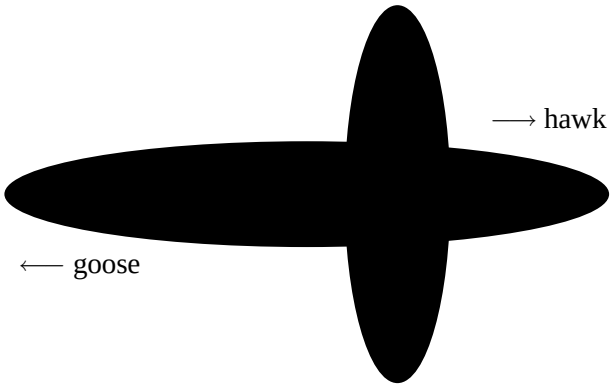


Figure 17: Instinct (Innate Knowledge) in goslings

(243)
- If Davey is wearing (any) footwear, he is in trouble. ⇒
- If Davey is wearing (any) socks, he is in trouble.

(244)
a. Nobody ever saw Davey.
b. Sami didn't ever see Davey.
c. Sami didn't see Davey ever.
d. *Sami ever saw Davey.

e. *Sami saw Davey ever.

(245) Hypothesis I: *ever* can occur only if the sentence contains . . .

(246) f. *Davey ever sees nobody.

(247) Hypothesis II: *ever* can occur only if . . .

(248) g. *Mary claims that Sami ever sings.

h. Mary claims that Sami doesn't ever sing.

i. Mary doesn't claim that Sami ever sings. [= She does not claim "Sami sometimes sings ."]

(249) j. *A man I don't know claims that Sami ever sings.

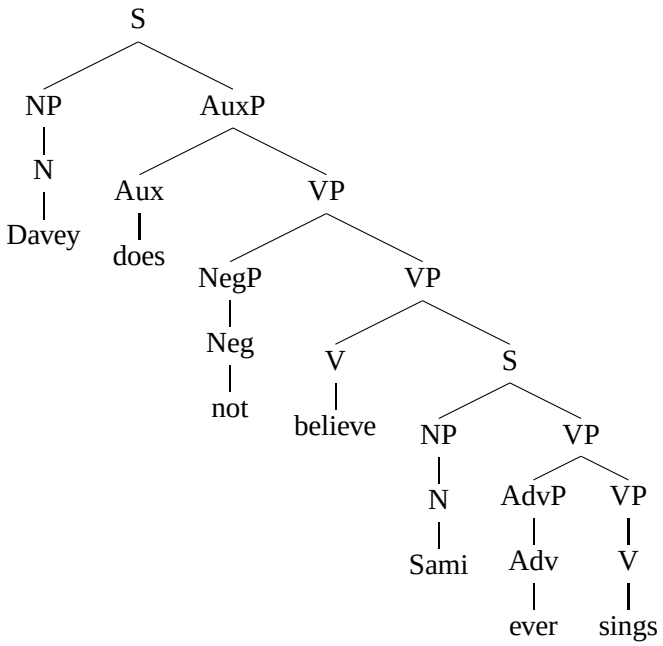
k. I never said that Sami ever sings.

l. *A man who never did anything nice said that Sami ever sings.

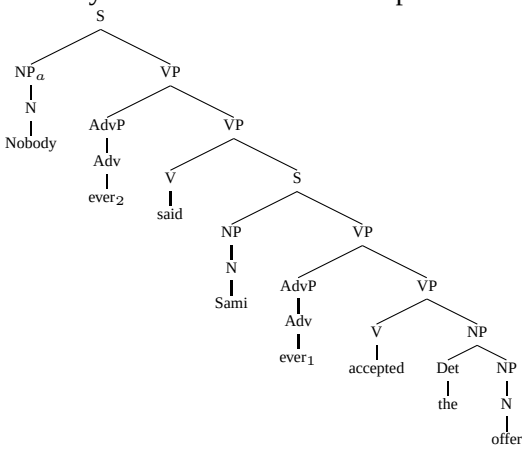
(250) m. Davey does not believe Sami ever sings.

n. Davey agrees that Fred does not know that Trevor insists that Mary believes that Sami ever sings.

(251) Position of negation



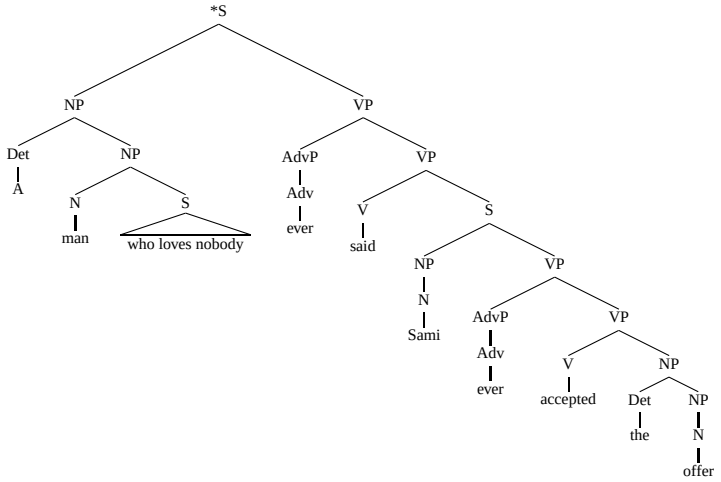
(252) Nobody ever said Sami ever accepted the offer.



