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Syntax & Semantics WiSe 2022/2023

Lecture 13: Lexical Functional Grammar I (Feature Descriptions)

08/12/2022, Christian Bentz

Overview

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Section 1: Recap of Lecture 12 (Minimalism)

Features

Features are a core part of Minimalist Syntax. The term is here generally interpreted in a similar way as for so-called *feature descriptions* (see lectures on LFG and HPSG). An important terminological difference, however, is that the term *feature* in MP refers to a *feature value*, rather than to the *feature label*. For example, verbs might be said to have the "feature" *past*, *plural*, etc. Against this background, the following types of features are defined:

1. categorial features
2. ϕ-features
3. Case features
4. strong F, where F is categorial

Chomsky (2015). The Minimalist Program, p. 254.

Interpretable Features in English

Broad category:	**Feature labels:**	**Feature values:**
categorial features	POS	N, P, V, NP, VP, etc.
ϕ-features *of nouns*	GENDER	masculine, feminin, neuter
	NUMBER	singular, plural
	PERSON	1 person, 2 person, 3 person
Semantically interpretable features of predicates (*not* ϕ-features)	TENSE	present, past
	ASPECT	perfective, imperfective

Example:

(1) The girl saw ghost-s
the.NOM.3SG girl.F.NOM.3SG see/PAST.3SG ghost-N.ACC.3PL

Note: As pointed out above, feature labels are normally not given within the MP framework, only the feature values. I here add the feature labels for completeness. Also, it is assumed here that we know the GENDER value of *girl* and *ghost* (F and N) since these could be replaced by the respective pronouns, i.e. *she* and *it*.

Uninterpretable Features in English

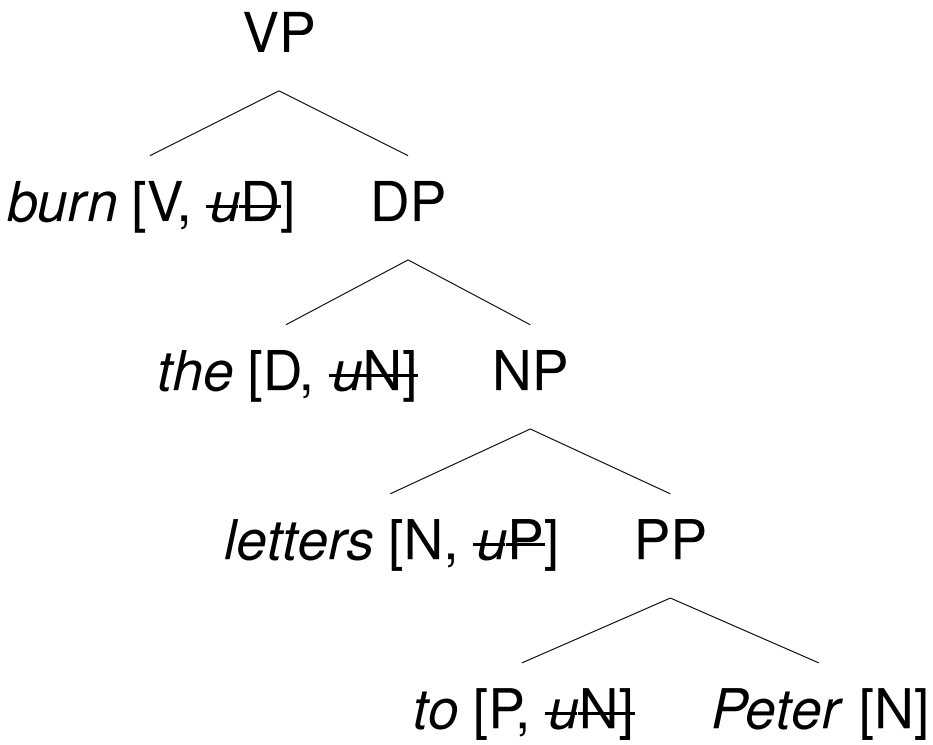
Broad category:	**Feature labels:**	**Feature values:**
ϕ-features *of predicates*	NUMBER	singular, plural
	PERSON	1 person, 2 person, 3 person
Case features	CASE	nominative, accusative
F features	_	strong, weak

Example:

(2) The girl saw ghost-s
the.NOM.3SG girl.F.NOM.3SG see/PAST.**3SG** ghost-N.ACC.3PL

Note: Somewhat counterintuitively, NUMBER and PERSON are supposed to be interpretable on *nouns*, but *not on verbs*. The idea is that the difference between *the child see-s* and *the child see* is somewhat arbitrary, and does not contribute to a change in meaning. However, the difference between *the child see* and *the children see* does contribute to a change in meaning. This definition is later used to justify why agreement is necessary between nouns and verbs.

