

Psych 56L/ Ling 51:  
Acquisition of Language

Lecture 12  
Development of Morphology & Syntax I

Announcements

- HW2 due today by 1:50pm
- Review questions for morphology and syntax available
- HW3 available (begin working on it): due 3/12/13

Adult knowledge:  
The target state for morphology



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.

$\text{goblins} = \text{goblin} + \text{s} =$




+ plural

Morpheme = smallest unit of meaning

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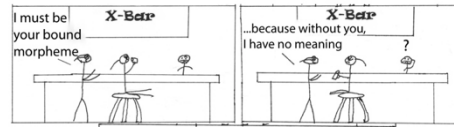
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Bound morpheme = morpheme that can't stand on its own - it must be attached to something

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Two goblins.      goblins = goblin + s =  + plural


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'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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goblin  
goblinish      goblinish = goblin + ish =  + similar to

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

### Crosslinguistic 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)

### 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



### 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 on the chessboard.”



Sentences of prodigious length...


“Hoggle 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

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

Cross-language 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

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 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

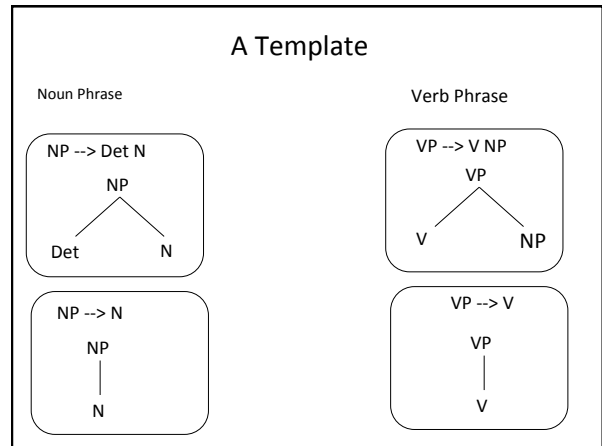
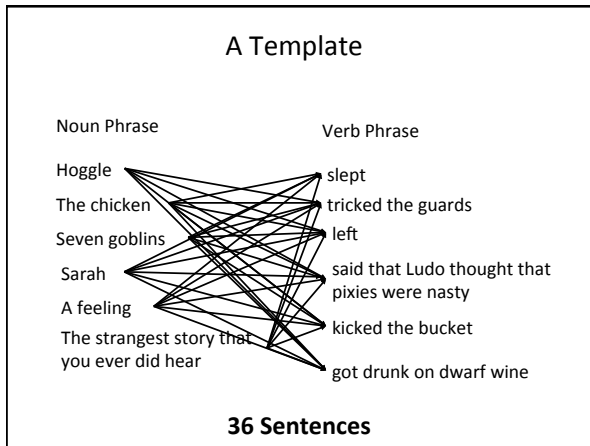
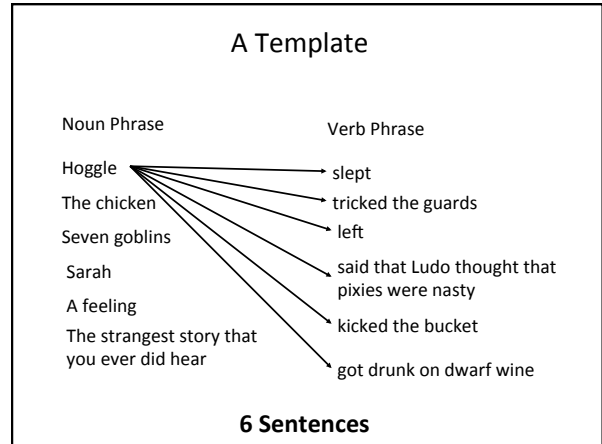
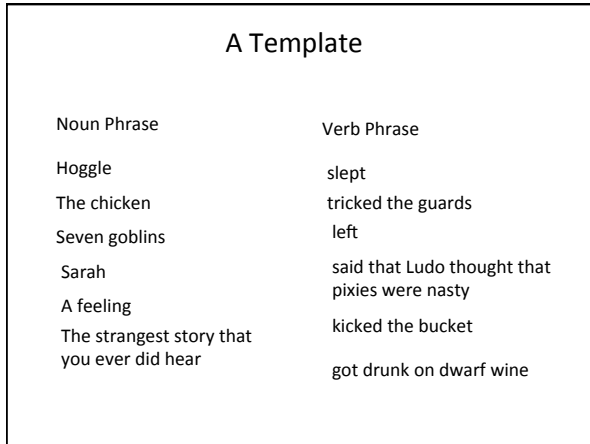
S --> NP VP      ← Phrase Structure Rule

