EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

Faculty of Philosophy
General Linguistics

Syntax & Semantics WS2019/2020

Lecture 17: Intermediate Summary (Syntax)

20/12/2019, Christian Bentz

Overview

Lecture 10: Lexical Functional Grammar I (Feature Descriptions)

Lecture 11: Lexical Functional Grammar II

Lecture 12: Head-Driven Phrase Structure Grammar I

Lecture 13: Head-Driven Phrase Structure Grammar II

Lecture 14: Construction Grammar

Lecture 15: Minimalism

Lecture 16: The Evolution of Syntax

Comments on Exercises in Week 8

Exercise 1: Construction Grammar

Take the following English utterances:

(1) Mary had Peter bake her a cake.

(2) He had her swim all the way.

(3) She has him crying.

(4) The neighbours have him arrested.

1. Formulate a construction which captures the similarities in these utterances (use POS as the main variables).

Solution:

1. NP_{Subj} $have_{fin}$ VP_{inf}; alternatively
   NP_{Subj} $have_{fin}$ $NP_{Subj/Obj}$ **VP**$_{inf}$

Comments on Exercises in Week 8

Exercise 1: Construction Grammar

Take the following English utterances:

(5) Mary had Peter bake her a cake.

3. Name all the constructions involved in constructing the first of these example sentences.

Solution:

- *Mary*, *had*, *Peter*, *bake*, *her*, *a*, *cake* constructions (individual words)
- NP_{Subj} have_{fin} VP_{inf} construction (that we defined above)
- **ditransitive construction** (*Peter bake her a cake*. Note: we have to assume here that the verb in the ditransitive construction is not further specified with regards to whether it is finite or non-finite)
- NP construction (*Mary*, *Peter*, *a cake*)
- VP construction (*bake her a cake*, *had Peter*). Note: the subjects (Mary, Peter) are here not considered part of the verb phrase (this goes back to the idea that subjects are specifiers rather than complements of the verb phrase).

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Lecture 10: Lexical Functional Grammar I (Feature Descriptions)

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):

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

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*:

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

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.)

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*

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

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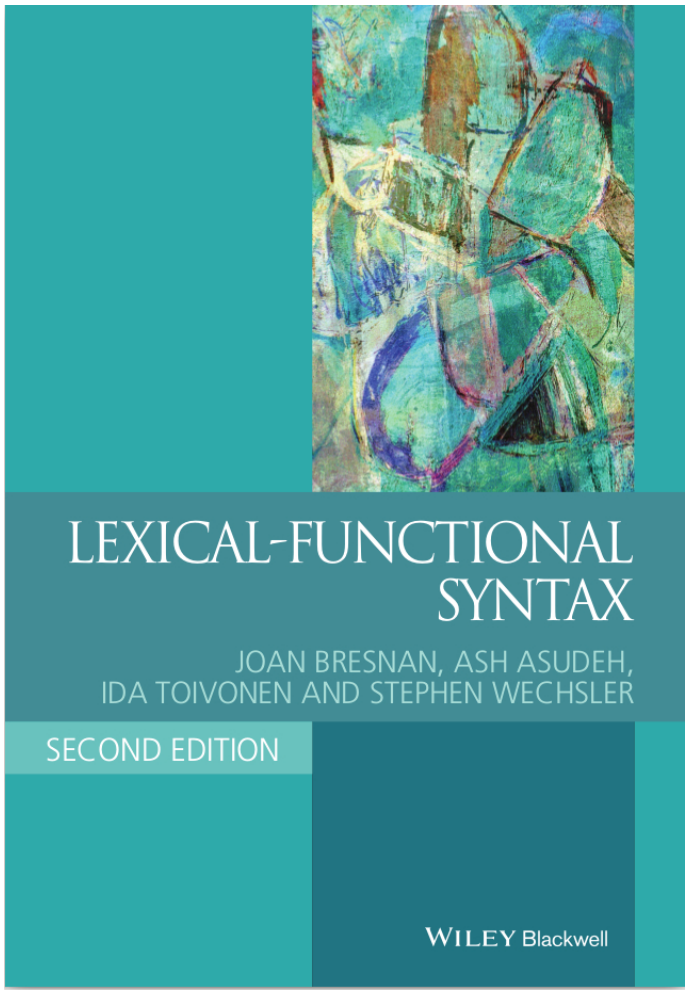
Lecture 11:
Lexical Functional Grammar II

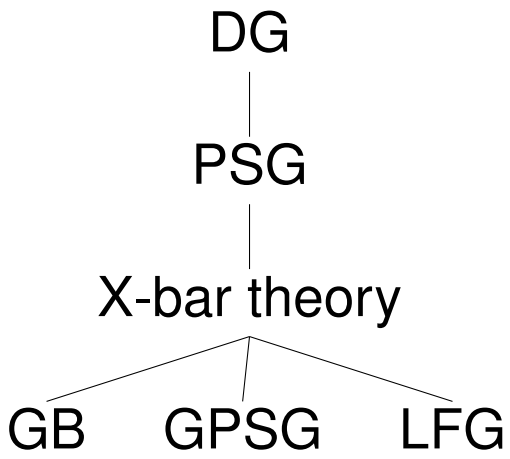
How is it different?

- "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.



Syntactic Framework Tree



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

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*:

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

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.

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.

F-Structure Examples: Transitive Sentence + Adjuncts

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

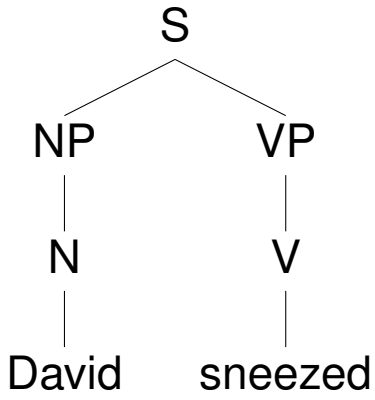
$$\begin{bmatrix} \text{PRED} & \text{'devour}\langle \text{SUBJ,OBJ} \rangle\text{'} \\ \text{TENSE} & \textit{past} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'david'} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \text{a} \\ \text{PRED} & \text{'sandwich'} \end{bmatrix} \\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

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

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:



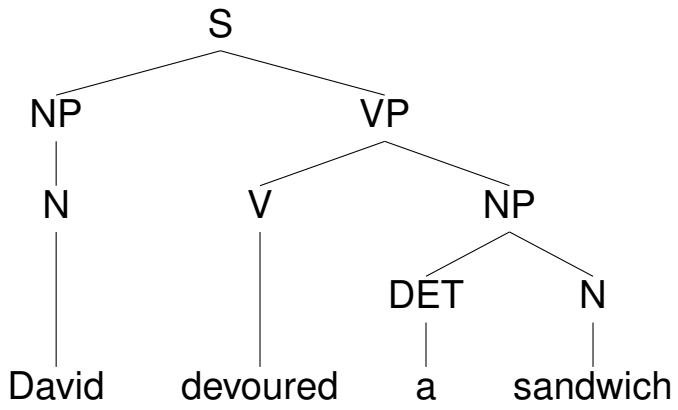
f-structure:

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

Constituent Structure (C-Structure)

Here is another example with the transitive sentence from above.

c-structure:



f-structure:

