EBERHARD KARLS
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Faculty of Philosophy
General Linguistics

Syntax & Semantics WiSe 2020/2021

Lecture 14: Head-Driven Phrase Structure Grammar I (HPSG)

07/01/2021, Christian Bentz

Overview

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- Analyzed Languages

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- Notational Conventions
- Nouns
- Adjectives
- Prepositions
- Verbs

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- Representation of Constituent Structure
- The Noun-Phrase

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Section 1: Recap of Lecture 11

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.

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Example from GB theory (Lecture 7):

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

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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.

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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*:

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

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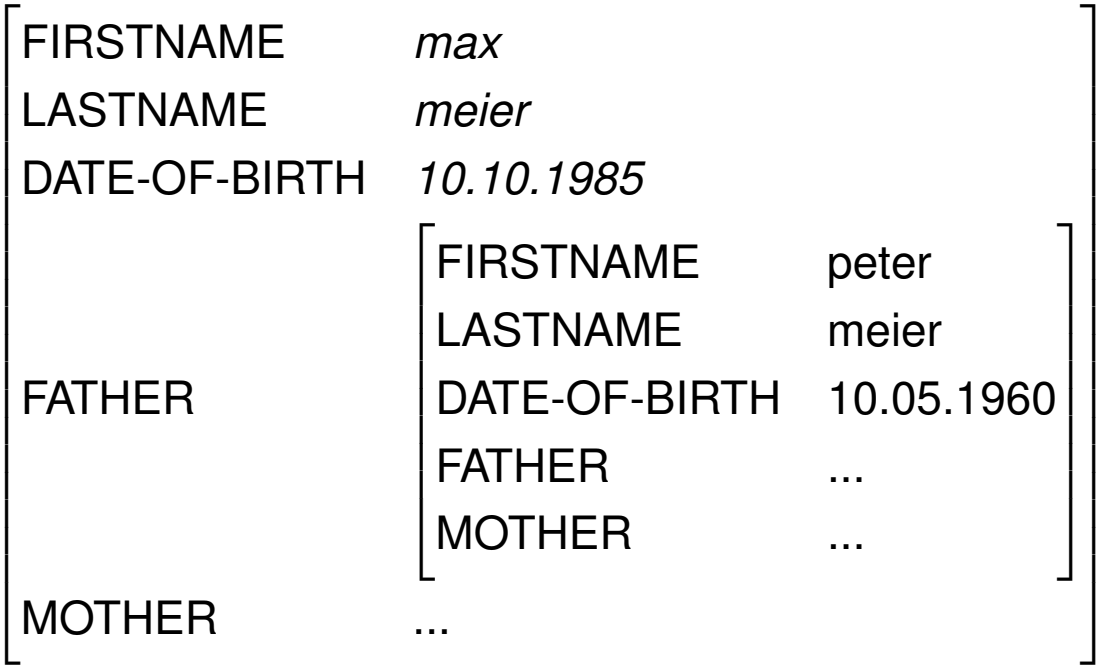
Embedding

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



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Paths

"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.

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$$\begin{bmatrix} \text{FIRSTNAME} & \textit{max} \\ \text{LASTNAME} & \textit{meier} \\ \text{DATE-OF-BIRTH} & \textit{10.10.1985} \\ \text{FATHER} & \begin{bmatrix} \text{FIRSTNAME} & \text{peter} \\ \text{LASTNAME} & \text{meier} \\ \text{DATE-OF-BIRTH} & \text{10.05.1960} \\ \text{FATHER} & \ldots \\ \text{MOTHER} & \ldots \end{bmatrix} \\ \text{MOTHER} & \ldots \end{bmatrix}$$

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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.

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Word form: *unhelpfully*

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

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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* (COMP).[1]

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phrase: *the green house*

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

[1] 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 what we will see in Head-Driven Phrase Structure Grammar, though in HPSG the article would be called a *specifier*.

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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.

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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.)

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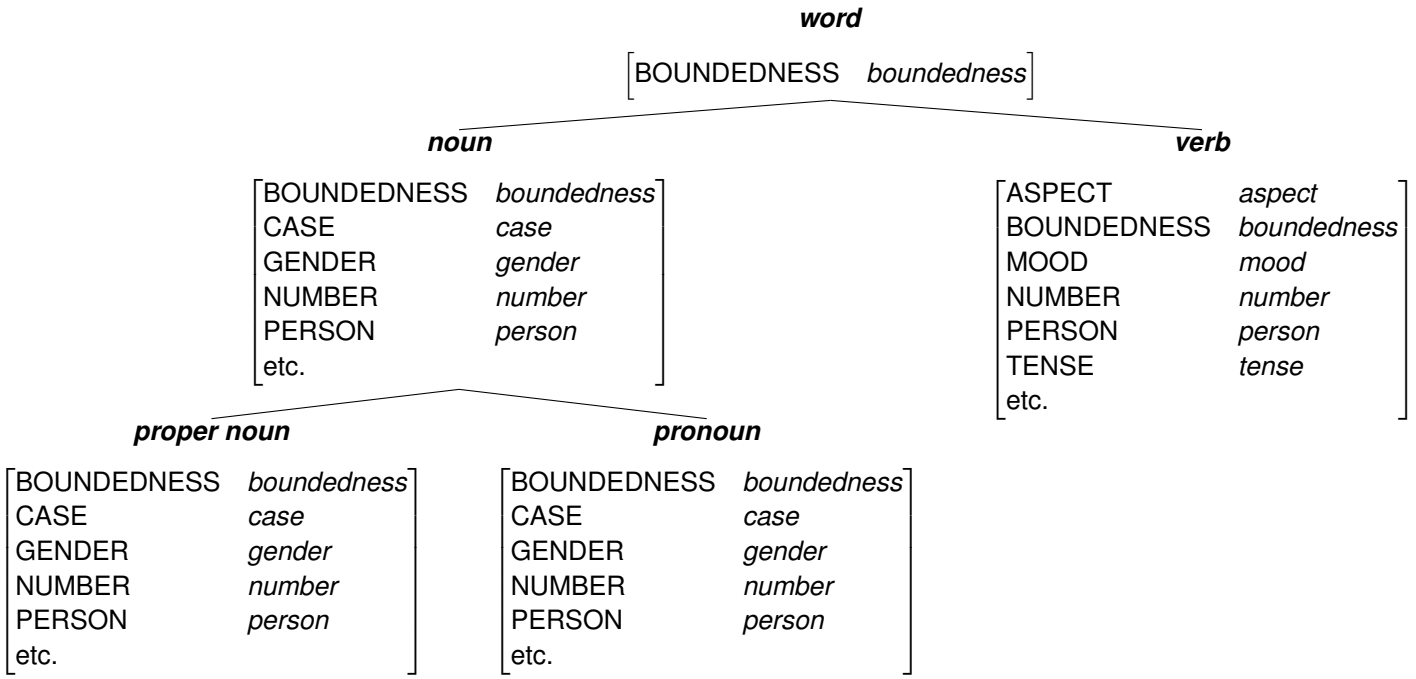
Type Hierarchies

