SPR4106 – Syntax and semantics in formal terms

Lecture I: Formal syntax, LFG, constituent structure

29 January 2015

Why formal syntax? (Chomsky, *Syntactic Structures*, p. 5)

Precisely constructed models for linguistic structure can play an important role, both negative and positive, in the process of discovery itself. By pushing a precise but inadequate formulation to an unacceptable conclusion, we can often expose the exact source of this inadequacy and, consequently, gain a deeper understanding of the linguistic data. More positively, a formalized theory may automatically provide solutions for many problems other than those for which it was explicitly designed. Obscure and intuition-bound notions can neither lead to absurd conclusions nor provide new and correct ones, and hence they fail to be useful in two important respects. I think that some of those linguists who have questioned the value of precise and technical development of linguistic theory have failed to recognize the productive potential in the method of rigorously stating a proposed theory and applying it strictly to linguistic material with no attempt to avoid unacceptable conclusions by ad hoc adjustments or loose formulation.

Frameworks and theories

To do formal syntax, we need to have a framework in which to express our theories.

- Our framework provides us with concepts, vocabulary and notation

Frameworks and theories

To do formal syntax, we need to have a framework in which to express our theories.

- Our framework provides us with concepts, vocabulary and notation
- We use the framework to state our theories, e.g.
  - Describe languages
  - Compare languages
  - State generalizations about languages

Frameworks and theories

To do formal syntax, we need to have a framework in which to express our theories.

- Our framework provides us with concepts, vocabulary and notation
- We use the framework to state our theories, e.g.
  - Describe languages
  - Compare languages
  - State generalizations about languages
- Although the framework is conceptually distinct from the theory, it is not unimportant:
  - In should make it easy to make the statements we want...

Frameworks and theories

To do formal syntax, we need to have a framework in which to express our theories.

- Our framework provides us with concepts, vocabulary and notation
- We use the framework to state our theories, e.g.
  - Describe languages
  - Compare languages
  - State generalizations about languages
- Although the framework is conceptually distinct from the theory, it is not unimportant:
  - In should make it easy to make the statements we want...
  - notation that has a clear interpretation (computer-interpretable at least in principle)

Frameworks and theories

To do formal syntax, we need to have a framework in which to express our theories.

- Our framework provides us with concepts, vocabulary and notation
- We use the framework to state our theories, e.g.
  - Describe languages
  - Compare languages
  - State generalizations about languages
- Although the framework is conceptually distinct from the theory, it is not unimportant:
  - In should make it easy to make the statements we want...
  - notation that has a clear interpretation (computer-interpretable at least in principle)
- Some frameworks also try to make it hard/impossible to say what we do not want to say; this is less of an issue in LFG, though not absent.

Lexical Functional Grammar

"Grammar" is formal grammar as Chomsky defined it in *Syntactic Structures*. But what about "Lexical" and "Functional"?

Lexical Functional Grammar

"Grammar" is formal grammar as Chomsky defined it in *Syntactic Structures*. But what about "Lexical" and "Functional"?

Lexical Integrity Principle, Falk p. 4

Words are the "atoms" out of which syntactic structure is built. Syntactic rules cannot create words or refer to the internal structures of words, and each terminal node is a word.

Lexical Functional Grammar

"Grammar" is formal grammar as Chomsky defined it in *Syntactic Structures*. But what about "Lexical" and "Functional"?

Lexical Integrity Principle, Falk p. 4

Words are the "atoms" out of which syntactic structure is built. Syntactic rules cannot create words or refer to the internal structures of words, and each terminal node is a word.

LFG is called *functional* because grammatical function (i.e. grammatical relations such as subjecthood and objecthoood) is an important concept of the theory.

Formal predictions

- I first said that formal predictions are not a central issue in LFG, but we already see that the basic assumptions do lead to some

Formal predictions

- I first said that formal predictions are not a central issue in LFG, but we already see that the basic assumptions do lead to some
- The lexical integrity principle predicts
  - there are no languages with "free morpheme order"
  - there is no extraction, gapping, coordination, anaphora or recursion in morphology

Formal predictions

- I first said that formal predictions are not a central issue in LFG, but we already see that the basic assumptions do lead to some
- The lexical integrity principle predicts
  - there are no languages with "free morpheme order"
  - there is no extraction, gapping, coordination, anaphora or recursion in morphology
- Grammatical relations as primitives predicts that there are interesting generalizations based on them

Formal predictions

- I first said that formal predictions are not a central issue in LFG, but we already see that the basic assumptions do lead to some
- The lexical integrity principle predicts
  - there are no languages with "free morpheme order"
  - there is no extraction, gapping, coordination, anaphora or recursion in morphology
- Grammatical relations as primitives predicts that there are interesting generalizations based on them
- So LFG does make predictions, though this aspect is perhaps not as prominent as in other frameworks

Formal predictions

- I first said that formal predictions are not a central issue in LFG, but we already see that the basic assumptions do lead to some
- The lexical integrity principle predicts
  - there are no languages with "free morpheme order"
  - there is no extraction, gapping, coordination, anaphora or recursion in morphology
- Grammatical relations as primitives predicts that there are interesting generalizations based on them
- So LFG does make predictions, though this aspect is perhaps not as prominent as in other frameworks
- This is a result of LFG being a declarative framework

Formal predictions

- I first said that formal predictions are not a central issue in LFG, but we already see that the basic assumptions do lead to some
- The lexical integrity principle predicts
  - there are no languages with "free morpheme order"
  - there is no extraction, gapping, coordination, anaphora or recursion in morphology
- Grammatical relations as primitives predicts that there are interesting generalizations based on them
- So LFG does make predictions, though this aspect is perhaps not as prominent as in other frameworks
- This is a result of LFG being a declarative framework
- LFG grammars state *constraints* on grammatical sentences and abstracts away from parsing and generation algorithms

Argument structure

- Argument structure relates thematic roles and syntactic functions

Argument structure

- Argument structure relates thematic roles and syntactic functions
- Crucially, we need to distinguish arguments (which are closely associated with the predicate) from adjuncts (which give 'extra' information, typically about time, place, manner, purpose etc.)

Argument structure

- Argument structure relates thematic roles and syntactic functions
- Crucially, we need to distinguish arguments (which are closely associated with the predicate) from adjuncts (which give 'extra' information, typically about time, place, manner, purpose etc.)
- The argument structure distinguishes the types of arguments (agent, patient, experiencer, stimulus etc.) and links them to grammatical functions (subject, object etc.)

Argument structure

- Argument structure relates thematic roles and syntactic functions
- Crucially, we need to distinguish arguments (which are closely associated with the predicate) from adjuncts (which give 'extra' information, typically about time, place, manner, purpose etc.)
- The argument structure distinguishes the types of arguments (agent, patient, experiencer, stimulus etc.) and links them to grammatical functions (subject, object etc.)
- Various proposals on the market in LFG and locus of active research

Constituent structure

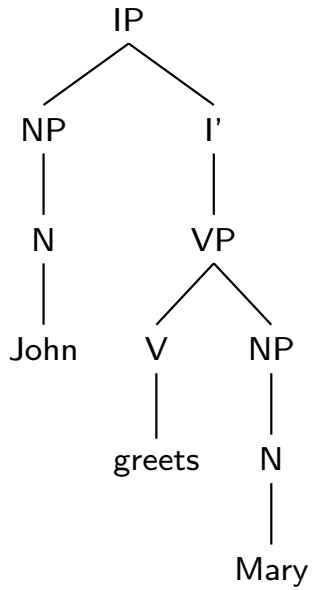
- The constituent structure models word order and the hierarchical grouping of words into phrases

Constituent structure

- The constituent structure models word order and the hierarchical grouping of words into phrases
- In LFG (and many other linguistic frameworks) the constituent structure is modelled as a tree of labelled nodes

Constituent structure

- The constituent structure models word order and the hierarchical grouping of words into phrases
- In LFG (and many other linguistic frameworks) the constituent structure is modelled as a tree of labelled nodes
- The constituent structure only represents the surface structure



Functional structure

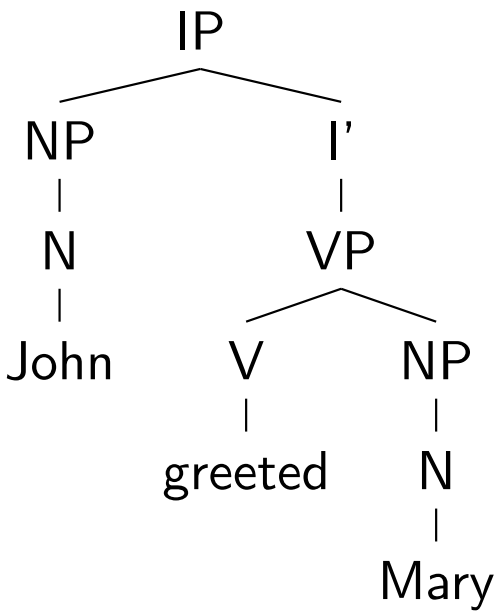
- The functional structure captures grammatical relations (subject, object etc.) and features (singular, plural etc.)