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

Basic Concepts in LFG

- Constituency ✓
- POS ✓
- Heads ✓
- Valency ✓
- Grammatical Functions ✓

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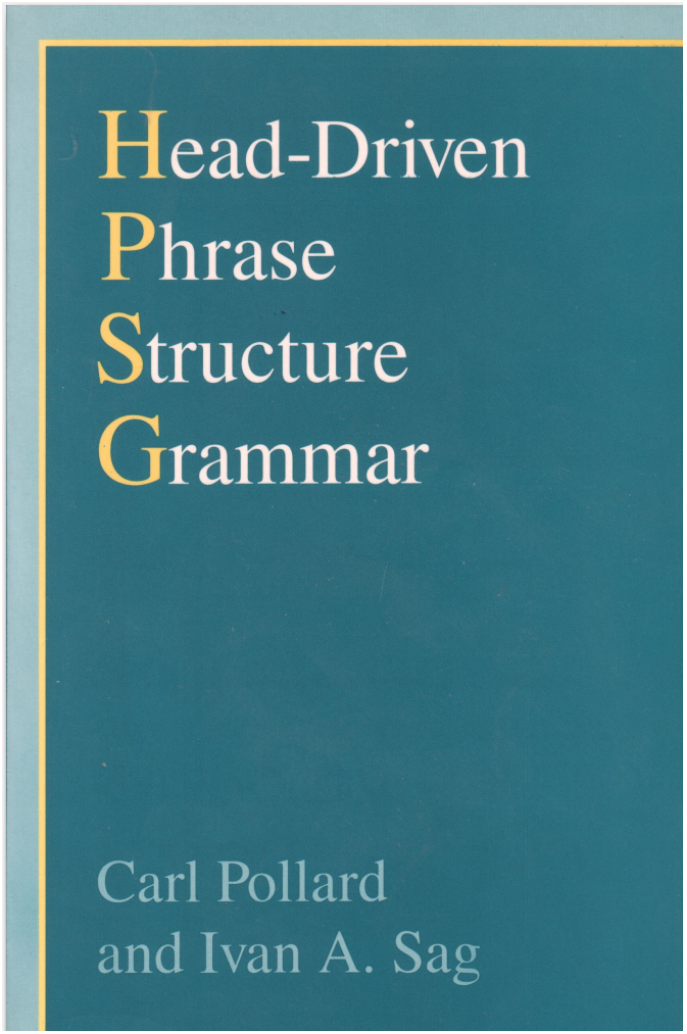
Lecture 12: Head-Driven Phrase Structure Grammar I

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.

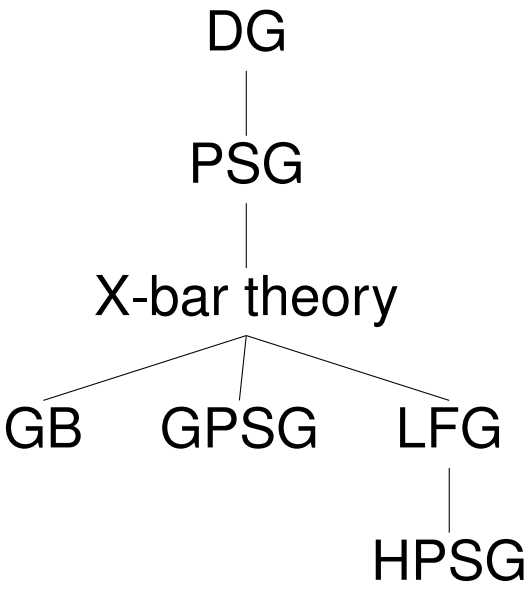


Further Characteristics of HPSG

- 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.

Syntactic Framework Tree



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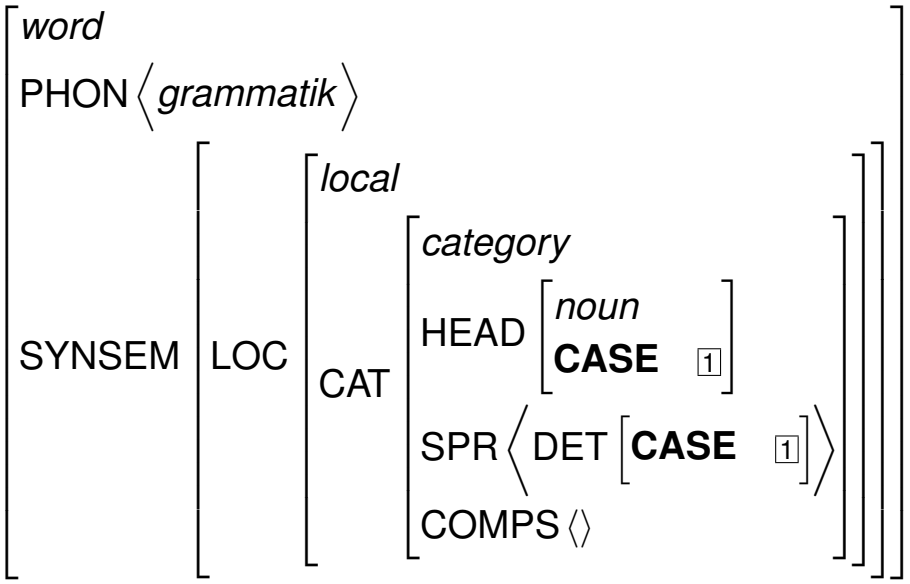
GPSG: Generalized Phrase Structure Grammar
LFG: Lexical Functional Grammar
HPSG: Head-Driven Phrase Structure Grammar

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.

Typed feature description for the word *Grammatik*.



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* ∨ *acc* ∨ *dat*∨ *gen*, or just leave the feature value empty and only use the structure sharing index.

The Word Level: Verbs (English)

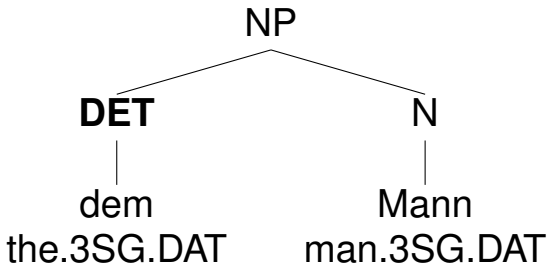
Verbs have a feature structure similar to nouns. Instead of a CASE feature given in the type *noun*, the type *verb* gives a **VFORM** feature which takes the same values as in GPSG (*fin*: finite; *inf*: to-infinitive; *bse*: bare infinitive; *prp*: present participle; *psp*: past participle; *pas*: 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)**.

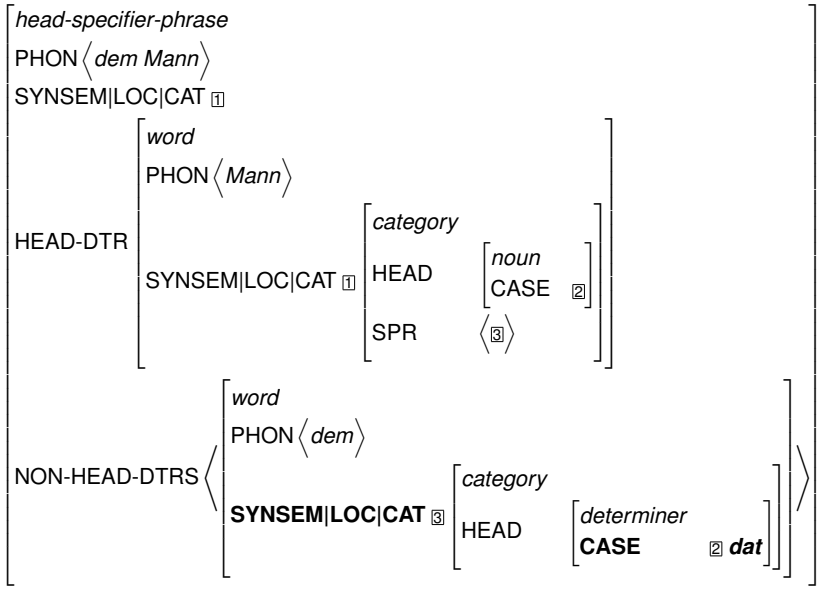
Typed feature description for the word *gives*.