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



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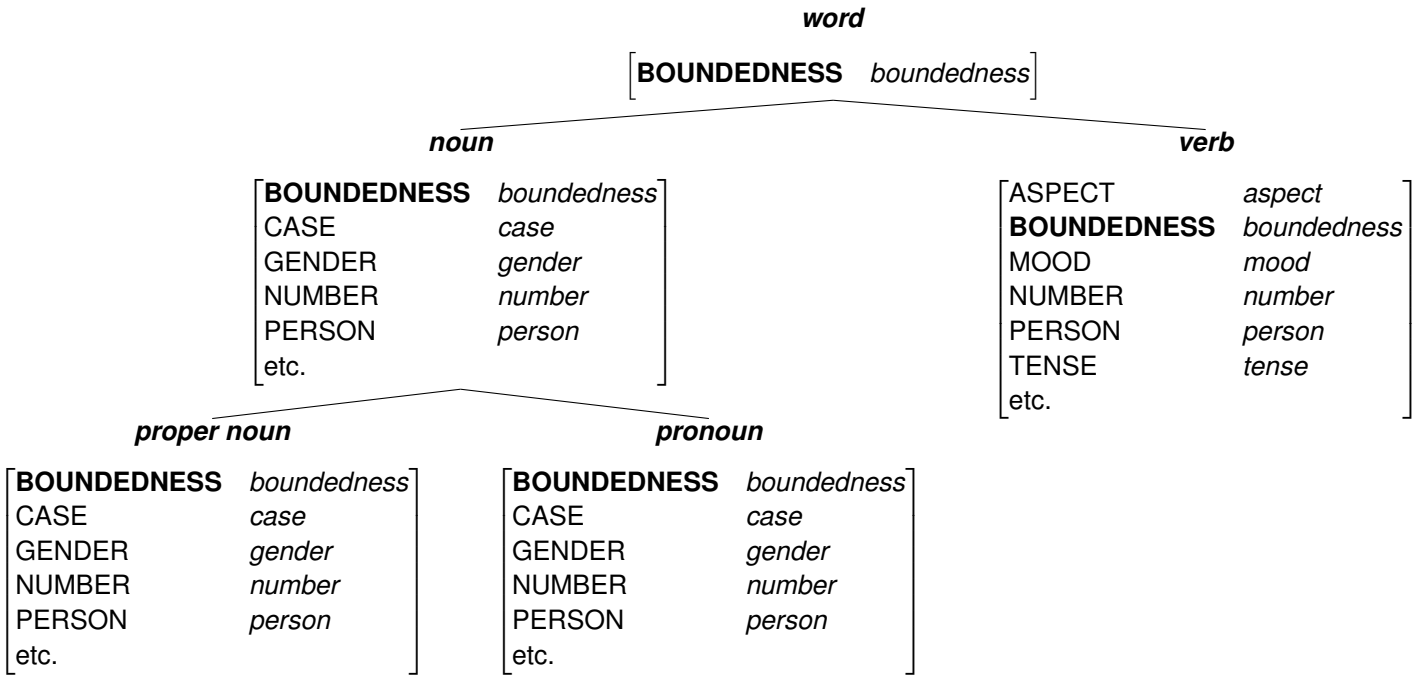
Inheritance

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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Structure Sharing: Lingustic Example

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

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phrase: *das grüne Haus*

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

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Lexical Functional Grammar
Transitive Sentence + Adjunct (F-Structure)

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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.

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Section 2: Historical Notes

Historical Perspective

"Head-Driven Phrase Structure Grammar (HPSG) was developed by Carl Pollard and Ivan Sag in the mid-80's in Stanford and in the Hewlett-Packard research laboratories in Palo Alto (Pollard & Sag 1987; 1994). Like LFG, HPSG is part of so-called West Coast linguistics. Another similarity to LFG is that HPSG aims to provide a theory of competence which is compatible with performance [...]"

Müller (2019). Grammatical theory, p. 263.

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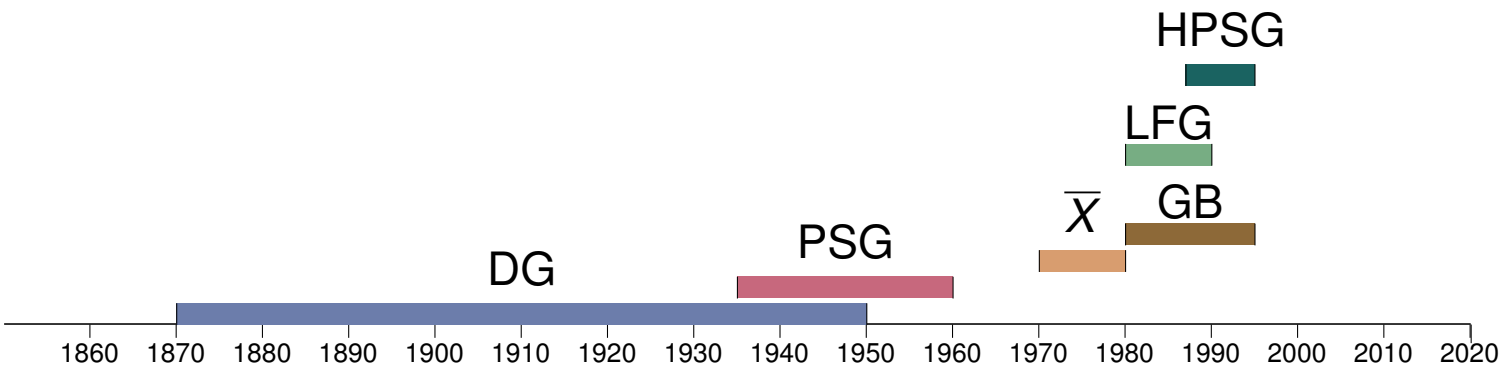

