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**.

Constituenthood

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.
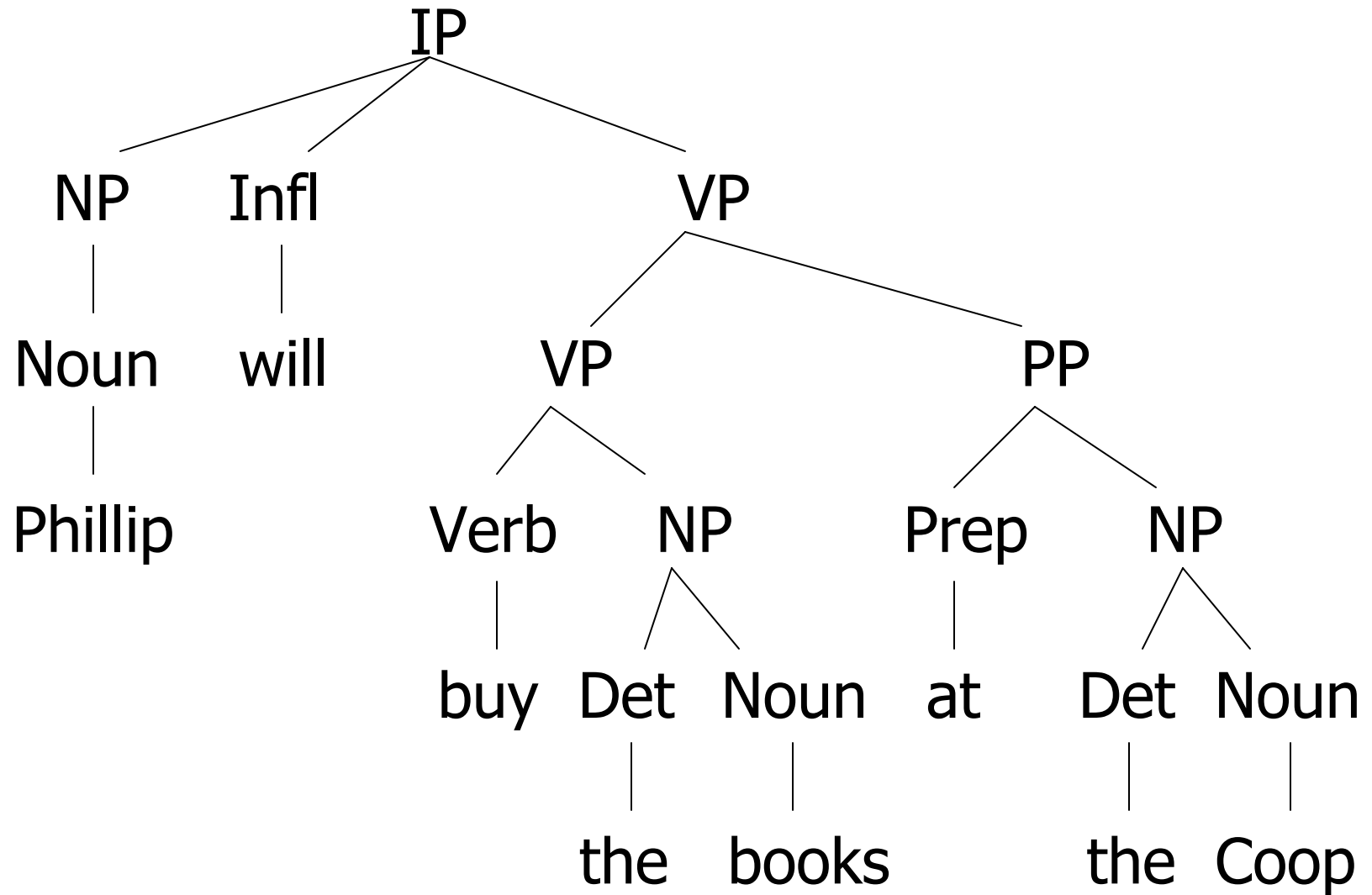
Allowable NP and PP substitutions

