Constituent Order in Head-Driven Phrase Structure Grammar

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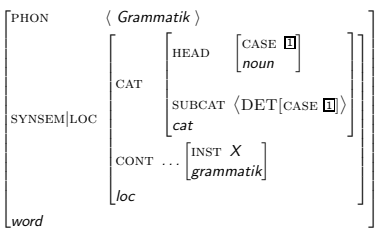
Course Page and Material

- Web page with the slides and handouts of the three lectures:
  http://www.cl.uni-bremen.de/~stefan/Lehre/LTC2005/
- The analyses are implemented.
  A CD rom image which contains the grammar development software and the grammars can be downloaded from there.
  If you have a writable CD we can burn it here.

General Overview of the Framework

- lexicalized (head-driven)
- sign-based (Saussure, 1916)
- typed feature structures (lexical entries, phrases, principles)
- multiple inheritance
- monostratal theory
  - Phonology
  - Syntax
  - Semantics



Valency and Grammar Rules: PSG

- huge number of rules:

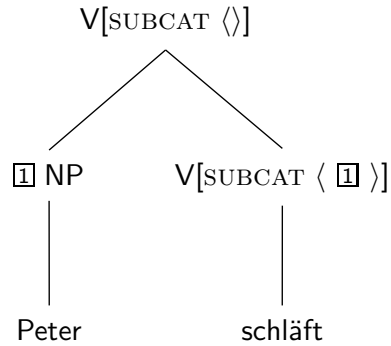
S → NP, V	*X schläft* ('sleeps')
S → NP, NP, V	*X Y liebt* ('loves')
S → NP, PP[*über*], V	*X über y spricht* ('talks about')
S → NP, NP, NP, V	*X Y Z gibt* ('gives')
S → NP, NP, PP[*mit*], V	*X Y mit Z dient* ('serves')

- verbs have to be used with the right rule
- → Valency is encoded twice: in grammar rules and in lexical entries

Valency and Grammar Rules: HPSG

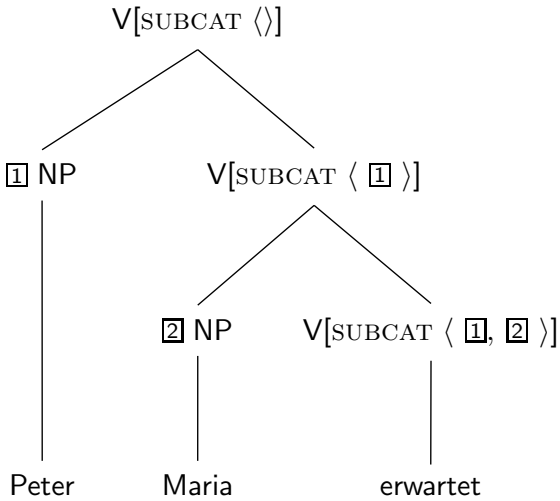
- arguments represented as complex categories in the lexical entry of the head
  (similar to categorial grammar)
- Verb SUBCAT
  schlafen ⟨ NP ⟩
  lieben ⟨ NP, NP ⟩
  sprechen ⟨ NP, PP[*über*] ⟩
  geben ⟨ NP, NP, NP ⟩
  dienen ⟨ NP, NP, PP[*mit*] ⟩

Example Tree with Valency Information (I)



V[SUBCAT ⟨ ⟩] corresponds to a fully saturated phrase (VP or S)

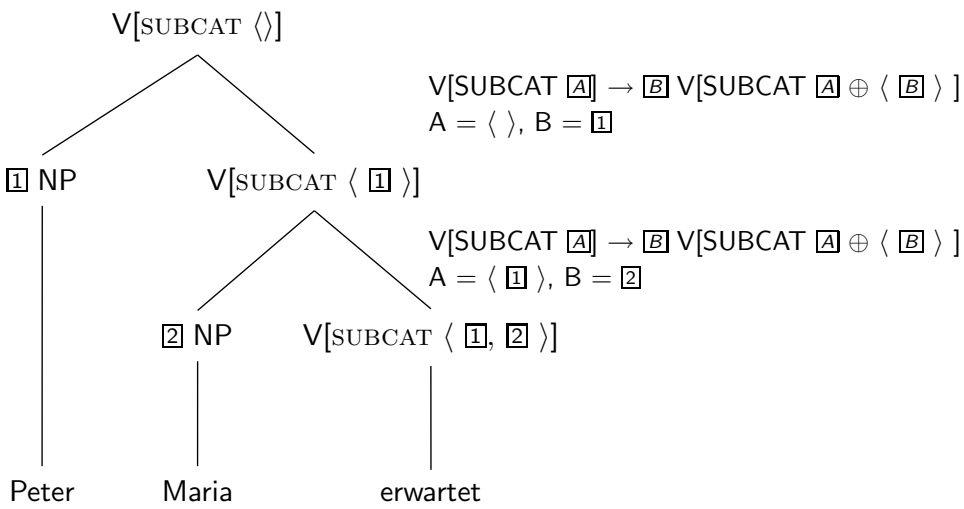
Example Tree with Valency Information (II)



Valency and Grammar Rules: HPSG

- specific rules for head argument combination:
  V[SUBCAT A] → B V[SUBCAT A ⊕ ⟨ B ⟩]
- ⊕ is a relation that concatenates two lists:
  ⟨ *a*, *b* ⟩ = ⟨ *a* ⟩ ⊕ ⟨ *b* ⟩ oder
  ⟨⟩ ⊕ ⟨ *a*, *b* ⟩ oder
  ⟨ *a*, *b* ⟩ ⊕ ⟨⟩

Valency and Grammar Rules (II)



V[SUBCAT A] → B V[SUBCAT A ⊕ ⟨ B ⟩]
A = ⟨ ⟩, B = 1

V[SUBCAT A] → B V[SUBCAT A ⊕ ⟨ B ⟩]
A = ⟨ 1 ⟩, B = 2

Generalization over Rules

- specific rules for head argument combinations:
  V[SUBCAT A] → B V[SUBCAT A ⊕ ⟨ B ⟩]
  A[SUBCAT A] → B A[SUBCAT A ⊕ ⟨ B ⟩]
  N[SUBCAT A] → B N[SUBCAT A ⊕ ⟨ B ⟩]
  P[SUBCAT A] → P[SUBCAT A ⊕ ⟨ B ⟩] B
- abstraction with respect to the order:
  V[SUBCAT A] → V[SUBCAT A ⊕ ⟨ B ⟩] B
  A[SUBCAT A] → A[SUBCAT A ⊕ ⟨ B ⟩] B
  N[SUBCAT A] → N[SUBCAT A ⊕ ⟨ B ⟩] B
  P[SUBCAT A] → P[SUBCAT A ⊕ ⟨ B ⟩] B
- generalized, abstract shema (H = head):
  H[SUBCAT A] → H[SUBCAT A ⊕ ⟨ B ⟩] B