(253) Hypothesis III: *ever* can occur only if . . .

(254) *A man who loves nobody ever said Sami ever accepted the offer.

(255) No c-command



(256)
- *her*—must not be in a local c-command relation (may be c-commanded, but not locally)
- *herself*—must be in a local c-command relation
- *the girl*—must not be c-commanded
- *ever*—must be c-commanded

	Locality crucial	Locality irrelevant
Must be c-commanded	*herself*	*ever*
Must NOT be c-commanded	*her*	*the girl*

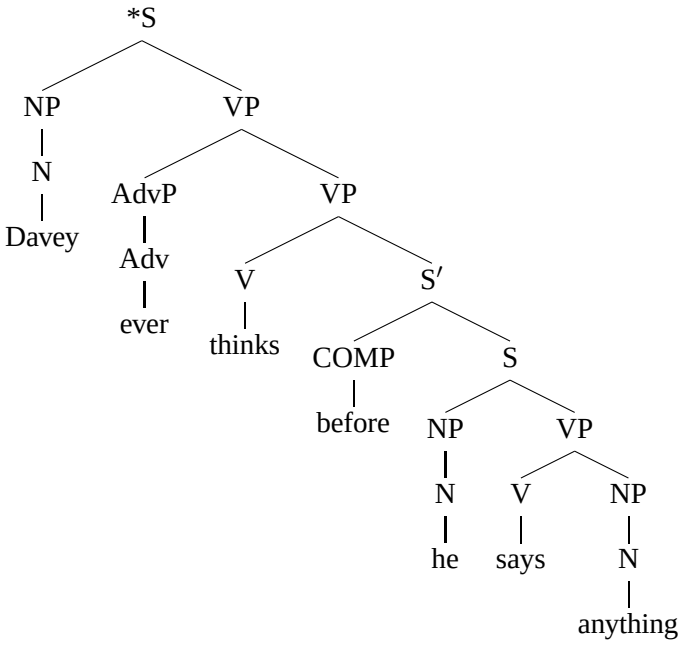
(257) NPIs like *ever* must be c-commanded by a NEGATIVE word.

(258)
- Davey left without ever saying goodbye.
- Few people ever impressed Davey as much as Sami.
- Davey thinks before he ever says anything.
- If Sami ever calls, Davey dances gracefully.

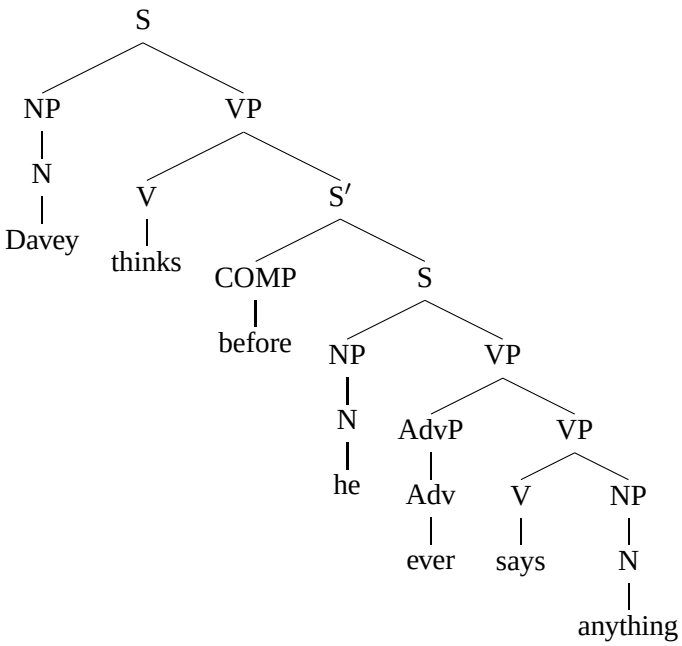
(259)
a. *Davey left *by* ever saying goodbye.
b. **Many* people ever impressed Davey as much as Sami.
c. *Davey thinks after he ever says anything.
d. *Sami ever calls, if Davey dances gracefully.

(260)
a. *Davey *ever* left *without* saying goodbye.
b. *Davey *ever* impressed *few* people as much as Sami.
c. *Davey *ever* thinks *before* he says anything.
d. *Sami ever calls, if Davey dances gracefully.

(261) Potential tree for (260c)



(262) Tree for (258c)



(263) NPIs must be c-commanded by a DOWNWARD-ENTAILING operator.

