Phrases and Sentences

1. Language models
2. Chunking
3. Structural descriptions
4. Parsing with phrase structure grammars
5. Probabilistic parsers
6. Parsing with dependency grammars
7. Principles and Parameters
8. Unification-based grammars
9. Semantics construction

Phrases and Sentences

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Principles and Parameters

- Universal grammar
- Phrases and phrasal heads
- The X-bar schema
- Applying the X-bar schema
- Sentence structure
- Movement

Universal Grammar

- biologically-oriented approach
- related to human language processing:

  "All languages share certain properties, because the human language faculty has certain properties."
  (von Stechow und Sternefeld 1988)

Universal Grammar

- idea of the human language module as a mental organ
  - innate language acquisition device
  - the language faculty cannot be learned
  - modelled by means of principles and parameters
  - details of the biological foundation unclear and controversial

Universal Grammar

Principles

- very general guidelines for structuring of utterances
- e.g. syntactic autonomy

  No syntactic rule has access to pragmatic, phonological oder semantic information.

- e.g. structural determination

  All grammar rules are structurally determined.

  no reference to absolute or relative positions within an utterance

Universal Grammar

- structural determinination
  - e.g. subject-auxiliar inversion

    The girl did call her father in the morning.
    Did the girl call her father in the morning?

  - rule (initial version): move the third wordform to the begin of the sentence

    She did call her father in the morning.
    The little girl did call her father in the morning.

  - rule (improved version): exchange the order of subject NP and auxiliary

    [The girl] did call her father in the morning.
    [She] did call her father in the morning.
    [The little girl] did call her father in the morning.

Universal Grammar

Parameter

- bundles of properties that alway occur together
- e.g. pro-drop
  - the subject can be empty in some languages (Italian, Greek, Spanish)

    Ital.: *Giovanni canta.*
    Canta.
    Engl.: *John sings.*
    ** Sings.*
  - emprical finding (Perlmutter und Rizzi): pro-drop languages have additional characteristics that non-pro-drop languages lack

Universal Grammar

- abstractions from
  - individual deficiencies of the language faculty
  - limited processing capacity
  - contextual influences
  - differences within the linguistic community

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Phrase and Phrasal Heads

- phrase structure grammars are too powerful
- cannot explain the difference to other sequential sign systems
- identifying contraints on the form of context-free rules that are universal

Phrases and Phrasal Heads

- assumption: phrases are always extensions of lexical elements

VP $\rightarrow$ V NP	*opens the door*	*hört die Kinder*
NP $\rightarrow$ AP N	*beautiful flowers*	*singende Kinder*
AP $\rightarrow$ NP A	*really beautiful*	*fröhliche Lieder singende*
PP $\rightarrow$ P NP	*on the road*	*mit den Kindern*

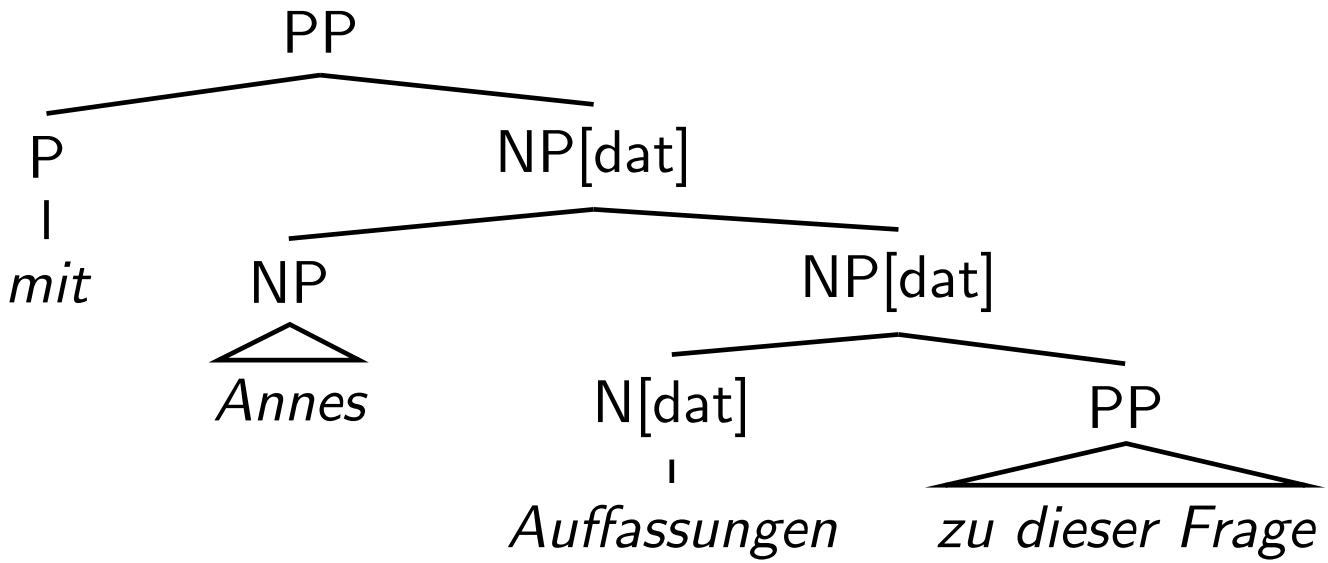
Phrases and Phrasal Heads

- two kinds of categories within a constituent
  - head: a single lexical category, core element of the constituent
  - modifier: (several) phrasal elements

- head principle: Every phrase has exactly one head.

