Ling 51/Psych 56L:
Acquisition of Language

Lecture 12

Development of morphology & syntax I

Announcements

- HW4 due today by 3:20pm
- Review questions for morphology and syntax available
- HW5 available (begin working on it): due 11/22/16

Adult knowledge: The target state for morphology

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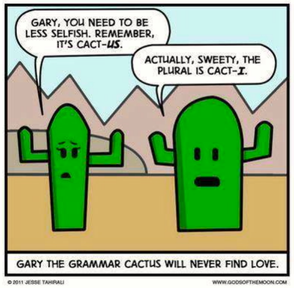
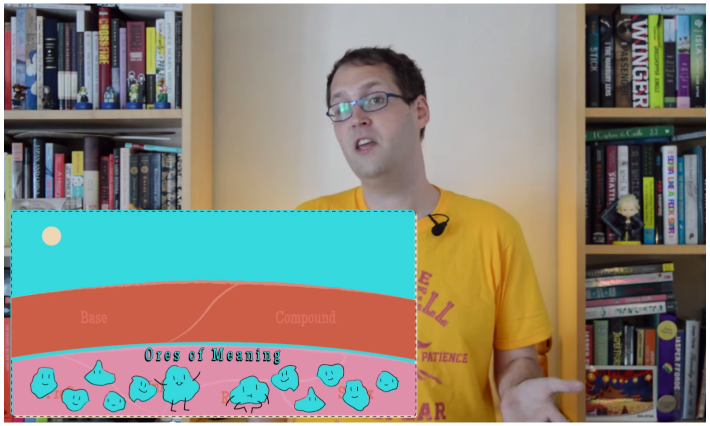


http://arnoldzwicky.org/category/morphology/inflection/

Words and word parts

https://www.youtube.com/watch?v=nduDAN9sKx4
http://www.thelingspace.com/episode-7
0:38 - 3:10: smallest units of meaning



Words and word parts

The smallest unit manipulated by the rules of syntax is *not* a single word. Instead there are units smaller than words that play a role, called morphemes.

One goblin.
Two goblins. goblins = goblin + s =  + plural

Morpheme = smallest unit of meaning

Words and word parts

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3:10 - 4:20: bound vs. free morphemes

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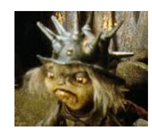
Two goblins. goblins = goblin + s =  + plural

Bound morpheme = morpheme that can't stand on its own - it must be attached to something

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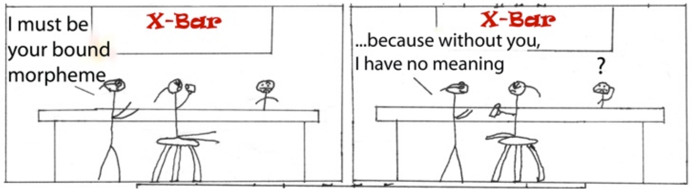

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Free morpheme = morpheme that can stand on its own - it does not need to be attached to another morpheme

Morphology types

https://www.youtube.com/watch?v=BTZCozhneKA

http://www.thelingspace.com/episode-72

1:56 - 3:20: derivational morphology + structure

Types of morphology

Derivational morphology: forms a new word, potentially changing the word's category (nouns become adjectives, verbs become nouns, etc.)

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goblin

goblinish   goblinish = goblin + ish =  + similar to

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goblin

goblinish   goblinish = goblin + ish =  + similar to

scowl

scowler   scowler = scowl + er =  + one who does that action

Morphology types

https://www.youtube.com/watch?v=BTZCozhneKA
http://www.thelingspace.com/episode-72
5:21-7:00: inflectional morphology

Types of morphology

Inflectional morphology: adds grammatical information, but does not change the word's category (nouns stay nouns, verbs stay verbs, etc.)

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He scowls. scowls = scowl + s =  + present tense

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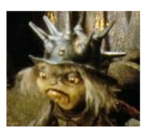
Two goblins. goblins = goblin + s =  + plural

He scowls. scowls = scowl + s =  + present tense

He's scowling. scowling = scowl + ing = + continuing action

Cross-linguistic comparison

English does not have a rich morphological system, compared to other languages. Instead, English mostly relies on word order to indicate who did what to whom.

