Psycholinguistics: Syntax I

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Syntactic structure

How to order the minimal meaning units (words / morphemes) so that they indicate a target meaning (e.g., in a communication situation).

e.g., in a situation where you want to ask what it is that John sees:

English: What does John see?

Chinese: John saw what?

Japanese: John what see?
Goal of research in syntax: to figure out the **grammar** of a language.

**language**: a set of strings over an alphabet of symbols. (an infinite set, for human languages)

e.g., John walked, Bill walked, Lucy kicked the ball, ...

**grammar**: a set of rules or structures that generates all and only the strings in a language.
Side effect of having this knowledge: grammaticality judgments.

The man saw the boy.

The man saw the boy on the hill.

The man saw the boy on the hill with the telescope.

* boy the the saw man

* saw the man boy the
Lecture overview

1. Parts of speech
2. Constituent structure
3. **Argument structure** of words
4. Cross-linguistic word order differences
5. Arguments vs. Modifiers: **X-bar theory**
6. (The categories Infl and Comp)
Parts of speech

Distributional analyses of words in sentences yields parts of speech or syntactic categories.

E.g., The boy saw the man on the hill with the telescope.

The boldface words are nouns.

A word $w_1$ that can substitute in the same position as another word $w_2$ in all grammatical sentences containing $w_2$ is said to be of the same syntactic category as $w_2$. 
Parts of speech

**Noun** (N): boy, girl, table, Mary, John, destruction, report, belief

**Verb** (V): buy, find, sleep, destroy, report, believe

**Preposition** (Prep): in, at, to

**Adjective** (Adj): tall, big, proud

**Determiner** (Det): the, a, some, this, these

**Adverb** (Adv): quickly, often

**Auxiliary verb** (Aux or Infl): will, can, might, has, is

**Complementizer** (Comp, C): that, whether: part of a CP
E.g., “John thinks that Mary is intelligent.”
By convention, categories with the same general semantic structure are grouped together. Distributional differences in these categories are treated as **features** of the larger category.

Examples of features: Number (singular, plural), verb-form (pres-tense, past-tense, infin, etc.)

N (person=third, number=singular): boy, girl

V (verb-form=pres-tense, number=singular): buys, sleeps, says, gives, takes
Constituent structure

- The distributional analysis of the parts of speech within sentences yields the constituent structure or phrase structure.
Constituencehood

**Semantic completeness**: The sequence of words is syntactically and semantically complete on its own. That is, it does not require other words and phrases to form an interpretable component of a sentence.

Two consequences of semantic completeness:

1. **Movement**: The string of words can be moved to a different location in the sentence, with a similar meaning for the sentence. E.g., movement to the beginning of the sentence: *Preposing*.

2. **Replacement**: The string of words can be replaced by a single word: a “pro-form”, such as a pronoun.

   Single words that replace nouns: it, him, she, her, one, what, who, whom;
   Single words that replace prepositional-phrases: there, here, where, when;
   A two-word verb-phrase replacement: “do so”
Example sentence:
**Philip will buy the books at the Coop.**

Word categories: Det, Noun, Verb, Infl (Aux), Prep

Higher constituent categories:

S: the sentence: also known as an “inflection phrase” or Infl phrase, **IP**

NP: a noun phrase: a phrase whose semantic head is a noun

VP: a verb phrase: a phrase whose semantic head is a verb

PP: a prepositional phrase: a phrase whose semantic head is a preposition
Allowable preposings

- The books, Philip will buy at the Coop.
- At the Coop, Philip will buy the books.
- Buy the books at the Coop, Philip will.
- Buy the books, Philip will, at the Coop.

The content of each of the preposed strings of words should be represented as a constituent.
Some Disallowed preposings

• * Books at, Philip will buy the the Coop.

• * Buy the, Philip will books at the Coop.
Allowable NP and PP substitutions

- Philip will buy **them** at the Coop.
- Philip will buy the books **there**.
- **He** will buy them at the Coop.
- **What** will Philip buy at the Coop?
- **Where** will Philip buy the books?
“do so” substitutions

- Philip will [buy the books at the Coop] today and Mary will do so tomorrow.