(264) a. *I Ilektra enekrine *kanena* sxedhio.
the Electra approved any plan

b. I Ilektra *dhen* enekrine *kanena* sxedhio.
the Electra not approved any plan
'Electra didn't approve any plan'

c. O papus pethane *xoris* na dhi *kanena* apo ta egonia tu
the grandfather died without subj. see any from the grandchildren his
'My grandfather died without seeing any of his grandchildren.'

d. O papus pethane *prin* na dhi *kanena* apo ta egonia tu
the grandfather died before subj. see any from the grandchildren his
'My grandfather died before seeing any of his grandchildren.'

e. *An* his tin Ilectra *puthena*, na tis pis na me perimeni
if see the Electra anywhere, subj her tell subj me wait
'If you see Electra anywhere, tell her to wait for me.'

f. *Elaxisti* fitites idhan *tipota*.
very-few students saw anything
'Very few students saw anything.'

(265) Mohawk:

a. Owiraa wahrake ne **owahru**. Baby ate the meat

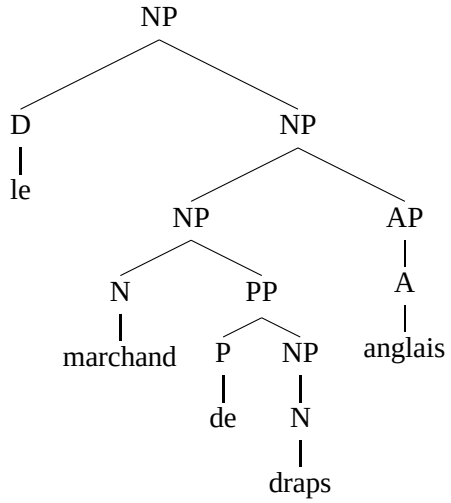
b. Owiraa wah**awahr**ake Baby meat-ate

c. *Wahawirake ne **owahru**. Baby-ate the meat

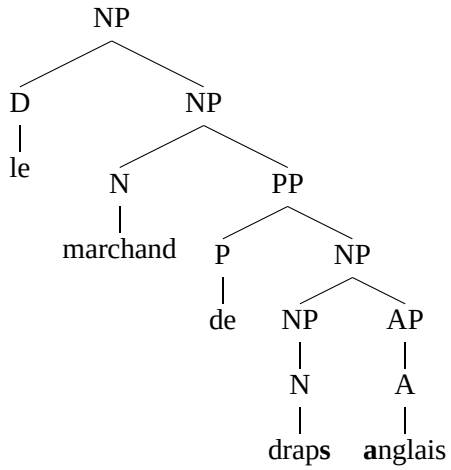
(266) French:

le	*marchand*	*de*	*draps*	*anglais*
the	merchant	of	cloth	English

(267)
- [Le [[marchand [de draps]] anglais]]
- the English cloth seller



(268)
- [Le [marchand [de [drap**s** **a**nglais]]]]
- the seller of English cloth



10.1 Exercises

Exercise 10.3.1. **Complex syntax of NPIs:** Consider the following example. Draw a tree with as much detail of structure as you can argue for. Explain why each instance of *ever* is well formed in accordance with the final hypothesis developed in the chapter. Discuss any complications that this example presents.

(269) Nobody who ever did anything nice ever said Sami sings.

Exercise 10.3.2. **'Mixed' languages:** Mark Baker, author of *Atoms of Language*, proposes that Universal Grammar determines that languages should be *either* head-initial (with prepositions and verbs before their objects, *etc.*) *or* head-final (with *postpositions* and verbs after their objects, *etc.*). Amharic however shows properties of both types. To explain such mixed cases Baker says

> Amharic, for example, is a Semitic language, related to pure head-initial languages like Arabic and Hebrew but spoken in Africa, in the environment of head-final Cushitic and Nilo-Saharan languages. The conflict of historical and geographic influences could partially explain why Amharic is a mixed case.

What do you think of Baker's proposal in the context of the I-language approach?

11 Approaches to UG: Logic

(270) General Principles:

- Each card is grammatical, ungrammatical or neither.
- A grammar is a set of conditions on cards.
- UG is a set of primitives, including:
  - types of symbols (features)
  - logical operators defined over these symbols
- A card *c* is 'grammatical' with respect to a grammar *G* iff *c* satisfies the conditions imposed by *G*. In such a case we will say, informally, that *c* is 'in *G*.'

(271) UG1

- Features:

  NUMBERCARD
  ♣, ♢, ♡, ♠
- Operators: AND

(272) UG2

- Features:

  [±PICTURE]
  [±RED]
- Operators: AND

(273) Some impossible grammars given UG2

- F_4 = [♠]
  "A sentence/card is in F_4 if and only if it is a spade."
- F_5 = [+PICTURE OR -RED]
  "A sentence/card is in F_5 if and only if it is a picture card or a black card (or both)."

