

Psych 56L/ Ling 51:  
Acquisition of Language

Lecture 12  
Development of morphology & syntax I

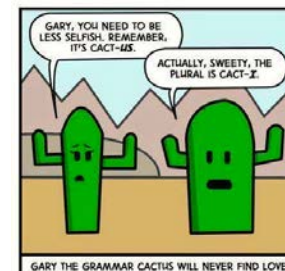
Announcements

- HW2 due today by 3:20pm
- Review questions for morphology and syntax available
- HW3 available (begin working on it): due 12/1/15

Adult knowledge:  
The target state for morphology



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The target state for morphology



<http://arnoldzwick.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



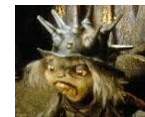
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**Bound morpheme** = morpheme that can't stand on its own - it must be attached to something

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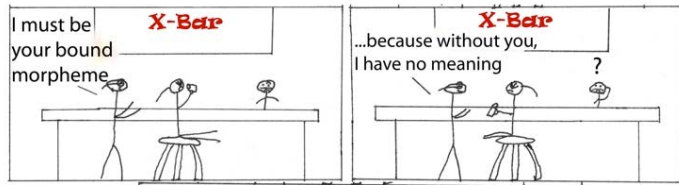
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**Free morpheme** = morpheme that can stand on its own - it does not need to be attached to another morpheme

## 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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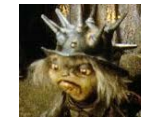
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He scowls.

scowls = scowl + s =



+ present tense

He's scowling. scowling = scowl + ing =

+ continuing action

## Types of morphology

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

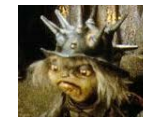
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goblin

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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

## 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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The boy a book+ACC gave the girl+DAT

Inflectional morphology:

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

## Words and word parts

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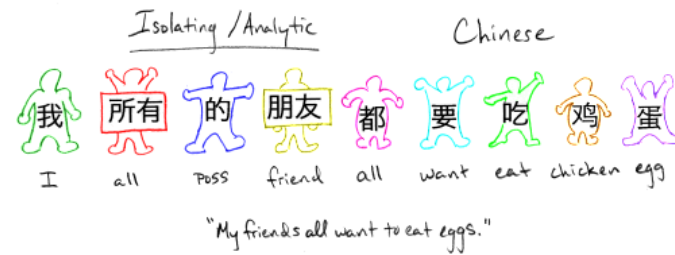
<http://www.thelingspace.com/episode-7>

5:08 - 5:36: cross-linguistic variation



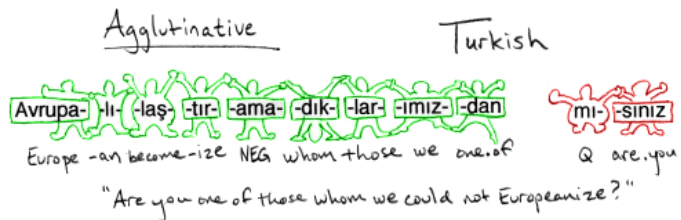
## Cross-linguistic comparison

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



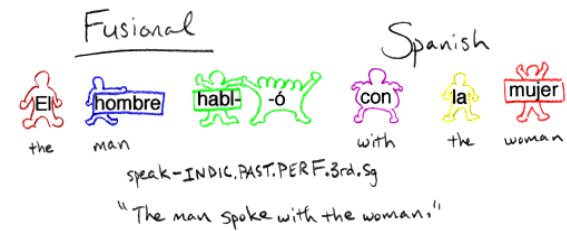
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## Adult knowledge: The target state for syntax



<http://mimiandeu.com/2011/09/23/sentenced-to-death/>

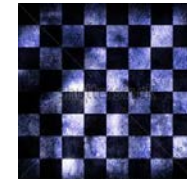
## Creativity of human language

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

Ability to combine signs with simple meanings to create

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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 ..."*