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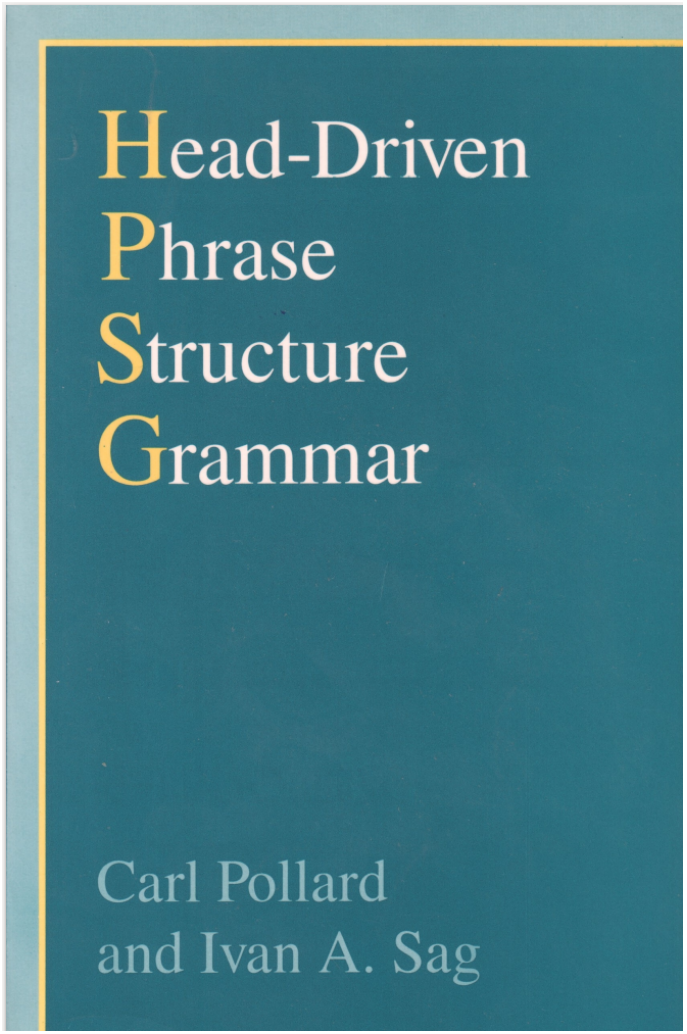
GB and HPSG: Similarities

- "A number of similarities between GB theory and the theory advocated here will be apparent. For example, in both theories, structure is determined chiefly by [...] rules reduced to a handful of highly general and universally available phrase structure (or immediate dominance) schemata [...]"

Pollard & Sag (1994). Head-Driven Phrase Structure Grammar, p. 2.



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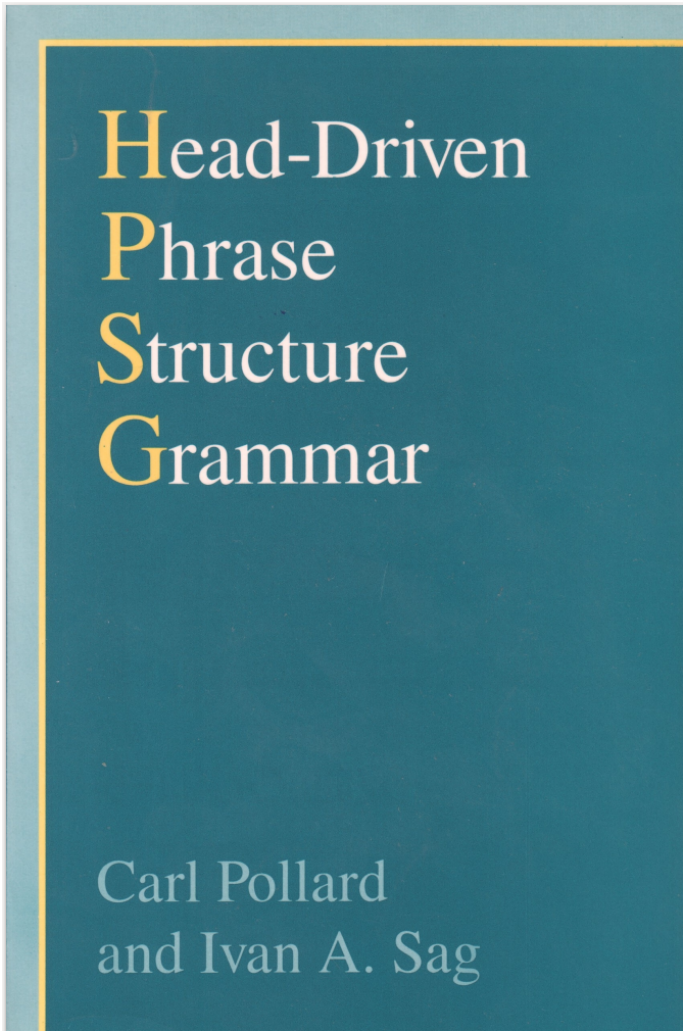
GB and HPSG: Similarities

- "[...] in both GB and HPSG, there are assumed to be several distinct 'levels' (or, as we will call them, attributes or features) of linguistic structure."

Pollard & Sag (1994). Head-Driven Phrase Structure Grammar, p. 2.



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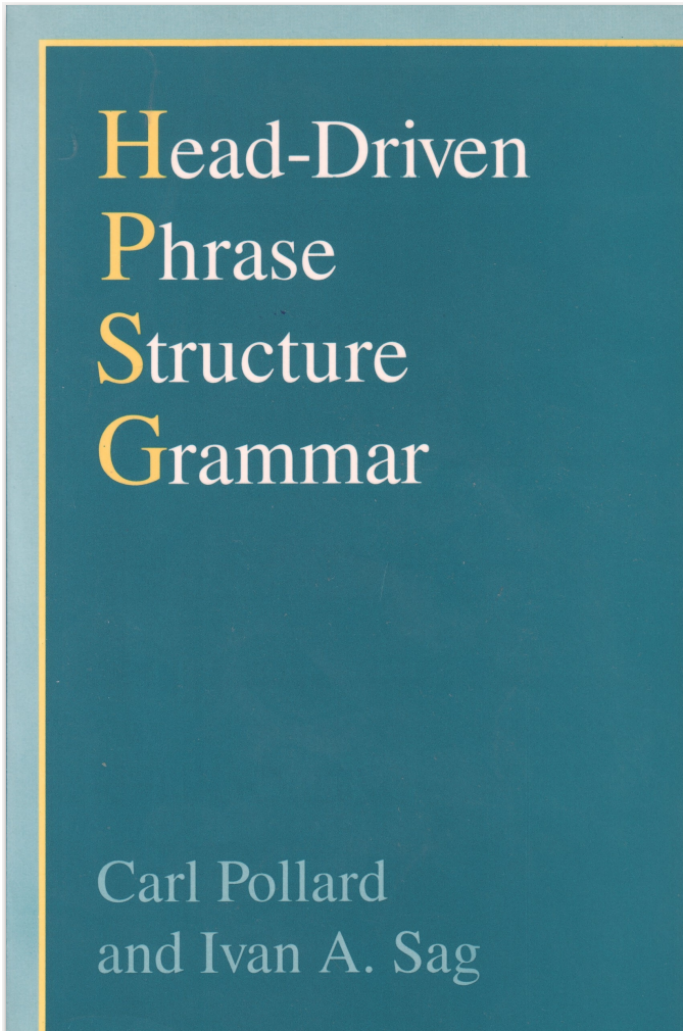
GB and HPSG: Differences

- "One key architectural difference is the absence from HPSG of any notion of transformation. Unlike GB levels [...] the attributes of linguistic structure in HPSG are related not by movement but rather by *structure sharing* [...]"