Application of the Rules

- generalized, abstract shema (H = head):
  H[SUBCAT A] → H[SUBCAT A ⊕ ⟨ B ⟩] B
- possible instanciations of the schema:

V[SUBCAT A]	→	V[SUBCAT A ⟨⟩ ⊕ ⟨ B NP ⟩]	B NP
		Maria erwartet	Peter
		schläft	Peter
V[SUBCAT A]	→	V[SUBCAT A ⟨ NP ⟩ ⊕ ⟨ B NP ⟩]	B NP
		erwartet	Maria
N[SUBCAT A]	→	N[SUBCAT A ⟨⟩ ⊕ ⟨ B DET ⟩]	B Det
		Mann	der

Representation of Valency in Feature Descriptions

gibt ('gives', finite form):

$$\begin{bmatrix} \text{PHON} & \langle\, \textit{gibt} \,\rangle \\ \text{PART-OF-SPEECH} & \textit{verb} \\ \text{SUBCAT} & \left\langle \text{NP}[\textit{nom}],\ \text{NP}[\textit{acc}],\ \text{NP}[\textit{dat}] \right\rangle \end{bmatrix}$$

NP[*nom*], NP[*acc*] and NP[*dat*] are abbreviations of complex feature descriptions.

Demo: Grammar 3

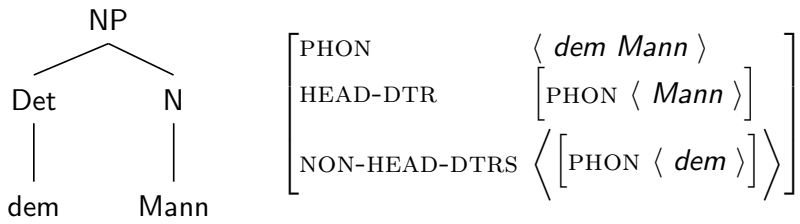
(1) a. der Mann schläft
the man sleeps
'The man sleeps'

b. der Mann die Frau kennt
the man the woman knows
'The man knows the woman.'

Representation of Grammar Rules (I)

- Feature Descriptions as uniform means for describing linguistic objects
  - morphological rules
  - lexical entries
  - syntactic rules
- separation of immediate dominance (ID) and linearer precedence (LP)
- dominance in DTR features (head daughters and non-head daughters)
- precedence is implicit in PHON

Part of the Structure in AVM Representation – PHON values (I)

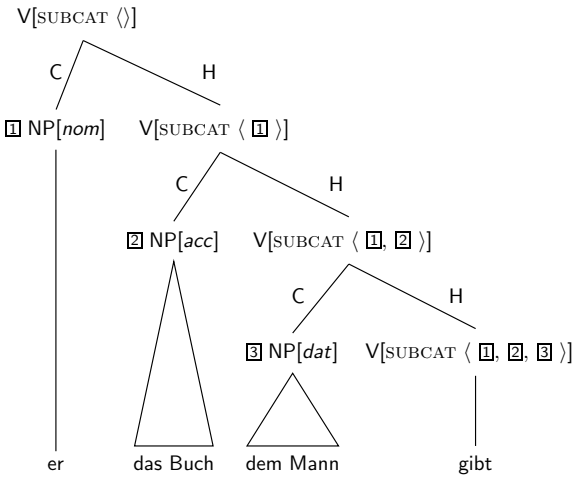


- There is exactly one head daughter (HEAD-DTR).
  The head daughter contains the head.
  a structure with the daughters *the* and *picture of Mary* →
  picture of Mary is the head daughter, since *picture* is the head.
- There may be several non-head daughters
  (if we assume flat structures or in headless binary branching structures).

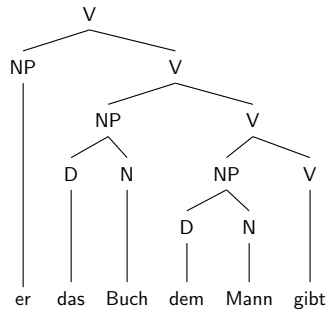
Representation of Grammar Rules

- Dominance Rule:
  head-argument-structure →
  [SUBCAT 1
  HEAD-DTR|SUBCAT 1 ⊕ ⟨ 2 ⟩
  NON-HEAD-DTRS ⟨ 2 ⟩]
  The arrow stands for implication
- alternative spelling, inspired by the $\overline{\text{X}}$ Schema:
  H[SUBCAT 1]→H[SUBCAT 1 ⊕ ⟨ 2 ⟩] 2
  The arrow stands for replacement (rewriting)
- possible instantiations:
  N[SUBCAT 1]→N[SUBCAT 1 ⟨⟩ ⊕ ⟨ DET ⟩] Det
  V[SUBCAT 1]→V[SUBCAT 1 ⟨⟩ ⊕ ⟨ NP ⟩] NP
  V[SUBCAT 1]→V[SUBCAT 1 ⟨ NP ⟩ ⊕ ⟨ NP ⟩] NP

An Example



Part of the Structure in AVM Representation – PHON values (I)



$$\begin{bmatrix} \text{PHON} & \langle\, \textit{dem Mann gibt} \,\rangle \\ \text{HEAD-DTR} & \left[\text{PHON} \;\langle\, \textit{gibt} \,\rangle\right] \\ \text{NON-HEAD-DTRS} & \left\langle \begin{bmatrix} \text{PHON} & \langle\, \textit{dem Mann} \,\rangle \\ \text{HEAD-DTR} & \left[\text{PHON} \;\langle\, \textit{Mann} \,\rangle\right] \\ \text{NON-HEAD-DTRS} & \left\langle \left[\text{PHON} \;\langle\, \textit{dem} \,\rangle\right] \right\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