Phrases and Phrasal Heads

- head feature projection: the morphological (agreement) features are realised at the head of a phrase



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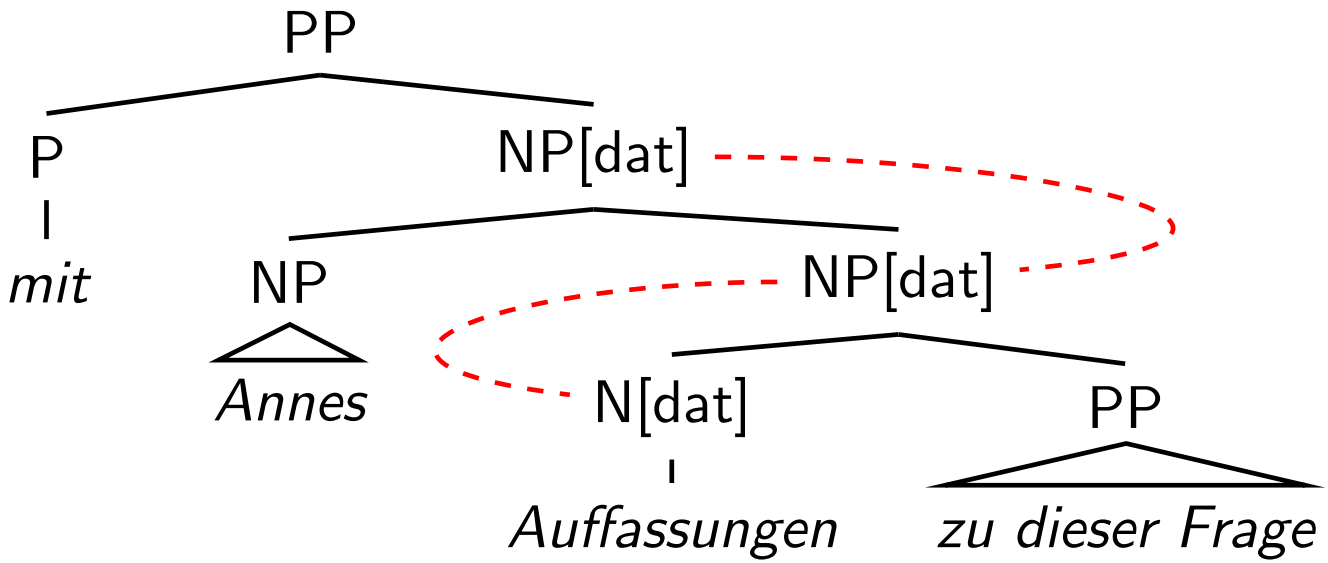
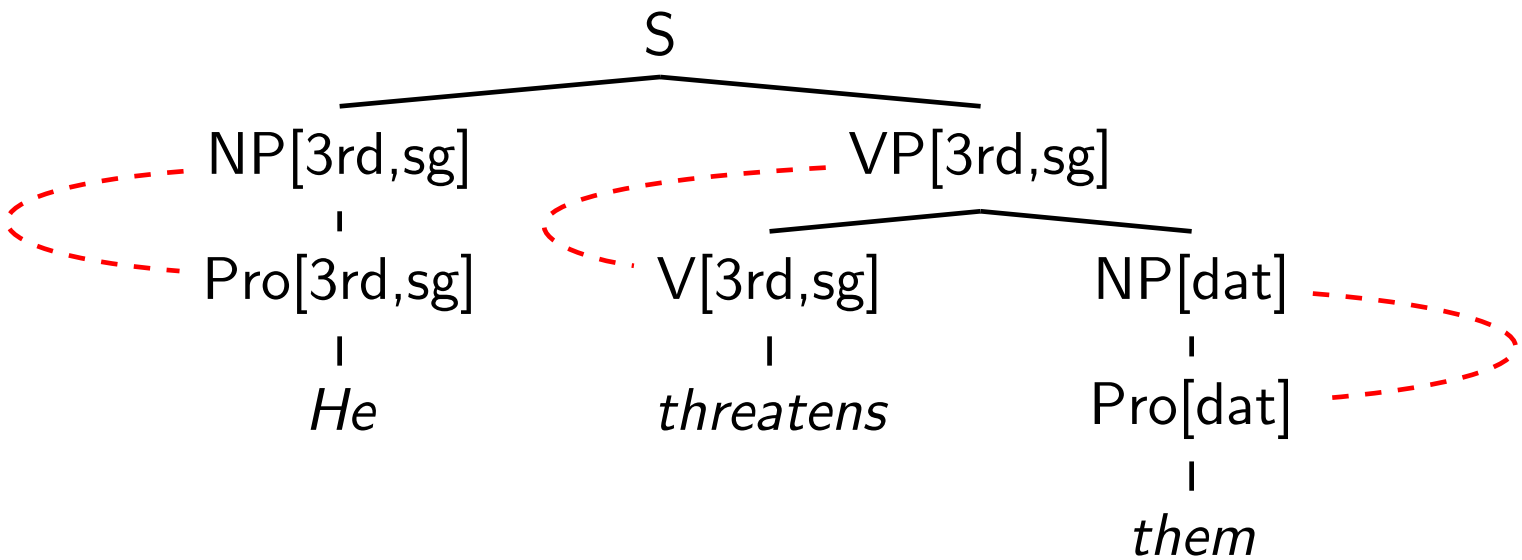