Pollard & Sag (1994). Head-Driven Phrase Structure Grammar, p. 2.



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Further Characteristics of HPSG

- HPSG "is a **lexicon-based theory**, that is, the majority of linguistic constraints are situated in the descriptions of words or roots."
- "HPSG is sign-based in the sense of Saussure (1916a): the **form and meaning** of linguistic signs are always represented together."
- "**Typed feature structures** are used to model all relevant information."
- "[...] trees [...] are only visualizations of the constituent structure and do not have any theoretical status. There are also **no rewrite rules in HPSG**."

Müller (2019), p. 266-271.

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Languages analyzed by HPSG

Arabic, **Bengali**, **Bulgarian**, Cantonese, **Danish**, **Dutch**, **English**, Esperanto, **French**, Ga, Georgian, **German**, **Greek**, Hausa, Hebrew, Hungarian, Indonesian, Japanese, Korean, Maltese, Mandarin Chinese, **Norwegian**, **Persian**, **Polish**, **Portuguese**, **Russian**, Sahaptin, **Spanish**, Sign Languages (German, French, British, Greek, South African), Turkish, Wambaya, **Yiddish**

According to Müller (2019). Grammatical theory, p. 263.

Language Families[2]

Afro-Asiatic, Artificial, Austronesian, Atlantic-Congo, **Indo-European**, Japonic, Kartvelian, Mirndi, Sahaptin, Sino-Tibetan, Turkic, Uralic

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

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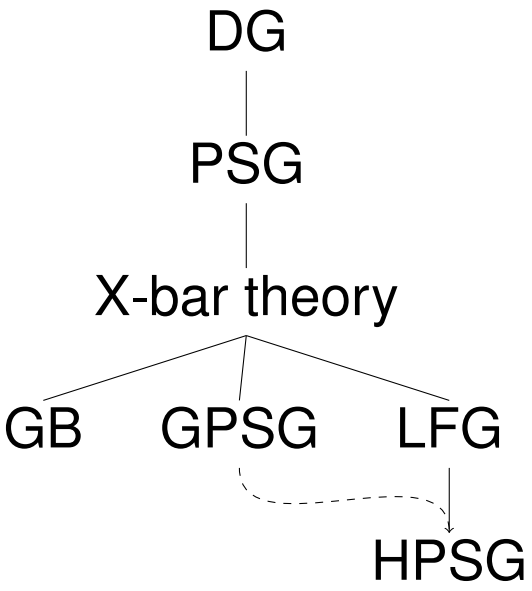
Syntactic Framework Tree



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

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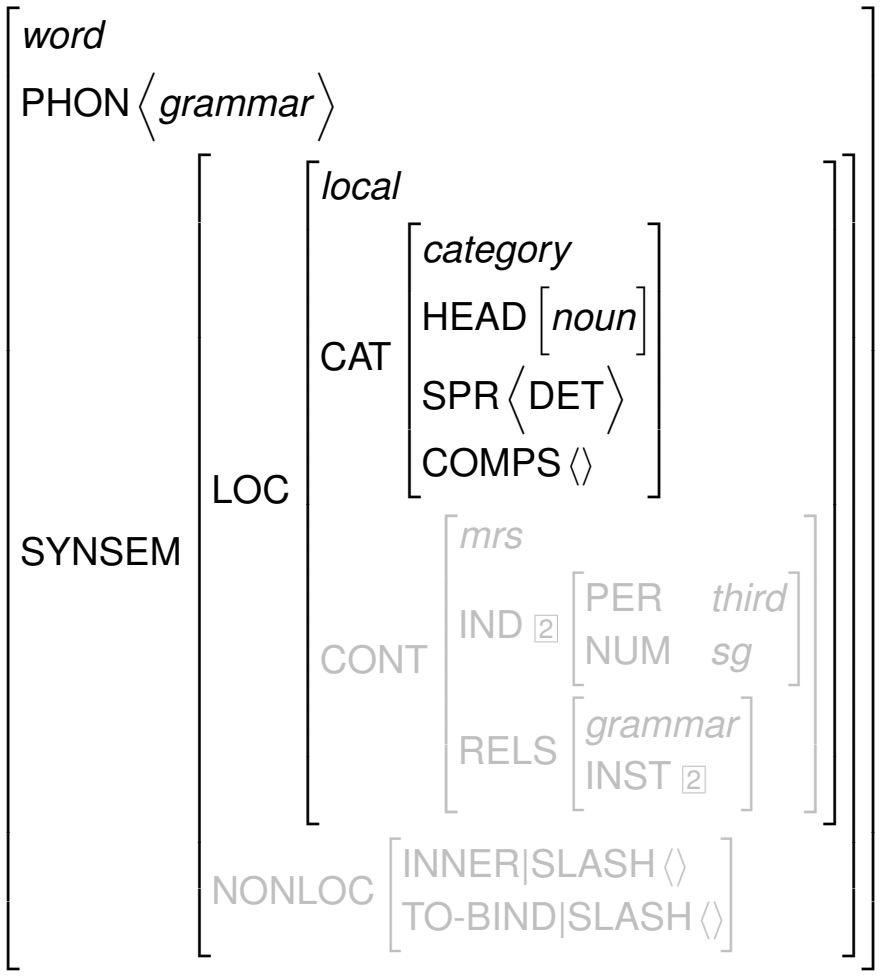
Section 3: The Word Level

Typed Feature Description: Word Level

In contrast to LFG, HPSG feature descriptions a) are **typed**, and b) start already at the **word level**, not only at the phrase level.

Note: everything marked in gray will not be discussed in the HPSG lectures.

Typed feature description for the word *grammar*.