Part of the Structure in AVM Representation – PHON values (II)

$$\begin{bmatrix} \text{PHON} & \langle\, \textit{er das Buch dem Mann gibt} \,\rangle \\ \text{HEAD-DTR} & \begin{bmatrix} \text{PHON} & \langle\, \textit{das Buch dem Mann gibt} \,\rangle \\ \text{HEAD-DTR} & \begin{bmatrix} \text{PHON} & \langle\, \textit{dem Mann gibt} \,\rangle \\ \text{HEAD-DTR} & \left[\text{PHON} \;\langle\, \textit{gibt} \,\rangle\right] \\ \text{NON-HEAD-DTRS} & \left\langle \begin{bmatrix} \text{PHON} & \langle\, \textit{dem Mann} \,\rangle \\ \text{HEAD-DTR} & \left[\text{PHON} \;\langle\, \textit{Mann} \,\rangle\right] \\ \text{NON-HEAD-DTRS} & \left\langle \left[\text{PHON} \;\langle\, \textit{dem} \,\rangle\right] \right\rangle \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{NON-HEAD-DTRS} & \left\langle \begin{bmatrix} \text{PHON} & \langle\, \textit{das Buch} \,\rangle \\ \text{HEAD-DTR} & \left[\text{PHON} \;\langle\, \textit{Buch} \,\rangle\right] \\ \text{NON-HEAD-DTRS} & \left\langle \left[\text{PHON} \;\langle\, \textit{das} \,\rangle\right] \right\rangle \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{NON-HEAD-DTRS} & \left\langle \left[\text{PHON} \;\langle\, \textit{er} \,\rangle\right] \right\rangle \end{bmatrix}$$

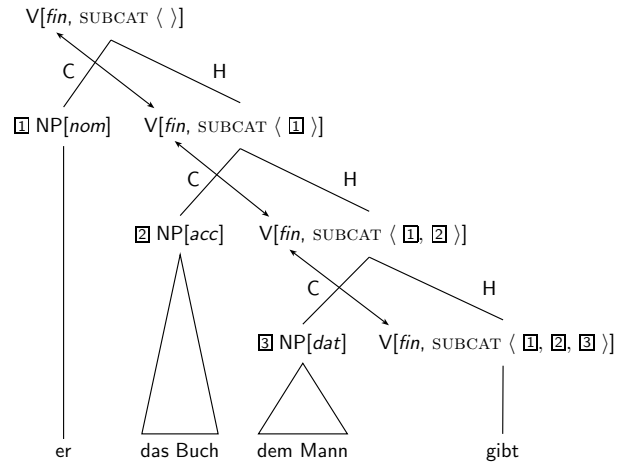
Partial Structure in Feature Structure Representation

$$\begin{bmatrix} \text{PHON} & \langle\, \textit{dem Mann gibt} \,\rangle \\ \text{SUBCAT} & \boxed{1}\, \langle \text{NP}[\textit{nom}],\, \text{NP}[\textit{acc}] \rangle \\ \text{HEAD-DTR} & \begin{bmatrix} \text{PHON} & \langle\, \textit{gibt} \,\rangle \\ \text{SUBCAT} & \boxed{1} \oplus \langle \boxed{2} \rangle \end{bmatrix} \\ \text{NON-HEAD-DTRS} & \left\langle \boxed{2} \begin{bmatrix} \text{PHON} & \langle\, \textit{dem Mann} \,\rangle \\ \text{P-O-S} & \textit{noun} \\ \text{SUBCAT} & \langle\rangle \\ \text{HEAD-DTR} & \ldots \\ \text{NON-HEAD-DTRS} & \ldots \\ & \textit{head-argument-structure} \end{bmatrix} \right\rangle \\ & \textit{head-argument-structure} \end{bmatrix}$$

Partial Structure in Feature Structure Representation

$$\begin{bmatrix}
\text{PHON} & \langle \textit{ er das Buch dem Mann gibt } \rangle \\
\text{SUBCAT} & \boxed{1}\ \langle\rangle \\
\text{HEAD-DTR} & \begin{bmatrix}
\text{PHON} & \langle \textit{ das Buch dem Mann gibt } \rangle \\
\text{SUBCAT} & \boxed{1} \oplus \langle \boxed{2} \rangle \\
\text{HEAD-DTR} & \ldots \\
\text{NON-HEAD-DTRS} & \ldots \\
 & \textit{head-argument-structure}
\end{bmatrix} \\
\text{NON-HEAD-DTRS} & \left\langle \boxed{2} \begin{bmatrix}
\text{PHON} & \langle \textit{ er } \rangle \\
\text{P-O-S} & \textit{noun} \\
\text{SUBCAT} & \langle\rangle \\
 & \textit{word}
\end{bmatrix} \right\rangle \\
 & \textit{head-argument-structure}
\end{bmatrix}$$

Projection of Head Properties



The finite verb is the head.

Feature Structure Representation: the HEAD Value

- possible feature geometry:

$$\begin{bmatrix}
\text{PHON} & \textit{list of phoneme strings} \\
\text{P-O-S} & \textit{p-o-s} \\
\text{VFORM} & \textit{vform} \\
\text{SUBCAT} & \textit{list}
\end{bmatrix}$$

- more structure, bundling of information that has to be projected:

$$\begin{bmatrix}
\text{PHON} & \textit{list of phoneme strings} \\
\text{HEAD} & \begin{bmatrix}
\text{P-O-S} & \textit{p-o-s} \\
\text{VFORM} & \textit{vform}
\end{bmatrix} \\
\text{SUBCAT} & \textit{list}
\end{bmatrix}$$

Different Heads Project Different Features

- feature VFORM makes sense for verbs only
- Prenominal adjectives and nouns project case.
- Possible structure: a structure that contains all features:

$$\begin{bmatrix}
\text{P-O-S} & \textit{p-o-s} \\
\text{VFORM} & \textit{vform} \\
\text{CASE} & \textit{case}
\end{bmatrix}$$

  CASE no value for verbs, VFORM no value for nouns
- Better solution: different types of feature structures
  - for verbs:

$$\begin{bmatrix}
\text{VFORM} & \textit{vform} \\
\textit{verb}
\end{bmatrix}$$

  - for nouns:

$$\begin{bmatrix}
\text{CASE} & \textit{case} \\
\textit{noun}
\end{bmatrix}$$

A Lexical Entry with Head Features

- A lexical entry contains the following:
  gibt: ('gives')

$$\begin{bmatrix} \text{PHON} & \langle\ \textit{gibt}\ \rangle \\ \text{HEAD} & \begin{bmatrix} \text{VFORM} & \textit{fin} \\ & \textit{verb} \end{bmatrix} \\ \text{SUBCAT} & \left\langle \text{NP}[\textit{nom}],\ \text{NP}[\textit{acc}],\ \text{NP}[\textit{dat}] \right\rangle \end{bmatrix}$$

