EBERHARD KARLS
UNIVERSITÄT
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Faculty of Philosophy
General Linguistics

Syntax & Semantics WS2019/2020

Lecture 11: Lexical Functional Grammar II (LFG)

29/11/2019, Christian Bentz

Overview

Section 1: Recap of Lecture 10

Section 2: Historical Notes
- Analyzed Languages

Section 3: Basic Definitions
- Notational Conventions
- Glossary

Section 4: Functional Structure (F-Structure)

Section 5: Constituent Structure (C-Structure)

Section 6: Mapping between C-Structure and F-Structure

Section 7: Pros and Cons of LFG
- Pros (Advantages)
- Cons (Disadvantages)

Exercises

Section 8: References

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Section 1: Recap of Lecture 10

Untyped Feature Descriptions

A typical example of **untyped feature descriptions** are matrices that contain inflectional information of a given word form. In this particular context, the *feature values* are often given without the *feature labels*, since there is little syncretism between feature values which could make them ambiguous.

Example from GB theory (Lecture 7):

$$\textit{drank}: \begin{bmatrix} +\textit{past} \\ 3\textit{pers} \\ +\textit{sg} \end{bmatrix}.$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Notational Conventions

However, to be maximally specific we will here use *upper case letters* for **feature labels**, and *lower case italics* for **feature values**, and always give both in the feature descriptions.

Example from Müller describing a person:

$$\begin{bmatrix} \text{FIRSTNAME} & \textit{max} \\ \text{LASTNAME} & \textit{meier} \\ \text{DATE-OF-BIRTH} & \textit{10.10.1985} \end{bmatrix}$$

Example from above for *drank*:

$$\begin{bmatrix} \text{TENSE} & \textit{past} \\ \text{PERSON} & \textit{3} \\ \text{NUMBER} & \textit{sg} \end{bmatrix}$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Embedding: Linguistic Example

A linguistic example of embeddings of feature descriptions is *derivational morphology*, which can create a new word form out of a word form that functions as a stem for derivational affixes.

Word form: *unhelpfully*

$$\begin{bmatrix} \text{POS} & \textit{adv} & & \\ \text{STEM} & \begin{bmatrix} \text{POS} & \textit{adj} & & \\ \text{STEM} & \begin{bmatrix} \text{POS} & \textit{adj} & \\ \text{STEM} & \begin{bmatrix} \text{POS} & \textit{noun} \vee \textit{verb} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Lists: Linguistic Examples

Going beyond the word level, we might want to capture the feature description, for example, of whole phrases such as *the green house*. In this particular example, we assume a HEAD feature for *house*, and a list of feature descriptions for the *complements* (COMPS).[1]

phrase: *the green house*

$$\begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{POS} & \textit{noun} \\ \text{CASE} & \textit{nom} \vee \textit{acc} \vee \textit{dat} \\ \text{NUMBER} & \textit{sg} \end{bmatrix} \\ \text{COMPS} & \left\langle \begin{bmatrix} \text{POS} & \textit{det} \end{bmatrix}, \begin{bmatrix} \text{POS} & \textit{adj} \end{bmatrix} \right\rangle \end{bmatrix}$$

[1] This is similar to what we will see in Head-Driven Phrase Structure Grammar, though in HPSG the article would be considered a specifier rather than a complement.

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Typed Feature Descriptions: Linguistic Example

When we deal, for instance, with *word forms* in our linguistic analyses, we might define a feature structure for the type *word*. Note, however, that the content of this structure is dependent on the theory we adopt, and the particular language we analyze.

Possible feature structure of the type *word*:

word	
ASPECT	*aspect*
BOUNDEDNESS	*boundedness*
CASE	*case*
GENDER	*gender*
MOOD	*mood*
NUMBER	*number*
PERSON	*person*
POS	*pos*
TENSE	*tense*
etc.	

Note: BOUNDEDNESS is here introduced to distinguish between *morphemes* and *words*, morphemes are *bound*, words are *unbounded* (according to the traditional definition.)

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Structure Sharing: Lingustic Example

A linguistic example of structure sharing is **agreement**. In the example below, between determiner, adjective and noun in German.

phrase: *das grüne Haus*

$$\begin{bmatrix} \textit{phrase} & & \\ \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{CASE} & \boxed{1}\ \textit{nom} \vee \textit{acc} \\ \text{GENDER} & \boxed{2}\ \textit{neut} \\ \text{NUMBER} & \boxed{3}\ \textit{sg} \end{bmatrix} \\ \text{COMPS} & \left\langle \begin{bmatrix} \textit{determiner} & \\ \text{CASE} & \boxed{1} \\ \text{GENDER} & \boxed{2} \\ \text{NUMBER} & \boxed{3} \end{bmatrix}, \begin{bmatrix} \textit{adjective} & \\ \text{CASE} & \boxed{1} \\ \text{GENDER} & \boxed{2} \\ \text{NUMBER} & \boxed{3} \end{bmatrix} \right\rangle \end{bmatrix}$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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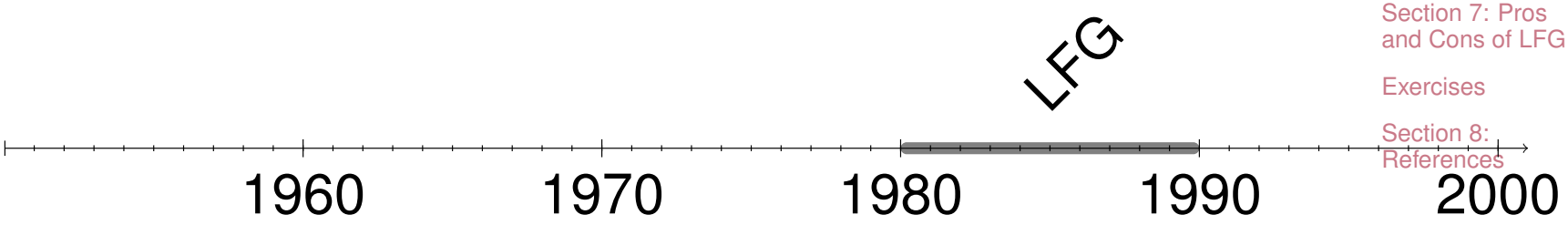
Section 2: Historical Notes