Functional structure

- The functional structure captures grammatical relations (subject, object etc.) and features (singular, plural etc.)
- These are represented in attribute-value matrices:

$$\begin{bmatrix} \textsc{pred} & \text{`}\textsc{greet}\left\langle \textsc{subj}, \textsc{obj} \right\rangle\text{'} \\ \textsc{tense} & \textsc{present} \\ \textsc{number} & \textsc{singular} \\ \textsc{person} & 3 \\ \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{john}\text{'} \end{bmatrix} \\ \textsc{obj} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{mary}\text{'} \end{bmatrix} \end{bmatrix}$$

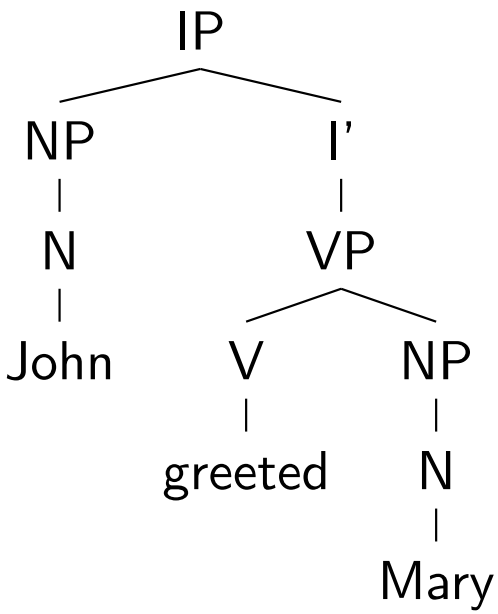
The projection architecture



$$\begin{bmatrix} \text{PRED} & \text{`GREET} \left\langle \text{SUBJ, OBJ} \right\rangle\text{'} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`JOHN'} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`MARY'} \end{bmatrix} \end{bmatrix}$$

- The grammar describes the sentence at several levels (here: c- and f-structure)

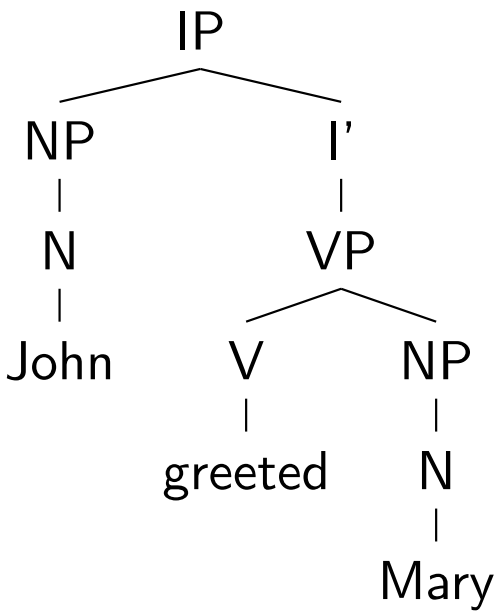
The projection architecture



$$\begin{bmatrix} \text{PRED} & \text{`GREET} \left\langle \text{SUBJ, OBJ} \right\rangle\text{'} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`JOHN'} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`MARY'} \end{bmatrix} \end{bmatrix}$$

- The grammar describes the sentence at several levels (here: c- and f-structure)
- The sentence is well-formed if all structures *and the mappings between them* are well-formed

The projection architecture



$$\begin{bmatrix} \text{PRED} & \text{`GREET} \left\langle \text{SUBJ, OBJ} \right\rangle\text{'} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`JOHN'} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`MARY'} \end{bmatrix} \end{bmatrix}$$

- The grammar describes the sentence at several levels (here: c- and f-structure)
- The sentence is well-formed if all structures *and the mappings between them* are well-formed
- NB: no level is derived from the others

About this course

- In the syntax part of this course, you will be introduced to LFG

About this course

- In the syntax part of this course, you will be introduced to LFG
- This is one of several competing theories on the market

About this course

- In the syntax part of this course, you will be introduced to LFG
- This is one of several competing theories on the market
- The way we reason in formal syntax is often similar across frameworks, and so are the phenomena we are looking at

About this course

- In the syntax part of this course, you will be introduced to LFG
- This is one of several competing theories on the market
- The way we reason in formal syntax is often similar across frameworks, and so are the phenomena we are looking at
- We use two books:
  - Yehuda Falk's book gives a proper introduction to the LFG formalism, but assumes familiarity with derivational syntax

About this course

- In the syntax part of this course, you will be introduced to LFG
- This is one of several competing theories on the market
- The way we reason in formal syntax is often similar across frameworks, and so are the phenomena we are looking at
- We use two books:
  - Yehuda Falk's book gives a proper introduction to the LFG formalism, but assumes familiarity with derivational syntax
  - Paul Kroeger's book is more basic, easier to read and provides more data, but simplifies the LFG framework in various respects
- I suggest that for each class you read the assignment from Kroeger first to get an intuitive grasp of the phenomena and then look at Falk to get the formal analysis

About this course

- In the syntax part of this course, you will be introduced to LFG
- This is one of several competing theories on the market
- The way we reason in formal syntax is often similar across frameworks, and so are the phenomena we are looking at
- We use two books:
  - Yehuda Falk's book gives a proper introduction to the LFG formalism, but assumes familiarity with derivational syntax
  - Paul Kroeger's book is more basic, easier to read and provides more data, but simplifies the LFG framework in various respects
- I suggest that for each class you read the assignment from Kroeger first to get an intuitive grasp of the phenomena and then look at Falk to get the formal analysis
- We will not attempt to cover all the details from Falk in this course

Trees

- A *tree* is a set of nodes ordered by precedence (left-right order) and dominance (top-bottom order)

Trees

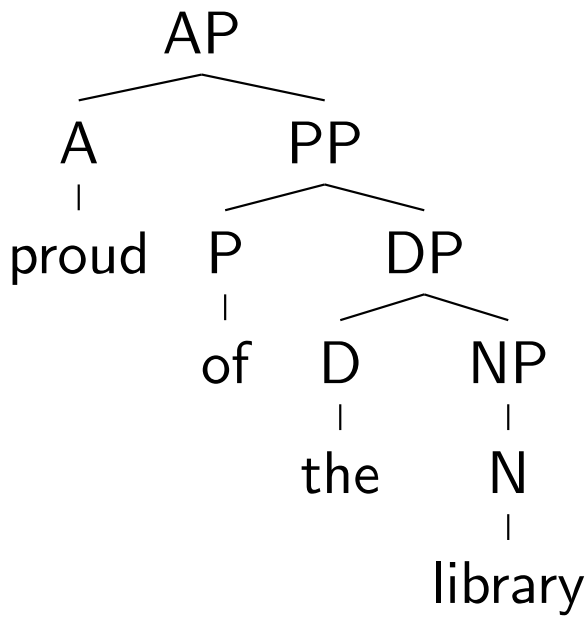
- A *tree* is a set of nodes ordered by precedence (left-right order) and dominance (top-bottom order)
- The topmost node is called the root

Trees

- A *tree* is a set of nodes ordered by precedence (left-right order) and dominance (top-bottom order)
- The topmost node is called the root
- The lowest nodes are called the terminals and correspond to the words

Trees

- A *tree* is a set of nodes ordered by precedence (left-right order) and dominance (top-bottom order)
- The topmost node is called the root
- The lowest nodes are called the terminals and correspond to the words
- Words group into bigger constituents and this gives rise to *phrases*, non-terminal nodes



Categories

- Categories are groups of words with similar distributional properties

Categories

- Categories are groups of words with similar distributional properties
- The basic lexical categories are verb (V), noun (N), preposition (P), adjective (A) and adverb (Adv)

Categories

- Categories are groups of words with similar distributional properties
- The basic lexical categories are verb (V), noun (N), preposition (P), adjective (A) and adverb (Adv)
- There are also functional categories: determiners (D), auxiliaries (I) and complementizers (C)

Categories

- Categories are groups of words with similar distributional properties
- The basic lexical categories are verb (V), noun (N), preposition (P), adjective (A) and adverb (Adv)
- There are also functional categories: determiners (D), auxiliaries (I) and complementizers (C)
- Since LFG is lexicalist, functional categories are projections of function words, not of abstract features

Categories

- Categories are groups of words with similar distributional properties
- The basic lexical categories are verb (V), noun (N), preposition (P), adjective (A) and adverb (Adv)
- There are also functional categories: determiners (D), auxiliaries (I) and complementizers (C)
- Since LFG is lexicalist, functional categories are projections of function words, not of abstract features
- Pre-terminals have one of these basic categories

X-bar theory

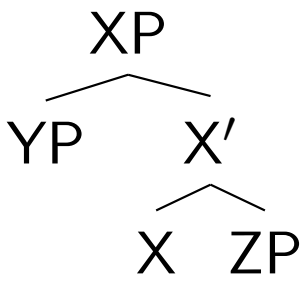
- What is the relationship between the categories of the preterminals and those of their dominating nodes?