  - phonological information
  - head information (part of speech, verb form, ...)
  - valency information: a list of descriptions of arguments

Head Feature Principle

In a headed structure the head features of the mother are identical to the head features of the head daughter.

$$\textit{headed-structure} \rightarrow \begin{bmatrix} \text{HEAD}\ \boxed{1} \\ \text{HEAD-DTR}|\text{HEAD}\ \boxed{1} \end{bmatrix}$$

All Constraints for a Local Tree (Head-Argument)

$$\begin{bmatrix} \text{HEAD} & \boxed{1} \\ \text{SUBCAT} & \boxed{2} \\ \text{HEAD-DTR} & \begin{bmatrix} \text{HEAD} & \boxed{1} \\ \text{SUBCAT} & \boxed{2} \oplus \langle\ \boxed{3}\ \rangle \end{bmatrix} \\ \text{NON-HEAD-DTRS} & \langle\ \boxed{3}\ \rangle \\ \textit{head-argument-structure} & \end{bmatrix}$$

Partial Structure in Feature Structure Representation

$$\begin{bmatrix} \text{PHON} & \langle\ \textit{dem Mann gibt}\ \rangle \\ \text{HEAD} & \boxed{1} \\ \text{SUBCAT} & \boxed{2}\ \langle\ \text{NP}[\textit{nom}],\ \text{NP}[\textit{acc}]\ \rangle \\ \text{HEAD-DTR} & \begin{bmatrix} \text{PHON} & \langle\ \textit{gibt}\ \rangle \\ \text{HEAD} & \boxed{1} \begin{bmatrix} \text{VFORM} & \textit{fin} \\ & \textit{verb} \end{bmatrix} \\ \text{SUBCAT} & \boxed{2} \oplus \langle\ \boxed{3}\ \rangle \\ & \textit{word} \end{bmatrix} \\ \text{NON-HEAD-DTRS} & \left\langle \boxed{3} \begin{bmatrix} \text{PHON} & \langle\ \textit{dem Mann}\ \rangle \\ \text{HEAD} & \begin{bmatrix} \text{CAS} & \textit{dat} \\ & \textit{noun} \end{bmatrix} \\ \text{SUBCAT} & \langle\rangle \\ \text{HEAD-DTR} & \ldots \\ \text{NON-HEAD-DTRS} & \ldots \\ & \textit{head-argument-structure} \end{bmatrix} \right\rangle \\ \textit{head-argument-structure} & \end{bmatrix}$$

Demo: Grammar 4

(2) a. der Mann schläft
the man sleeps
'The man sleeps'

b. der Mann die Frau kennt
the man the woman knows
'The man knows the woman.'

Constituent Order

- We will look at German,
since it is interesting in regard to its reordering possibilities.
- German is a SOV language, however in declarative main clauses and questions, the verb is placed in second and first position, respectively.
- How do we account for the serialization of arguments?
- How do we account for the verb position?

Relatively Free Constituent Order

- Arguments can be serialized in almost any order:

(3) a. weil der Mann der Frau das Buch gibt
because the man the woman the book gives
'because the man gives the book to the woman'

b. weil der Mann das Buch der Frau gibt

c. weil das Buch der Mann der Frau gibt

d. weil das Buch der Frau der Mann gibt

e. weil der Frau der Mann das Buch gibt

f. weil der Frau das Buch der Mann gibt

- For (3b–f) a different accenting is needed and the set of contexts in which the sentences may be uttered is restricted in comparison to (3a) (Höhle, 1982).

Adjuncts in the Mittelfeld

- Apart from the arguments, adjuncts may be serialized in the Mittelfeld.
- These can be placed at arbitrary positions between the arguments:

(4) a. weil morgen der Mann das Buch der Frau gibt
because tomorrow the man the woman the book gives
'because the man gives the book to the woman tomorrow'

b. weil der Mann morgen das Buch der Frau gibt

c. weil der Mann das Buch morgen der Frau gibt

d. weil der Mann das Buch der Frau morgen gibt

Scopal Adjuncts

- scopal adjuncts may not be reordered without changing the meaning:

(5) a. weil er oft nicht lacht (sondern weint)
because he often not laughs but crys
'because he often does not laugh'

b. weil er nicht oft lacht (sondern selten lacht)
because he not often laughs but seldomly laughs
'because he does not laugh often'

Binary Branching Structures

- Sentences like (6) are unproblematic:

(6) weil [der Mann [das Buch [der Frau gibt]]]
because the man the book the woman gives

- The integration of adjuncts is easy as well:

(7) a. weil [morgen [der Mann [das Buch [der Frau gibt]]]]
b. weil [der Mann [morgen [das Buch [der Frau gibt]]]]
c. weil [der Mann [das Buch [morgen [der Frau gibt]]]]
d. weil [der Mann [das Buch [der Frau [morgen gibt]]]]

- The difference in meaning in (8) follows from the difference in embedding:

(8) a. weil er [oft [nicht lacht]] (sondern weint)
b. weil er [nicht [oft lacht]] (sondern selten lacht)

Permutation of Arguments in the Mittelfeld

- Permutation of arguments is not explained yet.
- Until now we combine the head with the last element in the SUBCAT list.
head-argument-structure →

$$\begin{bmatrix} \text{SUBCAT } \boxed{1} \\ \text{HEAD-DTR}|\text{SUBCAT } \boxed{1} \oplus \langle\, \boxed{2} \,\rangle \\ \text{NON-HEAD-DTRS } \langle\, \boxed{2} \,\rangle \end{bmatrix}$$

- Generalization of the Head-Argument-Schema:
Instead of *append* ($\oplus$) we use *delete*.
delete takes one element from the list and returns the rest:
del(X,[1,2,3]) has the following results:
del(1,[1,2,3]) = [2,3]
del(2,[1,2,3]) = [1,3]
del(3,[1,2,3]) = [1,2]