Historical Perspective

"Lexical Functional Grammar (LFG) was developed in the 80s by Joan Bresnan and Ron Kaplan (Bresnan & Kaplan 1982). LFG forms part of so-called West-Coast linguistics: unlike MIT, where Chomsky works and teaches, the institutes of researchers such as Joan Bresnan and Ron Kaplan are on the west coast of the USA [...]. Bresnan & Kaplan (1982) view LFG explicitly as a psycholinguistically plausible alternative to transformation-based approaches."

Müller (2019). Grammatical theory, p. 222.



Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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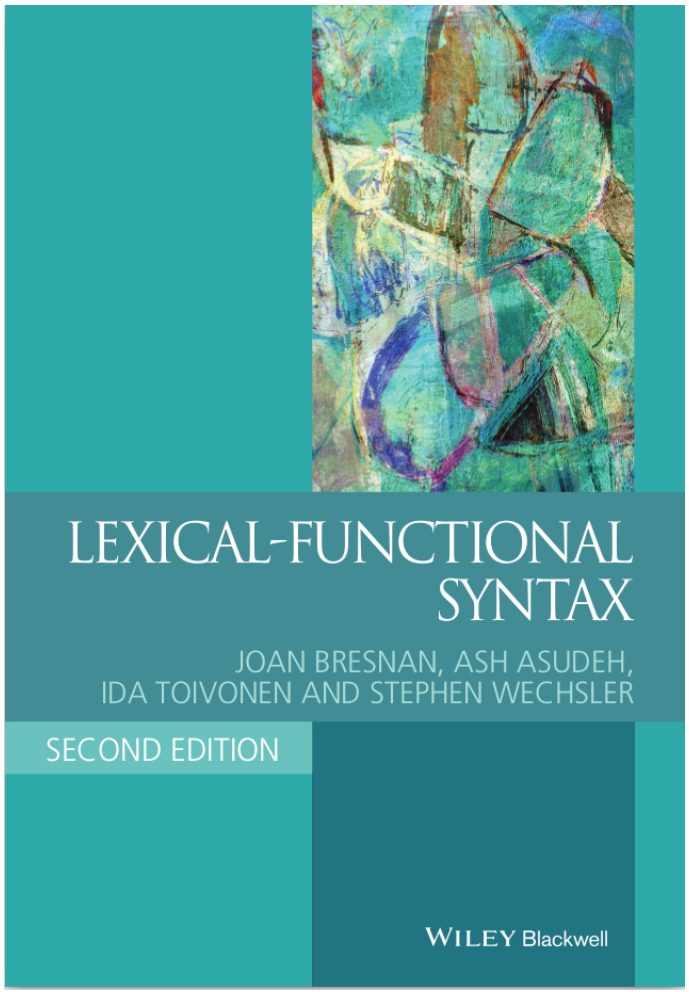
What is LFG?

"LFG (lexical-functional grammar) is a theory of grammar which has a powerful, flexible, and mathematically well-defined grammar formalism designed for typologically diverse languages. LFG has provided the framework for a substantial amount of descriptive and theoretical research on many languages [...]"

Bresnan et al. (2016).
Lexical-Functional Syntax, p. xi.



Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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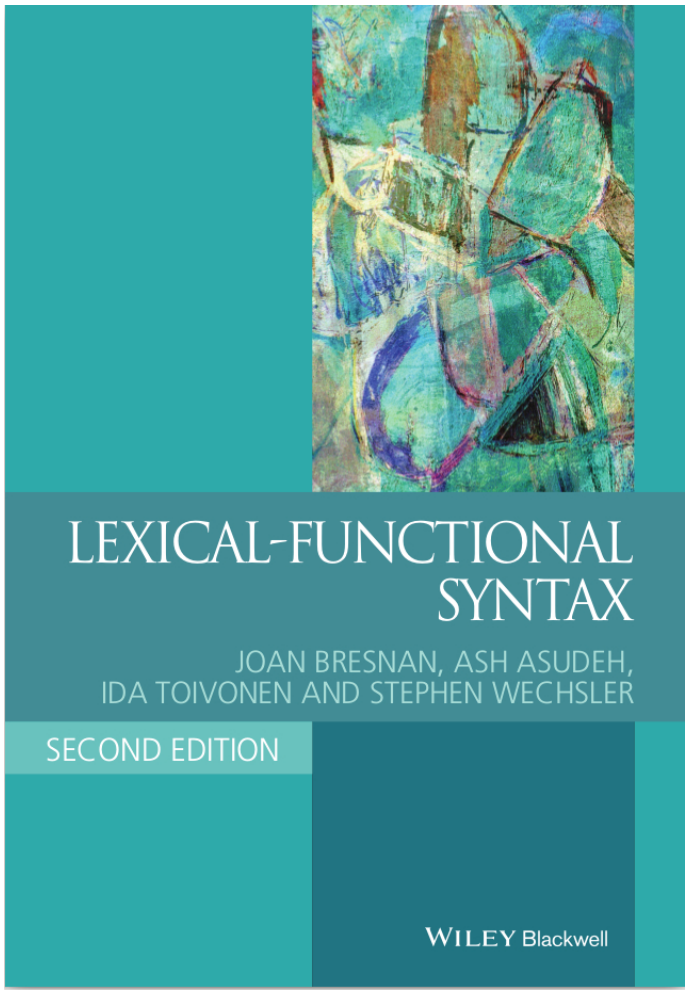
How is it different?