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Notational Conventions

- PHON: Phonology – an *orthographic representation* of the analyzed string.
- SYNSEM: Syntax-Semantics – highest level feature containing all features relevant in the *syntactic/semantic* domain.
- SYNSEM|LOC: *locally* relevant information, e.g. agreement information between determiner and noun.
- SYNSEM|NONLOC: *non-local* information relevant long-distance dependencies and binding.
- SYNSEM|LOC|CAT: feature specifying information linked to the *word category*, i.e part of speech of the head (HEAD), relevant specifiers of the head (SPR), and complements (COMPS).
- SYNSEM|LOC|CONT: feature specifying so-called *content* (i.e. semantic) according to Minimal Recursion Semantics (mrs).

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Simplified Typed Feature Description

We will not consider the semantic features of SYNSEM|LOC|CONT here. Also, SYNSEM|NONLOC is only relevant for particular constructions (e.g. long-distance dependencies) and can be dropped otherwise.

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Typed feature description for the word *grammar*.

$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{grammar} \right\rangle \\ \text{SYNSEM} \begin{bmatrix} \text{LOC} \begin{bmatrix} \textit{local} \\ \text{CAT} \begin{bmatrix} \textit{category} \\ \text{HEAD} \left[\textit{noun} \right] \\ \text{SPR} \left\langle \text{DET} \right\rangle \\ \text{COMPS} \left\langle \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

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The Word Level: Nouns

If case plays a role for the agreement between determiner and noun, a CASE feature is given in SYNSEM|LOC|CAT|HEAD, and it is *structure shared* with the determiner. Note that person, number, and gender features are not located here, since they are considered part of semantics, i.e. located in CONT|IND.

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Typed feature description for the word *Grammatik*.

$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{grammatik} \right\rangle \\ \text{SYNSEM} \begin{bmatrix} \text{LOC} \begin{bmatrix} \textit{local} \\ \text{CAT} \begin{bmatrix} \textit{category} \\ \text{HEAD} \begin{bmatrix} \textit{noun} \\ \textbf{CASE} \quad \boxed{1} \end{bmatrix} \\ \text{SPR} \left\langle \text{DET} \begin{bmatrix} \textbf{CASE} \quad \boxed{1} \end{bmatrix} \right\rangle \\ \text{COMPS} \left\langle \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Note: The case feature for the German word *Grammatik* can take any of the four possible values (i.e. nom, acc, dat, gen), since this particular word type displays syncretism in all four singular forms. Hence, we could either write *nom* $\vee$ *acc* $\vee$ *dat* $\vee$ *gen*, or just leave the feature value empty and only use the structure sharing index.

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The Word Level: Pronouns

Pronouns in English collapse accusative/dative case (we here just represent this with *acc*. In the feminine example below there is even syncretism with the genitive case form. Note that in contrast to proper nouns, pronouns do not take any specifiers.

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Typed feature description for *she*.

$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{she} \right\rangle \\ \text{SYNSEM} \begin{bmatrix} \text{LOC} \begin{bmatrix} \textit{local} \\ \text{CAT} \begin{bmatrix} \textit{category} \\ \text{HEAD} \begin{bmatrix} \textit{pronoun} \\ \textbf{CASE} \quad \textit{nom} \end{bmatrix} \\ \text{COMPS} \left\langle \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Typed feature description for *her*.

$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{her} \right\rangle \\ \text{SYNSEM} \begin{bmatrix} \text{LOC} \begin{bmatrix} \textit{local} \\ \text{CAT} \begin{bmatrix} \textit{category} \\ \text{HEAD} \begin{bmatrix} \textit{pronoun} \\ \textbf{CASE} \quad \textit{acc} \vee \textit{gen} \end{bmatrix} \\ \text{COMPS} \left\langle \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

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The Word Level: Adjectives

As in many other frameworks, *adjectives* are considered *adjuncts* to nouns (or noun phrases), hence they are construed with a MOD (modifier) feature in SYNSEM|LOC|CAT, which essentially means "modifier of..." and the value is then a (not further specified) noun phrase. This is a typical example of embedding, that is, one category with a noun as head is embedded into another category with an adjective as head.

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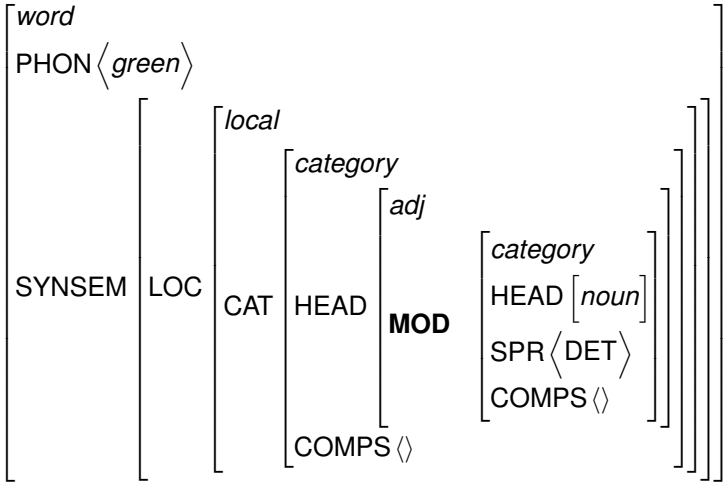
Typed feature description for the word *green*.



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The Word Level: Prepositions

Prepositions are handled at the word level in a similar manner to adjectives. Namely, they have have a head feature MOD which takes a noun phrase as its value. One important difference here is that now we also have to mention a complement to the preposition under COMPS.

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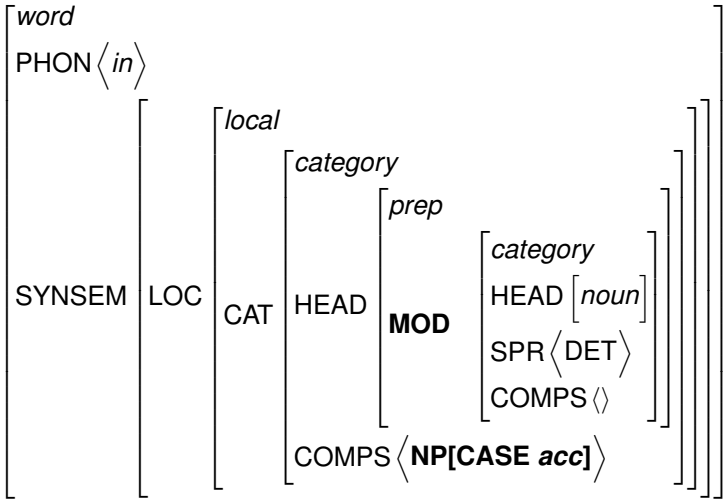
Typed feature description for the word *in*.