X-bar theory

- What is the relationship between the categories of the preterminals and those of their dominating nodes?
- The LFG framework does not constrain this, but X-bar theory does

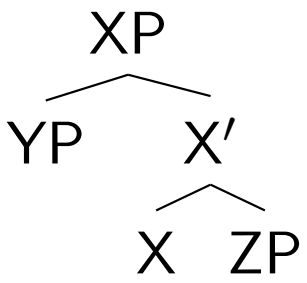
X-bar theory

- What is the relationship between the categories of the preterminals and those of their dominating nodes?
- The LFG framework does not constrain this, but X-bar theory does
- In the strongest version:



X-bar theory

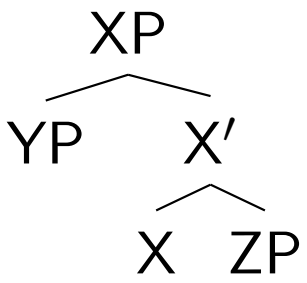
- What is the relationship between the categories of the preterminals and those of their dominating nodes?
- The LFG framework does not constrain this, but X-bar theory does
- In the strongest version:



- The *head* X projects two levels of structure: X′ and XP (aka X″)

X-bar theory

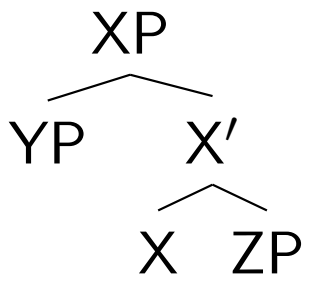
- What is the relationship between the categories of the preterminals and those of their dominating nodes?
- The LFG framework does not constrain this, but X-bar theory does
- In the strongest version:



- The *head* X projects two levels of structure: X′ and XP (aka X″)
- The phrase is endocentric: XP is headed by X

X-bar theory

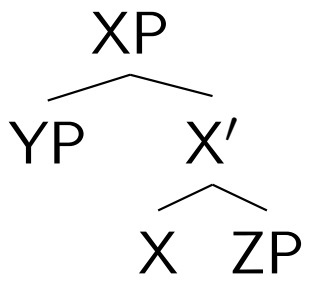
- What is the relationship between the categories of the preterminals and those of their dominating nodes?
- The LFG framework does not constrain this, but X-bar theory does
- In the strongest version:



- The *head* X projects two levels of structure: X′ and XP (aka X″)
- The phrase is endocentric: XP is headed by X
- ZP is called the *complement* of XP, and YP the *specifier*

X-bar theory

- What is the relationship between the categories of the preterminals and those of their dominating nodes?
- The LFG framework does not constrain this, but X-bar theory does
- In the strongest version:



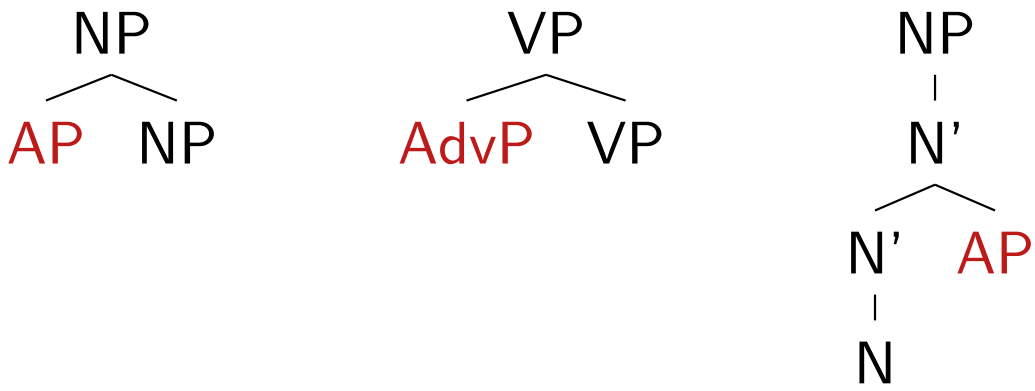
- The *head* X projects two levels of structure: X′ and XP (aka X″)
- The phrase is endocentric: XP is headed by X
- ZP is called the *complement* of XP, and YP the *specifier*

Adjunction

- X-bar theory covers the positioning of complements and specifiers

Adjunction

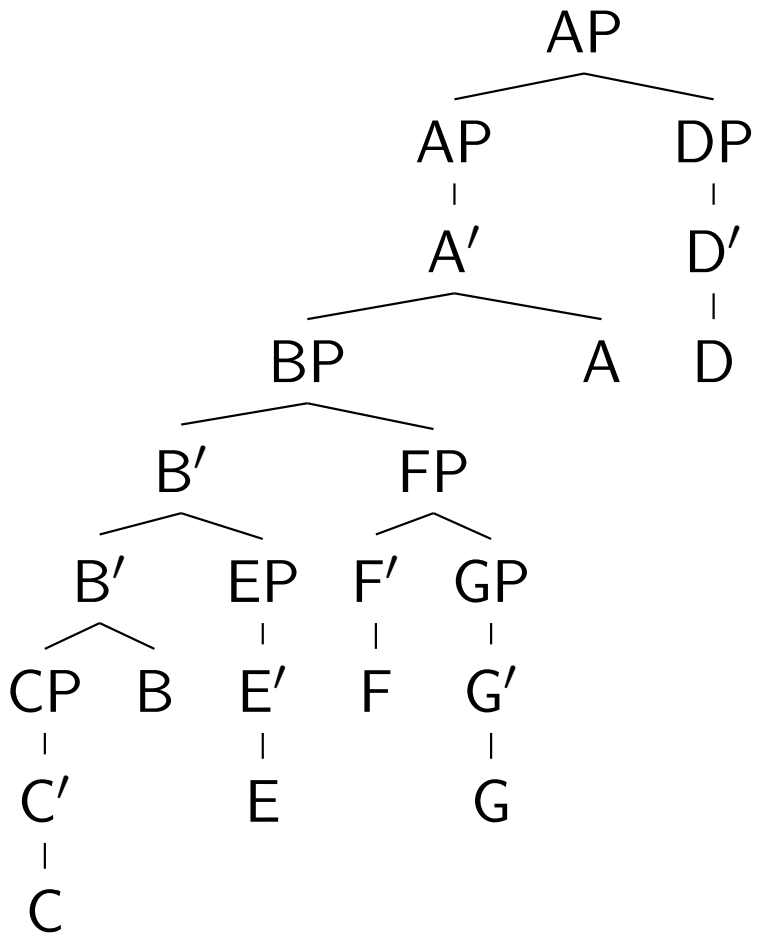
- X-bar theory covers the positioning of complements and specifiers
- There is also adjunction: we adjoin to a node by adding another node with same label above it and adding the adjunct as a sister:



Funglish

Let us practice complements, specifiers and adjuncts in X′ theory. In Funglish, all specifiers and adjuncts are on the right, and all complements on the left.

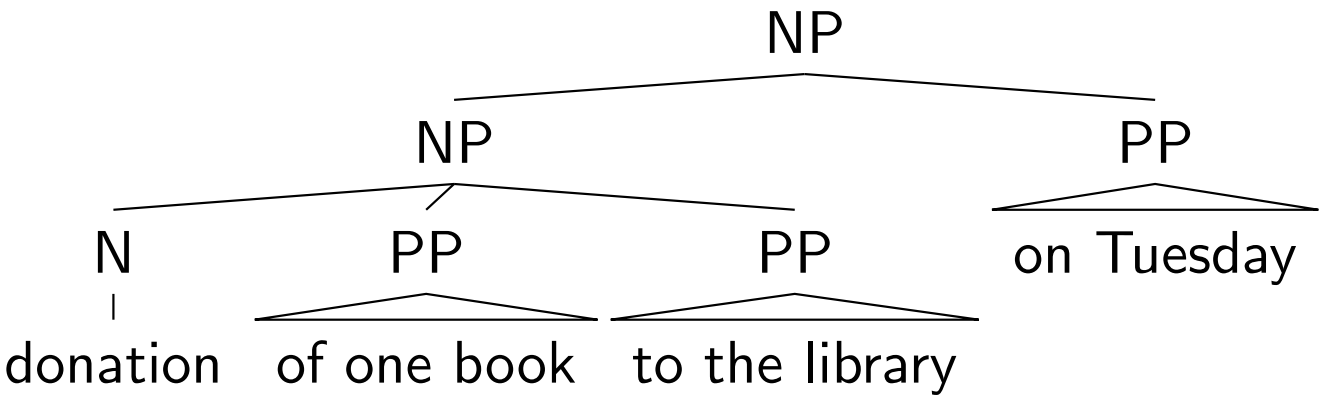
- Start with an AP
- AP has a BP complement
- BP has a CP complement
- Adjoin a DP to AP
- Adjoin an EP to B′
- BP has an FP specifier
- FP has a GP specifier


AP
AP
DP
A′
D′
BP
A
D
B′
FP
B′
EP
F′
GP
CP
B
E′
F
G′
C′
E
G
C

LFG's X-bar theory

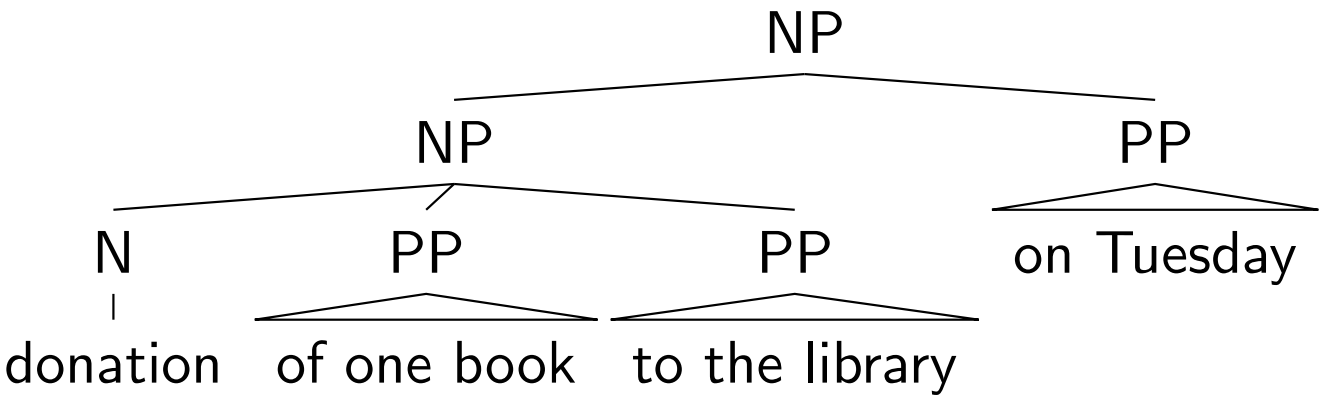
- Locus of active research; no consensus.
- Falk's assumptions
  - only functional categories have specifiers
  - binary branching not enforced
  - exocentricity allowed (but restricted)