- "LFG is closely attuned to the **overt perceptible expressions** of language [...]"
- "[...] there are **no 'deep structures'** or 'initial structures.'"
- "Being designed for a wide range of **nonconfigurational** and **configurational** language types, LFG departs radically from most other grammar formalisms in one striking way: it is **noncompositional**, allowing the 'content' of a constituent to vary depending on its context."

Bresnan et al. (2016).
Lexical-Functional Syntax, p. xi.



Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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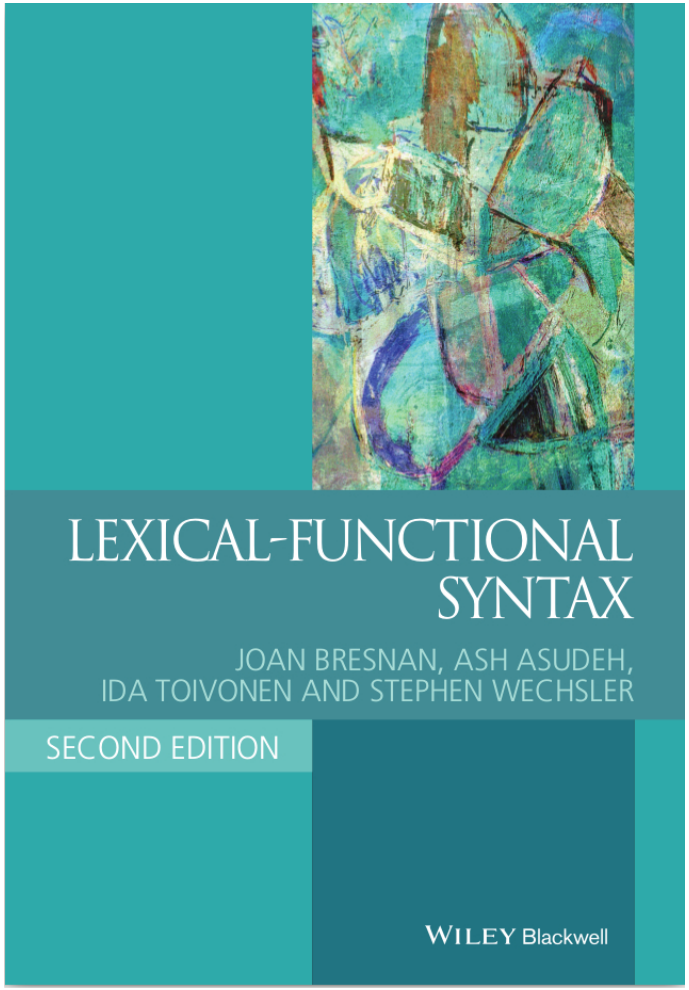
Psycholinguistic Plausibility

"LFG has attracted interest beyond linguistics proper, and has been incorporated into psychological theories of language acquisition, perception, and production, as well as into computational systems of language processing."

Bresnan et al. (2016).
Lexical-Functional Syntax, p. 85.



Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Languages analyzed by LFG

Arabic, Arrernte, **Bengali**, **Danish**, **English**, **French**, Georgian, **German**, Hungarian, Indonesian, **Italian**, **Irish**, Japanese, Korean, Malagasy, Mandarin Chinese, Murrinh-Patha, **Norwegian**, **Polish**, **Portuguese**, **Spanish**, Tigrinya, Turkish, **Urdu/Hindi**, **Welsh**, Wolof

According to Müller (2019). Grammatical theory, p. 222.

Language Families[2]

Afro-Asiatic, Austronesian, Atlantic-Congo, **Indo-European**, Japonic, Kartvelian, Pama-Nyungan, Sino-Tibetan, Southern Daly, Turkic, Uralic

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

[2] According to Glottolog 4.0, https://glottolog.org/.

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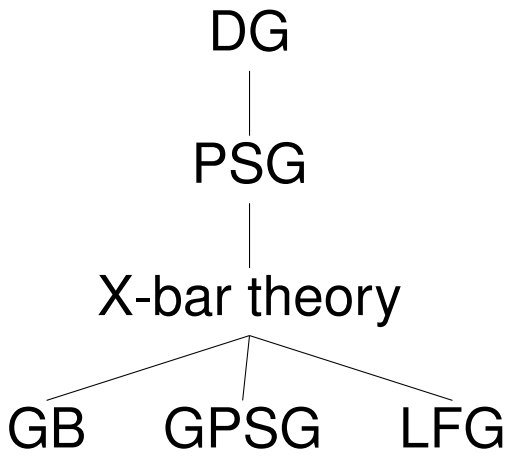
Syntactic Framework Tree



DG: Dependency Grammar
PSG: Phrase Structure Grammar
GB: Government & Binding
GPSG: Generalized Phrase Structure Grammar
LFG: Lexical Functional Grammar

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Section 3: Basic Definitions

Grammatical Functions

"In LFG, grammatical functions such as **subject** and **object** play a very important role. Unlike in most other theories discussed in this book, they are primitives of the theory."

Müller (2019). Grammatical theory, p. 223.

David devoured a sandwich.

$$\begin{bmatrix} \text{PRED} & \text{'DEVOUR}\langle \textbf{SUBJ}, \textbf{OBJ} \rangle\text{'} \\ \textbf{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'DAVID'} \end{bmatrix} \\ \textbf{OBJ} & \begin{bmatrix} \text{SPEC} & \text{A} \\ \text{PRED} & \text{'SANDWICH'} \end{bmatrix} \end{bmatrix}$$

Note: Example with the notation given in Müller (2019).

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Note: Structure Sharing Notation

It would also be possible to use indeces to indicate structure sharing, since the subject and the object of the predicate list and the SUBJ and OBJ features have to be the same entities. However, we here follow Müller und keep using the abbreviations of grammatical functions for ease of readability.