- Philip will [buy the books] at the Coop and Mary will do so at Amazon.com.
A structure for the sentence “Philip will buy the books at the Coop”
A structure for the sentence

**NP**
- **Noun**: Phillip

**Infl**: will

**VP**
- **Verb**: buy
- **Det**: the
- **Noun**: books

**PP**
- **Prep**: at
- **Det**: the
- **Noun**: Coop
Phrase structure rules

- IP \( \rightarrow \) NP Infl VP

Note: we are going to replace this rule with a more general set of rules soon

- VP \( \rightarrow \) VP PP
- VP \( \rightarrow \) Verb NP
- PP \( \rightarrow \) Prep NP
- NP \( \rightarrow \) Noun
- NP \( \rightarrow \) Det Noun
Syntactic structure

- Syntactic structure is part of a notation for meaning
- Different syntactic structures give rise to different meanings
- Different meanings are often due to different syntactic structures
Ambiguity

• Lexical ambiguity:
  Word sense ambiguity: “bank”, “take” ...
  Category ambiguity: “train”, “fly”, “time”, “light” ...

• Global syntactic ambiguity:

  The boy saw the man on the hill with the telescope.

  5 interpretations
Unwanted ambiguity in a letter of reference:

“I recommend the applicant with no qualifications whatsoever.”
Headlines:
Syntactic attachment ambiguity

- RUMORS ABOUT NBA REFEREES GETTING UGLY
- TWO SPIES SENTENCED TO LIFE IN MISSOURI
- TORONTO LAW TO PROTECT SQUIRRELS HIT BY MAYOR
More headlines: Lexical and syntactic ambiguity

- ENVIRONMENTAL UNIT HELPS DOG BITE VICTIM
- CLINTON WINS ON BUDGET, BUT MORE LIES AHEAD
- BRITISH LEFT WAFFLES ON FALKLAND ISLANDS
Ambiguity in medical records

- On the second day the knee was better, and on the third day, it had completely disappeared.

- The patient has been depressed ever since she began seeing me in 1983.

- She has had no rigors or shaking chills, but her husband states that she was very hot in bed last night.

- The patient states that there is a burning sensation in his penis which goes to his feet.
Ambiguity in bad translations

• Norway: Ladies are requested not to have children in the bar.

• Japan: You are invited to take advantage of the chambermaid.

• Russia: You are welcome to visit the cemetery where famous Russian and Soviet composers, artists, and writers are buried daily except Thursday.
Two structures for “British left waffles on Falklands.”
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Recursion: The infinity of human language

Recursion: A rule with a nonterminal syntactic category on the left which generates the same symbol on the right, (or further down after more rule expansions)

E.g., NP $\rightarrow$ NP PP; VP $\rightarrow$ VP PP

The boy saw the man on the hill with the telescope on Thursday in the morning after dawn ...

IP $\rightarrow$ NP VP; VP $\rightarrow$ V CP; CP $\rightarrow$ Comp IP

Mary thought that the bartender believed that the reporter said that ...

Argument structure:
Word-dependent phrase structure

VP expansion rules depend on the verb involved:

Philip will buy the books.  (buy:  VP → V NP)

* Philip will sleep the books.  (sleep:  VP → V)

* Philip will put the books.  (put:  VP → V NP PP)

* Philip will say the books.  (say:  VP → V CP)

Rules involving a word-level category (e.g., Verb, Noun, etc.) depend on the word involved.
The **argument structure** of a word (e.g. a verb): the phrases that are semantically required to make a phrase containing that word complete.

**Thematic roles**: agent (actor), patient, goal, etc.

**Head**: The word at the semantic core of a phrase.

**Subject** or **Specifier**: leftward argument.

**Objects** or **Complements**: rightward arguments.
Transitive verbs:
   a subject NP and an object NP.

buy, hit, kiss:

subject: NP, agent
complements: NP, patient

John bought the book.

* John bought.
Intransitive verbs:
  a subject NP and nothing else.

run, walk, smile, frown, swim, laugh, sleep, fall, die:

subject: NP, agent
complements: none

John laughs.

* John laughs the dog.
Ditransitive verbs: a subject NP and either two NPs or an NP and a PP.

* give, send

1. subject: NP, agent
   complements: NP, patient; PP, goal

2. subject: NP, agent
   complements: NP, goal; NP, patient

John gave the book to Mary.
John gave Mary the book.
* John gave the book.
* John gave Mary.
Verbs like “put” and “place”

put, place:
subject: NP, agent
complements: NP, patient; PP, destination

John put the book on the table.
* John put.
* John put the book.
* John put put on on the table.
More argument structures

say, think:
subject: NP, agent
complements: CP, proposition

* John thought the dog.
John thought that Mary ate the cheese.
More argument structures

tell, convince:
subject: NP, agent
complements: NP, goal; CP, proposition

* John told Mary.
John told Mary that the dog ate the cheese
More argument structures

annoy:

1. subject: NP, theme
   complements: NP, experiencer
2. subject: CP, proposition
   complements: NP, experiencer

John annoyed Mary
That John slept on the job annoyed Mary.