Structure-function mapping



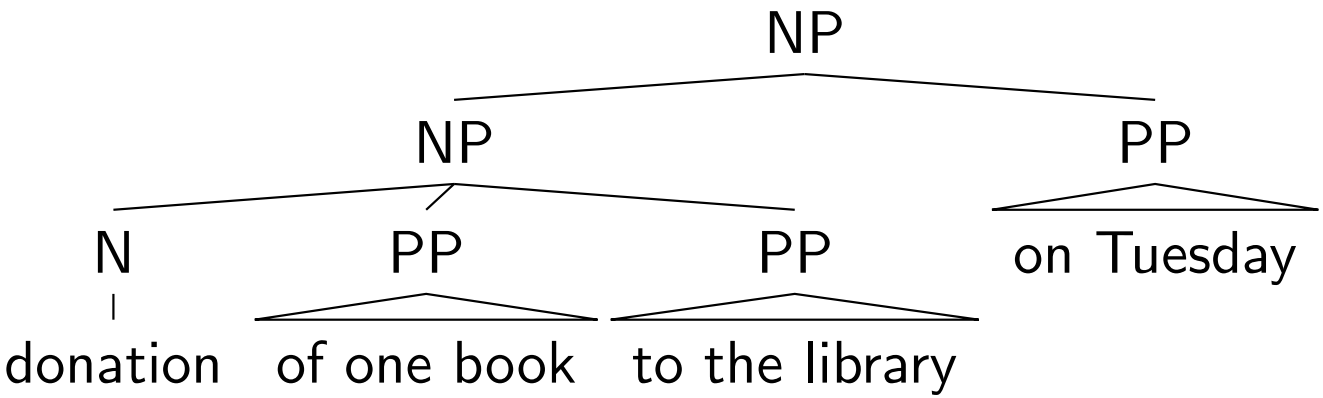
- *of one book* and *to the library* are arguments of *donation*, so they both occur in complement position

Structure-function mapping



- *of one book* and *to the library* are arguments of *donation*, so they both occur in complement position
- *on Tuesday* is an adjunct, so it appears in an adjunct position

Structure-function mapping



- *of one book* and *to the library* are arguments of *donation*, so they both occur in complement position
- *on Tuesday* is an adjunct, so it appears in an adjunct position
- NP is not a functional category, so there is no specifier

Functional categories

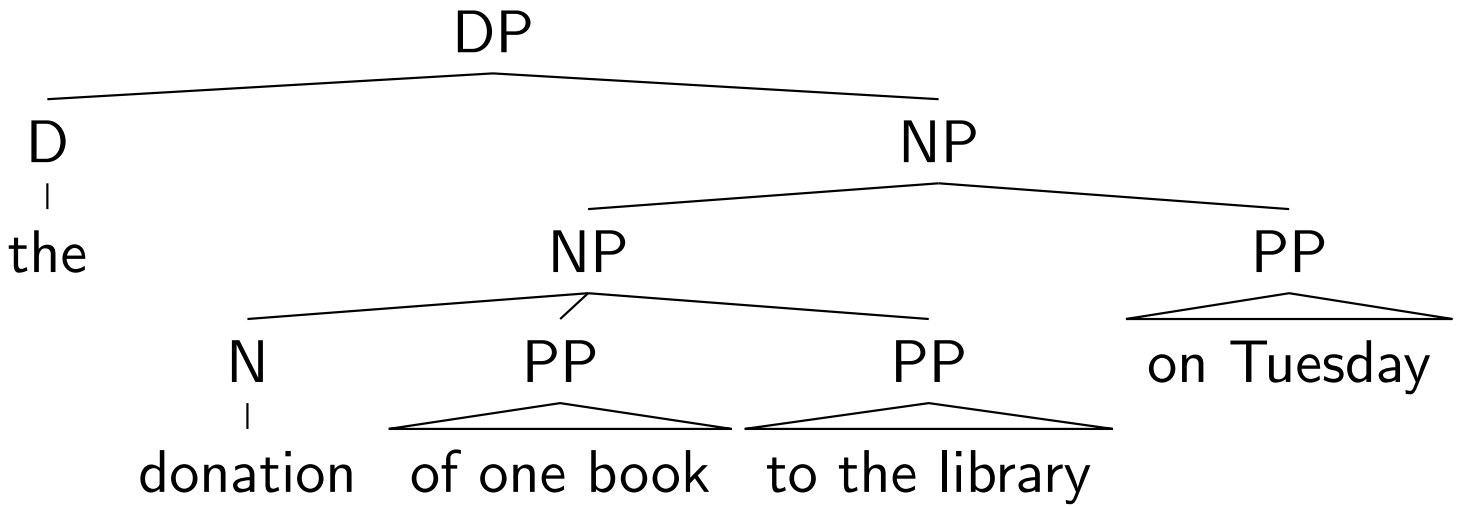
- Functional categories are projections of function words:

Functional categories

- Functional categories are projections of function words:
  - Determiners head DPs
  - (Auxiliary) verbs head IPs
  - Complementizers head CPs

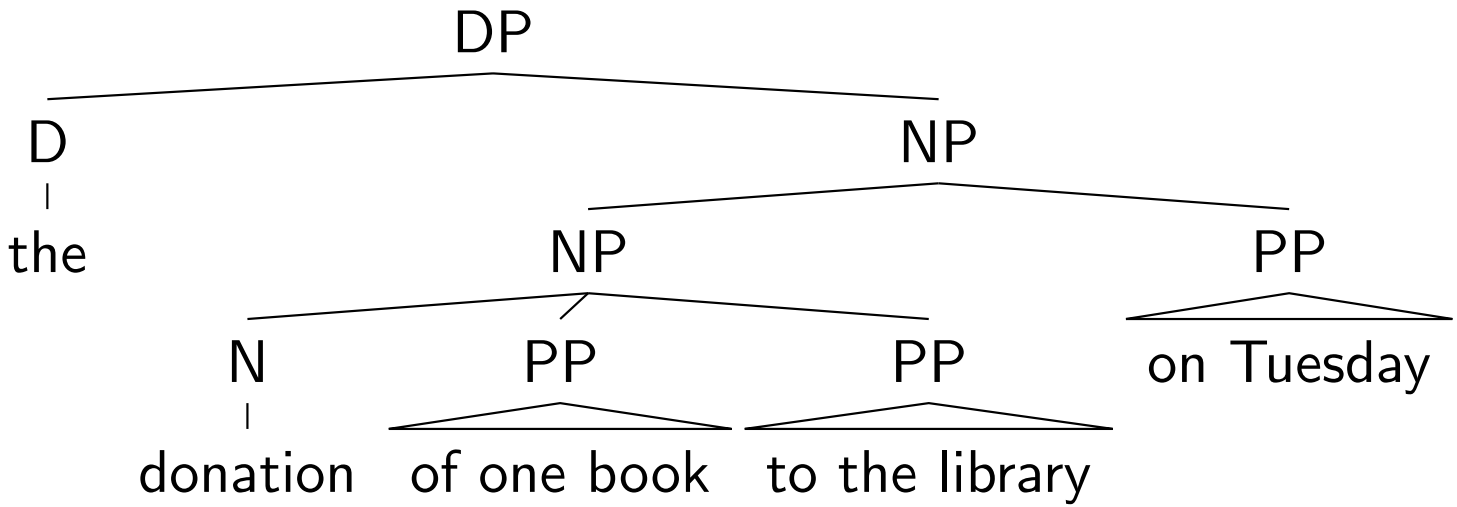
Functional categories

- Functional categories are projections of function words:
  - Determiners head DPs
  - (Auxiliary) verbs head IPs
  - Complementizers head CPs



Functional categories

- Functional categories are projections of function words:
  - Determiners head DPs
  - (Auxiliary) verbs head IPs
  - Complementizers head CPs



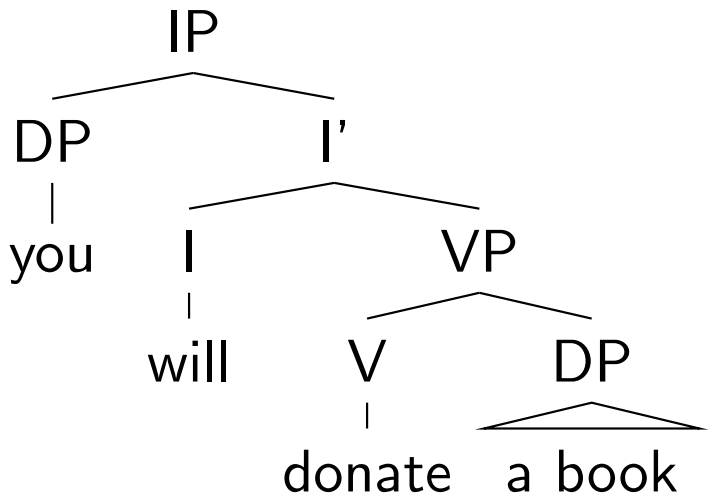
- Subject to cross-linguistic variation, e.g. not all languages have D, and there is considerable variation in what counts as I