(274) Description of UG3

- Features:

  [PICTURECARD]
  [2,3,4,5,6,7,8,9,10]
  [±RED]
- Operators: AND, OR

(275) Some Possible Grammars given UG3:

- G_7 = [+RED AND 9]
  "A sentence/card is in G_7 if and only if it is a red nine."
- G_8 = [-RED AND PICTURECARD]
  "A sentence/card is in G_8 if and only if it is a black picture card."
- G_9 = [PICTURECARD OR +RED]. "A sentence/card is in G_9 if and only if it is a red card or a picture card (or both)."

(276) Some Impossible Grammars given UG3:

- F_6 = [♠]
  "A sentence/card is in F_6 if and only if it is a spade."
- F_7 = [NUMBER]
  "A sentence/card is in F_7 if and only if it is a numbercard."
- F_8 = [-RED AND Q]
  "A sentence/card is in F_8 if and only if it is a black queen."

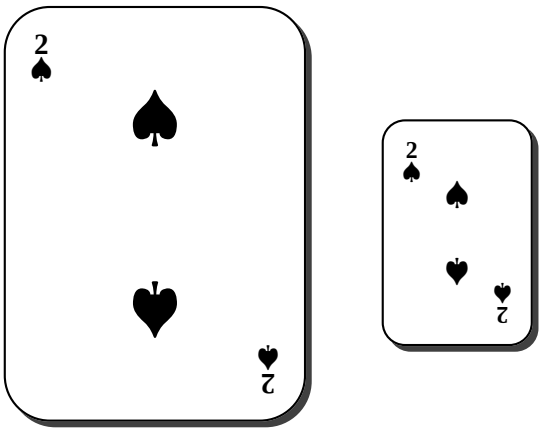


Figure 18: A Non-'linguistic' Card Contrast

(277) Some of the founding assumptions of Generative Phonology involve abstract units such as distinctive features, timing units, syllables, and constraints. The innateness of these units has been seen as an important part of their nature. Recent work has sought to undermine the claim that innate primitives are necessary for phonological theory, often drawing more directly upon more

concrete factors such phonetics and language change as sources of explanation. [Announcement of a recent conference workshop (*NELS 38, the 38th meeting of the North East Linguistics Society)*]

11.1 Exercises

Exercise 11.4.1 **Defining the initial state:** Your task in this exercise is to demonstrate how UG (the initial state of the language faculty) determines the set of grammars that a learner can possibly acquire. You are to create a parallel to the card languages we talked about in the chapter.

Instead of using playing cards your grammars will be based on Canadian coins of the following denominations: 1¢, 5¢, 10¢, 25¢, $1, $2. (Feel free to use some other set of things, for example, another currency or the pizza topping combinations on a menu—mushrooms and pepperoni, pepperoni, anchovies and extra cheese, *etc.*)

You should make up some feature systems based on these coins (or pizzas), as well as some operators—please use at least one operator other than AND and OR, and use one privative feature and one binary feature. One possibility for an operator is NOT, a negation operator, but we encourage you to find or invent others—just explain carefully. For this exercise, think of a language as a set of coins (parallel to the sets of cards)—for a given coin, a grammar has to treat it as grammatical or ungrammatical.

Before you begin your answer, read through all the questions. Your earlier choices will affect later ones.

UG_1: Define a coin Universal Grammar, UG_1, in terms of some operators and symbols (features) that can describe the coins.

a. Operators:

b. Features:

– Define two grammars that can be stated in terms of UG_1

c. $G_{1.1}$:

d. $G_{1.2}$:

– Now define two grammars that cannot be stated in terms of UG_1 and explain why each is not possible

e. $F_{1.1}$:

f. $F_{1.2}$:

UG_2: Define another coin Universal Grammar, UG_2, in terms of some operators and symbols (features) that can describe the coins. Before you proceed with defining UG_2, read the rest of this question.

g. Operators:

h. Features:

- Define two grammars that can be stated in terms of UG_2
  i. $G_{2.1}$—a language that generates a set of sentences equivalent to that described by one of the impossible languages item $F_{1.1}$ or $F_{1.2}$:
  j. $G_{2.2}$—a language that is extensionally equivalent to $G_{1.1}$ or $G_{1.2}$ (generates the same set of sentences), but does so using different symbols or operators:
- Now define two grammars that cannot be stated in terms of UG_2 and explain why each is not possible
  k. $F_{2.1}$:
  l. $F_{2.2}$:

12 Social implications

(278) a. Non-Standard Dialect: He didn't eat no cake.

- Standard: He didn't eat any cake.

b. Non-Standard Dialect: He didn't give nothing to nobody.

- Standard: He didn't give anything to anybody.

(279) *he nevere yet no villeyneye ne sayde*
in al his lyf unto no manner wight

(280) What is called a solecism is simply what results when words are not combined according to the rules by which our predecessors, who spoke with some authority, combined them. Whether you say *inter homines* or *inter hominibus* [to mean *among men*—di and cr] does not matter to a student intent upon things. Likewise, what is a barbarism but a word articulated with letters or sounds that are not the same as those with which it was normally articulated by those who spoke Latin before us? Whether one says *ignoscere* with a long or short third syllable is of little concern to someone beseeching God to forgive his sins. [*De Doctrina Christiana* 2.13.9; [**?**].]