Languages like Hungarian, however, rely more on morphology.

"The boy gave a book to the girl."

A	fiú	könyvet	adott	a	lánynak.
The	boy	a book+ACC	gave	the	girl+DAT

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Inflectional morphology:

ACC = accusative case = direct object (thing given)

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Inflectional morphology:

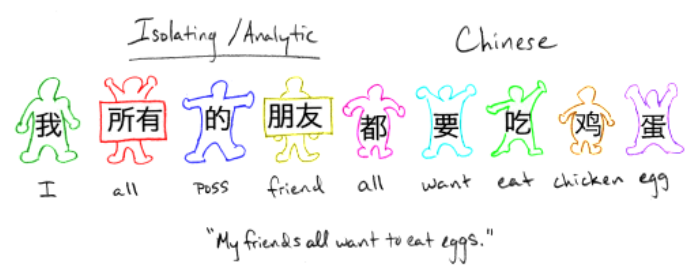
DAT = dative case = indirect object (recipient of giving)

Words and word parts

https://www.youtube.com/watch?v=nduDAN9sKx4
http://www.thelingspace.com/episode-7
5:08 - 5:36: cross-linguistic variation

Cross-linguistic comparison

http://specgram.com/CLII.3/09.phlogiston.cartoon.3.html

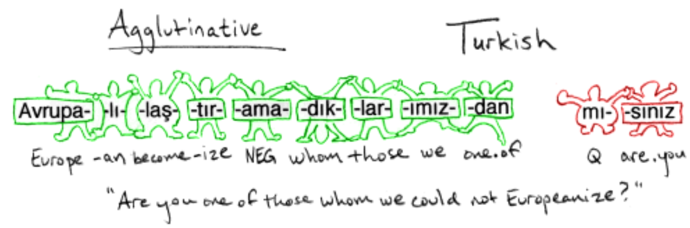


Isolating languages

https://www.youtube.com/watch?v=Ts2DS0ZsTyo&feature=youtu.be
1:30-2:24: isolating languages

Cross-linguistic comparison

http://specgram.com/CLII.3/09.phlogiston.cartoon.3.html

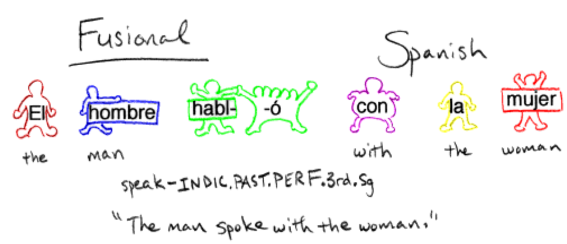


Agglutinative languages

https://www.youtube.com/watch?v=Ts2DS0ZsTyo&feature=youtu.be
2:24-3:34: agglutinative languages

Cross-linguistic comparison

http://specgram.com/CLII.3/09.phlogiston.cartoon.3.html



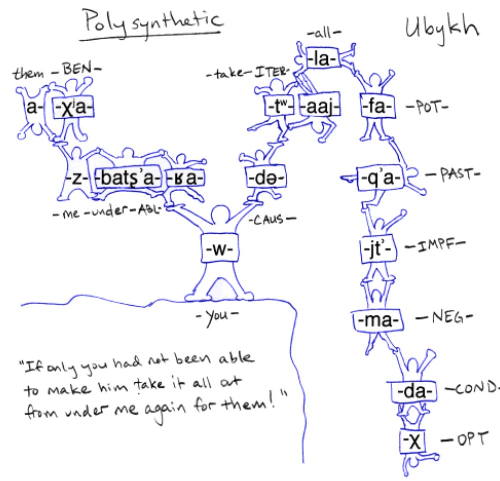
Fusional languages

https://www.youtube.com/watch?v=Ts2DS0ZsTyo&feature=youtu.be

3:34-4:34: fusional languages

Cross-linguistic comparison

http://specgram.com/CLII.3/09.phlogiston.cartoon.3.html



Polysynthetic languages

https://www.youtube.com/watch?v=Ts2DS0ZsTyo&feature=youtu.be

6:45-7:49: polysynthetic languages

Morphology recap

Morphology refers to how words are put together to convey meaning.