Specifiers of functional categories

- Functional categories have specifiers and these often have special grammatical functions

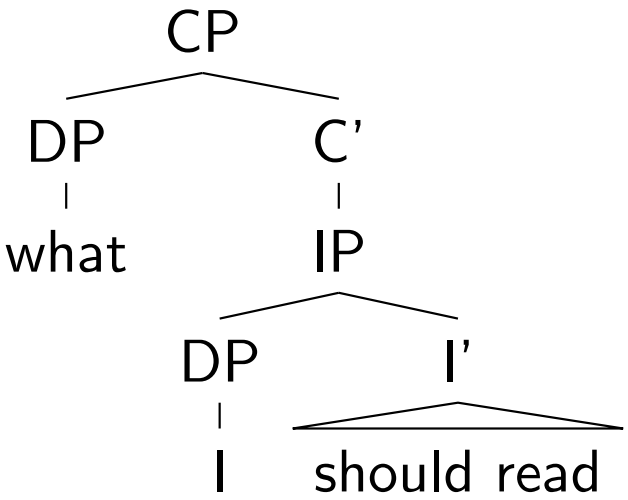
Specifiers of functional categories

- Functional categories have specifiers and these often have special grammatical functions
- English uses the specifier of IP as a subject position



Specifiers of functional categories

- Functional categories have specifiers and these often have special grammatical functions
- English uses the specifier of IP as a subject position
- Spec,CP often contributes information about sentence type (e.g. relative clauses, embedded questions and direct questions)

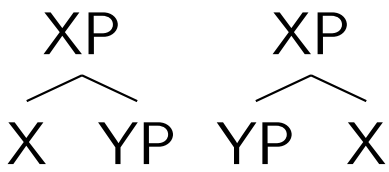


Variation in c-structure

- In LFG, the c-structure encodes only surface structure, which can vary a lot across languages

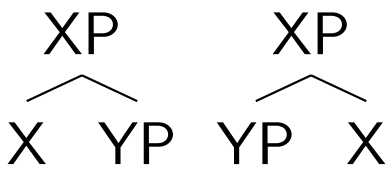
Variation in c-structure

- In LFG, the c-structure encodes only surface structure, which can vary a lot across languages
- One difference is whether phrases are head-initial or head-final

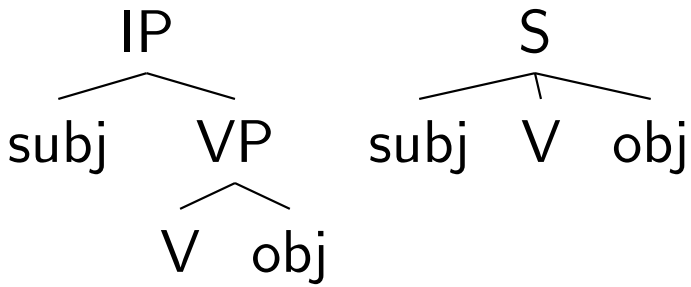


Variation in c-structure

- In LFG, the c-structure encodes only surface structure, which can vary a lot across languages
- One difference is whether phrases are head-initial or head-final



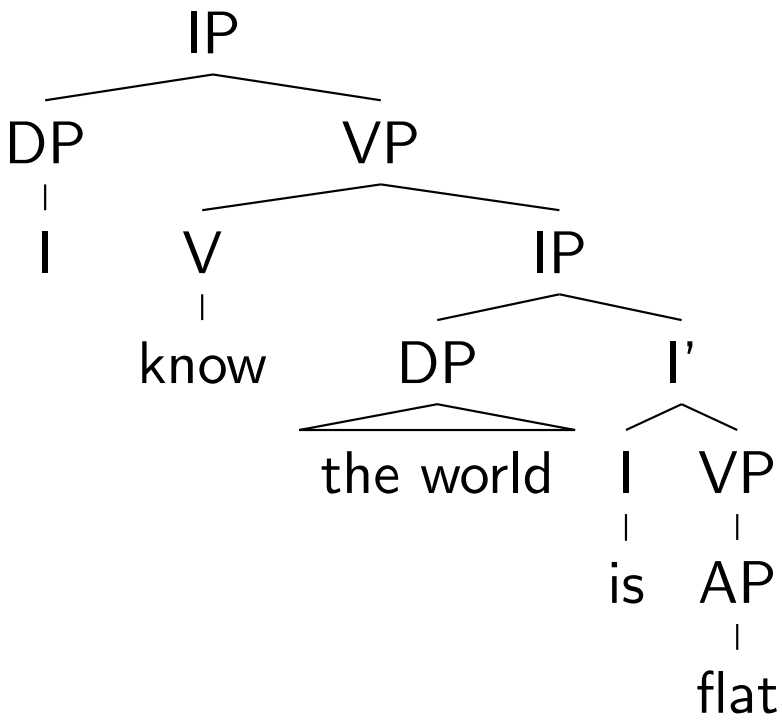
- Another is the use of exocentric structures

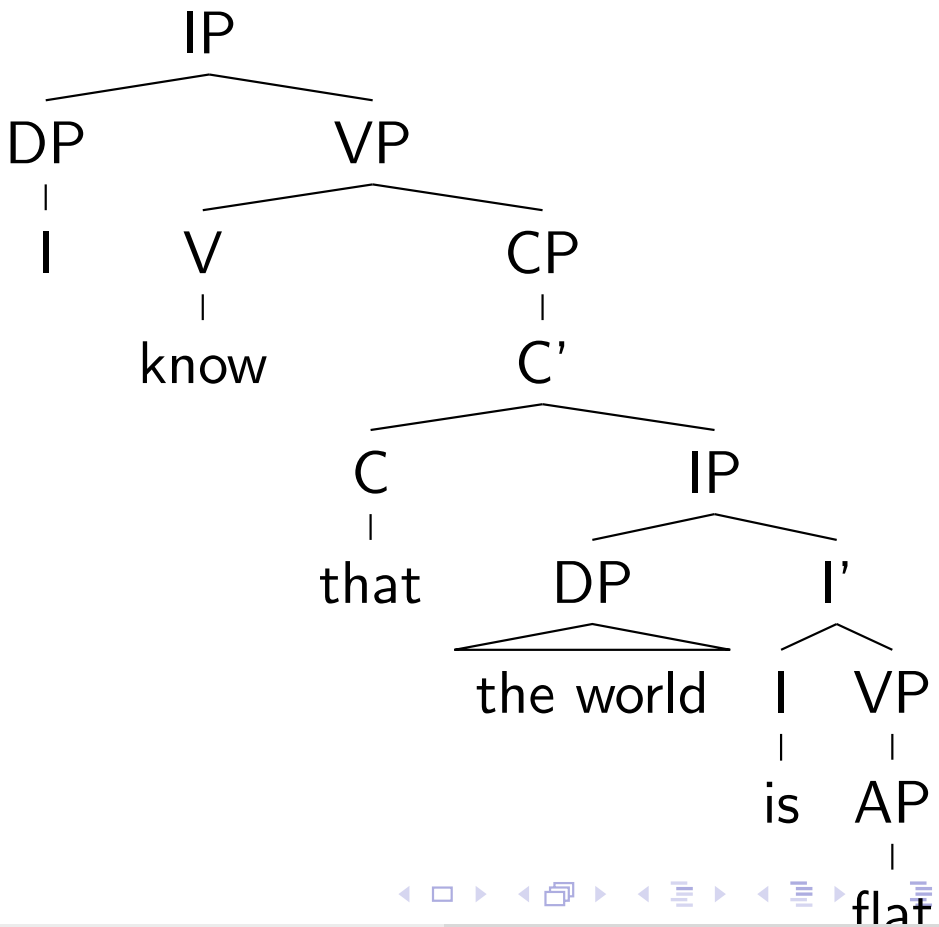


Internal variation in languages

(1) I know [that the world is flat]

(2) I know [the world is flat]





Constituency tests

- C-structure is the encoding of hierarchical groupings of the words of a sentence

Constituency tests

- C-structure is the encoding of hierarchical groupings of the words of a sentence
- It cannot be read directly off the string, so how do we argue for it?

Constituency tests

- C-structure is the encoding of hierarchical groupings of the words of a sentence
- It cannot be read directly off the string, so how do we argue for it?
- There is a standard battery of tests

Test 1: replace by a single word

- proud of the library

Test 1: replace by a single word

- proud of the library $\rightarrow$ proud of it

Test 1: replace by a single word

- proud of the library $\rightarrow$ proud of it
- proud of the library

Test 1: replace by a single word

- proud of the library $\rightarrow$ proud of it
- proud of the library $\rightarrow$ proud thereof

Test 1: replace by a single word

- proud of the library $\rightarrow$ proud of it
- proud of the library $\rightarrow$ proud thereof
- proud of the library

Test 1: replace by a single word

- proud of the library $\rightarrow$ proud of it
- proud of the library $\rightarrow$ proud thereof
- proud of the library $\rightarrow$ proud

Test 1: replace by a single word

- proud of the library $\rightarrow$ proud of it
- proud of the library $\rightarrow$ proud thereof
- proud of the library $\rightarrow$ proud
- proud of the library

Test 1: replace by a single word

- proud of the library $\rightarrow$ proud of it
- proud of the library $\rightarrow$ proud thereof
- proud of the library $\rightarrow$ proud
- proud of the library ??