Note: The complement NP[CASE *acc*] is necessary since the preposition *in* requires a accusative/dative complement. While proper nouns do not inflect for accusative/dative in English, we have a different form in pronouns, e.g. *in him*. Importantly, the noun phrase which is the value of MOD is not the same as the noun phrase in the COMPS list! The former would correspond to *the book* in a phrase like *the book in the library*, while the latter would correspond to *the library*.

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Some Further Comments On Adjuncts

- It might seem strange that noun phrases – while heading adjectives and prepositions – are at the same time embedded inside the *adj* and *prep* feature description. But note that we have here discussed feature descriptions of individual lexical items only. In HPSG, it is necessary to specify at the lexical level what type of category an adjunct modifies. Head/complement relationships in whole phrases are then handled separately (see below).
- Remember that it is common for adjuncts to also modify, for instance, verb phrases, not just noun phrases (e.g. *the child reads in the library*). This case is handled with the adjuncts being part of the verb phrase complements (see next Lecture).

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The Word Level: Verbs (English)

Verbs have a feature structure similar to nouns. Instead of a CASE feature given in the type *noun*, the type *verb* gives a **VFORM** feature which takes the same values as in GPSG (*fin*: finite; *inf*: to-infinitive; *bse*: bare infinitive; *prp*: present participle; *psp*: past participle; *pas*: passive participle). Also, the potential complements of the verb phrase are now given in **COMPS** with phrase notation and case feature values. **For English**, the subject NP is considered a **specifier (SPR)**.

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Typed feature description for the word *gives*.

$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{gives} \right\rangle \\ \text{SYNSEM} \begin{bmatrix} \text{LOC} \begin{bmatrix} \textit{local} \\ \text{CAT} \begin{bmatrix} \textit{category} \\ \text{HEAD} \begin{bmatrix} \textit{verb} \\ \textbf{VFORM} \quad \textit{fin} \end{bmatrix} \\ \text{SPR} \left\langle \textbf{NP[}\textit{nom}\textbf{]} \right\rangle \\ \text{COMPS} \left\langle \textbf{NP[}\textit{dat}\textbf{], NP[}\textit{acc}\textbf{]} \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

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The Word Level: Verbs (German)

For German, we have, in principle, the same structure, though with the important difference that the **subject NP** is not treated as a specifier, but also as a **complement**.

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Typed feature description for the word *gibt* 'gives'.

$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{gibt} \right\rangle \\ \text{SYNSEM} \begin{bmatrix} \text{LOC} \begin{bmatrix} \textit{local} \\ \text{CAT} \begin{bmatrix} \textit{category} \\ \text{HEAD} \begin{bmatrix} \textit{verb} \\ \textbf{VFORM} \quad \textit{fin} \end{bmatrix} \\ \text{COMPS} \left\langle \textbf{NP[}\textbf{\textit{nom}}\textbf{], NP[}\textbf{\textit{dat}}\textbf{], NP[}\textbf{\textit{acc}}\textbf{]} \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

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The Word Level: Verbs

Since we do not give any number, person and tense information here, the feature description would actually be the same for other inflected (i.e. finite) forms of the word *give*, e.g. *gave*. It is only different in the **VFORM feature** if a different type of verb form is used (e.g. infinitives or past participles).

Typed feature description for the word *give*.

$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{give} \right\rangle \\ \text{SYNSEM} \begin{bmatrix} \text{LOC} \begin{bmatrix} \textit{local} \\ \text{CAT} \begin{bmatrix} \textit{category} \\ \text{HEAD} \begin{bmatrix} \textit{verb} \\ \textbf{VFORM} \quad \textbf{\textit{bse}} \end{bmatrix} \\ \text{SPR} \left\langle \text{NP}[\textit{nom}] \right\rangle \\ \text{COMPS} \left\langle \text{NP}[\textit{dat}], \text{NP}[\textit{acc}] \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Typed feature description for the word *given*.

$$\begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{given} \right\rangle \\ \text{SYNSEM} \begin{bmatrix} \text{LOC} \begin{bmatrix} \textit{local} \\ \text{CAT} \begin{bmatrix} \textit{category} \\ \text{HEAD} \begin{bmatrix} \textit{verb} \\ \textbf{VFORM} \quad \textbf{\textit{psp}} \end{bmatrix} \\ \text{SPR} \left\langle \text{NP}[\textit{nom}] \right\rangle \\ \text{COMPS} \left\langle \text{NP}[\textit{dat}], \text{NP}[\textit{acc}] \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

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Some Further Comments On Verbs

- As was mentioned also for nouns, inflectional features in HPSG feature descriptions are given in CONT, i.e. considered part of the semantics of a word, rather than its syntax (CAT).
- Note, however, that deviating from the simplified notation given in Müller (2019), Pollard & Sag (1994), p. 28 actually give the person and number feature of the word *walks* as an index to the complement representing the subject of a potential intransitive sentence, i.e. NP[nom]$_{[3rd,sg]}$. Hence, inflectional features here come into the CAT feature description "through the backdoor" so to speak.

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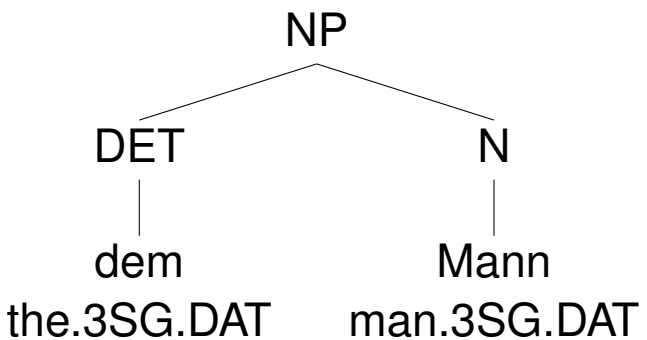
Section 4: The Phrase Level

Representation of Constituent Structure

Just as for LFG, in HPSG **constituent tree structures** are represented by means of **feature description matrices**, such that trees have no theoretically important status anymore, but might be used for visualization.



$$\begin{bmatrix} \textit{head-specifier-phrase} & \\ \text{PHON} & \langle \textit{dem Mann} \rangle \\ \text{HEAD-DTR} & \begin{bmatrix} \textit{noun} \\ \text{PHON} \langle \textit{Mann} \rangle \end{bmatrix} \\ \text{NON-HEAD-DTR} & \left\langle \begin{bmatrix} \textit{determiner} \\ \text{PHON} \langle \textit{dem} \rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

Adopted from Müller (2019). Grammatical theory, p. 269.

Note: I have here added the type *head-specifier-phrase*. Remember that determiners are considered specifiers to the head noun in this framework.