Checking of Categorial Features: VP

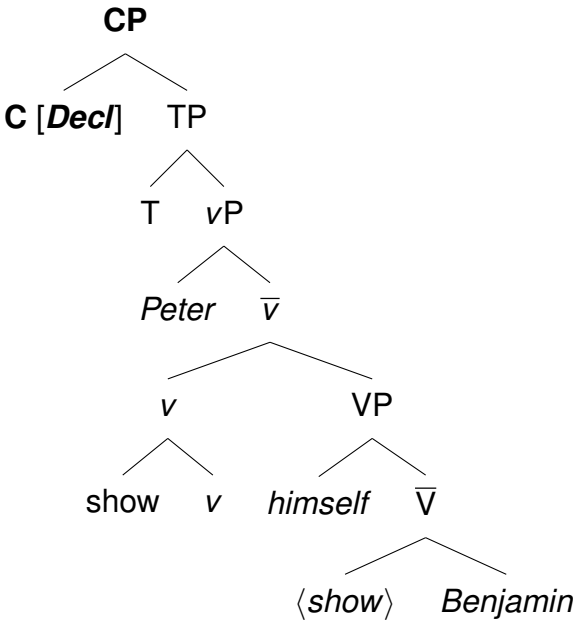


Adopted from Adger (2003), p. 84.

Complementizer Phrase (CP)

In contrast to GB – where full sentences could be IPs – full sentences in the MP are always **complementizer phrases**. The head of a complementizer phrase (C) can take an actual complementizer (e.g. *that*) or a wh-word (i.e. question word Q) as before in GB. However, if it is empty then it still contributes a so-called **clause-type feature**, e.g. *Decl* for *declarative*.

Müller (2019), p. 134.



Adopted from Müller (2019), p. 136.

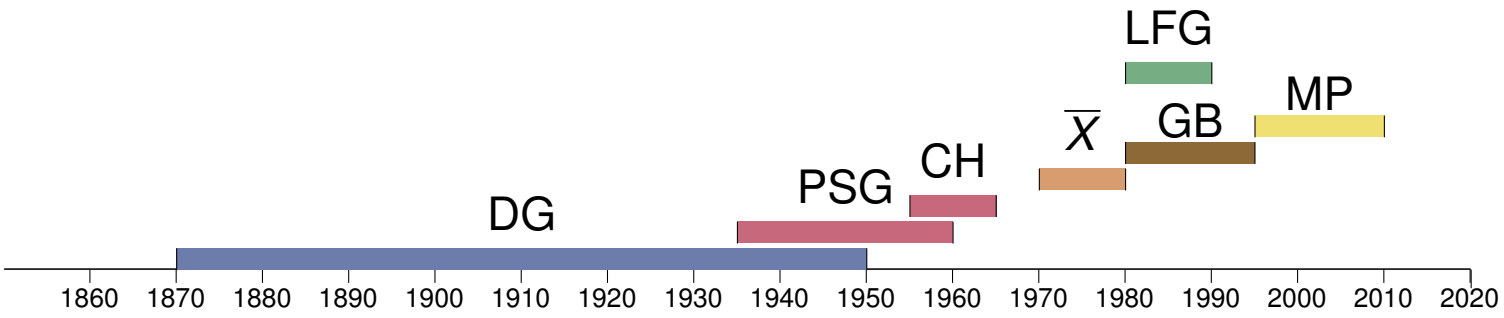
- The **Complementizer Phrase** (CP) is thus considered the highest level phrase in MP.
- Here we only look at the tree structure with the respective lexical items of the sentence, but without feature checking of categorial or inflectional features.
- Note that feature checking can also be relevant for the CP (see Adger 2003, pp. 240), but we do not discuss this here further.

Section 2: Historical Notes

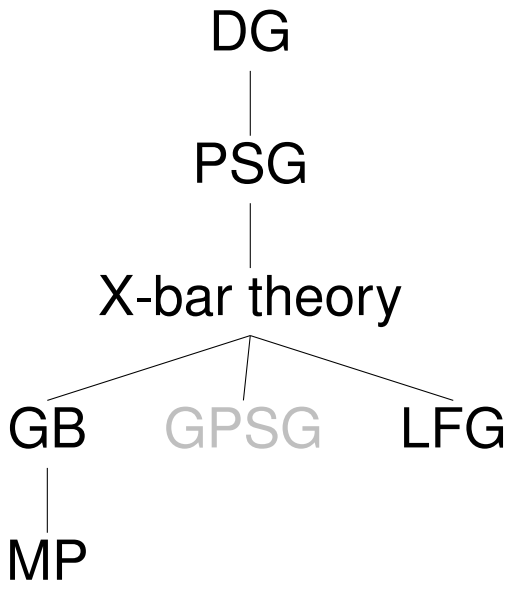
Historical Perspective

"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.