Test 1: replace by a single word

- proud of the library → proud of it
- proud of the library → proud thereof
- proud of the library → proud
- proud of the library ??
- pronominalization is a special variant of this test, which holds for some types of constituents

Test 2: semantic unity

- A constituent is typically a semantic unit, bearing one semantic role and one grammatical relation

Test 2: semantic unity

- A constituent is typically a semantic unit, bearing one semantic role and one grammatical relation
- What about *proud of the library* and its subparts?

Test 2: semantic unity

- A constituent is typically a semantic unit, bearing one semantic role and one grammatical relation
- What about *proud of the library* and its subparts?
- NB: careful with this in languages with free word order!

Test 3: a variety of positions

- *the library* can be the object of a preposition, the subject or object of a verb, etc.

Test 3: a variety of positions

- *the library* can be the object of a preposition, the subject or object of a verb, etc.
- *of the library* can be the complement of an adjective, the adjunct of a noun, etc.

Test 3: a variety of positions

- *the library* can be the object of a preposition, the subject or object of a verb, etc.
- *of the library* can be the complement of an adjective, the adjunct of a noun, etc.
- *proud of the library* can be the complement of a copula, the adjunct of a noun, etc.

Test 3: a variety of positions

- *the library* can be the object of a preposition, the subject or object of a verb, etc.
- *of the library* can be the complement of an adjective, the adjunct of a noun, etc.
- *proud of the library* can be the complement of a copula, the adjunct of a noun, etc.
- Meaningful generalizations about *of the*?

Test 3: a variety of positions

- *the library* can be the object of a preposition, the subject or object of a verb, etc.
- *of the library* can be the complement of an adjective, the adjunct of a noun, etc.
- *proud of the library* can be the complement of a copula, the adjunct of a noun, etc.
- Meaningful generalizations about *of the*?
- The point is that if our rules uniformly refer to *proud of the library* AP, we don't need a separate account of the internal structure in each position

Test 4: questions and answers

- It is typically possible to form a content question by replacing a constituent with a question

Test 4: questions and answers

- It is typically possible to form a content question by replacing a constituent with a question
- *He is proud of the library*

Test 4: questions and answers

- It is typically possible to form a content question by replacing a constituent with a question
- *He is proud of the library* $\rightarrow$ *What is he proud of?*

Test 4: questions and answers

- It is typically possible to form a content question by replacing a constituent with a question
- *He is proud of the library* $\rightarrow$ *What is he proud of?*
- Constituents can function as answers:

Test 4: questions and answers

- It is typically possible to form a content question by replacing a constituent with a question
- *He is proud of the library* $\rightarrow$ *What is he proud of?*
- Constituents can function as answers: *proud of the library*, but not *proud of*

Test 5: reordering

- Most languages have mechanisms for changing the word order of a sentence

Test 5: reordering

- Most languages have mechanisms for changing the word order of a sentence
- These mechanisms typically apply to a constituent as a whole

Test 5: reordering

- Most languages have mechanisms for changing the word order of a sentence
- These mechanisms typically apply to a constituent as a whole
- Relevant operations in English are topicalization and clefting

Test 5: reordering

- Most languages have mechanisms for changing the word order of a sentence
- These mechanisms typically apply to a constituent as a whole
- Relevant operations in English are topicalization and clefting
  - *[Your elder sister]$_{NP}$ I can't stand.*
  - **[Your elder] I can't stand sister.*

Test 6: coordination

- Normally, only constituents may be coordinated:
  - *[John's video camera] and [Mary's digital camera]*
  - **[John's video] and [Mary's digital] camera*.

Test 6: coordination

- Normally, only constituents may be coordinated:
  - *[John's video camera] and [Mary's digital camera]*
  - **[John's video] and [Mary's digital] camera*.
- Beware of ellipsis!: *Would you like [white wine] or [red]?*

Test 6: coordination

- Normally, only constituents may be coordinated:
  - *[John's video camera] and [Mary's digital camera]*
  - **[John's video] and [Mary's digital] camera*.
- Beware of ellipsis!: *Would you like [white wine] or [red]?*
- Also, right node raising: two truncated sentences that would be completed by the same final constituent:

Test 6: coordination

- Normally, only constituents may be coordinated:
  - *[John's video camera] and [Mary's digital camera]*
  - **[John's video] and [Mary's digital] camera*.
- Beware of ellipsis!: *Would you like [white wine] or [red]?*
- Also, right node raising: two truncated sentences that would be completed by the same final constituent:

(3) John walked, and Mary ran, up the hill.

Test 6: coordination

- Normally, only constituents may be coordinated:
  - *[John's video camera] and [Mary's digital camera]*
  - **[John's video] and [Mary's digital] camera*.
- Beware of ellipsis!: *Would you like [white wine] or [red]?*
- Also, right node raising: two truncated sentences that would be completed by the same final constituent:

(3) John walked, and Mary ran, up the hill.

- The final shared phrase must be a constituent

Applying the tests: English VPs

What is the evidence that verb + object forms a constituent in English?

Applying the tests: English VPs

What is the evidence that verb + object forms a constituent in English?

- Replace by single word?

Applying the tests: English VPs

What is the evidence that verb + object forms a constituent in English?

- Replace by single word? Who killed Roger Rabbit? John did.

Applying the tests: English VPs

What is the evidence that verb + object forms a constituent in English?

- Replace by single word? Who killed Roger Rabbit? John did.
- Coordination:

Applying the tests: English VPs

What is the evidence that verb + object forms a constituent in English?

- Replace by single word? Who killed Roger Rabbit? John did.
- Coordination: You can either surrender these documents or move to Mexico.

Applying the tests: English VPs

What is the evidence that verb + object forms a constituent in English?

- Replace by single word? Who killed Roger Rabbit? John did.
- Coordination: You can either surrender these documents or move to Mexico.
- Question and answers:

Applying the tests: English VPs

What is the evidence that verb + object forms a constituent in English?

- Replace by single word? Who killed Roger Rabbit? John did.
- Coordination: You can either surrender these documents or move to Mexico.
- Question and answers: What are you going to do now? Give my dog a bath.

Applying the tests: English VPs

What is the evidence that verb + object forms a constituent in English?

- Replace by single word? Who killed Roger Rabbit? John did.
- Coordination: You can either surrender these documents or move to Mexico.
- Question and answers: What are you going to do now? Give my dog a bath.
- Reorderings:

Applying the tests: English VPs

What is the evidence that verb + object forms a constituent in English?

- Replace by single word? Who killed Roger Rabbit? John did.
- Coordination: You can either surrender these documents or move to Mexico.
- Question and answers: What are you going to do now? Give my dog a bath.
- Reorderings: I will dance with your mother if I must, but kiss your sister I will not. I try, whenever circumstances allow it, to give Helen the benefit of the doubt.

Applying the tests: English VPs

What is the evidence that verb + object forms a constituent in English?

- Replace by single word? Who killed Roger Rabbit? John did.
- Coordination: You can either surrender these documents or move to Mexico.
- Question and answers: What are you going to do now? Give my dog a bath.
- Reorderings: I will dance with your mother if I must, but kiss your sister I will not. I try, whenever circumstances allow it, to give Helen the benefit of the doubt.
- Right node raising:

Applying the tests: English VPs

What is the evidence that verb + object forms a constituent in English?

- Replace by single word? Who killed Roger Rabbit? John did.
- Coordination: You can either surrender these documents or move to Mexico.
- Question and answers: What are you going to do now? Give my dog a bath.
- Reorderings: I will dance with your mother if I must, but kiss your sister I will not. I try, whenever circumstances allow it, to give Helen the benefit of the doubt.
- Right node raising: My father occasionally, and my mother regularly, lets the cat into the bedroom.

The English VP: ellipsis

- English VPs have a property not shared by any other constituents, namely that they can be deleted when recoverable

The English VP: ellipsis

- English VPs have a property not shared by any other constituents, namely that they can be deleted when recoverable
- Crucially different from gapping
  - Ernie loves the French girl, Bert _ the Russian _.
  - I drank beer and Peter _ liquor.