David devoured a sandwich.

$$\begin{bmatrix} \text{PRED} & \text{`DEVOUR}\left\langle \boxed{1}, \boxed{2} \right\rangle\text{'} \\ \boxed{1} & \begin{bmatrix} \text{PRED} & \text{`DAVID'} \end{bmatrix} \\ \boxed{2} & \begin{bmatrix} \text{SPEC} & \text{A} \\ \text{PRED} & \text{`SANDWICH'} \end{bmatrix} \end{bmatrix}$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Interlude: Notational Conventions

We will change the notation – compared to Müller (2019) – slightly. This is in order to a) stay closer to the reference introduction by Bresnan et al. (2016), and b) to keep it as close as possible to the notation used in the lecture on *Feature Descriptions*.

Müller (2019). Grammatical theory, p. 223.

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

David devoured a sandwich.

$$\begin{bmatrix} \text{PRED} & \text{`devour}\left\langle \text{SUBJ,OBJ} \right\rangle\text{'} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`david'} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \text{a} \\ \text{PRED} & \text{`sandwich'} \end{bmatrix} \end{bmatrix}$$

Note: I added a TENSE feature here for illustration puproses, but also since it is relevant here for inflection (i.e. devour-ed).

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Interlude: Notational Conventions

The symbols in **upper case letters** are **features** in accordance with the lecture on *Feature Descriptions* (though called *attributes* by Bresnan et al., 2016).

David devoured a sandwich.

$$\begin{bmatrix} \textbf{PRED} & \text{'devour}\left\langle \text{SUBJ,OBJ} \right\rangle\text{'} \\ \textbf{TENSE} & \textit{past} \\ \textbf{SUBJ} & \begin{bmatrix} \textbf{PRED} & \text{'david'} \end{bmatrix} \\ \textbf{OBJ} & \begin{bmatrix} \textbf{SPEC} & \text{a} \\ \textbf{PRED} & \text{'sandwich'} \end{bmatrix} \end{bmatrix}$$

Note: We could here also specify further features of the predicate (*devour*) and the subject and object, for example, NUMBER and PERSON. However, note that these features are here not relevant in terms of agreement since *devoured* could occur with any person and number.

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Interlude: Notational Conventions

The symbols in **lower case italics** are **feature values** in accordance with the lecture on *Feature Descriptions*.

David devoured a sandwich.

$$\begin{bmatrix} \text{PRED} & \text{‘devour}\left\langle \text{SUBJ,OBJ} \right\rangle\text{’} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{‘david’} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \text{a} \\ \text{PRED} & \text{‘sandwich’} \end{bmatrix} \end{bmatrix}$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Interlude: Notational Conventions

The strings in **single quotation marks** and **normal script** (not italics or upper case) are also **feature values**. However, they constitute a particular type of feature value that is called a **semantic form** by Bresnan et al. (2016), p. 44.

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

David devoured a sandwich.

$$\begin{bmatrix} \text{PRED} & \text{‘}\textbf{devour}\left\langle \textbf{SUBJ,OBJ} \right\rangle\text{’} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{‘}\textbf{david}\text{’} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \textbf{a} \\ \text{PRED} & \text{‘}\textbf{sandwich}\text{’} \end{bmatrix} \end{bmatrix}$$

Note: The specifier *a* is written without quotation marks in Müller (2019). This indicates that determiners – in contrast to other lexical items written inside quotation marks – are not considered to contribute meaning to the sentence.

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Predicates (PRED)

The **PRED feature** is used for all lexical items that **contribute meaning to the sentence** (remember the remarks on *predicate logic* in earlier lectures). The value of a PRED feature is either just a lexical item (e.g. 'david'), or – if the lexical item is a *head* (e.g. devour) which *governs grammatical functions* (e.g. SUBJ, OBJ) – then the lexical item is followed by a list specifying the grammatical functions.

$$\begin{bmatrix} \textbf{PRED} & \text{'devour}\langle \text{SUBJ,OBJ} \rangle\text{'} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \textbf{PRED} & \text{'david'} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \text{a} \\ \textbf{PRED} & \text{'sandwich'} \end{bmatrix} \end{bmatrix}$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Notation Glossary

ADJ: adjunct

BEN: benefactive

COMP: complement feature (typically representing a *that*-clause)

OBJ: object feature

OBL: oblique feature (typically prepositional phrases required as arguments of the head-verb)

PRED: predicate feature

SPEC: specifier (here typically used for determiners)

SUBJ: subject feature

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Section 4: Functional Structure (F-Structure)

Functional Structure (F-Structure)

The **functional structure (f-structure)** is essentially a *feature description for a whole phrase*. The head of this phrase is given under PRED, the grammatical functions that it *governs* (e.g. SUBJ and OBJ) are separate features with their embedded feature descriptions. Hence, the *valence* of a head is specified by the PRED value.

Müller (2019). Grammatical theory, p. 223.

f-structure for *David devoured a sandwich*:

$$\begin{bmatrix} \text{PRED} & \text{`devour}\left\langle \text{SUBJ,OBJ} \right\rangle\text{'} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`david'} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \text{a} \\ \text{PRED} & \text{`sandwich'} \end{bmatrix} \end{bmatrix}$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Governable Grammatical Functions

It follows from the definitions above that **governable grammatical functions** are the ones which have to be specified by the head of the overall phrase.

- SUBJ: subject
- OBJ: object
- OBJ_θ: so-called *secondary* object(s). In English, there is only OBJ_{THEME}, where the *theme* typically corresponds to the direct object of a ditransitive sentence (e.g. *gave the book* ...)
- COMP: sentential complement (*that*-clause)
- OBL: so-called *oblique grammatical functions*, e.g. OBL_{LOC}. Often correspond to adpositional phrases which are necessary to build a grammatical sentence. Remember the example of *to be located* which takes an *obligatory* argument, namely, a prepostional phrase starting with *in...* or *at...*.