Syntactic Framework Tree

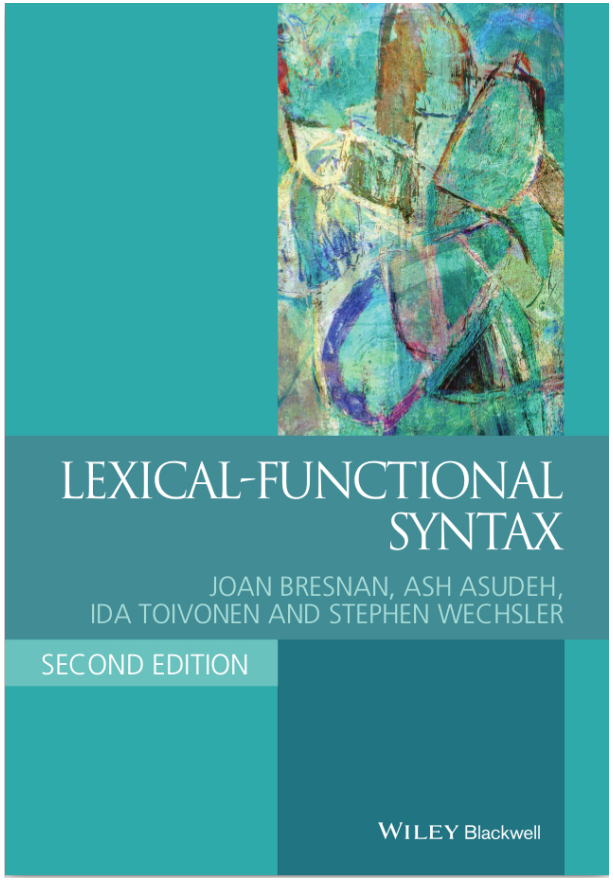


DG: Dependency Grammar
PSG: Phrase Structure Grammar
GB: Government & Binding
GPSG: Generalized Phrase Structure Grammar
LFG: Lexical Functional Grammar
MP: Minimalist Program

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 [...]"

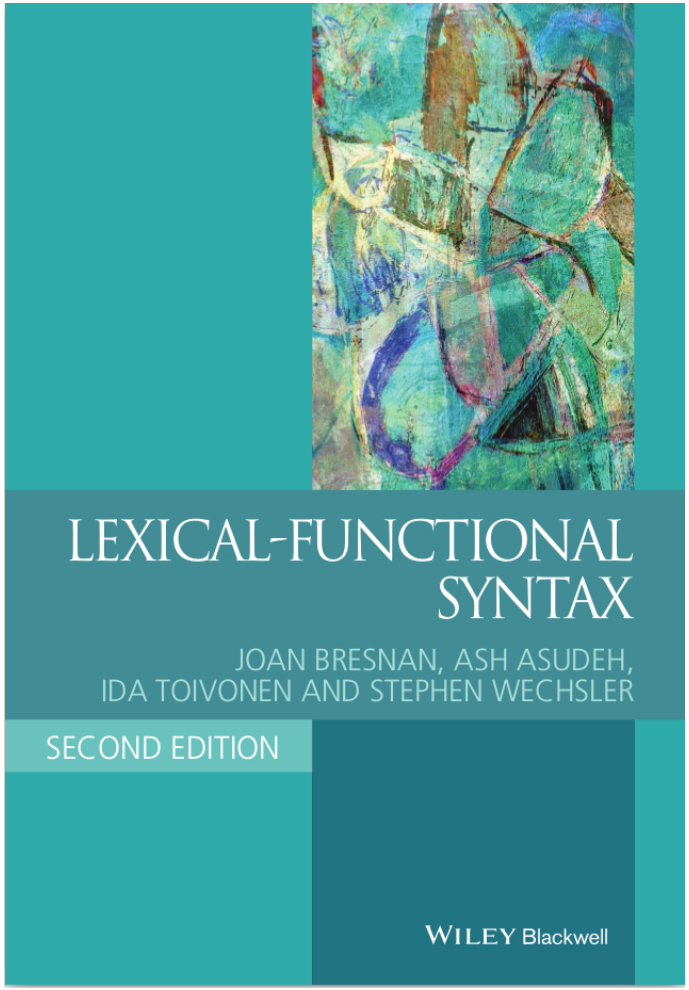
Bresnan et al. (2016). Lexical-Functional Syntax, p. xi.



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."

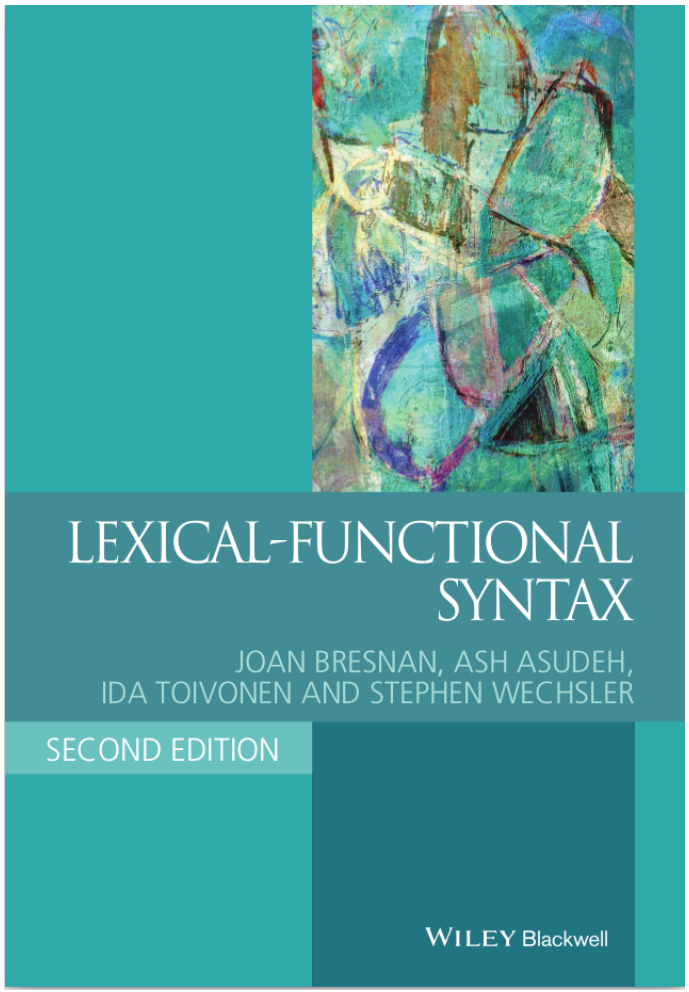
Bresnan et al. (2016).
Lexical-Functional Syntax, p. xi.