(281) Are archaic forms more acceptable?

	Modern Standard forms	Unacceptable archaic forms
i. a.	You are losers.	b. *Ye are losers.
ii. a.	You (sg.) are a loser.	b. *Thou art a loser.
iii. a.	The table stands on its legs.	b. *The table stands on his legs.
iv. a.	Both of my brothers are losers.	b. *Both of my brethren are losers.

(282) Some Canadianisms

a. Canadian
   - *You're allowed playing ball here.*
   - *I'm done my homework.*

b. Standard
   - *You're allowed to play ball here.*
   - *I'm done with my homework* or *I've done my homework.*

12.1 Exercises

Exercise 12.4.1 **Reflexives in two dialects:** Consider the following forms of the reflexive pronoun from both Standard English and a non-Standard dialect.

Standard		*Nonstandard*	
myself	ourselves	myself	ourselves
yourself	yourselves	yourself	yourselves
herself himself	themselves	herself hisself	theirselves

Assume that these forms are all composed of two parts, a personal pronoun and *-self / -selves*. Is there any basis for claiming that the set of Standard forms is more logical than the set of dialect forms? Less logical?

Exercise 12.4.2 **Second person pronouns:** In Brooklyn some people say things like *I'll see yous later* (we have adopted standard orthography.) One of the features of this dialect seen in this sentence is the form of the plural second person pronoun *yous* which is distinct from the singular *you*. Many people argue that speakers of Brooklyn English are clearly more careful and less lazy than speakers of Standard English who do not distinguish a second person singular from a second person plural pronoun. How could you convince such snobs that Standard English speakers are not necessarily illogical and sloppy people who can't express basic distinctions of number

like that expressed by the Brooklynites? (Can the SE speakers tell if they are talking to more than one person?) Can you suggest a way to help the poor Standard English speakers learn the (superficially, at least) more logical Brooklyn system? (Can you somehow show the SE speakers data from their own dialects that suggests a singular-plural distinction in second person?) You can also relate your answer to other linguistic prejudices you know about.

Exercise 12.4.3 **Two dialects of polarity items:** Consider the following sentences of Standard English and a non-Standard dialect. Assume that the paired sentences have the same meaning.

		STANDARD	DIALECT
a.	*Free choice*	He'll eat anything	He'll eat anything
b.	*Positive polarity*	He ate something nasty	He ate something nasty
c.	Negative object 1	He won't eat anything	He won't eat nothing
d.	Negative object 2	He will eat nothing	He won't eat nothing
e.	Negative subject	Nothing happened	Ain't nothing happened

The two dialects appear to agree in Free Choice contexts like (a) where they both use *anything*. They also agree in Positive polarity contexts where they use *something*. What can you say about the last three sentences? How would you characterize the forms used in each dialect? It may help to know that the form *nothing* in the standard is sometimes called a negative quantifier. We'll assume that **Nothing happened* is ungrammatical in the non-Standard dialect in question.

How does this dialect difference support the perspective of I-language? Can you incorporate into your response the fact that like the other forms *nothing* varies widely in its pronunciation among dialects, with a range including such diverse forms as the following [nəθn̩, nəθɪŋ, nəfn̩, nəʔn̩]?

13 Some philosophy

(283) What did the tall guy with bright green dreadlocks and a friendly pregnant German shepherd really want the fat bald guy in a bright pink tutu to hear ~~what~~?

(284) More *wh*-movement

a. What did the bad dog eat ~~what~~?

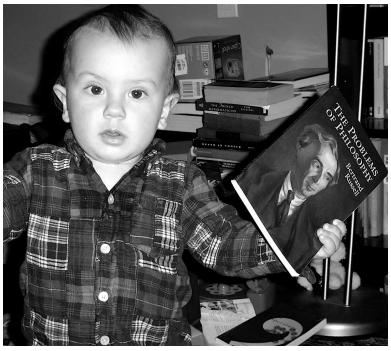


Figure 19: Where does knowledge come from?

b. Who did the tall guy with bright green dreadlocks and a friendly pregnant German shepherd really want the fat bald guy in a bright pink tutu to hear ~~who~~?

c. *The boy did the tall guy with bright green dreadlocks and a friendly pregnant German shepherd really want the fat bald guy in a bright pink tutu to hear ~~the boy~~?

(285) Chomskian linguistics is explicitly anti-empiricist, and all indications are that current philosophy of science is moving toward a rejection of the empiricist programme (Fodor 1968:xiv). A key feature of the new programme is exactly a reevaluation of the concept of observation. Observations are now held to be judgments, and these judgments are made in terms of the criteria provided by the paradigm. Thus the taxonomy of a discipline is to be regarded as imposed from above, rather than emerging from below, i.e., rather than emerging in the form of brute facts before the unprejudiced eyes or ears of the researcher. The relevance of this to the study of phonetics and phonology should be obvious: the concept of the segment, which is indispensable to phonetics and phonology, is a creature of the paradigm, not of the raw data. [Hammarberg 1976: 354.]