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

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.





Note: While the determiner is construed as a feature (DET) of the specifier feature SPR as part of the type *noun*, in an actual noun phrase, there has to be a word for the determiner with its own typed feature description i.e. *determiner*.

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Lecture 13: Head-Driven Phrase Structure Grammar II

The Verb Phrase: Valence Information

Just as in earlier frameworks, in HPSG the **valence information** of a verb is explicitely modelled in a so-called **argument structure (ARG-ST)**, which combines information about the **specifier (SPR)**, i.e. the subject of a sentence, as well as the **complements (COMPS)**.

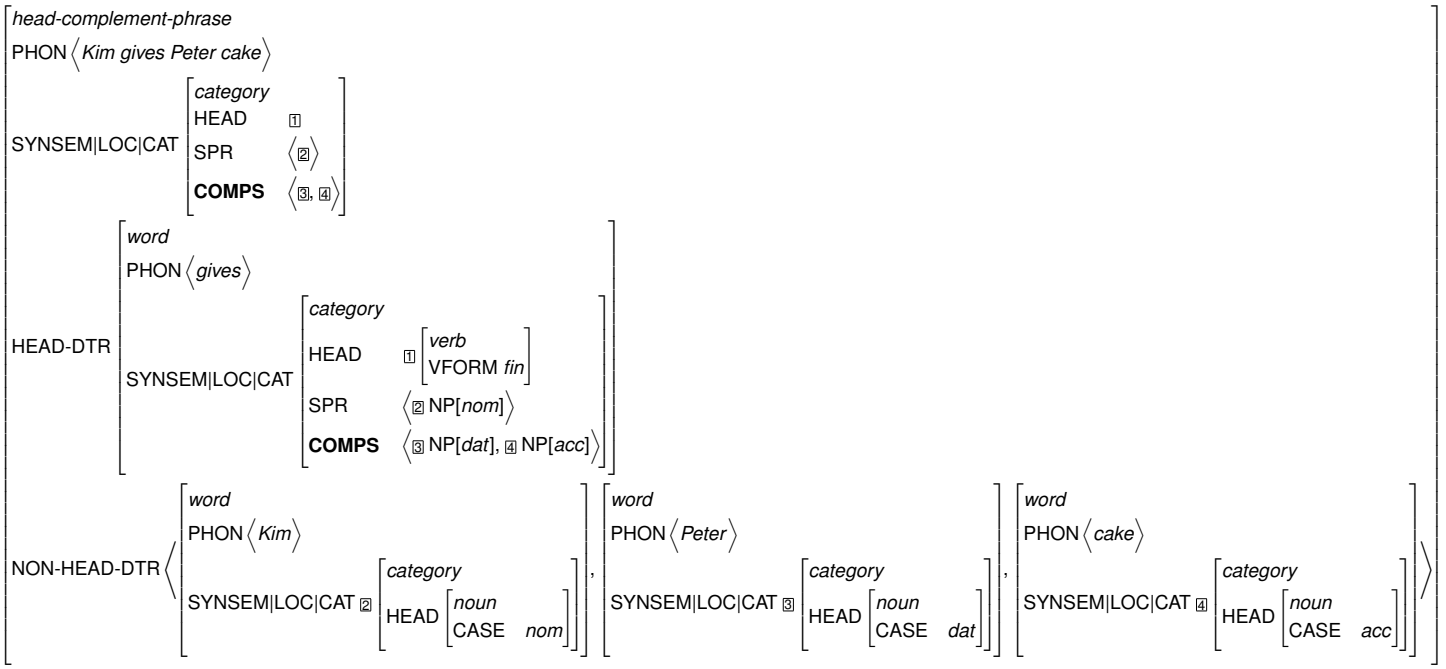
verb	SPR	COMPS	ARG-ST
sleep	⟨ NP[*nom*] ⟩	⟨ ⟩	⟨ NP[*nom*] ⟩
expect	⟨ NP[*nom*] ⟩	⟨ NP[*acc*] ⟩	⟨ NP[*nom*], NP[*acc*] ⟩
talk	⟨ NP[*nom*] ⟩	⟨ PP[*about*]⟩	⟨ NP[*nom*], PP[*about*] ⟩
give	⟨ NP[*nom*] ⟩	⟨ NP[*dat*], NP[*acc*]⟩	⟨ NP[*nom*], NP[*dat*], NP[*acc*] ⟩
serve	⟨ NP[*nom*] ⟩	⟨ NP[*acc*], PP[*with*]⟩	⟨ NP[*nom*], NP[*acc*], PP[*with*] ⟩

Adopted from Müller (2019), p. 269.

Note: For German, there is no distinction between COMPS and SPR, all the elements would be listed in COMPS.

Example: Ditransitive Sentence

By extension, the exact same principle applies to **ditransitive sentences**.



Feature Description (Simplified):

$$\begin{bmatrix} \textit{head-complement-phrase} \\ \text{PHON} \left\langle \textit{Kim gives Peter cake} \right\rangle \\ \text{HEAD-DTR} \begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{gives} \right\rangle \end{bmatrix} \\ \text{NON-HEAD-DTR} \left\langle \begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{Kim} \right\rangle \end{bmatrix}, \begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{Peter} \right\rangle \end{bmatrix}, \begin{bmatrix} \textit{word} \\ \text{PHON} \left\langle \textit{cake} \right\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

Orders Licensed:

gives	Kim			Peter		cake	
	Kim	**gives**		Peter		cake	
	Kim			Peter	**gives**	cake	
	Kim			Peter		cake	**gives**

Linearization Rules

Hence, **linearization rules** need to be specified for the different features. An English linearization rule could look like below:

$$\text{SPR} \prec \text{HEAD} \prec \text{COMPS} \tag{1}$$

This rule (almost) correctly linearizes the phrases we have analyzed above:

- *the man*, i.e. SPR $\prec$ HEAD
- *Kim sleeps*, i.e. SPR $\prec$ HEAD
- *Kim expects Peter*, i.e. SPR $\prec$ HEAD $\prec$ COMPS
- *Kim gives Peter cake*, i.e. SPR $\prec$ HEAD $\prec$ COMPS
  (though the order of *Peter* and *cake* is not captured here!)
- *Kim talks about Peter*, i.e. SPR $\prec$ HEAD $\prec$ COMPS