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.



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[1]

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

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

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Section 3: Untyped Feature Descriptions

Feature Descriptions

"In this chapter, we will introduce **feature descriptions** which play a role in theories such as LFG, HPSG, Construction Grammar, versions of Categorial Grammar and TAG (and even some formalizations of Minimalist theories (Veenstra 1998)). This chapter will therefore lay some of the groundwork for the chapters to follow."

Müller (2019). Grammatical theory, p. 206.

Beware: Terminological Confusion

"**Feature structures** are complex entities which can model properties of a linguistic object. Linguists mostly work with **feature descriptions** which describe *only parts of a given feature structure*."

Müller (2019). Grammatical theory, p. 206.

Alternative terms for *feature structures*:

- feature-value structure
- attribute-value structure

Alternative terms for *feature descriptions*:

- attribute-value matrix (AVM)
- feature matrix

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 lecture on GB theory:

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

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*:

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

Glossing and Feature Descriptions

Note that the **glossings** we find in grammatical example sentences can be directly *translated into feature descriptions*. We therefore might assume that if there is a gloss, then this is relevant grammatical information that should go into a feature description, while if there is none, then the feature description is basically empty.

Ayacucho Quechua (quy, Quechuan)

(3) wayna runa mikuy-ta yanu-n
young man.**NOM.SG** food-**ACC.SG** cook-PRS.**3SG**
"The young man cooks the food."

Example

Glossing:

(4) wayna runa mikuy-ta yanu-n
young man.**NOM.SG** food-**ACC.SG** cook-**PRS.3SG**
"The young man cooks the food."

Feature Description:

wayna:
[]

runa:
$$\begin{bmatrix} \text{CASE} & \textit{nom} \\ \text{NUMBER} & \textit{sg} \end{bmatrix}$$

mikuy-ta:
$$\begin{bmatrix} \text{CASE} & \textit{acc} \\ \text{NUMBER} & \textit{sg} \end{bmatrix}$$

yanu-n:
$$\begin{bmatrix} \text{NUMBER} & \textit{sg} \\ \text{PERSON} & \textit{3} \\ \text{TENSE} & \textit{prs} \end{bmatrix}$$

Note: Henceforth, we will order the feature-value pairs alphabetically inside the matrix from top to bottom.

Empty Morphemes

In some theories of morphology, **empty morphemes** are posited (in parallel to empty slots in a tree structure as discussed in the lecture on GB) whenever there is no overt morphological marker for a grammatical function which *in theory* should be there. This could be represented by a feature label without value in the feature description matrix...

runa-∅-ta
man-∅-ACC

$$\begin{bmatrix} \text{NUMBER} & \_ \\ \text{CASE} & \textit{acc} \end{bmatrix}$$

runa-kuna-ta
man-PL-ACC

$$\begin{bmatrix} \text{NUMBER} & \textit{pl} \\ \text{CASE} & \textit{acc} \end{bmatrix}$$

Empty Morphemes

... However, emtpy features **are not considered here in feature descriptions**. As an alternative, we might assume that the lack of a marker means that all *theoretically possible* grammatical functions are possible, except the one that is not explicitely marked. For Ayacucho Quechua, there is an overt plural marker, but no overt singular marker. Hence, whenever the plural marker is lacking, singular is assumed as the NUMBER value.

runa-ta
man-ACC.SG

$$\begin{bmatrix} \text{NUMBER} & sg \\ \text{CASE} & acc \end{bmatrix}$$

runa-kuna-ta
man-PL-ACC

$$\begin{bmatrix} \text{NUMBER} & pl \\ \text{CASE} & acc \end{bmatrix}$$

Note: in the glossing, this is then often represented by using a dot (ACC.SG), which according to the Leipzig glossing rules indicates that a marker (i.e. -ta) is assigned both singular number and accusative case. Another option would be to just drop the SG glossing.