(286) [I]t should be perfectly obvious by now that segments do not exist outside the human mind. [354]

(287) there would be little value in such an approach. Science aims for a theory of the real, and to base one's descriptions and generalizations on a fictional taxonomy could only lead to one's theories being fictional as well. [355]

(288) Linguistic theory is concerned primarily with an ideal speaker listener, in a completely homogeneous speech community, who knows its language perfectly and is unaffected by such grammatically irrelevant conditions as **memory limitations, shifts of attention and interest, and errors (random or characteristic)** in applying his knowledge of language in actual performance.This seems to me to have been the position of the founders of modern general linguistics, and no cogent reason for modifying it has been offered. To study actual linguistic performance, we must consider the interaction of a variety of factors, of which the underlying competence of the speaker-hearer is only one. In this respect, study of language is no different from empirical investigation of other complex phenomena. [Chomsky 1965:3, *Aspects of the Theory of Syntax*. Emphasis added]

(289) Chomsky proposes to study language by modeling an ideal speaker-hearer in a completely homogenous speech community, but there are no languages like this—there is always intra- and interspeaker variation correlated with temporary or more permanent social circumstances, and no speech community is completely homogenous. Therefore, Chomsky's idealizations are so radical as to be uninteresting and useless for an understanding of how language really works.

(290) In my opinion, many psychologists have a curious definition of their discipline. A definition that is destructive, suicidal. A dead end. They want to confine themselves solely to the study of performance—behavior—yet, as I've said, it makes no sense to construct a discipline that studies the manner in which a system is acquired or utilized, but refuses to consider the nature of this system. [Chomsky 1977:49]

(291) [I]f we confine ourselves to the scientific and intellectual goals of understanding psychological phenomena [as opposed to predicting observed behavior—di & cr] one could certainly

make a good case for the claim that there is a need to direct our attention away from superficial "data fitting" models toward deeper structural theories. [Pylyshyn 1973:48]

(292) And to those philosophers who tell [the nominalist] that before having answered the 'what is' question he cannot hope to give exact answers to any of the 'how' questions, he will reply, if at all, by pointing out that he much prefers that modest degree of exactness which he can achieve by his methods to the pretentious muddle which they have achieved by theirs.

. . . methodological nominalism is nowadays fairly generally accepted in the natural sciences. The problems of the social sciences, on the other hand, are still for the most part treated by essentialist methods. This is in my opinion, one of the main reasons for their backwardness. But many who have noticed this situation judge it differently. They believe that the difference in method is necessary, and that it reflects an 'essential' difference between the 'natures' of these two fields of research. [Popper 1952: 33. Popper's footnote deleted]

(293) The problem of definitions and of the 'meaning of terms' is the most important source of Aristotle's regrettably still prevailing intellectual influence, of all that verbal and empty scholasticism that haunts not only the Middle Ages, but our own contemporary philosophy; for even a philosophy as recent as that of L. Wittgenstein suffers, as we shall see, from this influence. The development of thought since Aristotle could, I think, be summed up by saying that every discipline, as long as it used the Aristotelian method of definition, has remained arrested in a state of empty verbiage and barren scholasticism, and that the degree to which the various sciences have been able to make any progress depended on the degree to which they have been able to get rid of this essentialist method. (This is why so much of our 'social science' still belongs to the Middle Ages.) The discussion of this method will have to be a little abstract, owing to the fact that the problem has been so thoroughly muddled by Plato and Aristotle, whose influence has given rise to such deep-rooted prejudices that the prospect of dispelling them does not seem very bright. In spite of all that, it is perhaps not without interest to analyse the source of so much confusion and verbiage. [Popper 1952, Vol. II]

(294) The original question “Can machines think?” I believe to be too meaningless to deserve discussion. Nevertheless I believe that at the end of the century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted. [Alan Turing 1951]

(295) Why do we think computers may have the “right stuff?” The reasons are among some of the most significant philosophical concepts of the late 20th century.

In one variant or another, the question “can a machine think” has occupied the attention of philosophers and others for centuries, stimulated from time-to-time by the emergence of ingenious mechanisms which suggested at least the possibility of an affirmative answer. In our own times, we have seen the creation of machines that are autonomous–robots, for example, that can perform tasks without constant human supervision. Does this mean that the device thinks? Thinking about what it means for a machine to think means thinking, as well, about ourselves. Indeed, what does it mean to think? Does thinking define humanity? Do animals think? [Clinton Kelly 2001]

(296) [I]t is not a question of fact, but a matter of decision as to whether to adopt a certain metaphorical usage, as when we say (in English) that airplanes fly, but comets do not—and as for space shuttles, choices differ. Similarly, submarines set sail, but do not swim. There can be no sensible debate about such topics; or about machine intelligence, with the many familiar variants. [Chomsky 2000:114]