Basic Concepts in HPSG

- Constituency ✓
- POS ✓
- Heads ✓
- Valency ✓
- Grammatical Functions ✓

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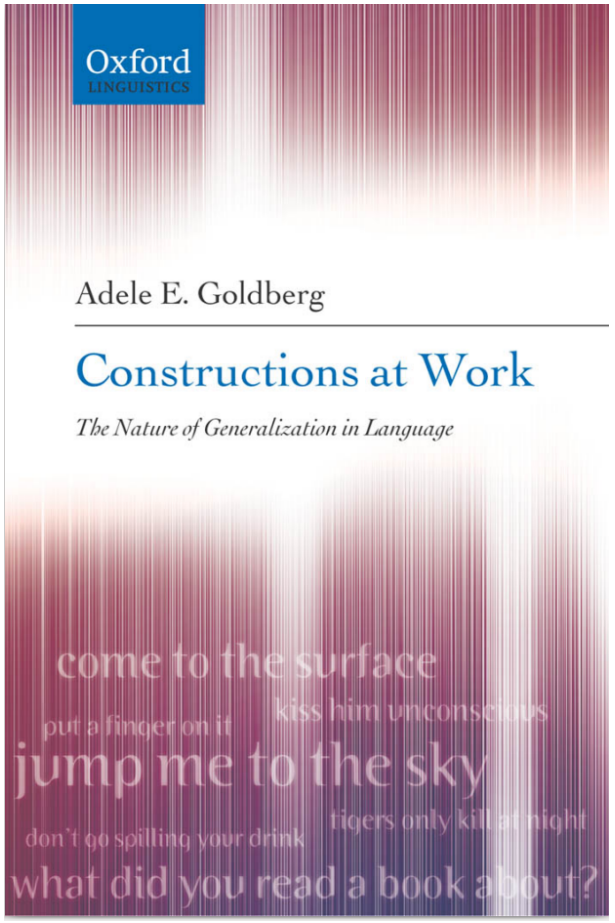
Lecture 14: Construction Grammar

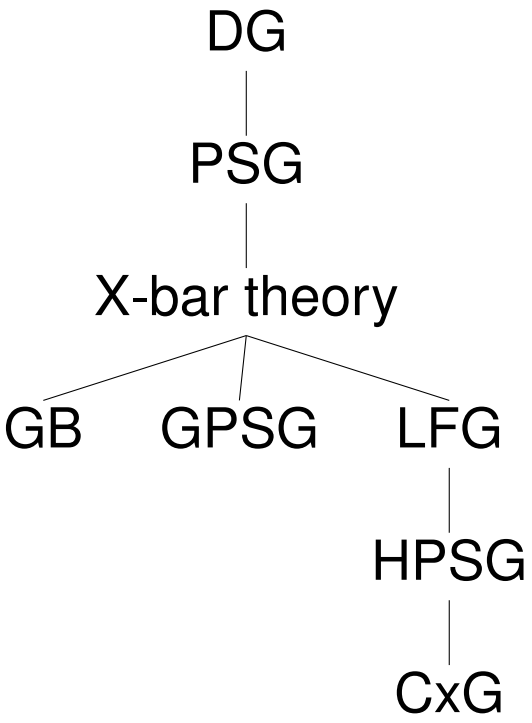
The Term *Construction*

- "The primary motivation for the term [constructionist] is that constructionist approaches emphasize the role of grammatical *constructions*: conventionalized pairings of *form and function*."
- "[...] constructionist approaches generally emphasize that languages are learned – that they are constructed on the basis of the input together with general cognitive, pragmatic, and processing constraints."

Golderg (2006). Constructions at work, p. 3.



Syntactic Framework Tree



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GPSG: Generalized Phrase Structure Grammar
LFG: Lexical Functional Grammar
HPSG: Head-Driven Phrase Structure Grammar
CxG: Construction Grammar

What is stored in the Human Brain (Lexicon)?

- **PSG answer**: the set of terminals, i.e. lexical items **corresponding to words**.
- **GB answer**: lexical items **corresponding to words** *with some specification* of what syntactic rules they can be involved in (i.e. θ-roles (valency) for verbs)
- **HPSG answer**: lexical items **corresponding to words** with *exact specifications* of the specifiers, complements, argument structures they require.
- **CxG answer**: **constructions**, which can be morphemes, words, idioms, phrasal patterns.

Constructions

"**All levels of grammatical analysis involve constructions**: learned pairings of form with semantic or discourse function, including morphemes or words, idioms, partially lexically filled and fully general phrasal patterns."

Goldberg (2006). Constructions at work, p. 5.

TABLE 1.1. Examples of constructions, varying in size and complexity

Morpheme	e.g. *pre-*, *-ing*
Word	e.g. *avocado, anaconda, and*
Complex word	e.g. *daredevil, shoo-in*
Complex word (partially filled)	e.g. [N-s] (for regular plurals)
Idiom (filled)	e.g. *going great guns, give the Devil his due*
Idiom (partially filled)	e.g. *jog* <someone's> *memory, send* <someone> *to the cleaners*
Covariational Conditional	The Xer the Yer (e.g. *the more you think about it, the less you understand*)
Ditransitive (double object)	Subj V Obj1 Obj2 (e.g. *he gave her a fish taco; he baked her a muffin*)
Passive	Subj aux VPpp (PP_{by}) (e.g. *the armadillo was hit by a car*)

Beware Notational Confusion

For consistency, we will here use **POS symbols**. If necessary, these can be further specified by indices.

Examples:

- Complex word (partially filled): **[N-s]** (regular plurals)
- Idiom (partially filled): send $\mathbf{N}_{person(s)}$ to the cleaners
- Covariational Conditional: the $\mathbf{ADJ}_1$**-er** the $\mathbf{ADJ}_2$**-er**[1]
- Ditransitive (double object): $\mathbf{NP}_{Subj}$ **V** $\mathbf{NP}_{Obj_1}$ $\mathbf{NP}_{Obj_2}$

[1] The number indices are here used to indicate that normally a different adjective is used in the second position.

How to Identify a Construction?

In order to identify a **construction** we have to ask whether in a set of different words, phrases, sentences there are reoccurring elements that can be learned and used as a *fixed scaffolding* to built further sentences according to the same template.

Example (sentence):

- **Go** do your homework
- **Go** tell him the truth
- **Go** get me pizza
- etc.

Construction: **go** $VP_{\textit{bare infinitive}}$

Adopted from Goldberg (2006), p. 54.

How to Identify a Construction?

Note that the reoccurring elements might not be material at "the surface" but the underlying sentence structure represented by POS symbols.

Example (sentence):

- He gave Pat a ball
- Pat baked George a cake
- The child handed her the book
- etc.

Construction: **NP**$_{Subj}$ **V NP**$_{Obj_1}$ **NP**$_{Obj_2}$

Multiple Constructions

"Constructionist theories do not derive one construction from another, as is generally done in mainstream generative theory. An actual expression typically involves the combination of at least half a dozen different constructions."

Goldberg (2006), p. 10.

(6) what did Liza buy Zach?

- *Liza*, *buy*, *Zach*, *what*, *do* constructions (i.e. individual words)
- ditransitive construction
- question construction (wh-word VP)
- subject-auxiliary inversion construction (aux Subj, i.e. *did Liza*)
- VP construction
- NP construction

Why Constructions? – Argument 1

"Examples need not be particularly novel to make the point. Verbs typically appear with a wide array of complement configurations. Consider the verb *slice* and the various constructions in which it can appear [...] It is the **argument structure constructions** that provide the direct link between surface form and general aspects of the interpretation"

Goldberg (2006), p. 7.