The English VP: ellipsis

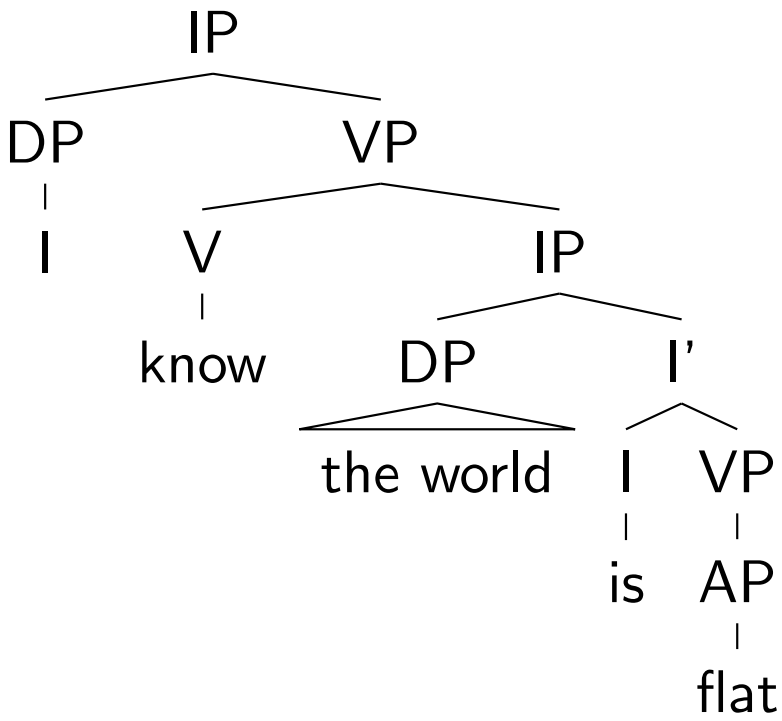
- English VPs have a property not shared by any other constituents, namely that they can be deleted when recoverable
- Crucially different from gapping
  - Ernie loves the French girl, Bert _ the Russian _.
  - I drank beer and Peter _ liquor.
- Gapping is only possible in parallel, coordinated clauses; that's not the case with VP ellipsis
  - *If I drink beer, then Peter liquor.
  - If I drink beer, then Peter will _ too.

The English VP: ellipsis

- English VPs have a property not shared by any other constituents, namely that they can be deleted when recoverable
- Crucially different from gapping
  - Ernie loves the French girl, Bert _ the Russian _.
  - I drank beer and Peter _ liquor.
- Gapping is only possible in parallel, coordinated clauses; that's not the case with VP ellipsis
  - *If I drink beer, then Peter liquor.
  - If I drink beer, then Peter will _ too.
- VP ellipsis must leave at least one auxiliary behind
  - Max didn't help me with the dishes, but his brother *(did) _.
- The simplest analysis of all this involves a VP category

Copula clauses

Can you think of a way of motivating the VP above the AP in this tree that we already saw?



Economy of expression

All syntactic phrase structure nodes are optional and are not used unless required to license elements required to create a well-formed f-structure or to add semantic content.

Phrase structure rules

- LFG expresses constraints on licit c-structures via phrase structure rules
- Let us have closer look at the rules Falk proposes (p. 46), and motivate them

Functional maximal projections

CP	$\rightarrow$	XP C′	
IP	$\rightarrow$	(DP|CP|PP) I′	
DP	$\rightarrow$	DP D′	Typo in Falk!

Functional single-bar projections

$$
\begin{array}{lcl}
C' & \rightarrow & C\ IP \\
I' & \rightarrow & I\ VP \\
D' & \rightarrow & D\ NP
\end{array}
$$

Lexical phrases

VP $\rightarrow$ V DP DP PP* (IP|CP)
PP $\rightarrow$ P DP PP IP
NP $\rightarrow$ N PP* CP
AP $\rightarrow$ A PP (IP|CP)

Factorising the rules

- Phrase structure rules such as these express both dominance and precedence

Factorising the rules

- Phrase structure rules such as these express both dominance and precedence
- Falk "factorises" this into immediate dominance (ID) and linear precedence (LP) rules

Factorising the rules

- Phrase structure rules such as these express both dominance and precedence
- Falk "factorises" this into immediate dominance (ID) and linear precedence (LP) rules
- We can use the rules on the previous slides as ID rules (formally this will be expressed by putting commas between the daughter nodes)

Factorising the rules

- Phrase structure rules such as these express both dominance and precedence
- Falk "factorises" this into immediate dominance (ID) and linear precedence (LP) rules
- We can use the rules on the previous slides as ID rules (formally this will be expressed by putting commas between the daughter nodes)
- Separate LP rules can then be stated which apply across the ID rules

Factorising the rules

- Phrase structure rules such as these express both dominance and precedence
- Falk "factorises" this into immediate dominance (ID) and linear precedence (LP) rules
- We can use the rules on the previous slides as ID rules (formally this will be expressed by putting commas between the daughter nodes)
- Separate LP rules can then be stated which apply across the ID rules
  - heads initial
  - specifiers initial
  - DP $\prec$ PP
  - PP ($\prec$ (IP|CP)) final

Adjunction

- APs and AdvPs adjoin to the left, PPs to the right

XP $\rightarrow$ (AP|AdvP) XP
XP $\rightarrow$ XP PP

Adjunction

- APs and AdvPs adjoin to the left, PPs to the right

$$\begin{aligned} XP &\rightarrow (AP|AdvP)\ XP \\ XP &\rightarrow XP\ PP \end{aligned}$$

- We can express this with a single ID rule and a single LP rule

$$\begin{aligned} XP &\rightarrow (AP|AdvP\ |PP),\ XP \\ (AP|AdvP) &\prec (NP|AP\ |PP) \end{aligned}$$

Coordination

$$X \rightarrow X^{+} \text{ CONJ } X$$

- The superscript $+$ means 'one or more' and so violates economy of expression

Coordination

$$X \rightarrow X^{+} \text{ CONJ } X$$

- The superscript $+$ means 'one or more' and so violates economy of expression
- The rule is also the only exocentric rule in Falk's toy grammar of English

Coordination

$$X \rightarrow X^{+} \text{ CONJ } X$$

- The superscript $+$ means 'one or more' and so violates economy of expression
- The rule is also the only exocentric rule in Falk's toy grammar of English

Exocentricity

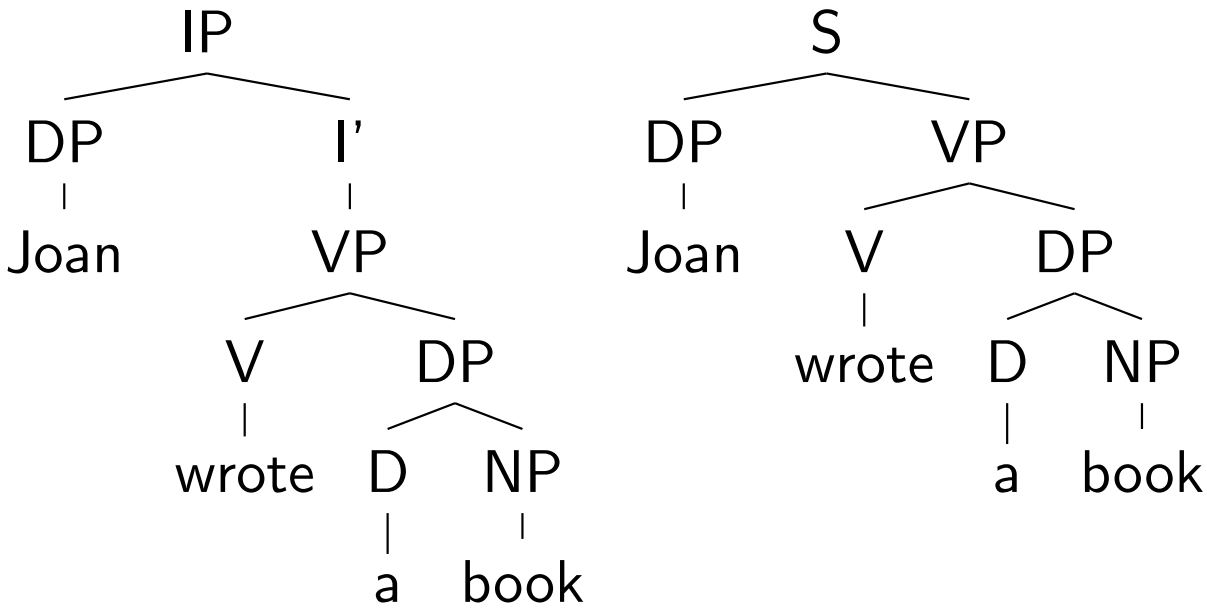
- Apart from coordinations, LFG normally only assumes a single exocentric category, S

Exocentricity

- Apart from coordinations, LFG normally only assumes a single exocentric category, S
- S figures prominently in LFG work on "free word/constituent order"

Exocentricity

- Apart from coordinations, LFG normally only assumes a single exocentric category, S
- S figures prominently in LFG work on "free word/constituent order"
- How do we choose between the following analyses of an English sentence without auxiliary?