The smallest units of meaning are morphemes, which can be smaller than a whole word.

Some morphology can change the category of a word (derivational), while other morphology does not (inflectional).

Languages vary on how rich their system of morphology is. Children must learn how their language puts words together, and what types of meaning can be conveyed via morphology.

Adult knowledge:
The target state for syntax

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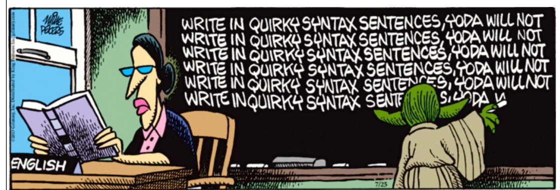

http://arnoldzwicky.org/category/syntax/word-order/

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Adult knowledge:
The target state for syntax

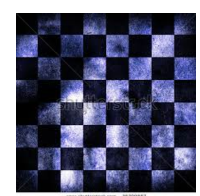
http://mimiandeunice.com/2011/09/23/sentenced-to-death/

Creativity of human language

Ability to combine signs with simple meanings to create
(1) Utterances with complex meanings
(2) Novel expressions
(3) *Infinitely* many

Sentences never heard before...

"Some tulips are starting to samba across the chessboard."



Creativity of human language

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(2) Novel expressions
(3) *Infinitely* many

Sentences of prodigious length…

"Sir Didymus said that he thought that the odiferous leader of the goblins had it in mind to tell the unfortunate princess that the cries that she made during her kidnapping from the nearby kingdom that the goblins themselves thought was a general waste of countryside ..."

Creativity of human language

Ability to combine signs with simple meanings to create
(1) Utterances with complex meanings
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(3) *Infinitely* many

https://www.ted.com/talks/ajit_narayanan_a_word_game_to_communicate_in_any_language

"So there is another hidden abstraction here which children with autism find a lot of difficulty coping with, and that's the fact that **you can modify words and you can arrange them to have different meanings, to convey different ideas**. Now, this is what we call grammar. And grammar is incredibly powerful, because grammar is this one component of language which **takes this finite vocabulary that all of us have and allows us to convey an infinite amount of information, an infinite amount of ideas**. It's the way in which you can put things together in order to convey anything you want to."

An account that won't work

"You just string words together in an order that makes sense"

In other words...

*"**Syntax** is determined by **Meaning**"*

(The way words are put together is determined solely by what they mean)

Syntax is more than meaning

Nonsense sentences with clear syntax

Colorless green ideas sleep furiously. (Chomsky)
A verb crumpled the ocean.
I gave the question a goblin-shimmying egg.

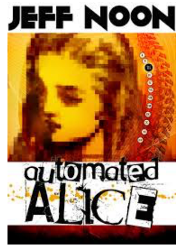
…which are incomprehensible when the syntax is nonsense

*Furiously sleep ideas green colorless.
*Ocean the crumpled verb a.
*The question I an egg goblin-shimmying gave.

Syntax is more than meaning

More nonsense sentences with clear syntax

From “Automated Alice” by Jeff Noon:



Oh spoons may dangle from a cow
With laughter ten feet tall;
But all I want to know is how
It makes no sense at all.
Oh shirts may sing
to books who pout
In rather rigid lines;
But all I want to turn about
Is how the world unwinds.

Syntax is more than meaning

Famous nonsense sentences with clear syntax

‘Twas brillig and the slithy toves
Did gyre and gimble in the wabe;
All mimsy were the borogroves,
And the mome raths outgrabe

Beware the Jabberwock, my son!
The jaws that bite, the claws that catch!
Beware the Jubjub bird, and shun
The frumious Bandersnatch!”

- Lewis Carroll, *Jabberwocky*

Syntax is more than meaning

'It seems very pretty,' she said when she had finished it, 'but it's RATHER hard to understand!' (You see she didn't like to confess, even to herself, that she couldn't make it out at all.) 'Somehow it seems to fill my head with ideas -- only I don't exactly know what they are! However, SOMEBODY killed SOMETHING: that's clear, at any rate -- '

Syntax is more than meaning

And these same nonsense sentences with nonsense syntax are incomprehensible…

‘Toves slithy the and brillig ‘twas
wabe the in gimble and gyre did…

Syntax is more than meaning

Ungrammatical sentences that make perfect sense

Jareth put the cape on.
Jareth put on the cape.