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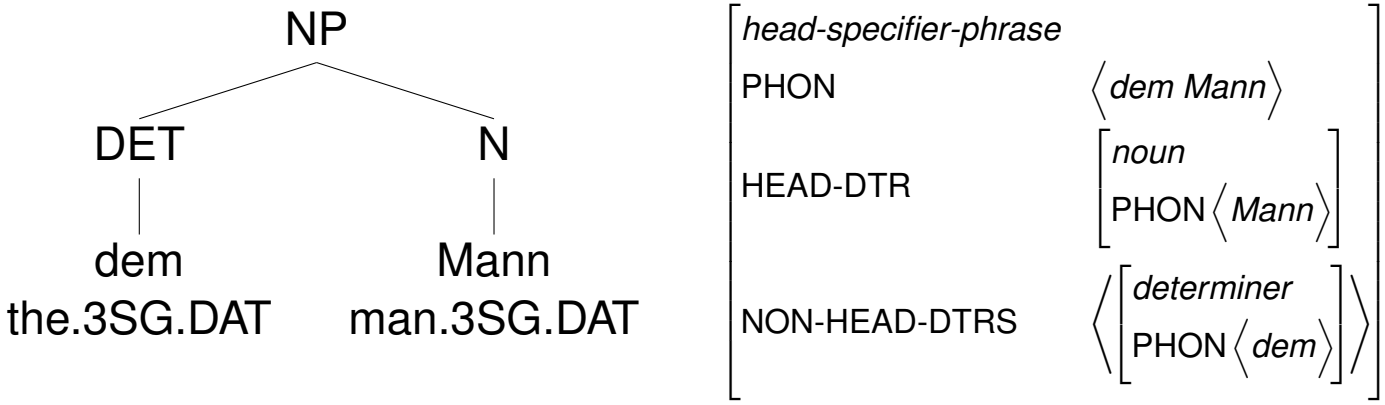
Representation of Constituent Structure

The nodes in the tree are then associated with particular parts in the feature description, e.g. **NP with the whole *head-specifier-phrase***, **DET with NON-HEAD-DTR** (non-head-daughter), and **N with HEAD-DTR** (head-daughter).



Adopted from Müller (2019). Grammatical theory, p. 269.

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The Phrase Level: Noun-Phrase

However, note that the atribute-value matrix (AVM), i.e. feature description matrix, given by Müller (2019) for this particular *head-specifier-phrase* is **highly underspecified**. Namely, it only specifies the PHON feature but none of the syntactically relevant features in SYNSEM|LOC|CAT. A more complete AVM is developed below.

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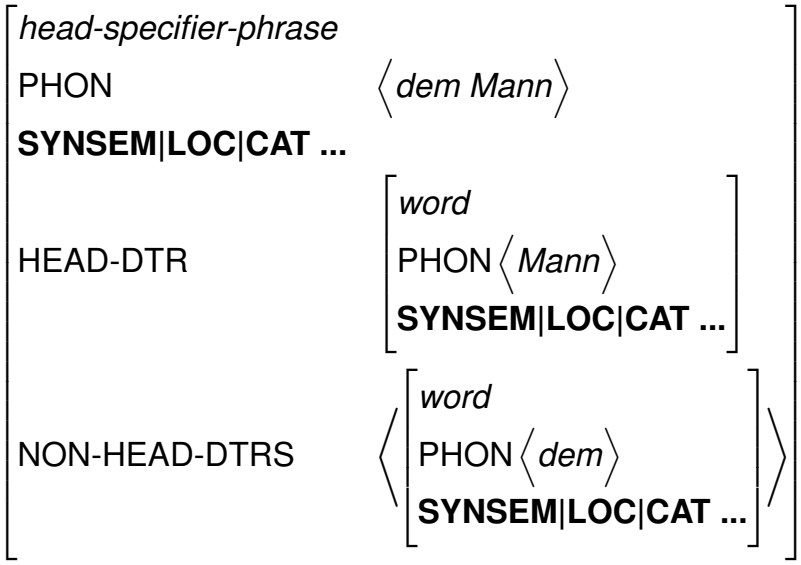

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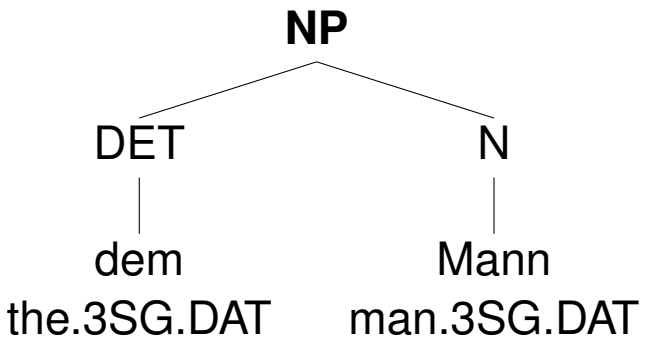
The Phrase Level: Noun-Phrase

First, we need to add the **SYNSEM|LOC|CAT feature** for the highest level NP *dem Mann*. Note that the CAT feature matrix is here not further specified, just represented **with an index** 1. Imagine that this reflects the fact that we are here in the highest level NP node in the tree, where we do not yet "see" the actual head and specifier features of the category.



$$\begin{bmatrix} \textit{head-specifier-phrase} \\ \text{PHON} \left\langle \textit{dem Mann} \right\rangle \\ \textbf{SYNSEM|LOC|CAT} \ \boxed{1} \\ \text{HEAD-DTR} \begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{Mann} \right\rangle \end{bmatrix} \\ \text{NON-HEAD-DTRS} \left\langle \begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{dem} \right\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

Note: From here on we use the path notation SYNSEM|LOC|CAT instead of spelling out all the matrices.

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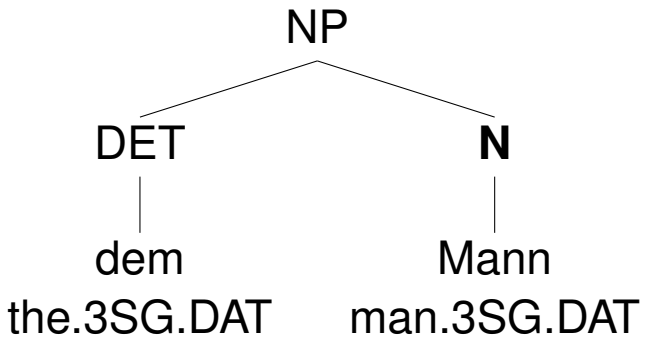
The Phrase Level: Noun-Phrase