The Head-Argument-Schema

- old:
head-argument-structure →

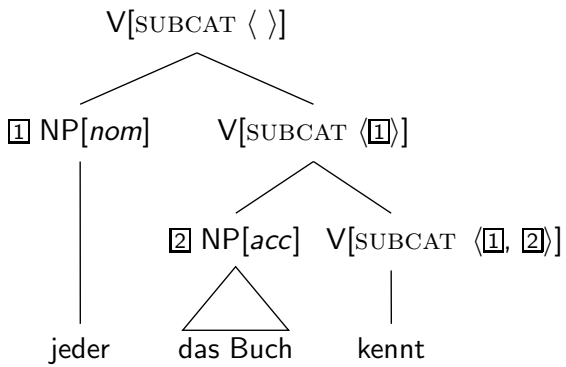
$$\begin{bmatrix} \text{CAT}|\text{SUBCAT } \boxed{1} \\ \text{HEAD-DTR}|\text{CAT}|\text{SUBCAT } \boxed{1} \oplus \langle\, \boxed{2} \,\rangle \\ \text{NON-HEAD-DTRS } \langle\, \boxed{2} \,\rangle \end{bmatrix}$$

- new:
head-argument-structure →

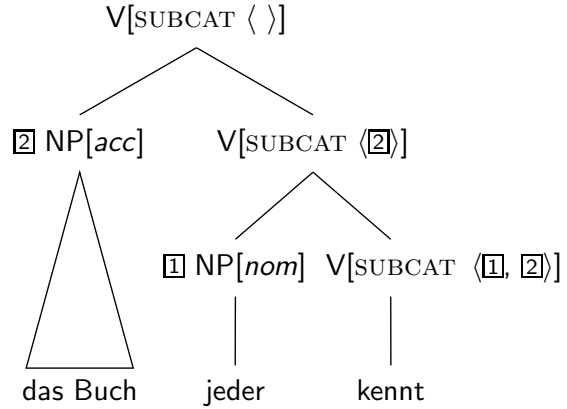
$$\begin{bmatrix} \text{CAT}|\text{SUBCAT } \text{del}(\boxed{1},\boxed{2}) \\ \text{HEAD-DTR}|\text{CAT}|\text{SUBCAT } \boxed{2} \\ \text{NON-HEAD-DTRS } \langle \boxed{1} \rangle \end{bmatrix}$$

Example: Normal Order

(9) a. weil jeder das Buch kennt
because everybody the book knows
b. weil das Buch jeder kennt



Example: Reordering

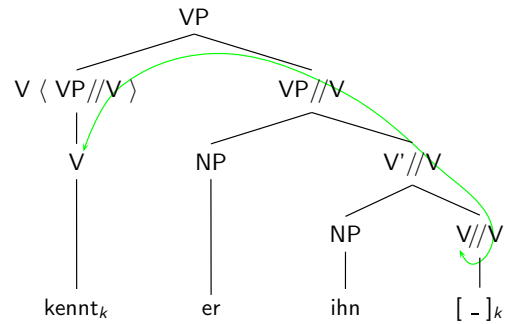


The difference is the order in which the elements in SUBCAT get saturated.

Demo: Grammar 9

(10) a. daß der Mann der Frau das Buch gibt
that the man-NOM the woman-DAT the book-ACC gives
b. daß der Mann das Buch der Frau gibt
that the man-NOM the book-ACC the woman-DAT gives
c. daß der Mann der Frau das Buch morgen gibt
that the man-NOM the woman-DAT the book-ACC tomorrow gives
d. daß der Mann der Frau morgen das Buch gibt
that the man-NOM the woman-DAT tomorrow the book-ACC gives
e. daß er oft nicht lacht

Verb Placement

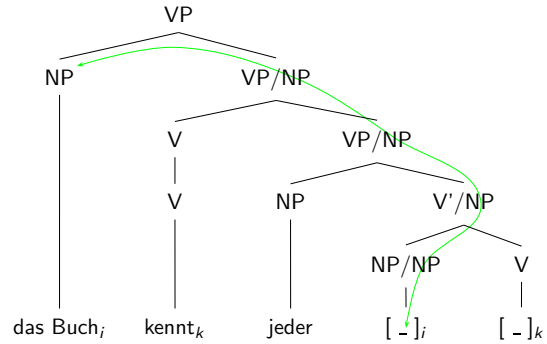


- A trace takes the position of the finite verb in verb initial sentences.
- A special form of the verb is in initial position.
It selects the projection of the empty verb.
- The special lexical item is licenced by a lexical rule.
- Connection between verb and trace is established by percolation.

Demo: Grammar 9

(11) Gibt der Mann der Frau das Buch.
gives the man-NOM the woman-DAT the book-ACC

Overview: Fronting



- As in the analysis of verb movment: trace in the "base position".
- Percolation of information through the tree
- constituent movement is not local, but verb movement is
  We use two features to model the two kinds of movement (SLASH vs. DSL)

Propoerties of the Analysis

- percolation of non-local information
- structure sharing
- Information is simultaneously present at every node in the extraction path.
- Nodes in the middle of an unbounded dependncy may access this information
  (Bouma, Malouf and Sag (2001): Irish, Chamorro, Palauan, Icelandic, Kikuyu, Ewe, Thompson Salish, Moore, French, Spanish, and Yiddish)

Data Structure: Local and Non-Local Information

HPSG devides the information into such that is locally relevant (LOCAL) and information that plays a role in long distance dependencies (NONLOCAL)

$$\begin{bmatrix} \text{PHON} & \textit{list of phoneme strings} \\ \text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{head} \\ \text{SUBCAT} & \textit{list of synsem objects} \end{bmatrix} \\ & \textit{cat} \\ \text{CONT} & \textit{cont} \\ & \textit{loc} \end{bmatrix} \\ \text{NONLOC} & \textit{nonloc} \\ \textit{sign} & \end{bmatrix}$$

Data Structure for Non-Local Information

- The NONLOC value has internal structure:

$$\begin{bmatrix} \text{QUE} & \textit{list of npros} \\ \text{REL} & \textit{list of indices} \\ \text{SLASH} & \textit{list of local structures} \\ \textit{nonloc} & \end{bmatrix}$$