Jareth put it on.
*Jareth put on it.

Syntax is more than meaning

Ungrammatical sentences that make perfect sense

Sarah gave a ring to the Wiseman.
Sarah gave him a ring.

Sarah donated a ring to the Wiseman.
*Sarah donated him a ring.

Syntax is more than meaning

Ungrammatical sentences that make perfect sense

Jareth made Hoggle leave.
Jareth let Hoggle leave.
Jareth saw Hoggle leave.
*Jareth wanted Hoggle leave.

*Jareth made Hoggle to leave.
*Jareth let Hoggle to leave.
*Jareth saw Hoggle to leave.
Jareth wanted Hoggle to leave.

Syntax is more than meaning

Ungrammatical sentences that make perfect sense

Hoggle poked at the wall.
Hoggle hit at the wall.
*Hoggle touched at the wall.

*Hoggle poked the stick against the wall.
Hoggle hit the stick against the wall.
*Hoggle touched the stick against the wall.

Syntax is more than meaning

Cross-linguistic variation

If syntax was entirely determined by meaning, then we should not expect to find syntactic differences between languages of the world….but we do see variation.

English:	Sarah	sees	that book.
Korean:	Sarah	ku chayk	poata.
	Sarah	that book	see

Syntax is more than meaning

Cross-linguistic variation

If syntax was entirely determined by meaning, then we should not expect to find syntactic differences between languages of the world….but we do see variation.

English:
Baso put the money in the cupboard.

Selayarese (spoken in Indonesia):

Lataroi	doe	injo	ri lamari	injo	i Baso.
put	money	the	in cupboard	the	Baso

So…what does determine how you string words together?

Answer: Syntax!

(That is, our knowledge of the possible *forms* of sentences in our language.)

~~“***Syntax*** is determined by ***Meaning***”~~
~~(The way words are put together is determined solely by what they mean)~~

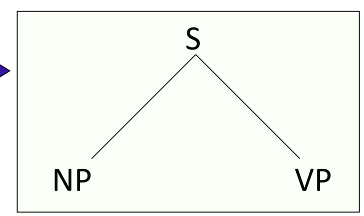
A template

A sentence often consists of a Noun Phrase followed by a Verb Phrase

S --> NP VP

Phrase Structure Rule

Phrase Structure Tree



A template

Noun Phrase

Hoggle
The chicken
Seven goblins
Sarah
A feeling
The strangest story that you ever did hear

Verb Phrase

slept
tricked the guards
left
said that Ludo thought that pixies were nasty
kicked the bucket
got drunk on dwarf wine

A template

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6 Sentences

A template

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Verb Phrase

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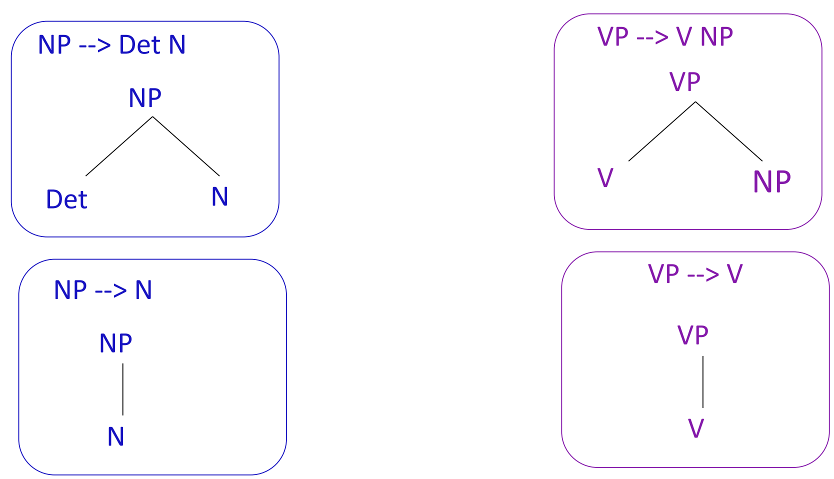
36 Sentences