Adopted from Müller (2019). Grammatical theory, p. 224.

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Non-Governable Grammatical Functions

Non-governable grammatical functions are then the ones which are not specified by the head (i.e. not being arguments of the head).

- ADJ: adjuncts (typically adpositional phrases)
- TOPIC: the topic of an utterance
- FOCUS: the focus of an utterance

Note: we will not consider TOPIC and FOCUS constructions here.

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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F-Structure Examples: Intransitive Sentence

f-structure for *David sneezed*:

$$\begin{bmatrix} \text{PRED} & \text{`sneeze}\langle \text{SUBJ} \rangle\text{'} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`david'} \end{bmatrix} \end{bmatrix}$$

Governable functions (arguments): SUBJ
Non-Governable functions (adjuncts):

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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F-Structure Examples: Intransitive Sentence with Agreement

f-structure for *David sneezes*:

$$\begin{bmatrix} \text{PRED} & \text{‘sneeze}\langle \text{SUBJ} \rangle\text{’} \\ \text{NUMBER} & \boxed{1}\ sg \\ \text{PERSON} & \boxed{2}\ 3 \\ \text{TENSE} & pres \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{‘david’} \\ \text{NUMBER} & \boxed{1} \\ \text{PERSON} & \boxed{2} \end{bmatrix} \end{bmatrix}$$

Governable functions (arguments): SUBJ
Non-Governable functions (adjuncts):

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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F-Structure Examples: Intransitive Sentence + Oblique

f-structure for *Lions lived in the savannah*:

$$\begin{bmatrix} \text{PRED} & \text{`live}\left\langle \text{SUBJ, OBL}_{LOC} \right\rangle\text{'} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`lion'} \\ \text{NUMBER} & \textit{pl} \end{bmatrix} \\ \text{OBL}_{LOC} & \begin{bmatrix} \text{PRED} & \text{`in}\left\langle \text{OBJ} \right\rangle \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`savannah'} \\ \text{SPEC} & \text{the} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Governable functions (arguments): SUBJ, OBL_{LOC}
Non-Governable functions (adjuncts):

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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F-Structure Examples: Intransitive Sentence + Complement

f-structure for *David knows **that** he snores*:

$$\begin{bmatrix}
\text{PRED} & \text{'know}\langle\text{SUBJ, COMP}\rangle\text{'} \\
\text{NUMBER} & \boxed{1}\ sg \\
\text{PERSON} & \boxed{2}\ 3 \\
\text{TENSE} & pres \\
\text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'david'} \\ \text{NUMBER} & \boxed{1} \\ \text{PERSON} & \boxed{2} \end{bmatrix} \\
\text{COMP} & \begin{bmatrix} \text{PRED} & \text{'snore}\langle\text{SUBJ}\rangle\text{'} \\ \text{NUMBER} & \boxed{3}\ sg \\ \text{PERSON} & \boxed{4}\ 3 \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'he'} \\ \text{NUMBER} & \boxed{3} \\ \text{PERSON} & \boxed{4} \end{bmatrix} \end{bmatrix}
\end{bmatrix}$$

Governable functions (arguments): SUBJ, COMP

Non-Governable functions (adjuncts):

Note: The structure shared features of the subject in the main clause have to get different indices to the structure shared features of the complement clause (i.e. 1 and 2 versus 3 and 4). While in this particular example, the feature values are the same (i.e. *sg* and *3*), this does not have to be the case. For example, for the sentence *David knows that we snore* the feature values would be *3* and *sg* for the main clause, but *2* and *pl* for the complement clause.

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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F-Structure Examples: Transitive Sentence

f-structure for *David devoured a sandwich*:

$$\begin{bmatrix} \text{PRED} & \text{`devour}\left\langle \text{SUBJ,OBJ} \right\rangle\text{'} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`david'} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \text{a} \\ \text{PRED} & \text{`sandwich'} \end{bmatrix} \end{bmatrix}$$

Governable functions (arguments): SUBJ, OBJ
Non-Governable functions (adjuncts):

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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F-Structure Examples: Transitive Sentence + Adjunct

f-structure for *David devoured a sandwich in the library*:

$$\begin{bmatrix} \text{PRED} & \text{`devour}\langle \text{SUBJ,OBJ} \rangle\text{'} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`david'} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \text{a} \\ \text{PRED} & \text{`sandwich'} \end{bmatrix} \\ \text{ADJ} & \begin{bmatrix} \text{PRED} & \text{`in}\langle \text{OBJ} \rangle\text{'} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \text{the} \\ \text{PRED} & \text{`library'} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Governable functions (arguments): SUBJ, OBJ
Non-Governable functions (adjuncts): ADJ

Note: *the library* is here construed as an object of the prepositional head *in*. This is somewhat unusual, as in the other theories we have seen so far the noun phrase would here be construed as a complement.

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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F-Structure Examples: Transitive Sentence + Adjuncts

f-structure for *David devoured a sandwich in the library yesterday*:

$$\begin{bmatrix} \text{PRED} & \text{‘devour}\langle \text{SUBJ,OBJ} \rangle\text{’} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{‘david’} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \text{a} \\ \text{PRED} & \text{‘sandwich’} \end{bmatrix} \\ \text{ADJ} & \left\{ \begin{bmatrix} \text{PRED} & \text{‘in}\langle \text{OBJ} \rangle\text{’} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \text{the} \\ \text{PRED} & \text{‘library’} \end{bmatrix} \end{bmatrix}, \begin{bmatrix} \text{PRED} & \text{‘yesterday’} \end{bmatrix} \right\} \end{bmatrix}$$

Note: For Adjuncts, **curly brackets** (indicating a set) are used instead of the list brackets, since the order of adjuncts is irrelevant.