(297) One of its characteristics is certainly that it is an electrical disturbance; in fact, it is most frequently described as being just that. This disturbance is usually an electrical potential of something like 50 millivolts and of about a millisecond’s duration. Concurrently with this electrical disturbance there also occur chemical changes along the axon. Thus, in the area of the axon over which the pulse-potential is passing, the ionic constitution of the intracellular fluid changes, and so do the electrical-chemical properties (conductivity, permeability) of the wall of the axon, the *membrane*. At the endings of the axon the

chemical character of the change is even more obvious; there, specific and characteristic substances make their appearance when the pulse arrives. Finally, there are probably mechanical changes as well. Indeed, it is very likely that the changes of the various ionic permeabilities of the cell membrane (cf. above) can come about only by reorientation of its molecules, i.e. by mechanical changes involving the relative positions of these constituents. [John von Neumann 2000:40-41, *The Computer and the Brain*]

(298) a term used by some cognitive psychologists who have a computational view of the mind. The term is applied to precise symbolic constructs or codes corresponding to objects and, by their computation, putatively explaining behavior [Edelman 2004:167]

(299) In freeing the upper extremities from brachiation (climbing or hanging) or walking, a whole precursor set involving the interpretation of gestures by the self and by others may have been opened up for early hominines [102]

(300) Whether infants who have learned to walk, and have their upper limbs free, develop similar capabilities before the exercise of extensive speech acts is a question that remains. The acquisition of language may be enormously facilitated by the development of conscious imagery related to movements and motor control. Almost certainly, concepts of objects, events, and succession must exist in a child's mind before the exercise of language. According to these ideas, the sequences of actions of the free upper extremities may prepare the basal ganglion–cortical loops for the emergence of syntactical sequences, establishing what might be called a protosyntax.

Clearly, one of the largest steps towards the acquisition of true language is the realization that an arbitrary token—a gesture or a word—stands for a thing or an event. When a sufficiently large lexicon of such tokens is accumulated, higher-order consciousness can greatly expand in range. Association can be made by metaphor, and with ongoing activity, early metaphor can be transformed into more precise categorization of intrapersonal and interpersonal experience. The gift of narrative

and an expanded sense of temporal succession then follow. [102-3]

(301) A failure of analogy

a. *@#$&*% yourself!*

b. *Go @#$&*% yourself!*

c. *@#$&*% you!*

(302) **Go @#$&*% you!*

(303) Another failure of analogy

a. John is too tough to eat tofu

b. John is too tough to eat

c. John is too tough to talk to Bill

d. John is too tough to talk to

(304) The men$_m$ expected to see them$_{*m/n}$

(305) I wonder who$_i$ the men$_j$ expected to see them$_{*i/j/k}$

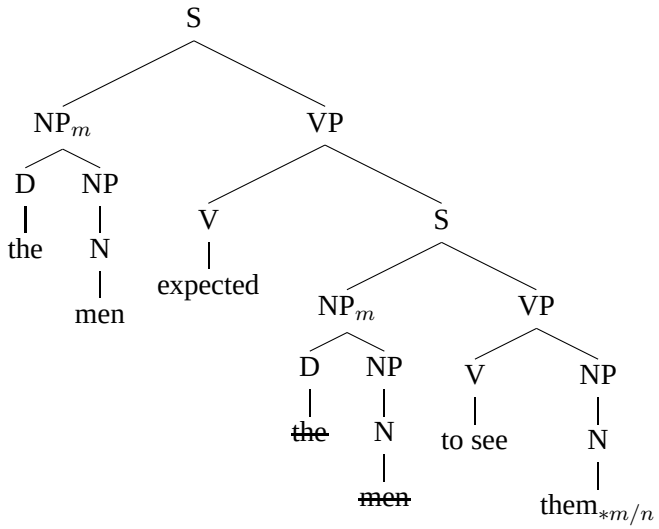
(306)

- The men are dressed up for Halloween; they expect to be seen by someone. I wonder who$_i$ the men$_j$ expected to see them$_j$.
- The women are dressed up for Halloween; the men expect that someone will see the women. I wonder who$_i$ the men$_j$ expected to see them$_k$.