A template

Noun Phrase

Verb Phrase



A tiny little grammar

5 Rules

S --> NP VP

NP --> Det N

NP --> N

VP --> V NP

VP --> V

9 Words

Det: *the, four, some*

N: *goblins, crystals, peaches*

V: *understood, ate, approached*

468 Sentences

A tiny little grammar

5 Rules

S --> NP VP

NP --> Det N

NP --> N

VP --> V NP

VP --> V

30 Words

10 Determiners

10 Nouns

10 Verbs

122,100 Sentences

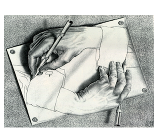
Embedded sentences

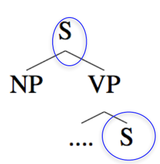
Additional VP Rule

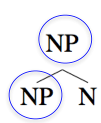
Hoggle thought Sarah ate the peach.
VP → V S

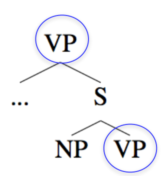
Can be used to create a sentence-inside-a-sentence = example of ***recursion***

Recursion = a phrase of one kind inside a phrase of the same kind (a sentence is a kind of phrase, so a sentence-inside-a-sentence fits this definition)









Recursion

Additional VP Rule

Hoggle thought Sarah ate the peach.
VP → V S

Infinitely many sentences can be generated!

Ludo said Hoggle thought Sarah ate the peach.

The fairy claimed Ludo said Hoggle thought Sarah ate the peach.

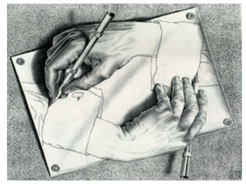
The Wiseman's birdhat hoped the fairy claimed Ludo said Hoggle thought Sarah ate the peach.

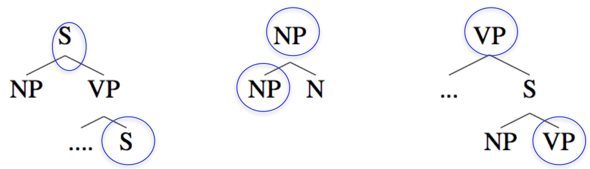
Recursion

We can also see this property in English noun phrases

NP → NP's Noun

Sarah's friend is a dwarf.
Sarah's friend's uncle is a dwarf.
Sarah's friend's uncle's neighbor is a dwarf.





Recursion

http://xkcd.com/1557/

Recursion

http://phdcomics.com/comics/archive.php?comicid=1758

"What if I know what I don't know, but **I don't know how to know what I need to know to know what I don't know**?"

Recursion

http://hyperboleandahalf.blogspot.com/2010/02/please-stop.html

Me: "It's a free country! I can sit on your bed if I want!"

My sister: "PLEASE STOP!"

Me: "PLEASE STOP SAYING PLEASE STOP!"

My sister: "PLEASE STOP TELLING ME TO PLEASE STOP SAYING PLEASE STOP!"

Me: "PLEASE STOP TELLING ME TO PLEASE STOP TELLING YOU TO PLEASE STOP SAYING PLEASE STOP!"

We had discovered a glitch in the system -- Please Stop was flawed. It could be used against itself *infinitely*, thereby becoming useless. We were in a goddamn Mexican standoff.

Complementizer

Complementizer (Comp): words like THAT, IF, and WHETHER that allow one sentence to be the subject or object of another sentence

Hoggle realized that Sarah ate the peach.
Whether Sarah ate the peach didn't matter.

S' → Comp S
VP → V S'
S → S' VP

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Example of Recursion 1:
S expands to include S'
S' expands to include S

S → S' VP → Comp S VP

Complementizer

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S' → Comp S
VP → V S'
S → S' VP

Example of Recursion 2:
S expands to include VP
VP expands to include S'
S' expands to include S

S → S' VP → S' V S' → S' V Comp S

A slightly bigger grammar

9 Rules

S --> NP VP
S --> S' VP

NP --> Det N
NP --> N

VP --> V NP
VP --> V
VP --> V S
VP --> V S'

S' --> Comp S

Sentences it can generate:

Hoggle likes jewels.