(7) He sliced the bread. (transitive)

(8) Pat sliced the carrots into the salad. (caused motion)

(9) Pat sliced Chris a piece of pie. (ditransitive)

(10) Emeril sliced and diced his way to stardom. (way construction)

(11) Pat sliced the box open. (resultative)

Basic Concepts in CxG (Goldbergian)

- Constituency ✓
- POS ✓
- Heads x
- Valency x
- Grammatical Functions ✓

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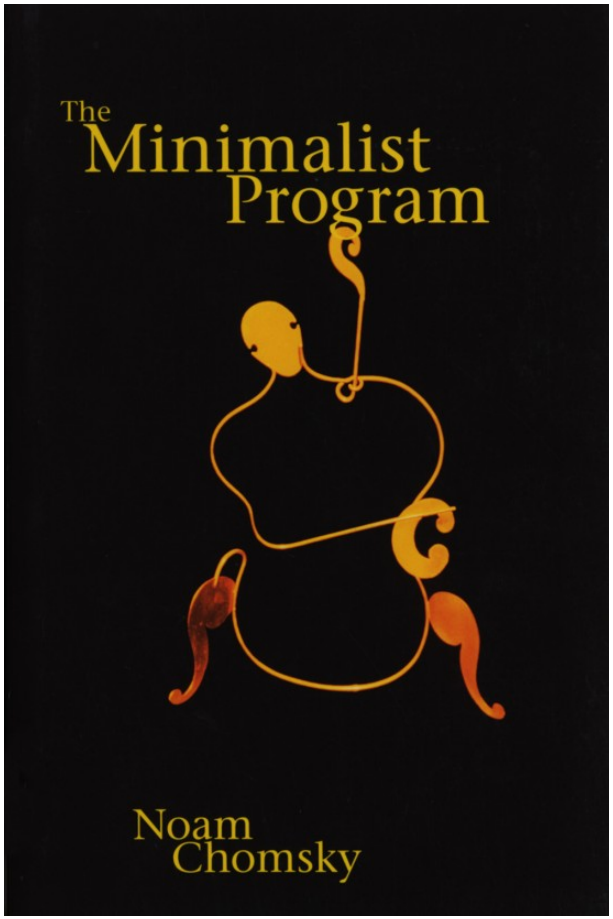
Lecture 15: Minimalism

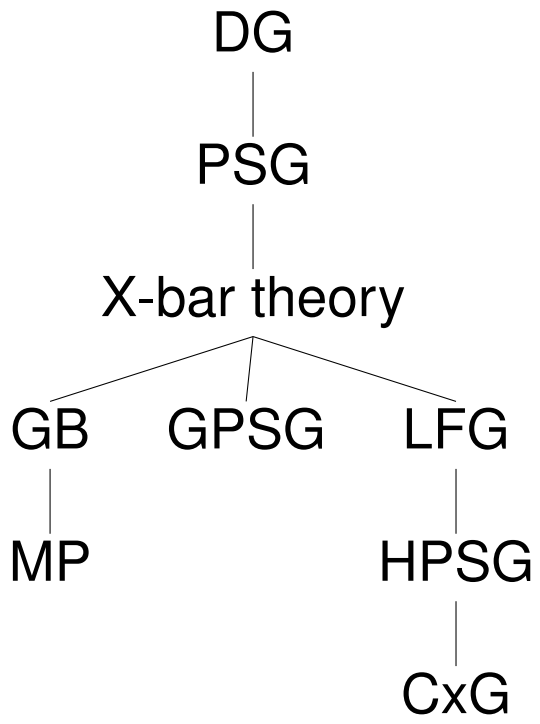
The Minimalist *Program*

- "It is important to recognize that the Minimalist Program (MP) under development in this work, and since, is a *program*, not a *theory*, a fact that has often been misunderstood. In central respects, MP is a seamless continuation of pursuits that trace back to the origins of generative grammar [...]"

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



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
CxG: Construction Grammar
MP: Minimalist Program

Interpretable and Uninterpretable Features

A further fundamental distinction is made between so-called **interpretable and uninterpretable** features:

> *"The Interpretable features, then, are categorial features generally and ϕ-features of nouns. Others are -Interpretable [i.e. Uninterpretable]."*

Chomsky (2015), p. 255.

Interpretable features:
categorial features (N, V, etc.)
ϕ-features *of nouns* (e.g. plural, neuter, third person)

Uninterpretable features:
ϕ-features *of predicates* (e.g. number and person of a verb)
Case features (e.g. nominative, accusative)
F features

Uninterpretable Categorial Features

We have defined above that categorial features (i.e. POS and phrase symbols) are *interpretable*. This generally holds true for categorial features which describe *the lexical item itself*. However, lexical items can also have **uninterpretable categorial features**, namely, representing a *complement* or *specifier* that is missing to build a complete phrase.

See also Adger (2003), p. 91.

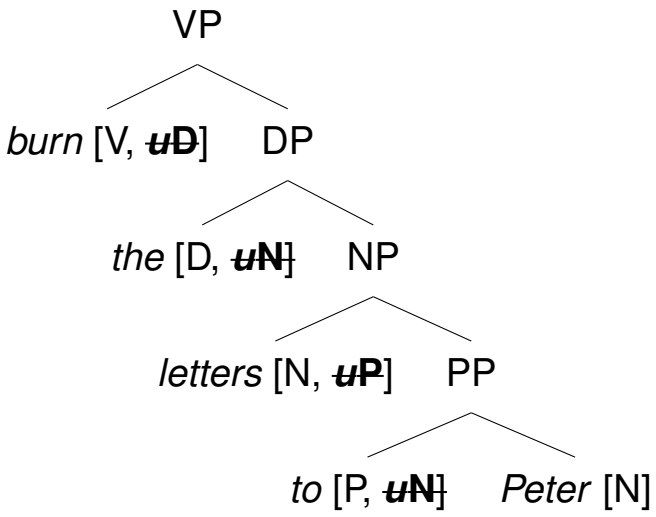
Examples:

kiss [V, ***u*N**] → a noun is missing as the complement, e.g. *kiss trees*
letter [N, ***u*P**] → a preposition is missing, e.g. *letters to*
to [P, ***u*D**] → a determiner is missing, e.g. *to him*
the [D, ***u*N**] → a noun is missing, e.g. *the letters*[2]

[2]Remember that for the combination of determiners and nouns the MP framework generally assumes a DP rather than NP, i.e. the determiner is the head. For arguments why, see Adger (2003), p. 250.

Merge

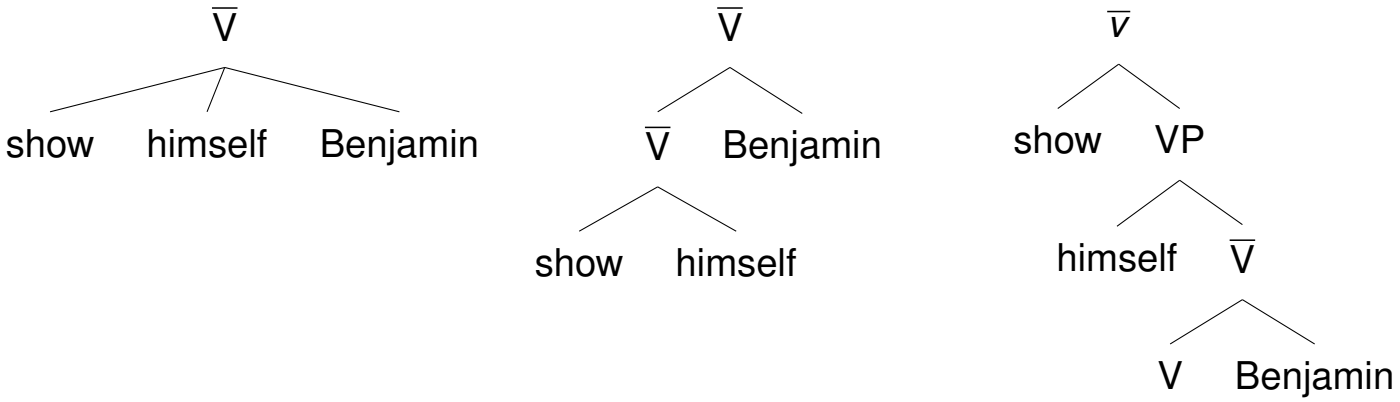
Note that in the examples above we have implicitely assumed that the tree is binary. This naturally derives from the fact that there is always only **one uninterpretable categorial feature in each node** which has to be feature checked and deleted. The operation which combines exactly two elements to a complex phrase is called **merge**.