- 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

```
                          IP
            ┌─────────────┼──────────────────────┐
           NP            Infl                     VP
            │             │            ┌──────────┴──────────────┐
          Noun           will         VP                         PP
            │                    ┌─────┴─────┐            ┌───────┴───────┐
         Phillip              Verb          NP          Prep             NP
                               │         ┌───┴───┐       │            ┌───┴───┐
                              buy       Det    Noun      at          Det    Noun
                                         │      │                     │      │
                                        the   books                  the   Coop
```

Phrase structure rules

- IP ➜ NP Infl VP

- VP ➜ VP PP
- VP ➜ Verb NP
- PP ➜ Prep NP
- NP ➜ Noun
- NP ➜ Det Noun

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

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

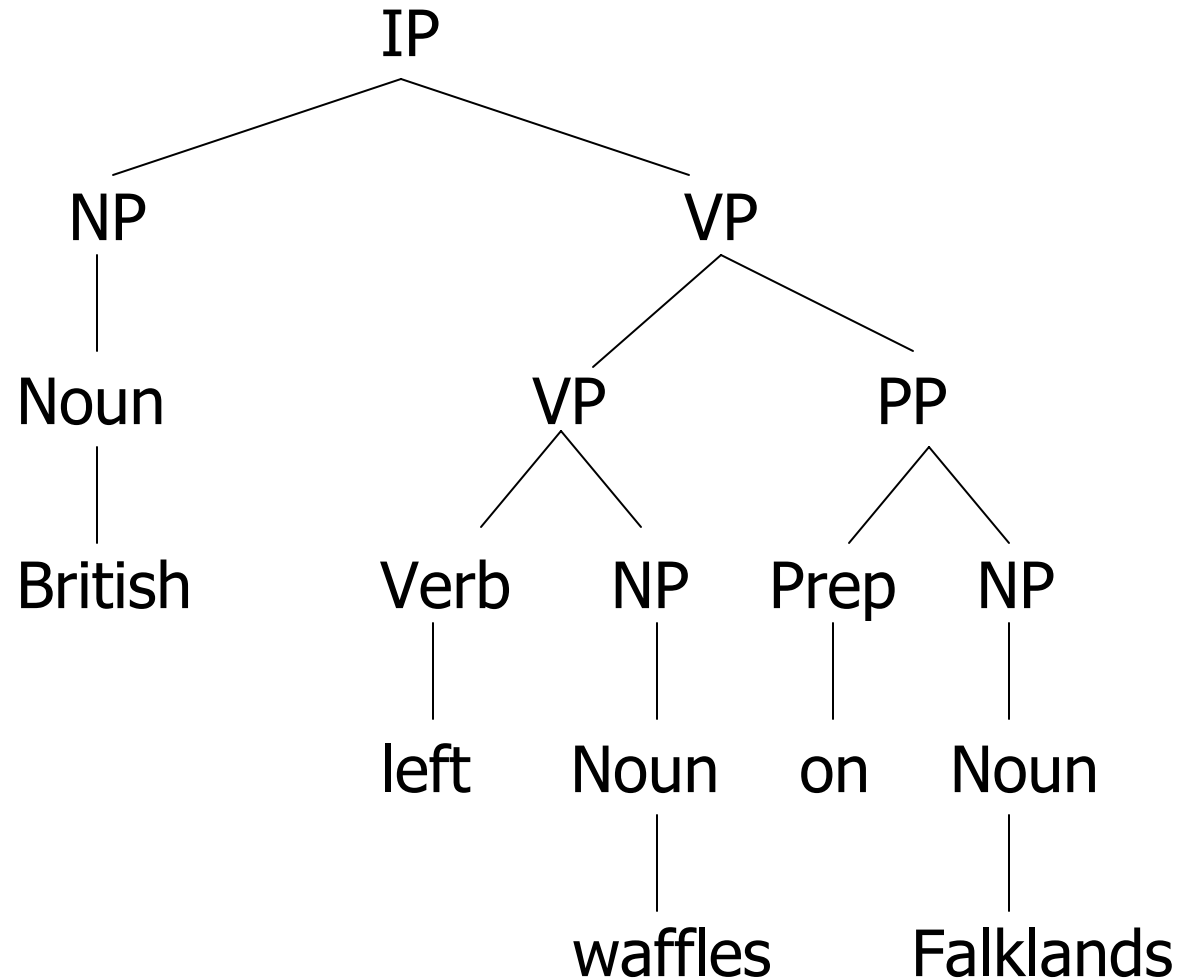- BRITISH LEFT WAFFLES ON FALKLAND ISLANDS

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.