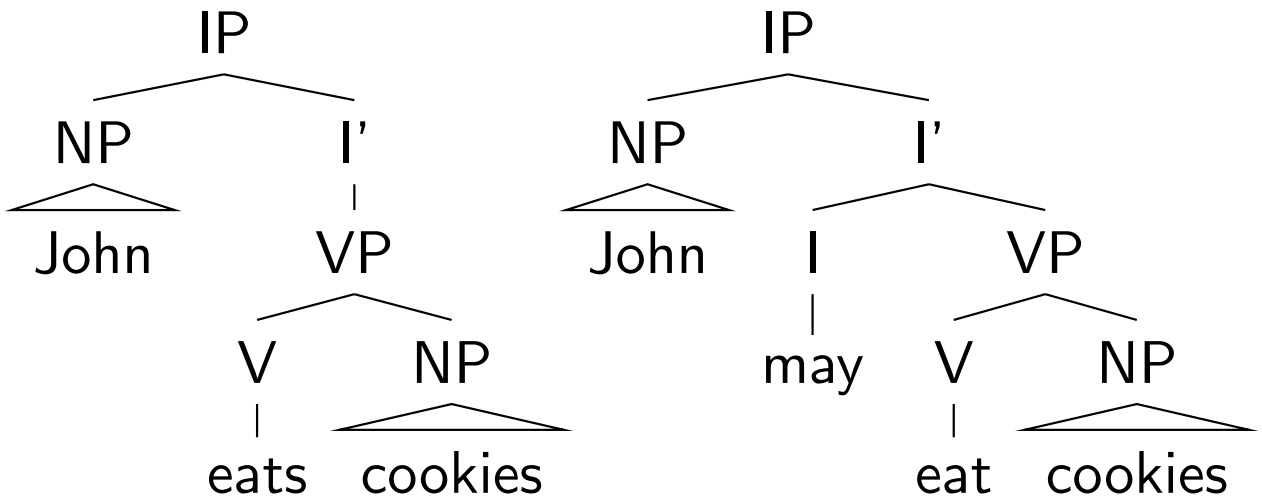
Kannada

naavu pustaka oodtiivi	'We are reading the book'
avaḷu pustaka oodtaḷe	'She is reading the book'
naanu bande	'I arrived'
naanu pustaka oodde	'I read (PAST) the book'
naanu pustaka huḍukuttiddeene	'I am looking for a book'

1. Draw the phrase structure tree for the first sentence
2. Write the phrase structure rules necessary for capture this data

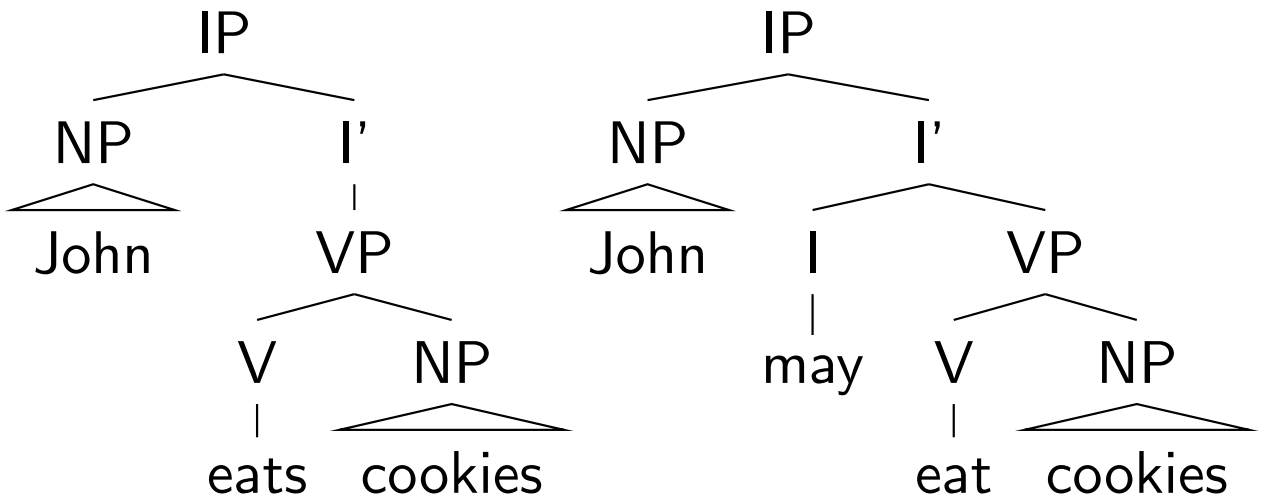
Head movement - verb raising

Let us assume the following trees for English sentences with and without an auxiliary



Head movement - verb raising

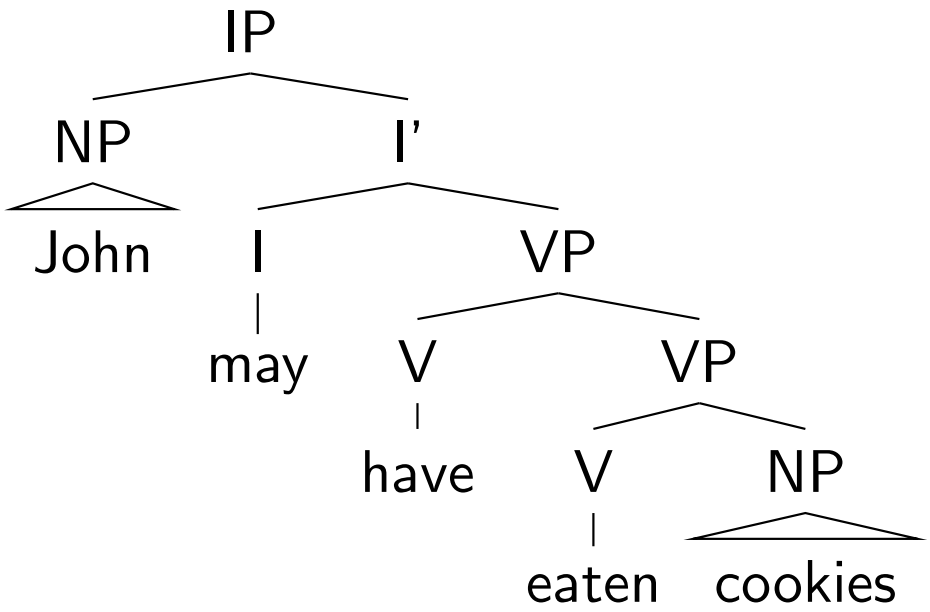
Let us assume the following trees for English sentences with and without an auxiliary



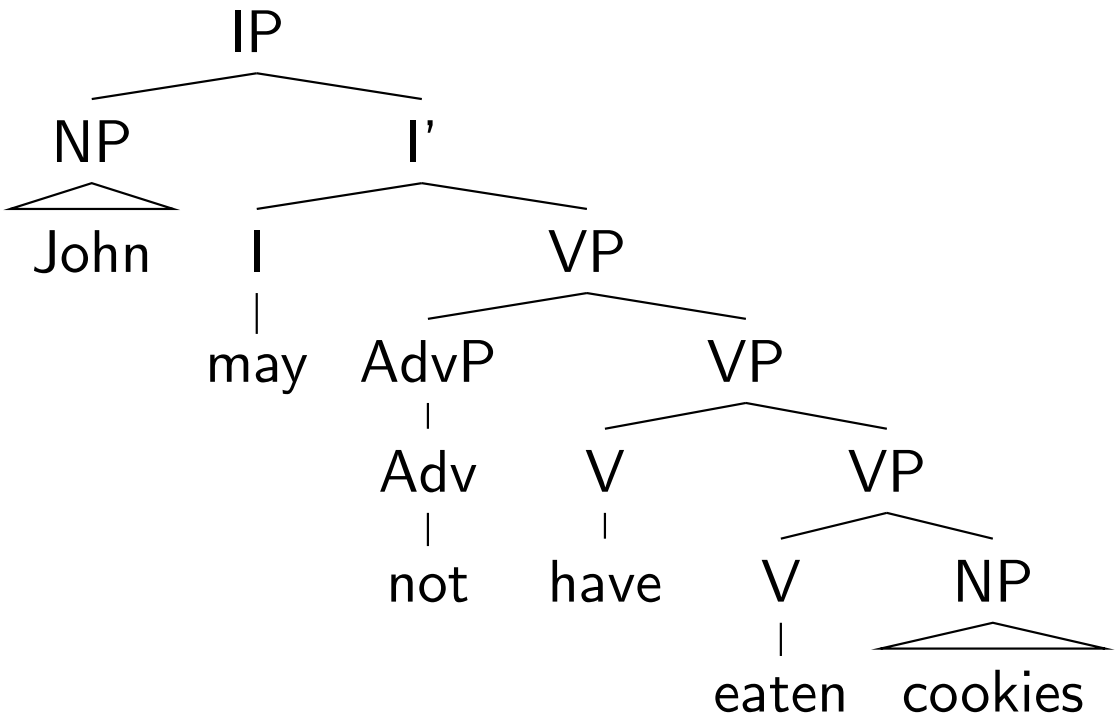
How do we capture the following contrast?

(4) John may have eaten the cookies.

(5) *John has may eaten the cookies.



Now where does negation go?


IP
NP
I'
John
I
VP
may
AdvP
VP
Adv
V
VP
not
have
V
NP
eaten
cookies

How can we analyze this data from Norwegian?

(6) Jonas har spist eplet.

(7) Jonas har ikke spist eplet.

(8) *Jonas ikke har spist eplet.

(9) Jonas spiste eplet.

(10) Jonas spiste ikke eplet.

(11) *Jonas ikke spiste eplet.

Draw tree structures for the grammatical sentences!

Wambaya

(12) Dawu gina alaji janyi-ni
bite 3.SG.M.ERG.PST boy.ABS dog-ERG

(13) a. Dawu gina janyi-ni alaji
b. Alaji gina janyi-ni dawu
c. Alaji gina dawu janyi-ni
d. Janyi-ni gina dawu alaji
e. Janyi-ni gina alaji dawu

(14) Naniyawulu nagawulu barajbulu
that.DU.ABS female.DU.ABS old.person.DU.ABS
wurlun duwa.
3DU.NONPST-PROG get.up
'The two old women are getting up.'