Syncretism

A problem related to empty morphemes is so-called **syncretism** of word forms. We can construe inflectional paradigms by assuming certain theoretical features like CASE, NUMBER, GENDER, etc. The theoretical grids can then be filled by the actual word forms used for these grammatical feature combinations. However, the set of different word types rarely matches these grids exactly in the sense that each cell would be filled by a different word type. We talk about a form being *syncretic* if it fills different cells.

Paradigm for *Frau* 'woman':

	NOM	**ACC**	**DAT**	**GEN**
SG	Frau	Frau	Frau	Frau
PL	Frauen	Frauen	Frauen	Frauen

Paradigm for *Mann* 'man':

	NOM	**ACC**	**DAT**	**GEN**
SG	Mann	Mann	Mann	Mannes
PL	Männer	Männer	Männern	Männer

Syncretism and Disjunction

In feature descriptions, **each word form gets a separate description**. If there is syncretism across a whole feature (i.e. all forms for the values of CASE are the same), then the feature can be dropped. If there is only partial syncretism, then it is indicated by using disjunction, i.e. the 'or' symbol $\vee$.

Word form: *Frau*

$$\begin{bmatrix} \text{NUMBER} & sg \end{bmatrix}$$

Word form: *Frauen*

$$\begin{bmatrix} \text{NUMBER} & pl \end{bmatrix}$$

Word form: *Mann*

$$\begin{bmatrix} \text{CASE} & nom \vee acc \vee dat \\ \text{NUMBER} & sg \end{bmatrix}$$

Word form: *Mannes*

$$\begin{bmatrix} \text{CASE} & gen \\ \text{NUMBER} & sg \end{bmatrix}$$

Word form: *Männer*

$$\begin{bmatrix} \text{CASE} & nom \vee acc \vee gen \\ \text{NUMBER} & pl \end{bmatrix}$$

Word form: *Männern*

$$\begin{bmatrix} \text{CASE} & dat \\ \text{NUMBER} & pl \end{bmatrix}$$

Note: we could also take grammatical gender into account to the effect that GENDER would always be *fem* for Frau and Frauen, and *masc* for *Mann* and *Männer*. Similarly, PERSON features could be included, i.e. the value would be 3 in all cases.

Disjunction: Alternative Notation

Instead of working with disjunctions inside the feature discriptions, we could also consider to have separate feature descriptions and then apply disjunctions to these.

Word form: *Mann*

$$\begin{bmatrix} \text{CASE} & \textit{nom} \\ \text{NUMBER} & \textit{sg} \end{bmatrix} \vee \begin{bmatrix} \text{CASE} & \textit{acc} \\ \text{NUMBER} & \textit{sg} \end{bmatrix} \vee \begin{bmatrix} \text{CASE} & \textit{dat} \\ \text{NUMBER} & \textit{sg} \end{bmatrix}$$

Embedding

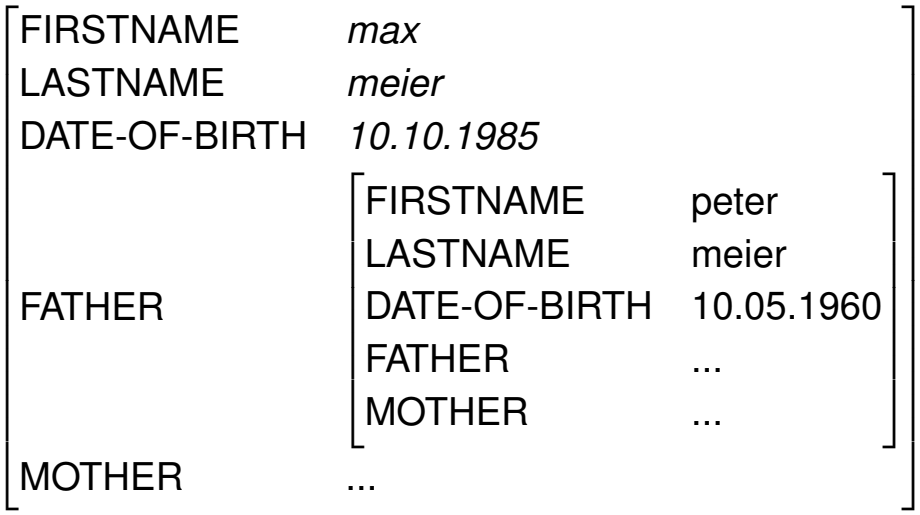
One feature description might be embedded in another feature description, as in the example below from Müller (2019), p. 206.

FIRSTNAME	*max*
LASTNAME	*meier*
DATE-OF-BIRTH	*10.10.1985*
FATHER	FIRSTNAME peter LASTNAME meier DATE-OF-BIRTH 10.05.1960 FATHER ... MOTHER ...
MOTHER	...

Path

"In feature descriptions, a *path* is a sequence of features which immediately follow each other. The *value of a path* is the feature description at the end of the path. Therefore, the value of FATHER|DATE-OF-BIRTH is *10.05.1960*."

Müller (2019), p. 206.