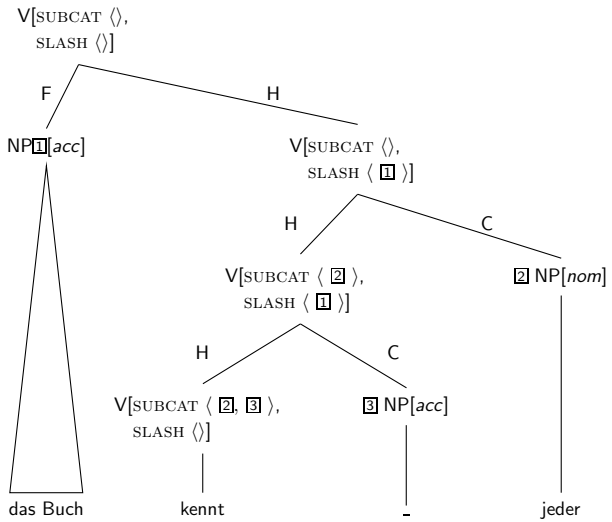
- QUE: list of indices of question words (interrogative clauses)
- REL: list of indices of relative pronouns (relative clauses)
- SLASH: list of *local* objects (fronting, relative and interrogative sentences)

The Trace of the Accusative Object of *kennen* ('know')

$$\begin{bmatrix} \text{PHON} & \langle\rangle \\ \text{LOC} & \boxed{1}\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{CAS} & \textit{acc} \\ & \textit{noun} \end{bmatrix} \\ \text{SUBCAT} & \langle\rangle \end{bmatrix} \end{bmatrix} \\ \text{NONLOC} & \begin{bmatrix} \text{SLASH} & \langle \boxed{1} \rangle \end{bmatrix} \\ \textit{word} & \end{bmatrix}$$

- The trace does not contribute phonologically.
- The trace has the local properties that *kennen* ('know') requires.
- This information is also introduced into SLASH.

Percolation of Non-Local Information (simplified → wrong verb placement!)



The Head Filler Schema

head-filler-structure →

$$\begin{bmatrix} \text{NONLOC}|\text{SLASH} & \langle\rangle \\ \text{HEAD-DTR} & \begin{bmatrix} \text{LOC}|\text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{VFORM} & \textit{fin} \\ \text{INITIAL} & + \\ & \textit{verb} \end{bmatrix} \\ \text{SUBCAT} & \langle\rangle \end{bmatrix} \\ \text{NONLOC}|\text{SLASH} & \langle \boxed{1} \rangle \end{bmatrix} \\ \text{NON-HEAD-DTRS} & \left\langle \begin{bmatrix} \text{LOC} & \boxed{1} \\ \text{NONLOC}|\text{SLASH} & \langle\rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

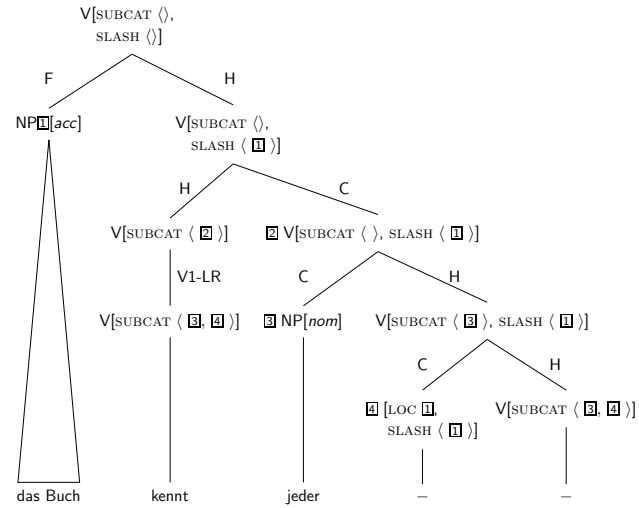
- Head daughter is a finite clause with verb in inital position (INITIAL+) and one element in SLASH
- The LOCAL value of the non-head is identical to the element in SLASH.
- Nothing may be extracted from the non-head daughter.

The Extraction Trace

$$\begin{bmatrix} \text{PHON} & \langle\rangle \\ \text{LOC} & \boxed{1} \\ \text{NONLOC} & \begin{bmatrix} \text{SLASH} & \langle\, \boxed{1} \,\rangle \end{bmatrix} \\ \textit{word} & \end{bmatrix}$$

- This is an abstraction over all possible instantiations of traces.
- We do not have to restrict the LOCAL value of the trace, since the verb imposes enough restrictions on the LOCAL values of its arguments.

Extraction + Verb Movement



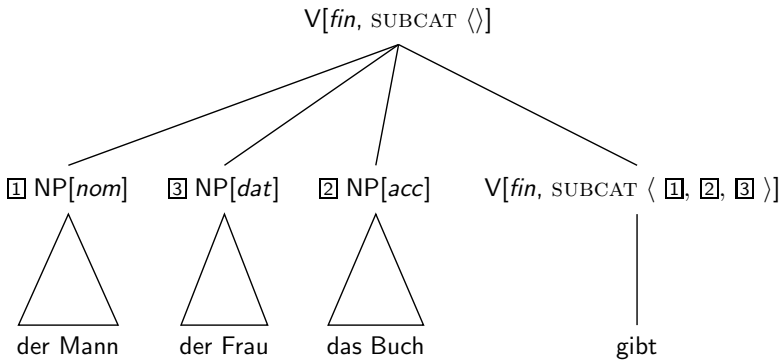
Demo: Grammar 9

(12) Der Mann gibt der Frau das Buch.
the man-NOM gives the woman-DAT the book-ACC

Alternative HPSG Proposals

- The following alternatives were suggested:
  - flat structures
    (Uszkoreit, 1987; Pollard, 1996; Kasper, 1994)
  - lienarization proposals
    (Reape, 1994; Kathol, 1995, 2000; Kathol and Pollard, 1995; Müller, 1995, 1999, 2002)
  - variable branching
    (Crysmann, 2003b; Kiss and Wesche, 1991; Schmidt, Rieder and Theofilidis, 1996).
- Some proposals are really influential in the framework:
  Reape, 1991, 1992, 1994; Pollard, Kasper and Levine, 1992, 1994; Kathol and Pollard, 1995; Kathol, 1995, 2000; Müller, 1995, 1997, 1999, 2002; Richter and Sailer, 1999; Donohue and Sag, 1999; Penn, 1999; Crysmann, 2001, 2002, 2003a; Beavers and Sag, 2004
- Therefore it is necessary to discuss them here.
  For a detailed discussion see Müller, 2004, 2005a,b.

Flat Structures



- Complements are daughters in the same local tree →
  All permutations are allowed.
- Verb initial and verb final orders are just alternative ordering possibilities.

Problemes with Flat Structures: Adjuncts

- Netter (1992):
  Integration of adjuncts is difficult because of meaning composition
- Kasper (1994) develops solution that relies on complex relational constraints that walk to the list of daughters and compute the adjunct meaning.
- Relational constraints are very powerful!
- Approaches that do without them have to be preferred.