## 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)



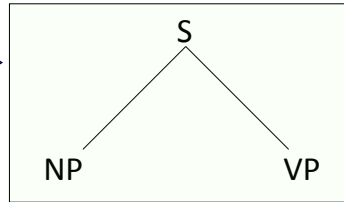
## A template

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**

**Verb Phrase**

Hoggle

slept

The chicken

tricked the guards

Seven goblins

left

Sarah

said that Ludo thought that

A feeling

pixies were nasty

The strangest story that

kicked the bucket

you ever did hear

got drunk on dwarf wine

## A template

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**6 Sentences**

## A template

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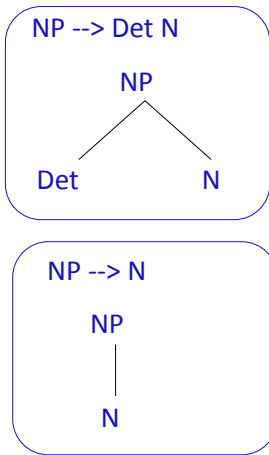
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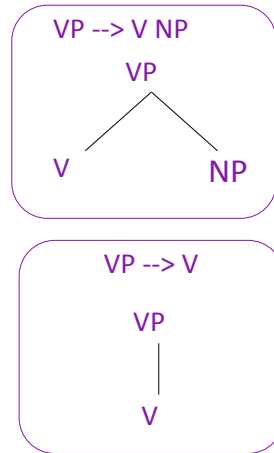
**36 Sentences**

## 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
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- VP --> V NP
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### 30 Words

- 10 Determiners
- 10 Nouns
- 10 Verbs

122,100 Sentences

## Embedded sentences

### Additional VP Rule

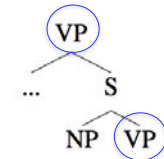
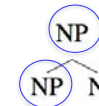
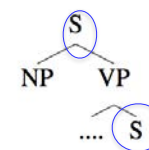
Hoggle thought Sarah ate the peach.

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!

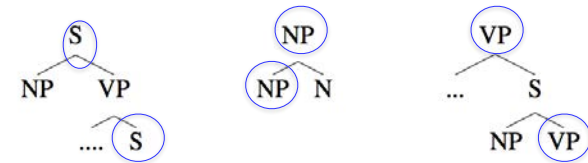
Ludo said Hoggle thought Sarah ate the peach.  
The fairy claimed Ludo said Hoggle thought Sarah ate the peach.  
The Wiseman's birdhat hoped the fairy claimed Ludo said Hoggle thought Sarah ate the peach.

## 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://phdcomics.com/comics/archive.php?comid=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.

$S' \rightarrow \text{Comp } S$   
 $VP \rightarrow V S'$   
 $S \rightarrow S' VP$

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Example of Recursion 1:

S expands to include S'

S' expands to include S

$S \rightarrow S' VP \rightarrow \text{Comp } S VP$

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Example of Recursion 2:

S expands to include VP

VP expands to include S'

S' expands to include S

$S \rightarrow S' VP \rightarrow S' V S' \rightarrow S' V \text{Comp } S$

## A slightly bigger grammar

9 Rules

Sentences it can generate:

$S \rightarrow NP VP$

$S \rightarrow S' VP$

Hoggle likes jewels.

$NP \rightarrow \text{Det } N$

$NP \rightarrow N$

$VP \rightarrow V NP$

$VP \rightarrow V$

$VP \rightarrow V S$

$VP \rightarrow V S'$

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

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$S \rightarrow NP VP$

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$V NP$

Hoggle

likes  $NP \rightarrow N$

$N$

jewels



## A slightly bigger grammar

9 Rules

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

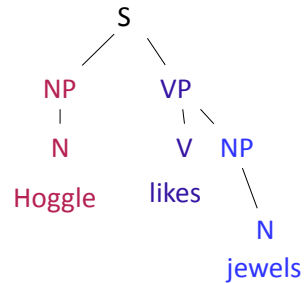
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Sentences it can generate:

Sarah thought that she solved the Labyrinth.