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: *help*

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

Word form: *helpful*

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

Linguistic Example

Word form: *unhelpful*

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

Word form: *unhelpfully*

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

List

In some cases, it is not just a single value that a feature can take, but rather several values. Therefore, we can use a **list of feature values** as in the example below from Müller (2019), p. 207. Note that a list is *different from disjunction*, since the former is essentially an 'and' statement, whereas the latter is an 'or' statement.

$$\begin{bmatrix} \text{FIRSTNAME} & \textit{max} \\ \text{LASTNAME} & \textit{meier} \\ \text{DATE-OF-BIRTH} & \textit{10.10.1985} \\ \text{FATHER} & \ldots \\ \text{MOTHER} & \ldots \\ \text{DAUGHTER} & \left\langle \begin{bmatrix} \text{FIRSTNAME} & \textit{clara} \\ \text{LASTNAME} & \textit{meier} \\ \text{DATE-OF-BIRTH} & \textit{10.10.2004} \\ \text{FATHER} & \ldots \\ \text{MOTHER} & \ldots \\ \text{DAUGTHER} & \langle\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

List: 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* (COMP).[2]

phrase: *the green house*

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

[2]Note that we use *complement* here in a general sense, i.e. everything which is not the head of the phrase. This is similar to Head-Driven Phrase Structure Grammar, though in HPSG the article would be called a *specifier*.

Linguistic Examples

phrase: *la casa verde*

$$\begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{POS} & \textit{noun} \\ \text{GENDER} & \textit{fem} \\ \text{NUMBER} & \textit{sg} \end{bmatrix} \\ \text{COMP} & \left\langle \begin{bmatrix} \text{POS} & \textit{det} \\ \text{GENDER} & \textit{fem} \\ \text{NUMBER} & \textit{sg} \end{bmatrix}, \begin{bmatrix} \text{POS} & \textit{adj} \\ \text{GENDER} & \textit{fem} \vee \textit{masc} \\ \text{NUMBER} & \textit{sg} \end{bmatrix} \right\rangle \end{bmatrix}$$

Note: Word order – in terms of adjective/noun order – does not play a role here, i.e. both *casa verde* and *verde casa* would have the same feature description matrix. So linearization constraints would need to be introduced separately. Also, as we will see below, feature values are typically not just repeated, i.e. *fem* in HEAD and COMP, but rather *feature shared* by indeces.

Linguistic Examples

phrase: *de**m** grüne**n** Haus*

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

Note: The CASE ambiguity of *Haus* and *grünen* would be solved here if the *dat* feature value was shared between COMPS and HEAD.

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Section 4: Typed Feature Descriptions

Types

In so-called **typed feature descriptions**, i.e. **feature structure**, the type determines the template of feature labels that can (but do not have to be) filled with values.

Müller (2019), p. 208.

Feature structure of the type *person*:

person	
FIRSTNAME	*firstname*
LASTNAME	*lastname*
DATE-OF-BIRTH	*date*
GENDER	*gender*
FATHER	*person*
MOTHER	*person*
CHILDREN	*list of person*

Types & Atomic Types (Values)

Note that both the *type* and the *feature values* are written in lower case italics. This is not a coincidence, since feature values are also types, though without any further features subcategorized under them. They are hence called **atomic types**.

Feature structure of the type *person*:

person	
FIRSTNAME	***firstname***
LASTNAME	***lastname***
DATE-OF-BIRTH	***date***
GENDER	***gender***
FATHER	***person***
MOTHER	***person***
CHILDREN	***list of person***

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.)

Important Question

Should we deal with differences between **parts-of-speech** at the level of *types* or at the level of *features*? – We will here take POS as separate types with their own feature structures.

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.	

Feature structure of the type *noun*:

noun	
BOUNDEDNESS	*boundedness*
CASE	*case*
GENDER	*gender*
NUMBER	*number*
PERSON	*person*
etc.	