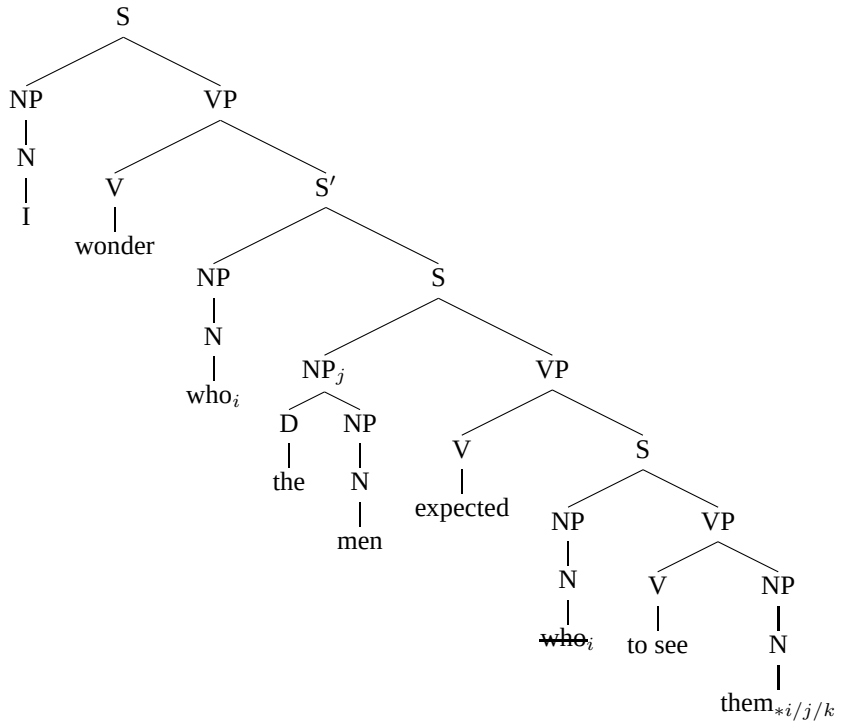
(307)

- *John expects to go*
- John expects John to go

(308) The tree for 304:



(309) The tree for 305:



(310) it is important to construct a brain theory that is principled and compatible with evolution and development. By principled, I mean a theory that describes the principles governing the major

> mechanisms by which the brain deals with information and novelty. [Edelman 2004:33]

13.1 Exercises

(311) We began this book claiming that we would relate Turkish vowel harmony to important philosophical questions. Have we succeeded? Can you trace a line of thought from vowel harmony to the mind-body problem, for example?

(312) Chomsky (2000b:12) says that

> it is a rare philosopher who would scoff at [the] weird and counterintuitive principles [of physics] as contrary to right thinking and therefore untenable. But this standpoint is commonly regarded as inapplicable to cognitive science, linguistics in particular . . . This seems to be nothing more than a kind of "methodological dualism," far more pernicious than the traditional metaphysical dualism, which was a scientific hypothesis, naturalistic in spirit. Abandoning this dualist stance, we pursue inquiry where it leads.

In a page or so, unpack this quotation, and explain the distinction between the two kinds of dualism that Chomsky is describing.

(313) At some point children are able to play a game in which they name an 'opposite' for words you provide to them, even for new pairs. For example, given *hot-cold* and *up-down*, a child will provide *dry* when prompted with *wet*, *small* when prompted with *big*, and so on. Sketch two theories for how children can come to be able to do this, a more empiricist theory and a more rationalist theory. What observations could lead children to develop the concept of 'opposite'? What challenges are faced by a rationalist, nativist approach?

14 Open questions and closing remarks

(314)

> . . . without a sufficient degree of isolability of systems we could never arrive at any lawlike regularities for describing the world at all. For unless systems were sufficiently independent of one another in their behavior, the understanding of the evolution of even the smallest part of the universe would mean keeping

track of the behavior of all of its constituents. It is hard to see how the means for prediction and explanation could ever be found in such a world… it can be argued that unless such idealization of isolability were sufficiently legitimate in a sufficiently dominant domain of cases, we could not have any science at all. [Lawrence Sklar 2000:54-55]

(315) Plainly, a naturalistic approach does not exclude other ways of trying to comprehend the world. Someone committed to it can consistently believe (I do) that we learn much more of human interest about how people think and feel and act by reading novels or studying history or the activities of ordinary life than from all of naturalistic psychology, and perhaps always will; similarly, the arts may offer appreciation of the heavens to which astrophysics does not aspire. [Chomsky 2000:77]

(316) What influences acceptability?

a. John told Bill to kiss himself.
b. John told Bill to kiss him.
c. Bill kissed himself.
d. Bill outlived himself.
e. The pilot called the flight attendant into the cabin because she needed his help.

(317) Since language is not, in its essence, a means for transmitting [cognitive] information—though no one denies that we constantly use language for this very purpose—then it is hardly surprising to find in languages much ambiguity and redundancy, as well as other properties that are obviously undesirable in a good communication code. [Morris Halle 1975]

(318) Where properties of language can be explained on such 'functional' grounds, they provide no revealing insight into the nature of mind. Precisely because the explanations proposed here are 'formal explanations,' precisely because the proposed principles are not essential or even natural properties of any imaginable language, they provide a revealing mirror of the mind (if correct). [Chomsky 1971:44]

(319) Questions about language

a. What constitutes knowledge of language?
b. How is knowledge of language acquired?
c. How is knowledge of language put to use?
d. What are the physical mechanisms that serve as the material basis for this system of knowledge and for the use of this knowledge.

(320) Big philosophical issues we addressed

- The Nature–Nurture debate: How much of what we are is innate and how much depends on our experience?
- What is knowledge? How is it acquired?
- What is reality?
- Is there a distinction between mind and body?
- How can our study of these issues bear on social questions and educational practice?