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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F-Structure Examples: Ditransitive Sentence

f-structure for *David gave her a book*:

$$\begin{bmatrix} \text{PRED} & \text{`give}\left\langle \text{SUBJ,OBJ,OBJ}_{\textit{THEME}} \right\rangle\text{'} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`david'} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`she'} \\ \text{CASE} & \textit{dat} \end{bmatrix} \\ \text{OBJ}_{\textit{THEME}} & \begin{bmatrix} \text{SPEC} & \text{a} \\ \text{PRED} & \text{`book'} \end{bmatrix} \end{bmatrix}$$

Note: We here also have a CASE feature which is relevant since the object has to be in dative case, and this changes *she* to *her*. If this was a noun or name (e.g. Susan) we wouldn't necessarily need the CASE feature, since these do not inflect for dative case in English.

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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F-Structure Examples: Ditransitive Sentence with Prepositional Phrase as Indirect Object

f-structure for *David gave a book* ***to her***:

$$\begin{bmatrix} \text{PRED} & \text{`give}\left\langle \text{SUBJ,OBJ}_{THEME}\text{, OBL}_{BEN} \right\rangle\text{'} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`david'} \end{bmatrix} \\ \text{OBJ}_{THEME} & \begin{bmatrix} \text{SPEC} & \text{a} \\ \text{PRED} & \text{`book'} \end{bmatrix} \\ \text{OBL}_{BEN} & \begin{bmatrix} \text{PRED} & \text{`she'} \\ \text{CASE} & \textit{dat} \end{bmatrix} \end{bmatrix}$$

Note: If the *indirect object* (here coded as the benefactive BEN of the giving) is realized by a prepositional phrase (e.g. *to*-phrase), then it is considered an oblique phrase (OBL_{BEN}) rather than an object. See also the discussion of different grammatical functions in Bresnan et al. (2016), p. 99.

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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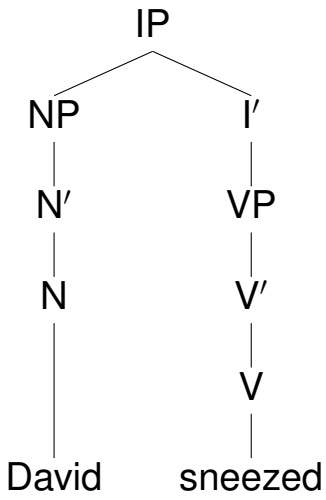
Section 5: Constituent Structure (C-Structure)

Constituent Structure (C-Structure)

"**c-structure** is the **constituent structure** and it is licensed by a phrase structure grammar. This phrase structure grammar uses $\overline{X}$ structures for languages for which this is appropriate."

Müller (2019). Grammatical theory, p. 223.

$\overline{X}$-theoretic **c-structure** for *David sneezed*:



Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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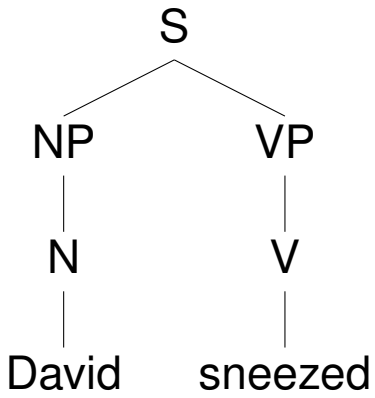
Constituent Structure (C-Structure)

However: We will use classical **binary PSG rules** as described in Lecture 5 for reasons of simplicity. Note that Bresnan et al. (2016) also use classical PSG rules in their introduction to f-structures and c-structures instead of $\overline{X}$ rules.

Classic PSG **c-structure** for *David sneezed*:



Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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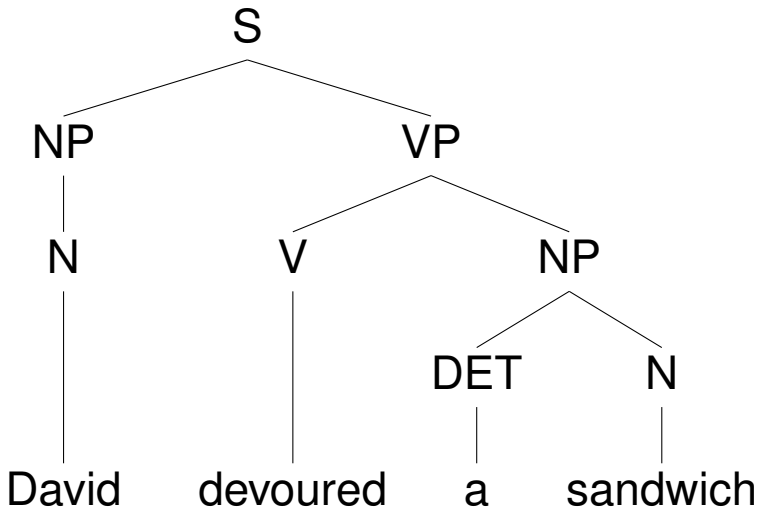
Constituent Structure (C-Structure)

"**c-structure** is the **constituent structure** and it is licensed by a phrase structure grammar. This phrase structure grammar uses $\overline{X}$ structures for languages for which this is appropriate."