Problems with Flat Structures: Multiple Frontings

Sentences like (13) can be explained with an empty head:

(13) a. [Nichts] [mit derartigen Entstehungstheorien] hat es natürlich zu
nothing with those.kinds.of creation.theories has it of.course to
tun, wenn . . .[1]
do when
'Of course it has nothing to do with that kind of creation theory when . . .'

b. [Zum zweiten Mal] [die Weltmeisterschaft] errang Clark 1965 . . .[2]
to.the second time the world.championship won Clark 1965
'Clark won the world championships for the second time in 1965.'

No satisfying explanation without empty head.

[1]K. Fleischmann, *Verbstellung und Reliefttheorie*, München, 1973, p. 72. quoted from (van de Velde, 1978, p. 135).

[2](Beneš, 1971, p. 162)

More Data

See Müller, 2003 for an extensive discussion of the data.

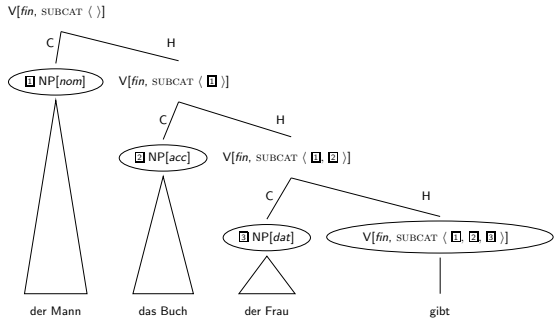
(14) a. [Trocken] [durch die Stadt] kommt man am Wochenende auch mit
dry through the town comes one at.the weekend also with
der BVG.[3]
the BVG
'The BVG (Berlin public transport system) will also get you about town on the weekend without getting wet.'

b. [Gezielt] [Mitglieder] [im Seniorenbereich] wollen die Kendoka
targeted members in.the senior.citizens.sector want.to the Kendoka
allerdings nicht werben.[4]
however not recruit
'However, the Kendoka do not intend to target the senior citizens sector with their member recruitment strategy.'

[3]taz berlin, 10.07.1998, p. 22

[4]taz, 07.07.1999, p. 18

Linearization Domains and Discontinuous Constituents



- circled nodes are inserted into a list: the linearization domain
- The permutation of elements in such domains is restricted by linearization rules
- Linearization domains are head domains ↔ Scrambling is local

Representation of Lexical Heads

$$\begin{bmatrix} \text{PHON} & \boxed{1} \\ \text{SYNSEM} & \boxed{2} \\ \text{DOM} & \left\langle \begin{bmatrix} \text{PHON} & \boxed{1} \\ \text{SYNSEM} & \boxed{2} \\ \text{DOM} & \langle\rangle \\ \textit{word} & \end{bmatrix} \right\rangle \\ \textit{word} & \end{bmatrix}$$

- Every head contains a description of it in its constituent order domain.
- Adjunct and complement daughters are inserted into this list and are ordered relative to the head.

Domain Formation

- All non-head daughters are inserted into the domain of the head:

$$\begin{bmatrix} \text{HEAD-DTR}|\text{DOM} & \boxed{1} \\ \text{NON-HEAD-DTRS} & \boxed{2} \\ \text{DOM} & \boxed{1} \bigcirc \boxed{2} \end{bmatrix}$$

- Domain elements can be ordered freely provided no LP constraint is violated.
- The *shuffle* relation holds between three lists A, B, and C, iff C contains all elements of A and B and the order of the elements in A and the order of the elements in B is preserved in C.

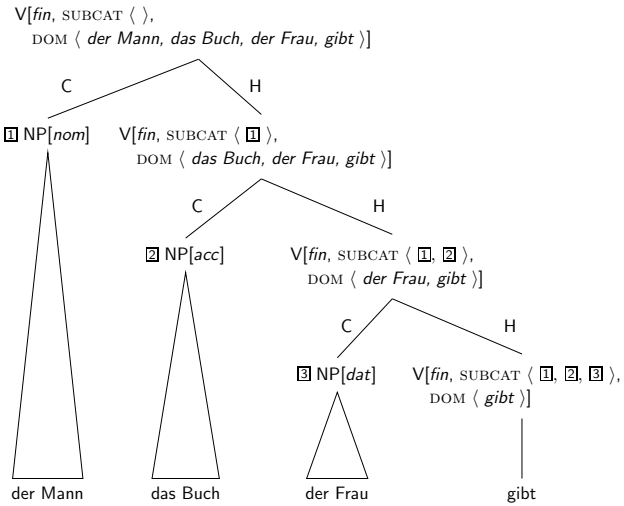
$$\begin{aligned} \langle\, a, b \,\rangle \bigcirc \langle\, c, d \,\rangle = {} & \langle\, a, b, c, d \,\rangle \vee \\ & \langle\, a, c, b, d \,\rangle \vee \\ & \langle\, a, c, d, b \,\rangle \vee \\ & \langle\, c, a, b, d \,\rangle \vee \\ & \langle\, c, a, d, b \,\rangle \vee \\ & \langle\, c, d, a, b \,\rangle \end{aligned}$$

PHON Computation

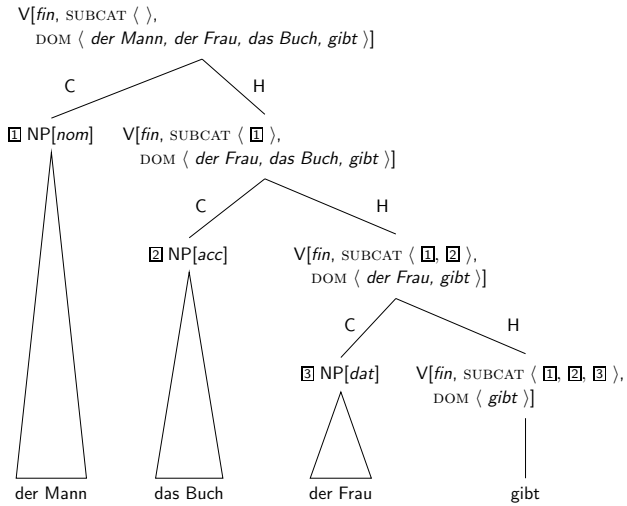
- Domain elements are ordered in surface order.
- → computation of the PHON value is simple concatenation

$$\begin{bmatrix} \text{PHON} & \boxed{1} \oplus \ldots \oplus \boxed{n} \\ \text{DOM} & \left\langle \begin{bmatrix} \text{PHON} & \boxed{1} \\ \textit{sign} & \end{bmatrix}, \ldots, \begin{bmatrix} \text{PHON} & \boxed{n} \\ \textit{sign} & \end{bmatrix} \right\rangle \\ \textit{phrase} & \end{bmatrix}$$