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NP --> N      VP --> V S'

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NP --> N

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

S' --> Comp S

Sentences it can generate:

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NP --> N      VP --> V S'  
N              V S'  
Sarah      thought S' --> Comp S

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Sarah thought that she solved the  
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$NP \rightarrow N$      $VP \rightarrow V S'$

$N$      $V S'$

Sarah thought that  $S \rightarrow NP VP$

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$NP \rightarrow N$      $VP \rightarrow V S'$

$N$      $V S'$

Sarah thought that  $NP VP$

$NP \rightarrow N$      $VP \rightarrow V NP$

$N$      $V NP$

she solved

## 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  
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N V NP  
she solved  
NP --> Det N

## A slightly bigger grammar

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NP --> N VP --> V NP  
N V NP  
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Det N  
the Labyrinth

## A slightly bigger grammar

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S --> NP VP  
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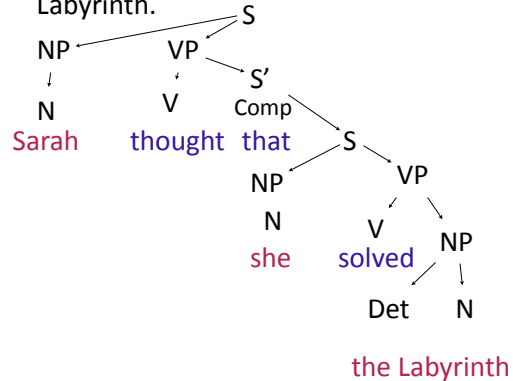
NP --> Det N  
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## Figuring out structure: bottom-up

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Sarah thought that Hoggle was a cheat.

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$S \rightarrow S' VP$

$NP \rightarrow Det N$

$NP \rightarrow N$

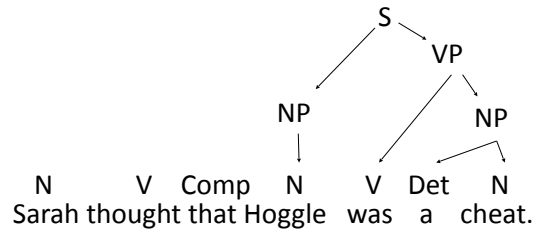
$VP \rightarrow V NP$

$VP \rightarrow V$

$VP \rightarrow V S$

$VP \rightarrow V S'$

$S' \rightarrow Comp S$



## Figuring out structure: bottom-up

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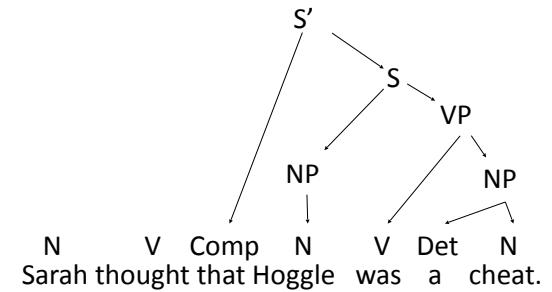
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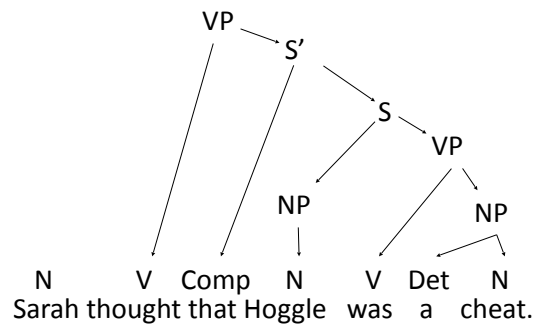
$VP \rightarrow V NP$

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$VP \rightarrow V S$

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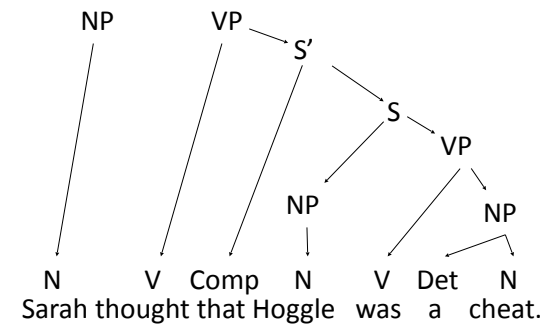
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$S \rightarrow NP VP$