Phrase Structure Tree →

```

    graph TD
      S --- NP
      S --- VP
    
```





### A Tiny Little Grammar

5 Rules	9 Words
S --> NP VP	Det: <i>the, four, some</i>
NP --> Det N	N: <i>goblins, crystals, peaches</i>
NP --> N	V: <i>understood, ate, approached</i>
VP --> V NP	
VP --> V	

**468 Sentences**

### A Tiny Little Grammar

5 Rules	30 Words
S --> NP VP	Det: <i>the, four, some + 7 more</i>
NP --> Det N	N: <i>goblins, crystals, peaches + 7 more</i>
NP --> N	V: <i>understood, ate, approached + 7 more</i>
VP --> V NP	
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**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)



Combine with S --> NP VP, to get recursion:

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

### Embedded Sentences

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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.



### Embedded Sentences

Additional VP Rule

Hoggle thought Sarah ate the peach.  
 $VP \rightarrow V S$  ←

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

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.

**Infinitely many sentences can be generated!**

### 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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$VP \rightarrow V S'$

$S \rightarrow S' VP$

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

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

Sentences it can generate:

Hoggle likes jewels.

NP --> Det N  
NP --> N

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

S' --> Comp S

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NP --> N      VP --> V NP  
                  N            V NP  
                  Hoggle      likes jewels.

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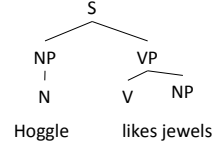
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Sentences it can generate:

Sarah thought that she solved the Labyrinth.

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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

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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

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Sentences it can generate:  
Sarah thought that she solved the Labyrinth.

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

Sarah   thought   S' --> Comp S

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

Sarah   thought   Comp S  
                                 that

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S --> S' VP

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

S' --> Comp S

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

Sarah   thought   that   S

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9 Rules

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

Sentences it can generate:  
 Sarah thought that she solved the Labyrinth.      S --> NP VP

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

Sarah    thought that S --> NP VP

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

S' --> Comp S

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

Sentences it can generate:  
 Sarah thought that she solved the Labyrinth.      S --> NP VP

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Sarah    thought that NP VP

VP --> V NP  
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NP --> Det N	NP --> N	VP --> V S'
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Sarah    thought that NP VP

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

NP --> N      VP --> V NP  
 N                  V NP  
 she                solved

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 that	NP VP
		NP → N
		VP → V NP
		N V NP
		she solved
		NP → Det N

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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:

Sarah thought that she solved the Labyrinth.

S → NP VP

NP → Det N	VP → V S'	
NP → N	N V S'	
Sarah	thought that	NP VP
		NP → N
		VP → V NP
		NP → N
		VP → V NP
		N V NP
		she solved
		Det N
		the Labyrinth

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### Figuring out structure: bottom-up

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Sarah thought that Hoggle was a cheat.