A slightly bigger grammar

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NP --> N   VP --> V NP

A slightly bigger grammar

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VP --> V S
VP --> V S'

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Sentences it can generate:

Hoggle likes jewels.

S --> NP VP

NP --> N   VP --> V NP

N   V NP

NP --> N

N

A slightly bigger grammar

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S --> NP VP
S --> S' VP

NP --> Det N
NP --> N

VP --> V NP
VP --> V
VP --> V S
VP --> V S'

S' --> Comp S

Sentences it can generate:

Hoggle likes jewels.

S --> NP VP

NP --> N   VP --> V NP

N   V NP

Hoggle   likes NP --> N

N

jewels

A slightly bigger grammar

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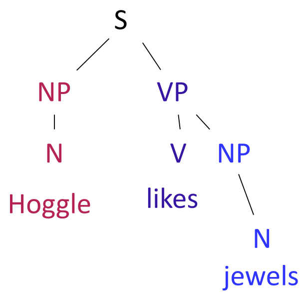

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NP --> Det N
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S' --> Comp S

Sentences it can generate:

Sarah thought that she solved the Labyrinth.

A slightly bigger grammar

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S --> NP VP
S --> S' VP

NP --> Det N
NP --> N

VP --> V NP
VP --> V
VP --> V S
VP --> V S'

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Sentences it can generate:

Sarah thought that she solved the Labyrinth.

S --> NP VP

A slightly bigger grammar

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NP --> Det N
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VP --> V S'

S' --> Comp S

Sentences it can generate:

Sarah thought that she solved the Labyrinth.

S --> NP VP

NP --> N   VP --> V S'

A slightly bigger grammar

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S --> NP VP
S --> S' VP

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VP --> V NP
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VP --> V S'

S' --> Comp S

Sentences it can generate:

Sarah thought that she solved the Labyrinth.

S --> NP VP

NP --> N VP --> V S'

N V S'

Sarah thought S' --> Comp S

A slightly bigger grammar

9 Rules

S --> NP VP
S --> S' VP

NP --> Det N
NP --> N

VP --> V NP
VP --> V
VP --> V S
VP --> V S'

S' --> Comp S

Sentences it can generate:

Sarah thought that she solved the Labyrinth.

S --> NP VP

NP --> N VP --> V S'

N V S'

Sarah thought Comp S

A slightly bigger grammar

9 Rules

S --> NP VP
S --> S' VP

NP --> Det N
NP --> N

VP --> V NP
VP --> V
VP --> V S
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that

A slightly bigger grammar

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A slightly bigger grammar

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Sarah thought that S --> NP VP

A slightly bigger grammar

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NP --> N VP --> V NP

A slightly bigger grammar

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NP --> N VP --> V S'

N V S'

Sarah thought that NP VP

NP --> N VP --> V NP

N V NP

she solved

A slightly bigger grammar

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S --> NP VP
S --> S' VP

NP --> Det N
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VP --> V NP
VP --> V
VP --> V S
VP --> V S'

S' --> Comp S

Sentences it can generate:

Sarah thought that she solved the Labyrinth.

S --> NP VP

NP --> N   VP --> V S'

N   V S'

Sarah   thought that NP VP

NP --> N   VP --> V NP

N   V NP

she   solved

NP --> Det N

A slightly bigger grammar

9 Rules

S --> NP VP
S --> S' VP

NP --> Det N
NP --> N

VP --> V NP
VP --> V
VP --> V S
VP --> V S'

S' --> Comp S

Sentences it can generate:

Sarah thought that she solved the Labyrinth.

S --> NP VP

NP --> N   VP --> V S'

N   V S'

Sarah   thought that NP VP

NP --> N   VP --> V NP

N   V NP

she   solved

Det N

the Labyrinth

A slightly bigger grammar

9 Rules

S --> NP VP
S --> S' VP

NP --> Det N
NP --> N

VP --> V NP
VP --> V
VP --> V S
VP --> V S'

S' --> Comp S

Sentences it can generate:

Sarah thought that she solved the Labyrinth.