Secondly, we need to add the **SYNSEM|LOC|CAT feature** for the **HEAD-DTR** *Mann*. Here the **HEAD feature** is further specified as a noun which takes CASE. The CASE value is represented with another index [2] for structure sharing. The SPR feature is still not specified, but just takes another index [3]. Remember that we are here in the branch of the head *Mann*, where we do not really yet "see" the specifier *dem*. The **whole CAT matrix** is then structure shared with the highest level NP by using the index [1].



$$\begin{bmatrix} \textit{head-specifier-phrase} \\ \text{PHON} \left\langle \textit{dem Mann} \right\rangle \\ \text{SYNSEM|LOC|CAT } \boxed{1} \\ \text{HEAD-DTR} \begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{Mann} \right\rangle \\ \textbf{SYNSEM|LOC|CAT } \boxed{1} \begin{bmatrix} \textit{category} \\ \text{HEAD} \begin{bmatrix} \textit{noun} \\ \text{CASE } \boxed{2} \end{bmatrix} \\ \text{SPR} \left\langle \boxed{3} \right\rangle \end{bmatrix} \end{bmatrix} \\ \text{NON-HEAD-DTRS} \left\langle \begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{dem} \right\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

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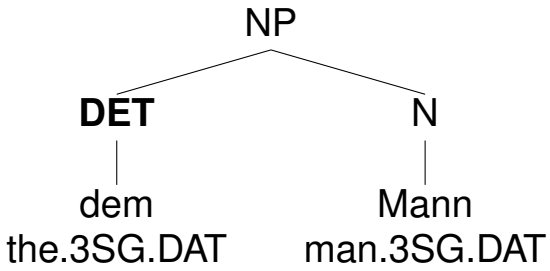
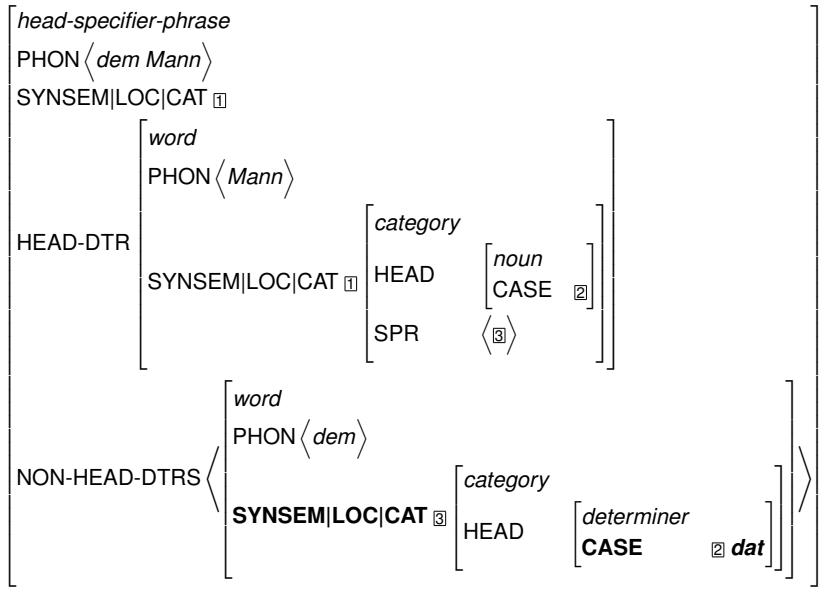
The Phrase Level: Noun-Phrase

Finally, we need to specify the CAT value of the NON-HEAD-DTR *dem*. The HEAD within this category is now of the type *determiner*, and the whole CAT matrix is structure shared with the HEAD-DTR as its specifier via the index 3. Also, it takes a CASE value which is specfied as *dative* and structure shared via the index 2.





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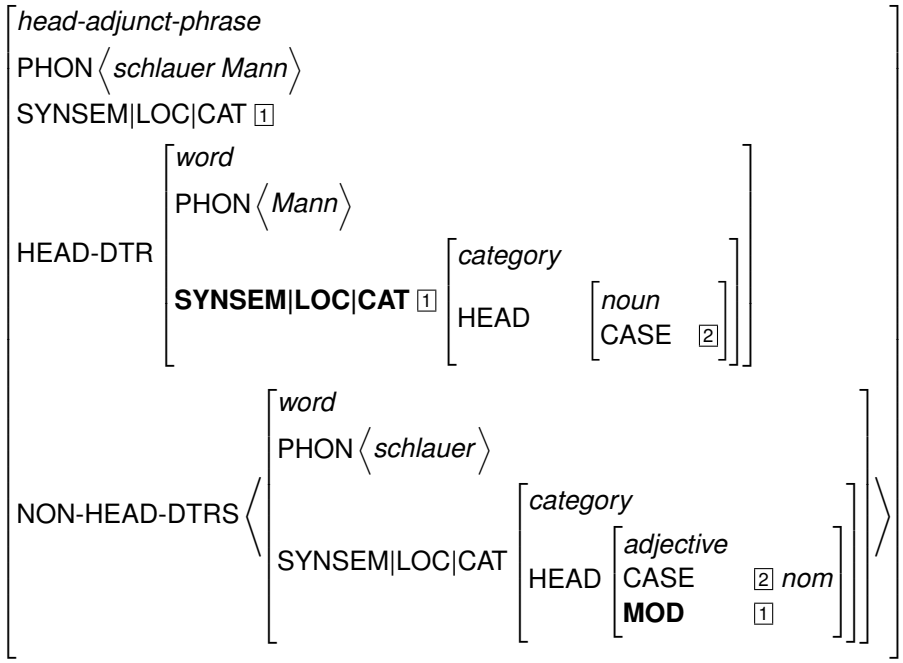
The Phrase Level: Noun-Phrase

In the case of nouns being modified by **adjectives**, we have a so-called **head-adjunct-phrase**. The **CAT value** of the highest level NP is again indicated by index 1. This is then specified and structure shared via the same index in the CAT value of the **HEAD-DTR**. As outlined above, the connection between the adjective and the noun is expressed by the **MOD feature** of the *adjective* type which takes the element modified by the adjective as its value, i.e. the noun in this case.



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Summary

- **HPSG** grew out of **LFG** and **GPSG** (with some parallels also to GB).
- It is different from LFG, however, in that **feature descriptions** are **typed**, and used right down to the **level of words**. It thus is a **highly lexicalized** theory of syntax.
- **Consitutent structure** is represented in **typed feature descriptions** as well, i.e. trees and re-write rules are only secondary.
- We have looked at how to model **individual words**, **head-specifier-phrases**, and **head-adjunct-phrases**.

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Outlook

- The representation of **constituent structure** in HPSG.
- **Head-complement-phrases**, i.e. verb phrases.
- **Linearization rules**, i.e. how to account for word order.
- General **schemata** for headed-phrases.

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References

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Thank You.

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