Little *v*

There are at least three different ways of how to model ditransitives (in this case with a reflexive pronoun) in a tree structure. The last of the three options below – which involves another higher level of the verb phrase termed **little *v*** – is preferred by many practitioners of the MP, since here *himself* is higher in the tree than Benjamin (i.e. c-commands Benjamin) and cannot be interpreted as referring to Benjamin.

Müller (2019), p. 132.



Note: The full sentence assumed here is *Peter shows himself Benjamin in the mirror*. Where the reflexive pronoun refers back to Peter.

Basic Concepts in Minimalism

- Constituency ✓
- POS ✓
- Heads ✓
- Valency ✓
- Grammatical Functions ✓

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Lecture 16: The Evolution of Syntax

Fundamental Problem

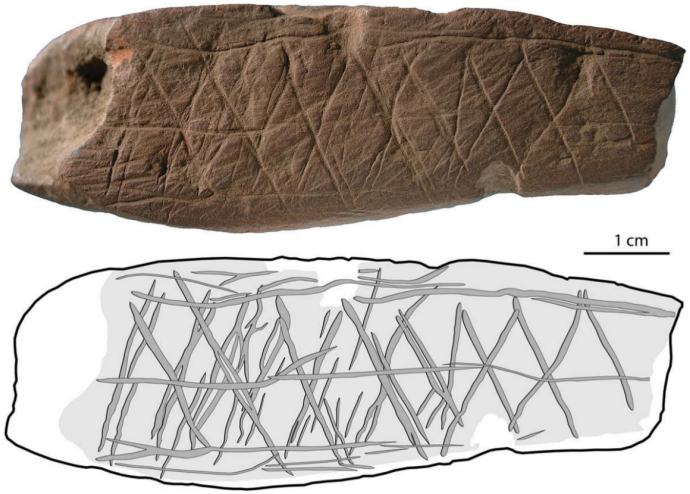
> *"Language leaves no direct imprint in the fossil record."*

Bolhuis et al. (2014)

Cueva de la pasiega ca. 16 000 BP
"La escritura"

... or does it?

How do we get from engravings...



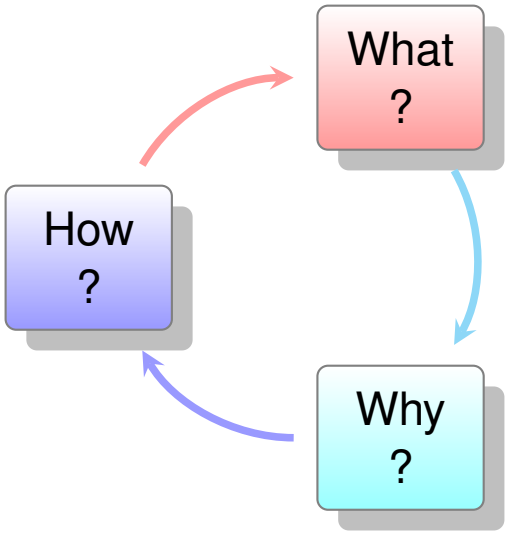
Blombos Cave ca. 70 000 BP
Henshilwood et al. (2002)

... to the earliest forms of writing?

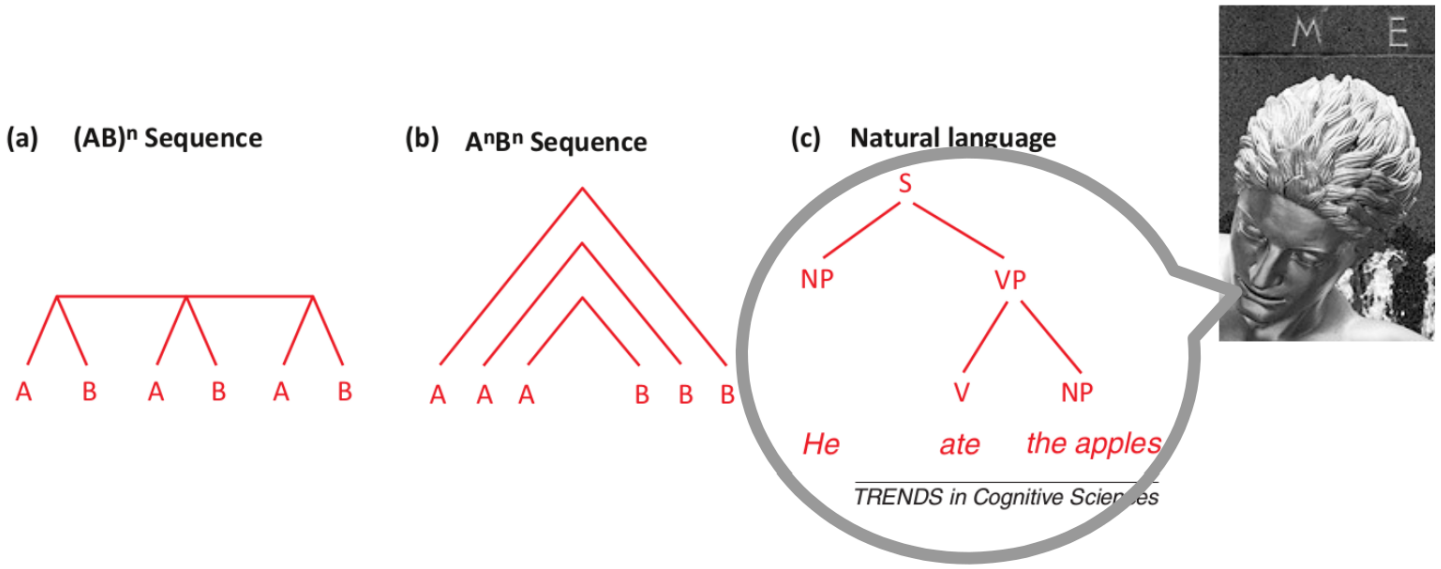
Sumerian Cuneiform ca. 5000 BP

Three Interdependent Questions

1. **What** evolved, i.e. what is “language” in the first place?
2. **Why** did it evolve, i.e. did it have particular functions?
3. **How** did it evolve?