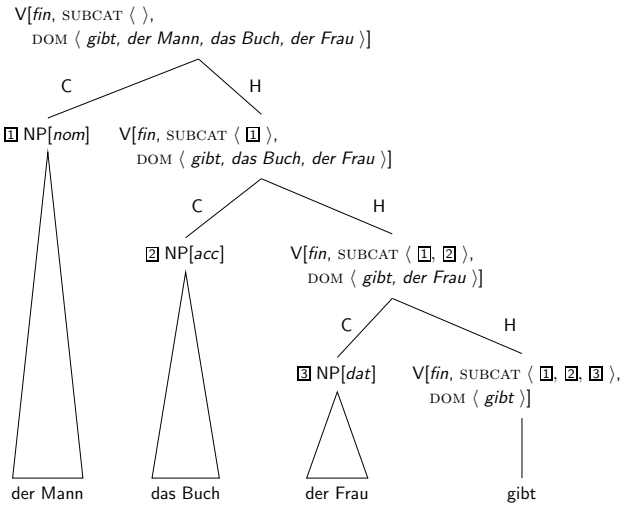
Continuous Constituents



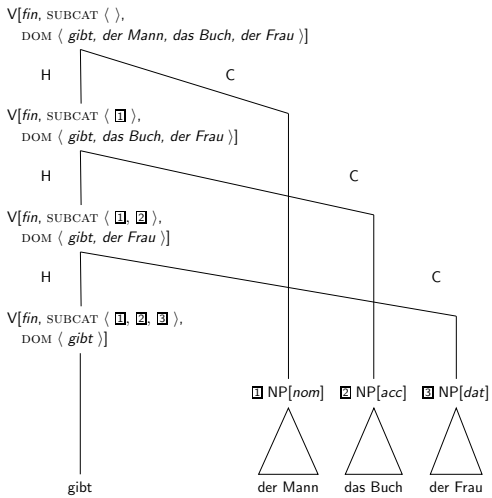
Discontinuous Constituents / Order in the Mittelfeld



Discontinuous Constituents / Verb Position



Verb Position with Constituents in Surface Order



A Remark

- The dominance structures of all the sentences in (15) are identical:

(15) a. der Mann der Frau das Buch gibt.
the man the woman the book gives

b. der Mann das Buch der Frau gibt.
the man the book the woman gives

c. Gibt der Mann das Buch der Frau.
gives the man the book the woman

- It is only the order in the constituent domains that differs.
- Demo!

Problems of Linearization Approaches

- These approaches have the same disadvantage as the ones that assume flat structures: It is impossible to explain the multiple fronting data.
- Topological field models fail, since multiple frontings require a new Mittelfeld, right sentence bracket, and Nachfeld embedded in the Vorfeld.

(16) a. [VF [MF Den Atem] [RS an]] hielt die ganze Judenheit.[5]

b. [VF [MF Wieder] [RS an]] treten auch die beiden Sozialdemokraten.[6]

c. [VF [RS Los] [NF damit]] geht es schon am 15. April.[7]
PART there.with went it already at.the 15 April
'It already started on April the 15th.'

See Müller To Appear; In Preparation

[5] Lion Feuchtwanger, *Jud Süß*, p. 276, quoted from Grubačić, 1965, p. 56.
[6] taz, bremen, 24.05.2004, S. 21
[7] taz, 01.03.2002, S. 8.

Problems of Linearization Approaches: Incomplete Category Fronting

- Impossible to explain why both dative objects and accusative objects can be fronted with the verb:

(17) a. Den Wählern erzählen sollte man diese Geschichte nicht.
the voters-DAT tell should one-NOM these stories-ACC not

b. Märchen erzählen sollte man den Wählern nicht.
fairy.tales-ACC tell should one-NOM the voters-DAT not

- The arguments of a head are combined with it in a fixed order, since the order of saturation is independend of the surface order of the arguments.
- with SUBCAT list ⟨ NP[*nom*], NP[*acc*], NP[*dat*] ⟩ we can analyze (17a) only no analysis for (17b) since *Märchen* can be combined with *erzählen* only after combination with the dative object.
- Kathol (2000): no order for objects in the SUBCAT list
Sentences in (17) can be analyzed, but we had spurious ambiguities for (18):

(18) daß er den Wählern Märchen erzählt
that he-NOM the voters-DAT fairy.tales-ACC tells

Incomplete Category Fronting

- The sentences in (19) are unproblematic for our proposal:

(19) a. Den Wählern erzählen sollte man diese Geschichte nicht.
the voters-DAT tell should one-NOM these stories-ACC not

b. Märchen erzählen sollte man den Wählern nicht.
fairy.tales-ACC tell should one-NOM the voters-DAT not

The head argument schema allows the combination of head and argument in any order.

- Note regarding GB: If we want to account for ICF as remnant movement (Webelhuth and den Besten, 1987; Thiersch, 1986), we get problems with unbound traces in the Vorfeld.
Appart from this there are empirical problems:
Haider, 1993; De Kuthy, 2002; De Kuthy and Meurers, 2001; Fanselow, 2002

Variable Branching

- Crysmann (2003b), Kiss and Wesche (1991) und Schmidt et al. (1996) Variable Branching:

(20) a. [[[Gibt er] dem Mann] das Buch]?
gives he the man the book
'Does he give the man the book?'

b. [Hat [er [dem Mann [das Buch gegeben]]]]?
has he the man the book given

- no empty head
- no explanation for appearently multiple frontings

Summary and Comparison

- Subjects are selected like other arguments.
- Scrambling is not analyzed as movement.
- No functional projections as landing sites
- Properties of objects are modelled directly not via tree positions
- More surface-oriented
- Verb position is analyzed similar to standard GB:
CP/IP system, but without inflectional head. Inflection is done lexically.
- Nonlocal dependencies are registered locally →
morphological effects can be accounted for.
- Only one representational level.
No PF, no LF, no DS, just SS,
valency (order information), and traces or equivalent mechanisms for reconstruction.

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