Müller (2019). Grammatical theory, p. 223.

c-structure for *David devoured a sandwich*:



Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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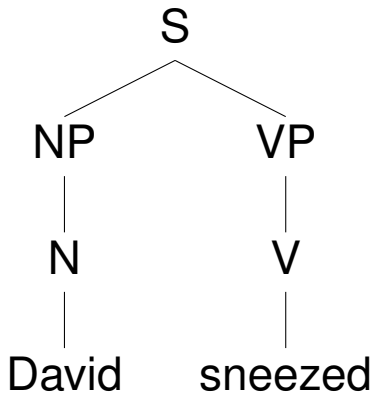
Section 6: Mapping between C-Structure and F-Structure

Constituent Structure (C-Structure)

Nodes in the c-structure tree can be connected to the corresponding **feature description (f-structure)**. This will here be indicated with *red color*, while arrows are used in Bresnan et al. (2016) and Müller (2019) to the same effect.

c-structure:



f-structure:

$$\begin{bmatrix} \text{PRED} & \text{`sneeze}\langle \text{SUBJ} \rangle\text{'} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`david'} \end{bmatrix} \end{bmatrix}$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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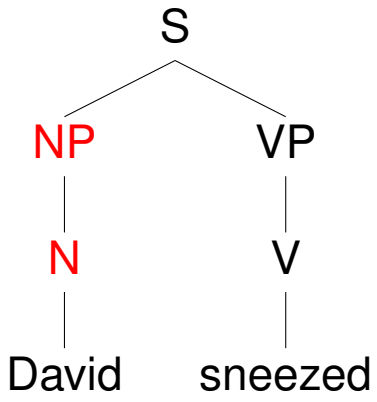
Constituent Structure (C-Structure)

For example, the subject in the NP is equivalent to the SUBJ|PRED feature in the f-structure.

c-structure:



f-structure:

$$\begin{bmatrix} \text{PRED} & \text{‘sneeze}\langle \text{SUBJ} \rangle\text{’} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{‘david’} \end{bmatrix} \end{bmatrix}$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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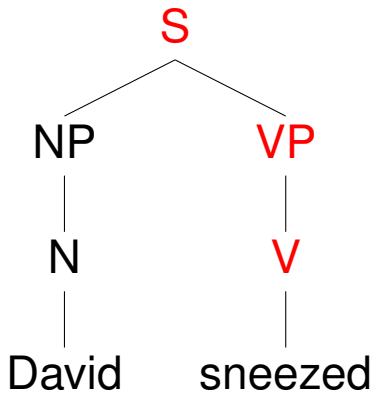
Constituent Structure (C-Structure)

The **highest level node** (e.g. S in PSGs) together with the **overall head** of the sentence (e.g. VP and V) is connected to the entire f-structure. Note that S and VP can here not be teased apart since the outermost brackets scope over both the VP and the other elements of the sentence.

c-structure:



f-structure:

$$\begin{bmatrix} \text{PRED} & \text{`sneeze}\langle \text{SUBJ} \rangle\text{'} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`david'} \end{bmatrix} \end{bmatrix}$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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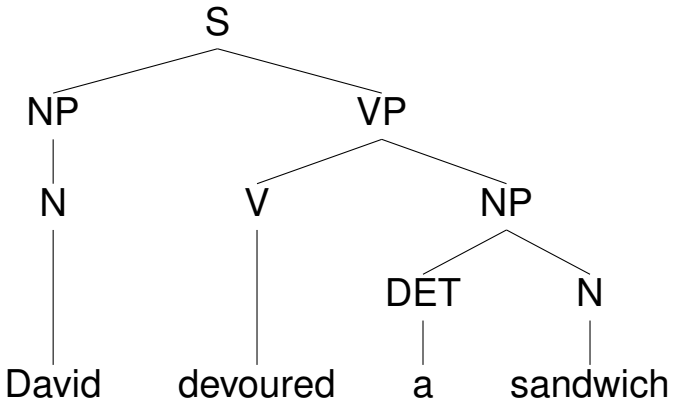
Constituent Structure (C-Structure)

Here is another example with the transitive sentence from above.

c-structure:



f-structure:

$$\begin{bmatrix} \text{PRED} & \text{‘devour}\langle \text{SUBJ,OBJ} \rangle\text{’} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{‘david’} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \text{a} \\ \text{PRED} & \text{‘sandwich’} \end{bmatrix} \end{bmatrix}$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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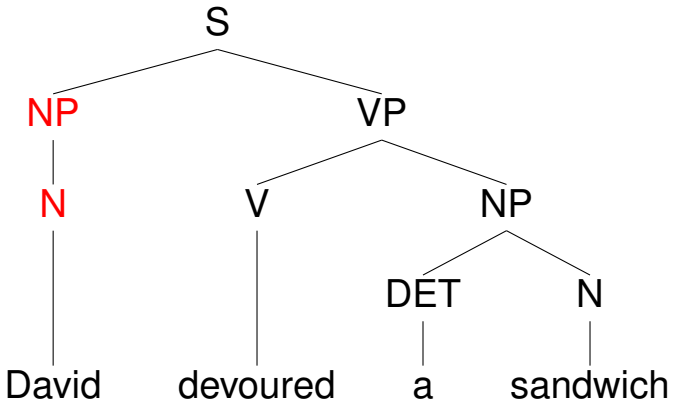
Constituent Structure (C-Structure)

The NP representing the subject in c-structure is equivalent to the value of SUBJ in f-structure.

c-structure:



f-structure:

$$\begin{bmatrix} \text{PRED} & \text{‘devour}\langle \text{SUBJ,OBJ} \rangle\text{’} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{‘david’} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \text{a} \\ \text{PRED} & \text{‘sandwich’} \end{bmatrix} \end{bmatrix}$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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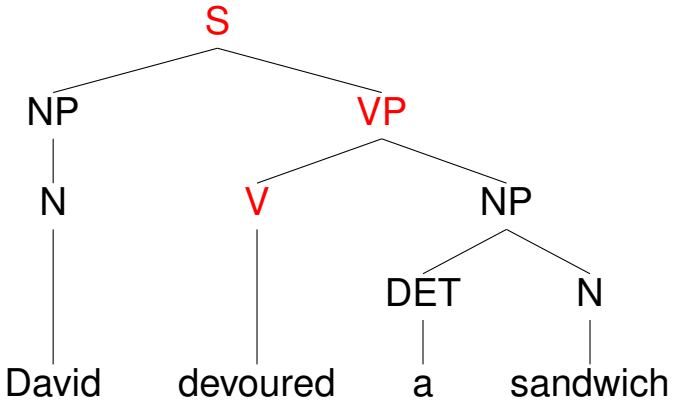
Constituent Structure (C-Structure)