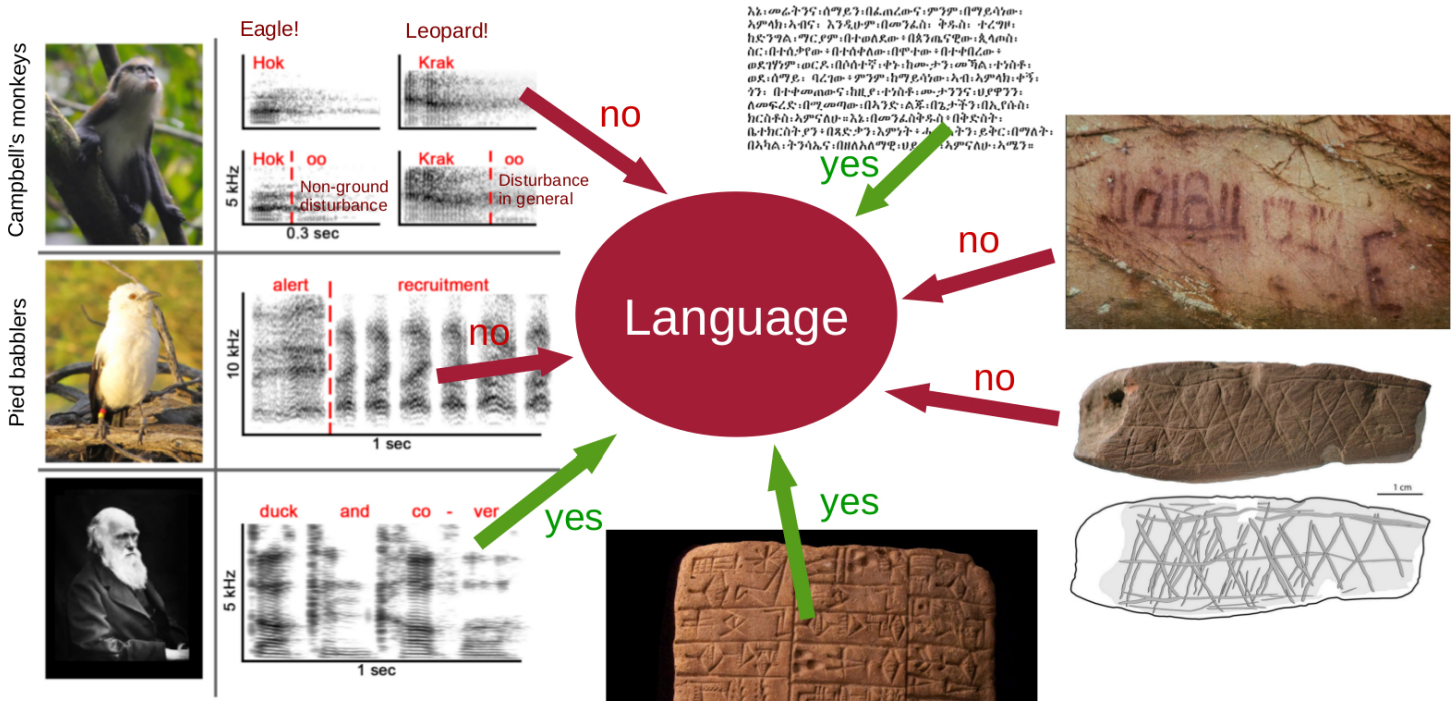
What is *Syntax*? – The Merge Hypothesis



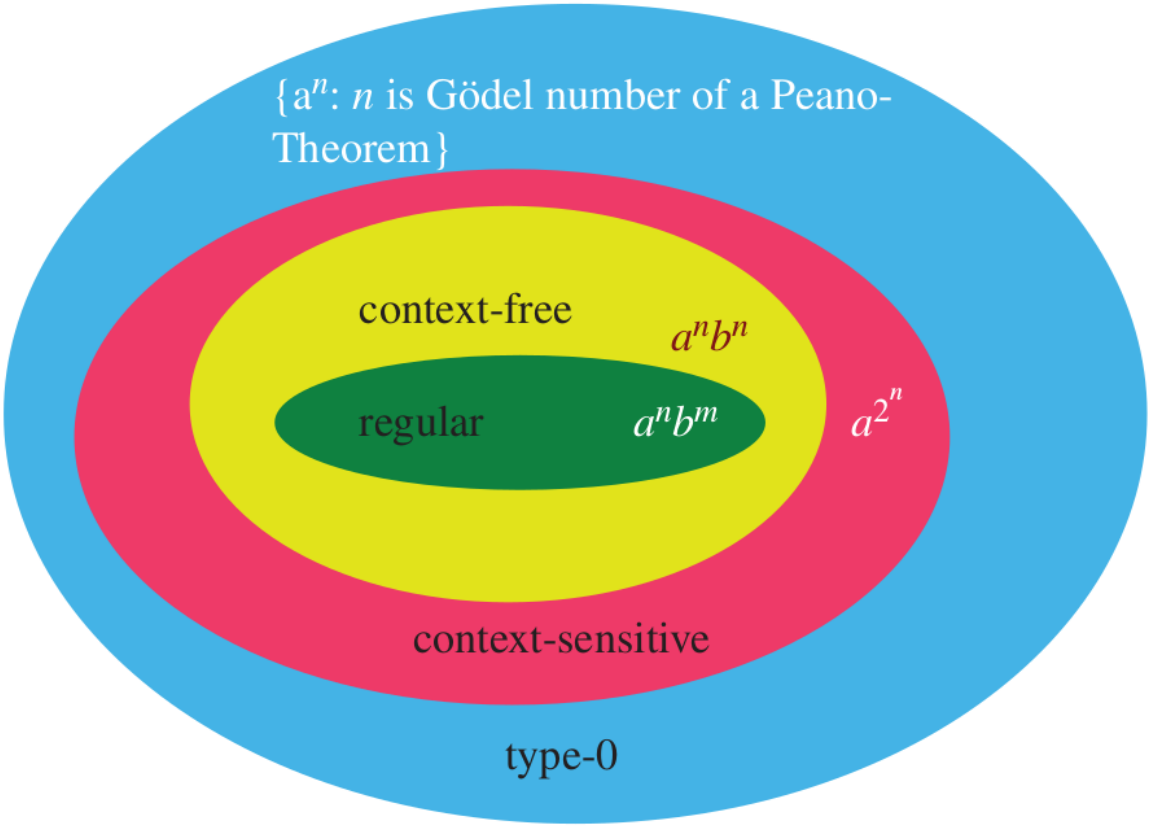
[...] the unified nature of human language arises from a shared, species-specific computational ability. This ability has identifiable correlates in the brain and has remained fixed since the origin of language approximately 100 thousand years ago.

Berwick et al. (2013). Evolution, brain, and the nature of language.

Is there an empirical way of deciding what is human language and what not?



The Chomsky Hierarchy



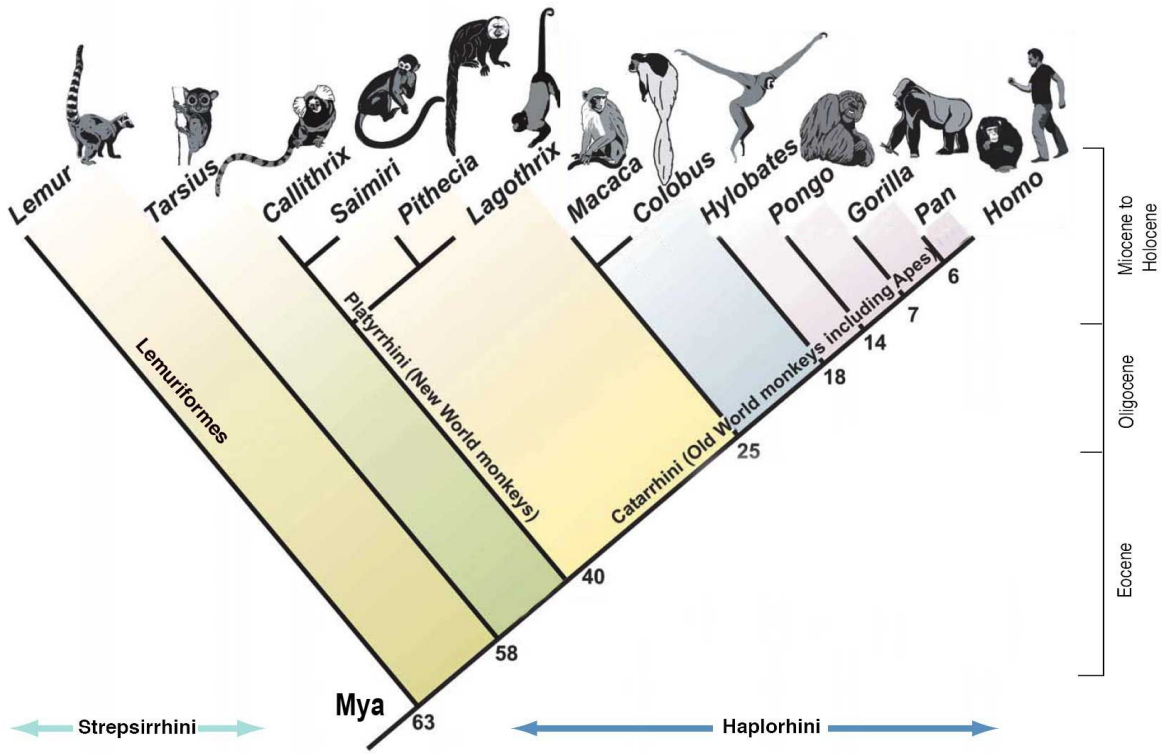
Chomsky (1956). Three models for the description of language.
Jäger & Rogers (2012). Formal language theory: refining the Chomsky hierarchy.