S

NP   VP

N   V   S'

Sarah   thought   Comp that

S

NP   VP

N   V   NP

she   solved   Det N

the Labyrinth

Figuring out structure: bottom-up

9 Rules

S --> NP VP
S --> S' VP

NP --> Det N
NP --> N

VP --> V NP
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VP --> V S
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S' --> Comp S

Sarah thought that Hoggle was a cheat.

Figuring out structure: bottom-up

9 Rules

S --> NP VP
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NP --> Det N
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VP --> V S
VP --> V S’

S’ --> Comp S

N V Comp N V Det N
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Figuring out structure: bottom-up

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S --> NP VP
S --> S’ VP

NP --> Det N
NP --> N

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VP --> V
VP --> V S
VP --> V S’

S’ --> Comp S

NP

N V Comp N V Det N
Sarah thought that Hoggle was a cheat.

Figuring out structure: bottom-up

9 Rules

S --> NP VP
S --> S’ VP

NP --> Det N
NP --> N

VP --> V NP
VP --> V
VP --> V S
VP --> V S’

S’ --> Comp S

VP
NP

N V Comp N V Det N
Sarah thought that Hoggle was a cheat.

Figuring out structure: bottom-up

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S --> NP VP
S --> S’ VP

NP --> Det N
NP --> N

VP --> V NP
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VP --> V S
VP --> V S’

S’ --> Comp S

VP
NP NP

N V Comp N V Det N
Sarah thought that Hoggle was a cheat.

Figuring out structure: bottom-up

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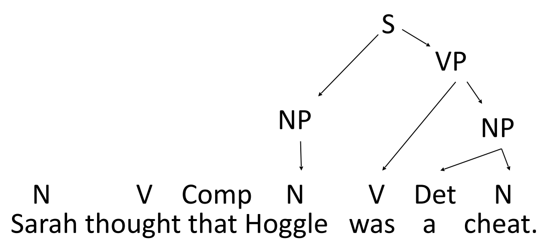

Figuring out structure: bottom-up

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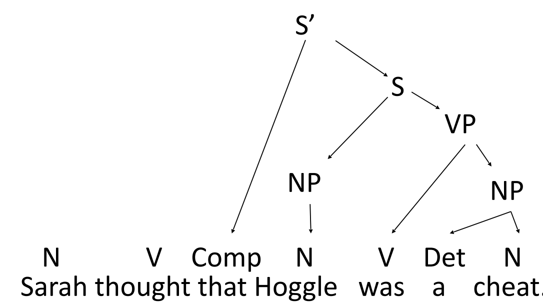

Figuring out structure: bottom-up

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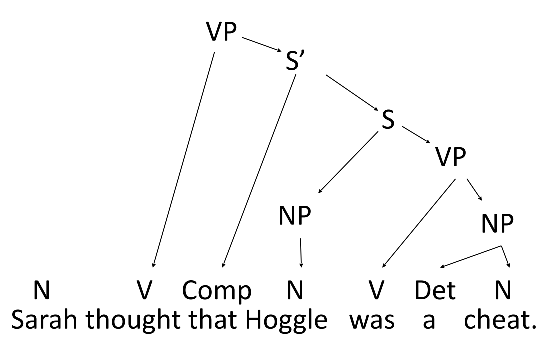

Figuring out structure: bottom-up

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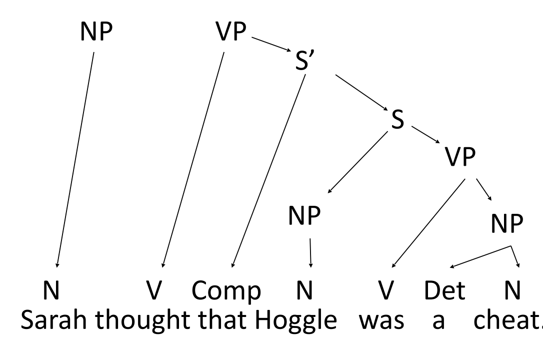

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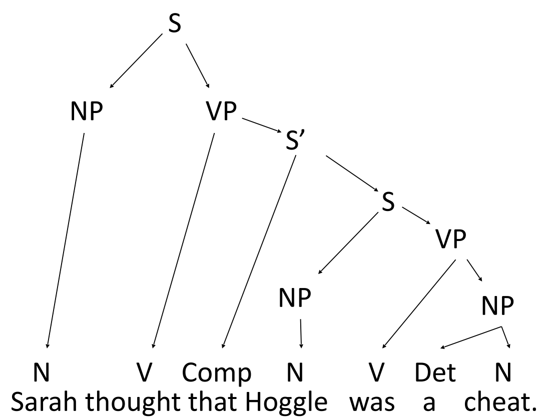

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S --> NP VP
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VP --> V NP
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S' --> Comp S

That Hoggle lied surprised Sarah.