The highest node (S) together with the overall head (VP) in c-structure are equivalent to the overall f-structure.

c-structure:



f-structure:

$$\begin{bmatrix} \text{PRED} & \text{'devour}\langle \text{SUBJ,OBJ} \rangle\text{'} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'david'} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \text{a} \\ \text{PRED} & \text{'sandwich'} \end{bmatrix} \end{bmatrix}$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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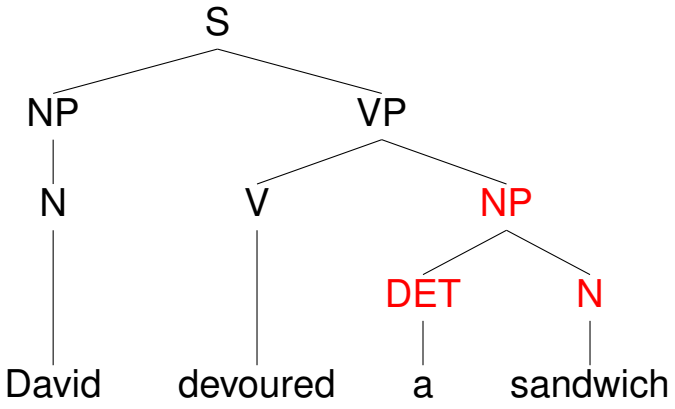
Constituent Structure (C-Structure)

The object NP of c-structure then corresponds to the OBJ value in f-structure.

c-structure:



f-structure:

$$\begin{bmatrix} \text{PRED} & \text{‘devour}\langle \text{SUBJ,OBJ} \rangle\text{’} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{‘david’} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \text{a} \\ \text{PRED} & \text{‘sandwich’} \end{bmatrix} \end{bmatrix}$$

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Section 7: Pros and Cons of LFG

Pros (Advantages)

- LFG is **fully formalized** and hence computationally implementable.
- LFG has the flexibility to deal with **configurational (fixed word order)** and **non-configurational (flexible word order)** languages. Note that the order of grammatical functions (e.g. SUBJ, OBJ) as well as adjuncts can – but does not have to be – constrained in the feature descriptions.
- **Agreement** and **case assignment** are modelled explicitely in the feature descriptions (similar to GPSG).
- Feature descriptions allow for analyses of long-distance dependencies and passive constructions **without recurrence to transformations** (though this was not discussed in this lecture).

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Cons (Disadvantages)

- **Feature descriptions are untyped**, which means that generalizations in terms of type hiearchies such as inheritance of features are not available (in contrast to HPSG).

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Exercise 1: Feature Descriptions

Consider the example sentences below from Imonda and Polish (glosses for Imonda: DUR (durative marker, i.e. marking an ongoing event); PST (past tense); BEN (benefactive marker, i.e. somebody is receiving sth.); 1 (first person); GL (goal marker, i.e. sb. is the goal of some action).

(1) atha **ne-n-b**.
sugarcane eat-PST-DUR
"He ate sugarcane."

(2) nne sobsaba **fi-ni-n-b**.
food cut do-BEN-PST-DUR
"They cut garden food for her."

(3) **ka toad-m** lōl-nòg
1 boys-GL talk-in.vain
"I talked to the boys in vain."

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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(4) To są **dobr-zy** **studen-ci**.
Those are good-M.NOM.PL student-M.NOM.PL
"Those are good students."

(5) To są **dobr-e** **student-ki**.
Those are good-F.NOM.PL student-F.NOM.PL
"Those are good students."

(6) **Pamiętam** wszystkich **mo-ich** **dobr-ych**
remember.PRS.1SG all my-M.GEN.PL good-M.GEN.PL
student-ów.
student-M.GEN.PL
"I remember all my good students."

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Do the following tasks:

1. Give the typed feature descriptions of the words in bold face. Assume that these all belong to the type *word* with the feature structure as given in the lecture. You can drop the feature BOUNDEDNESS. You can use the notation as given in the glossings. Assume that the benefactive marker and goal marker are case markers.
2. Give the typed feature description of *mo-ich dobr-ych student-ów* by using structure sharing as illustrated with *das grüne Haus* in the Lecture. Remember that we use *word* as type here, not individual POS!

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Exercise 2: LFG

Take the following English sentence:
The ghost resides happily in the shell.

1. Give the f-structure for this sentence according to the definitions and notation of lecture 11.
2. Give a c-structure for this sentence in the form of a binarized PSG tree (without morphological features).
3. Indicate how nodes in the tree correspond to different parts of the feature description (using arrows or colors). If you use arrows, the heads of the arrows should always point at the left outer bracket of a matrix.

Section 1: Recap of Lecture 10
Section 2: Historical Notes
Section 3: Basic Definitions
Section 4: Functional Structure (F-Structure)
Section 5: Constituent Structure (C-Structure)
Section 6: Mapping between C-Structure and F-Structure
Section 7: Pros and Cons of LFG
Exercises
Section 8: References

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Section 8: References

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Section 1: Recap of Lecture 10

Section 2: Historical Notes

Section 3: Basic Definitions

Section 4: Functional Structure (F-Structure)

Section 5: Constituent Structure (C-Structure)

Section 6: Mapping between C-Structure and F-Structure

Section 7: Pros and Cons of LFG

Exercises

Section 8: References

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Thank You.

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