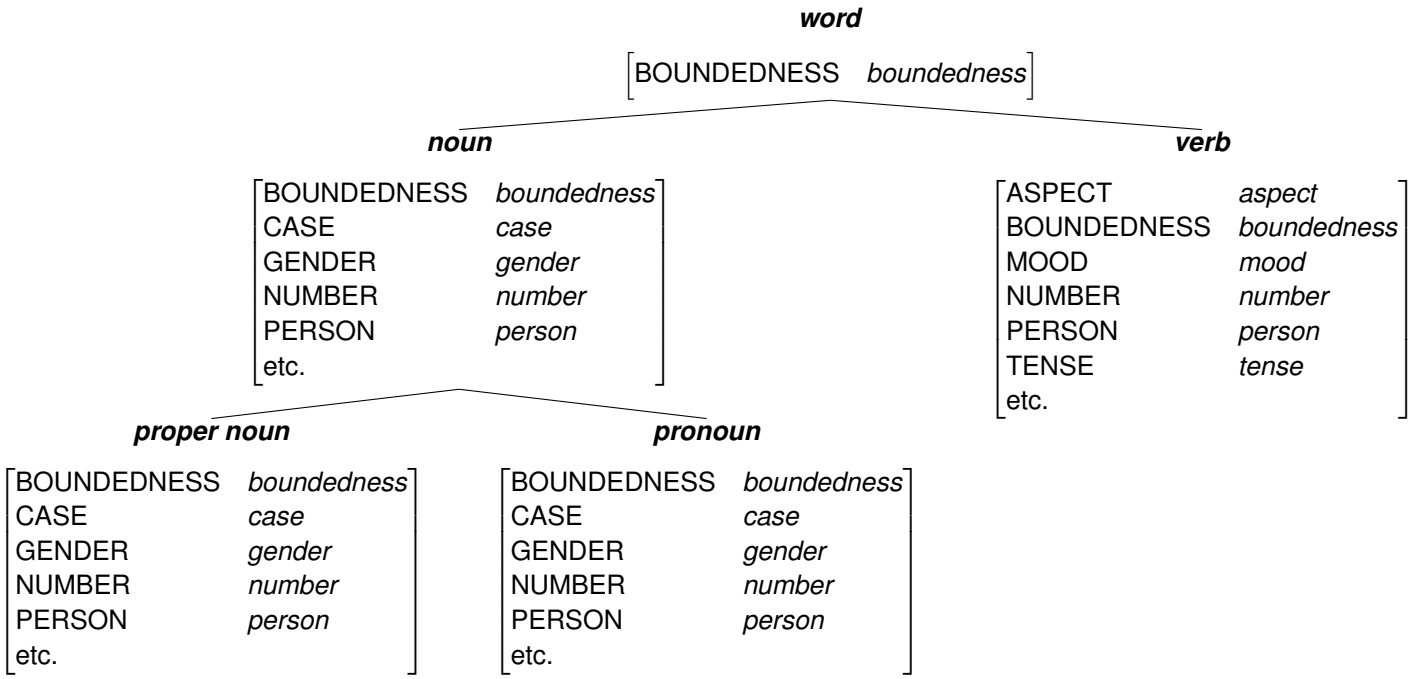
Feature structure of the type *verb*:

verb	
ASPECT	*aspect*
BOUNDEDNESS	*boundedness*
MOOD	*mood*
NUMBER	*number*
PERSON	*person*
TENSE	*tense*
etc.	

Note: In fact, if we decide to deal with POS at the level of types, then the type *word* would not have to contain all the POS specific features anymore, but just the BOUNDEDNESS feature. See type hierarchy on the next slide.

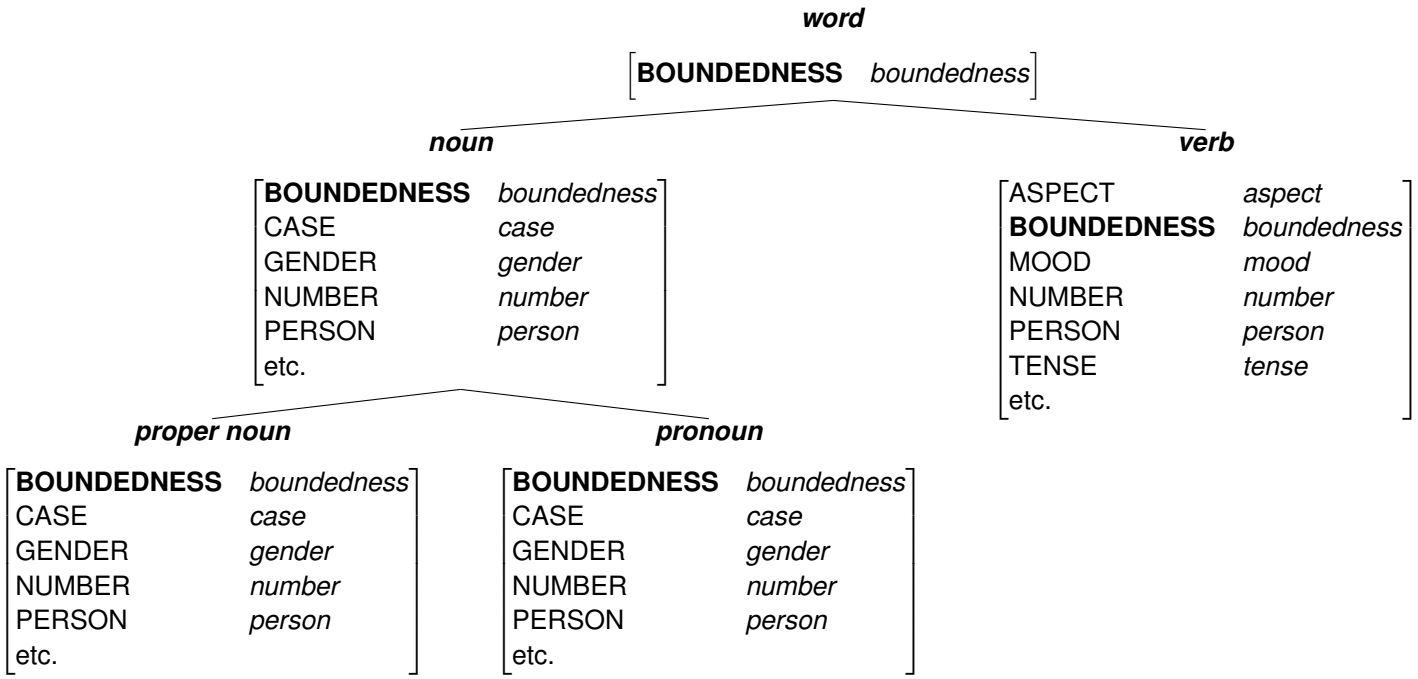
Type Hierarchies

Type hierarchies display the hierarchical relationships between different types, i.e. they display which type is a *subordinate* or *superordinate* of which other type.