Figuring out structure: bottom-up

9 Rules

S --> NP VP
S --> S' VP

NP --> Det N
NP --> N

VP --> V NP
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VP --> V S'

S' --> Comp S

Comp	N	V	V	N
That	Hoggle	lied	surprised	Sarah.

Figuring out structure: bottom-up

9 Rules

S --> NP VP
S --> S' VP

NP --> Det N
NP --> N

VP --> V NP
VP --> V
VP --> V S
VP --> V S'

S' --> Comp S

				NP
Comp	N	V	V	N
That	Hoggle	lied	surprised	Sarah.

Figuring out structure: bottom-up

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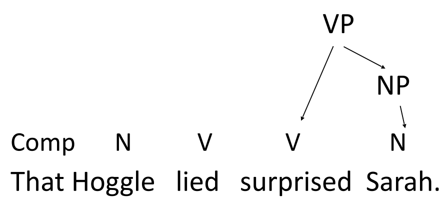

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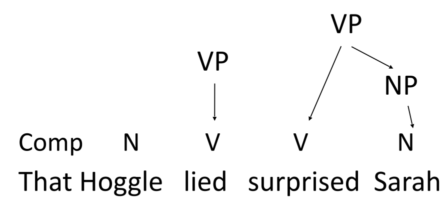

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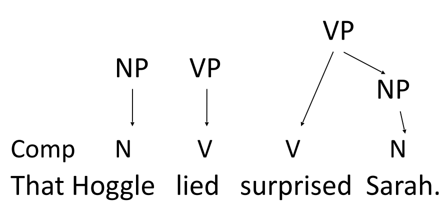

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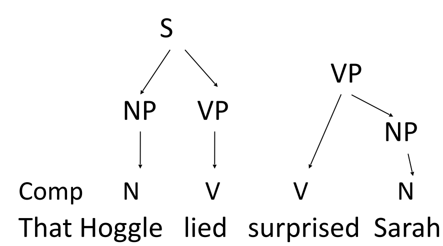

Figuring out structure: bottom-up

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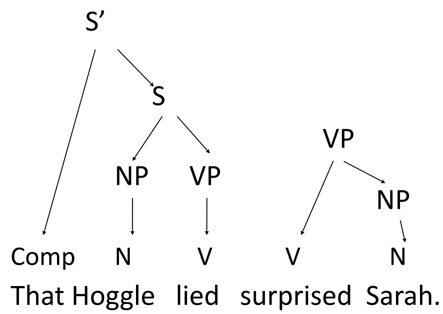

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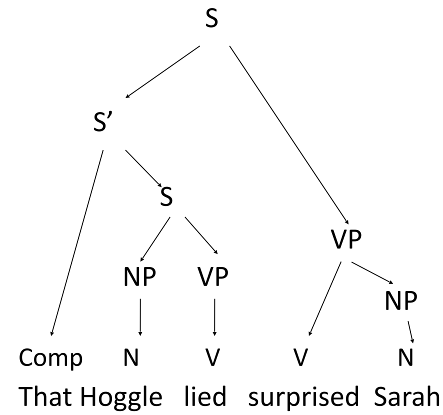

Syntax recap

The structure of language (syntax) involves more than simply the meaning of the words. It involves rules about how the words themselves are allowed to go together.

It isn't enough to know the list of possible sentences in the language. Because adults can generate novel sentences and sentences of infinite length, adults need to know a rule system that can generate sentences.

Adults know (unconsciously) a system of rules for generating the word orders they use. A fairly small set of rules can generate a fairly large set of sentences.

Questions?

You should be able to answer up through question 4 on the review questions, and up through question 10 on HW5.