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$NP \rightarrow Det N$

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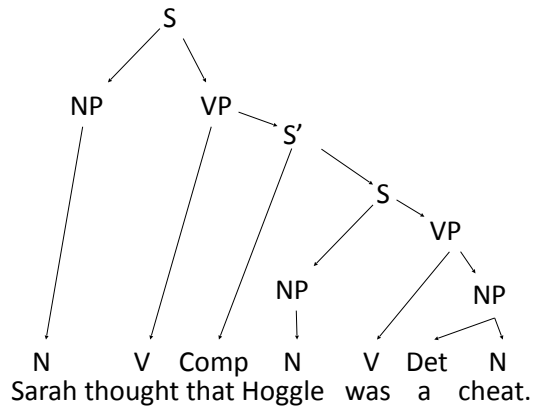
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That Hoggle lied surprised Sarah.

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$VP \rightarrow V$

$VP \rightarrow V S$

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Comp N V V N  
That Hoggle lied surprised Sarah.

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$VP \rightarrow V NP$

$VP \rightarrow V$

$VP \rightarrow V S$

$VP \rightarrow V S'$

$S' \rightarrow Comp S$

Comp N V V NP  
That Hoggle lied surprised Sarah.

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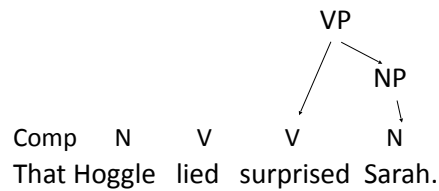
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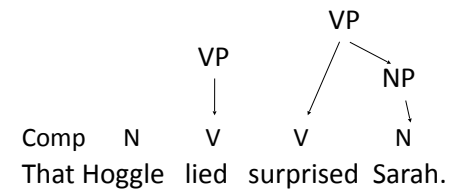
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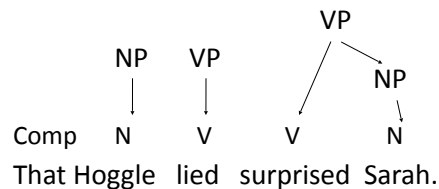
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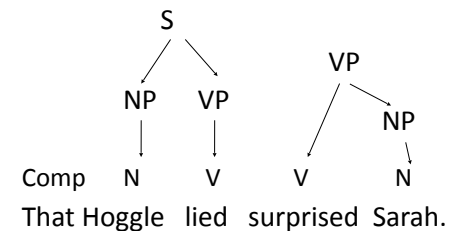
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VP --> V S'

S' --> Comp S





## Figuring out structure: bottom-up

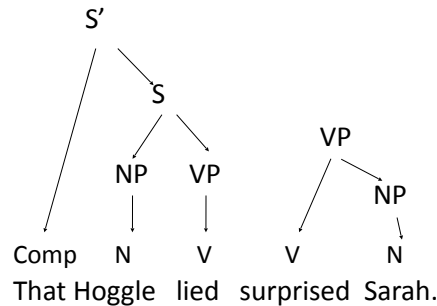
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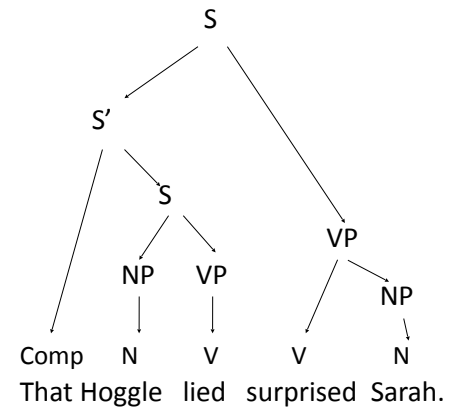
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## Syntax recap

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 3 on HW3.