Inheritance

Subordinate types **"inherit"** the features of their superordinate types. E.g. the feature BOUNDEDNESS is *multiply inherited* to all the subordinate types in this tree. It is the feature that all words share.



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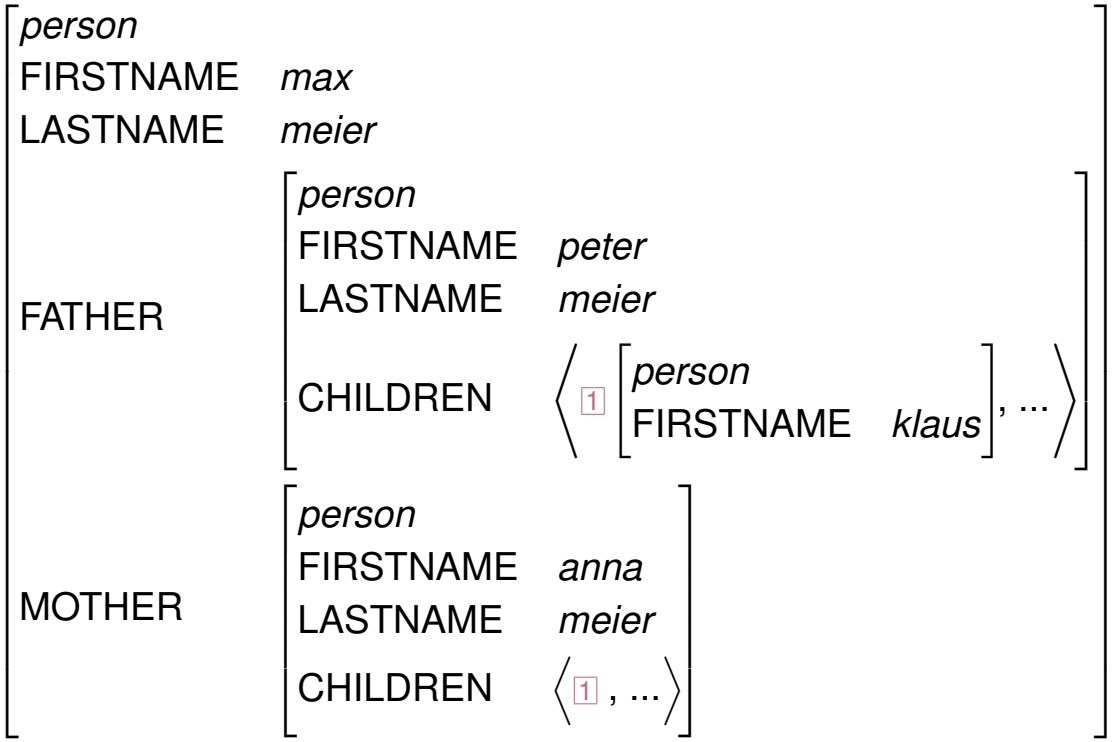
Section 5: Structure Sharing

Structure Sharing

Structure sharing can be used to indicate that an *identical feature structure* is used in different parts of the feature description.

Müller (2019), p. 211.



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*

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

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Section 6: Feature Decriptions and Structures

Difference: Feature Descriptions and Structures

"If we return to the example with people from the previous sections, we can capture the difference between a **model [feature structure]** and a **[feature] description** as follows: if we have a model of people that includes first name, last name, date of birth, gender and hair color, then it follows that every object we model also has a birthday. We can, however, decide to omit these details from our descriptions if they do not play a role for stating constraints or formulating searches."

Müller (2019), p. 217.

Feature structure
assumed for the word *Frau* 'woman':

$$\begin{bmatrix} \textit{noun} & \\ \text{CASE} & \textit{case} \\ \text{GENDER} & \textit{gender} \\ \text{NUMBER} & \textit{number} \\ \text{PERSON} & \textit{person} \\ \text{etc.} & \end{bmatrix}$$

Feature description
assumed for the word *Frau* 'woman':

$$\begin{bmatrix} \textit{noun} & \\ \text{GENDER} & \textit{fem} \\ \text{NUMBER} & \textit{sg} \\ \text{etc.} & \end{bmatrix}$$

Summary

- Feature descriptions give **feature labels and values** for a given object (e.g. a word).
- They can be **typed** (predefined feature structure and feature hierarchies), or **untyped**.
- A **feature structure** is a more general, stable model of all objects of a given type, while **feature descriptions** can give only (the relevant) parts of this model.

Section 7: References

References

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Thank You.

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