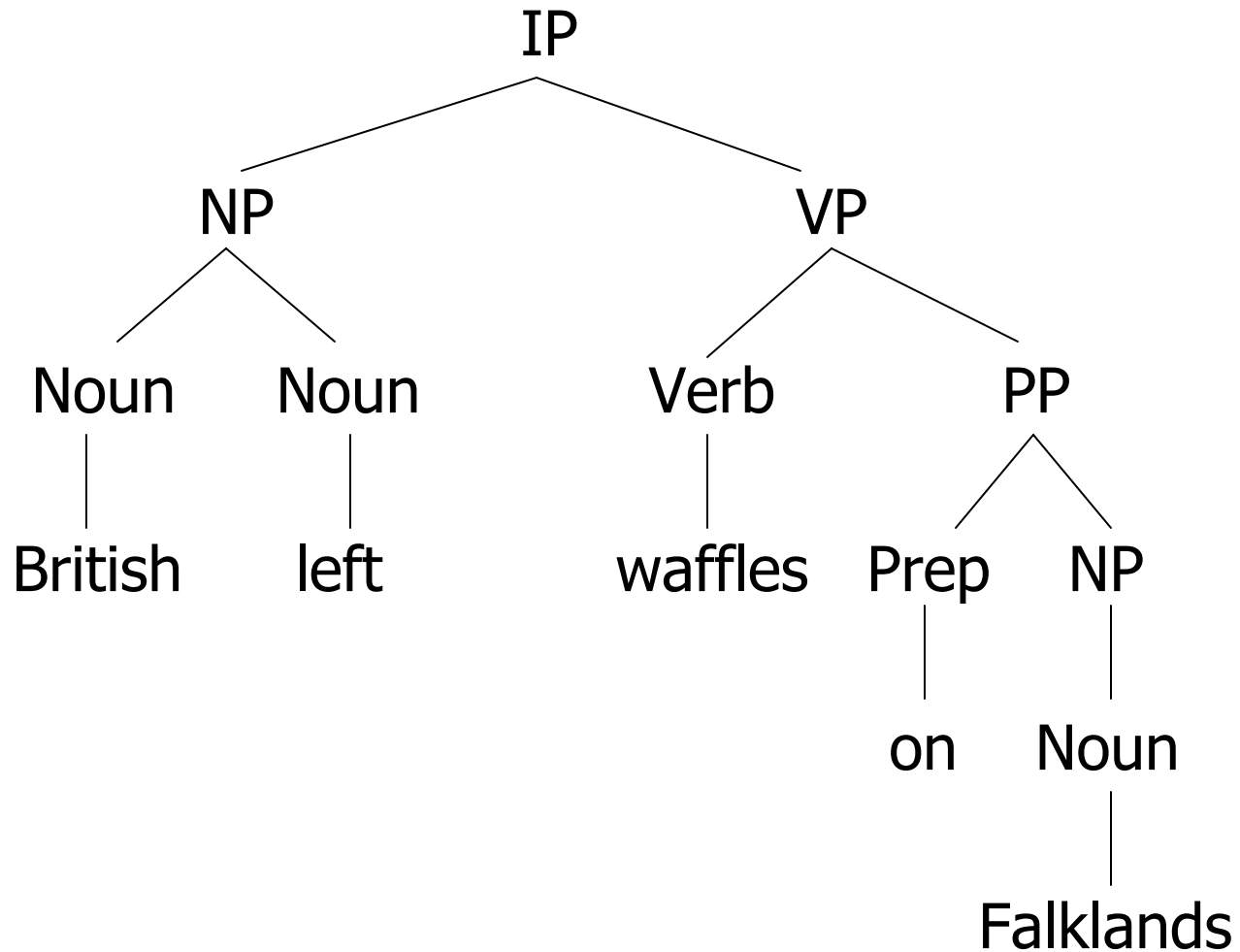- The patient states that there is a burning sensation in his penis which goes to his feet.

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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"British left waffles on Falklands."

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 ➔ NP PP; VP ➔ VP PP

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

IP ➔ NP VP; VP ➔ V CP; CP ➔ 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 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.