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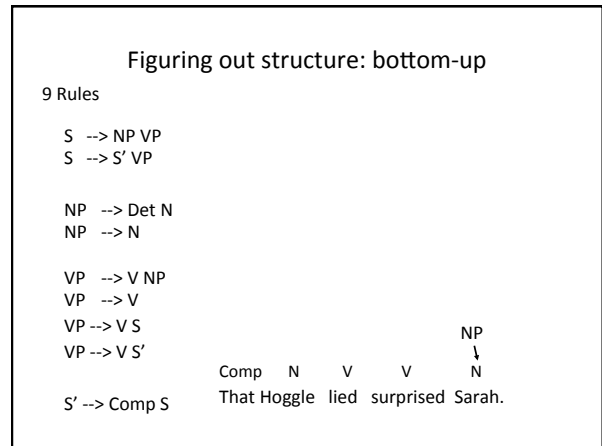
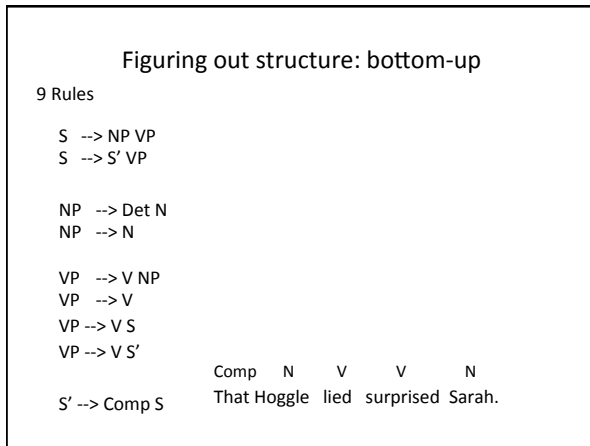
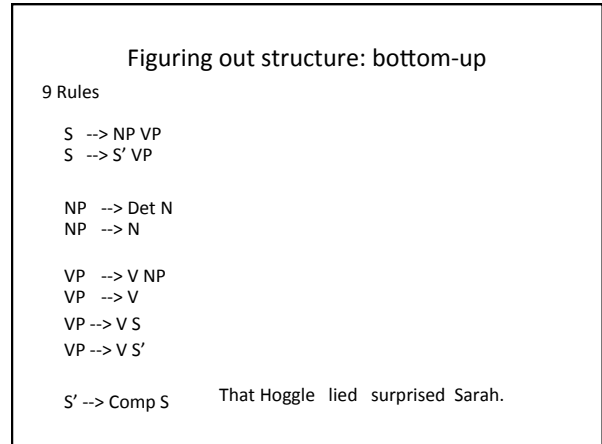
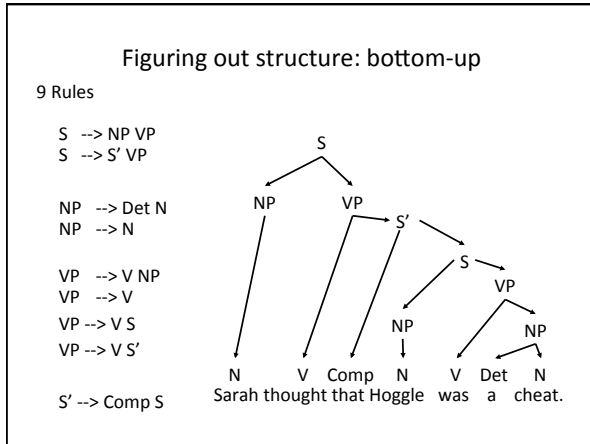
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VP --> V S'

S' --> Comp S

Comp    N    V

That Hoggle    lied

VP

↓

V    NP

↓    ↓

V    N

surprised Sarah.

**Figuring out structure: bottom-up**

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Comp    N    V

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NP

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VP

↓

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↓

V    NP

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Comp    N    V

That Hoggle    lied

S

↙    ↘

NP    VP

↓    ↓

N    V

VP

↓

V

VP

↓

V    NP

↓    ↓

V    N

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

Comp    N    V

That Hoggle    lied

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Comp    N    V

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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.