Decision Algorithm: Some Problems

- A finite-state automaton (regular grammar) **can generate** $a^n b^n$ sequences (either coincidentally or by implementing a simple counter).
- The argument that language is not a finite-state automaton is based on the assumption of **potentially infinite dependencies** (n). However, empirical data are always finite.
- In natural languages, there can be **intervening symbols** as in the example above (*neither* ... *neither* ... *nor* ... *nor*).
- In natural languages, the structural property of $a^n b^n$ does not necessarily refer to **"surface" properties** of the string (e.g. sequences of characters or phonemes), but higher order structures such as NP (noun phrase) or VP (verb phrase).

Vocal Communication

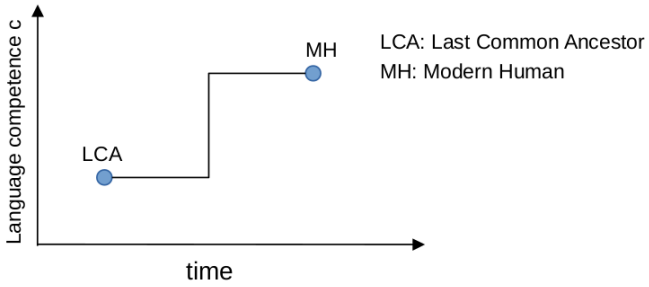
Problem: While more distant relatives (e.g. New World monkeys) indeed use sometimes complex vocal communication, our closest relatives (i.e. Apes) don't.



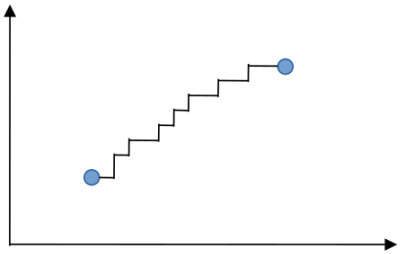
Evolutionary Models

There are several different models for the evolution of Language/Syntax depending on whether **adaptation** is supposed to play a role, and whether **discrete** or **continuous** changes are assumed:

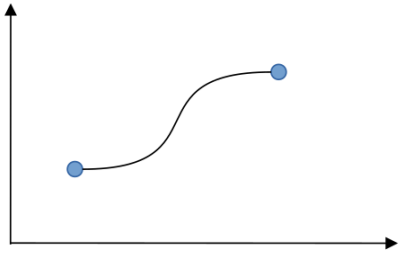
Sudden big jump (saltation)



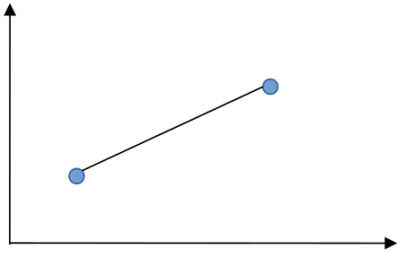
Small jumps (gradual, stepwise)



Continuous change with sudden spurts (variable rate)



Continuous change (constant rate)



Evolutionary Models

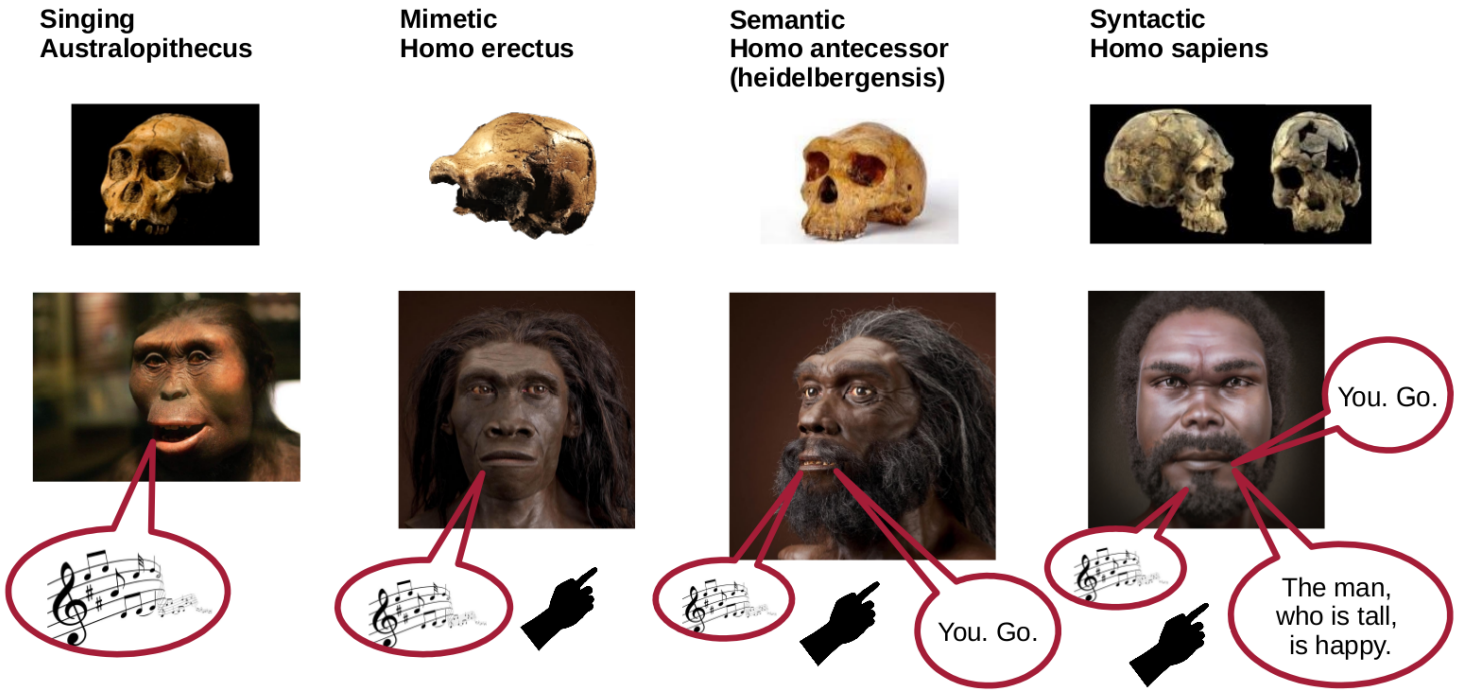
Decisive Question: Is language learning more like *growing a wing* or more *like learning to play chess*?

Saltational Account

Gradual Account

Co-evolution Account

Who was Prometheus?



Fitch (2017). Empirical approaches to the study of language evolution.

Thank You.

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