- projection line: path that connects a complex category with its lexical head

Phrases and Phrasal Heads

- phrases are maximal projections of the head
  - case of a nominal head is only projected up to the NP level
  - VP receives the agreement features from its own head (the verb)
  - sibling nodes are subject to agreement or government



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Complexity Levels

- XP is an X of higher (or maximum) complexity
  - *head*
  - *head of the department*
  - *head of the department, who addressed the audience*

Complexity Levels

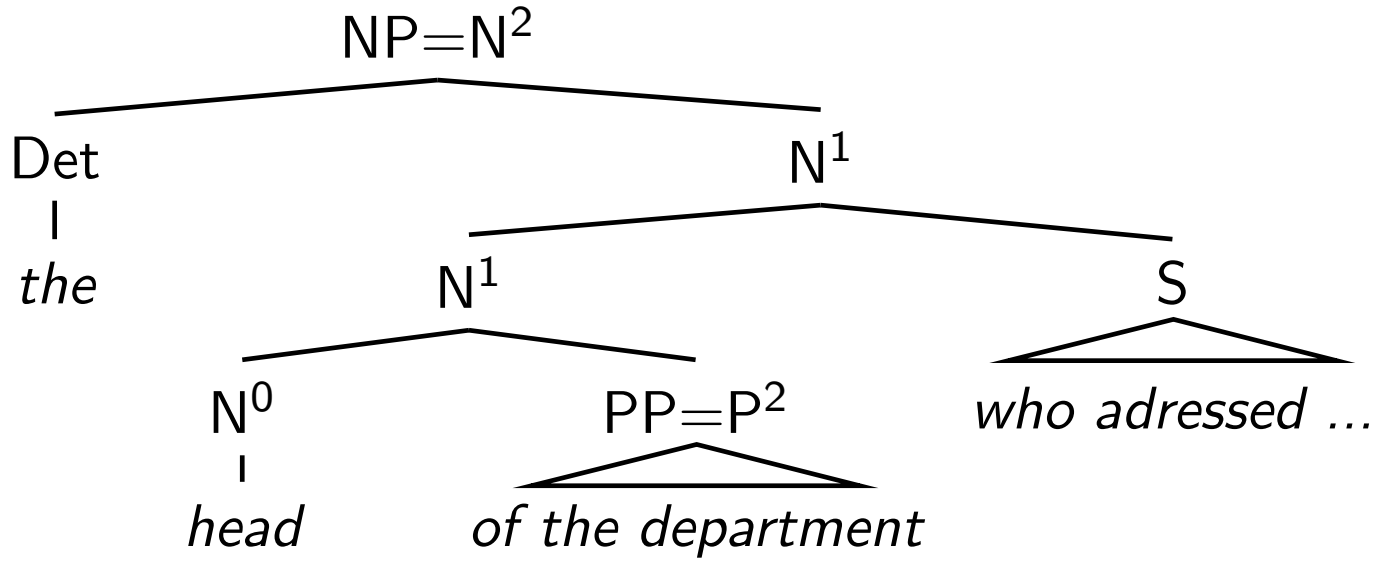
- complexity is described by means of level indices (Harris 1951)
  - lexical elements: X^0, head of the phrase
  - phrasal elements: X^{max} or XP, maximum syntagma that cannot become further modified
    $X \in \{N, V, A, P\}$

Complexity Levels

- additional observations
  - a longer phrase is not necessarily of higher complexity
    - adjunction: constituents with the same distribution might belong to the same complexity level
  - constituents closer to the head are assigned to a lower complexity level
    - e.g. phrasal vs. clausal modifiers

    The director of the department who adressed the audience.
    The director who addressed the audience of the department.
  - three distinct complexity levels seem to be sufficient

Complexity Levels



Complexity Levels

- possible rules:

$$\begin{aligned}
&NP \rightarrow D\ N^1\\
&N^1 \rightarrow N^1\ S\\
&N^1 \rightarrow N^1\ PP\\
&N^1 \rightarrow AP\ N^1\\
&N^1 \rightarrow NP\ N^1\\
&N^1 \rightarrow N^0\ (PP)
\end{aligned}$$

- the adjungation rules are recursive: arbitrarily many adjuncts can be added

  a [Cambridge] [high quality] [middle class] student

The X-bar Schema

- category variables

  $X \in \{V, N, P, A\}$

- complement rule

  $X^1 \rightarrow YP^* \; X^0 \; YP^*$

- adjungation rule

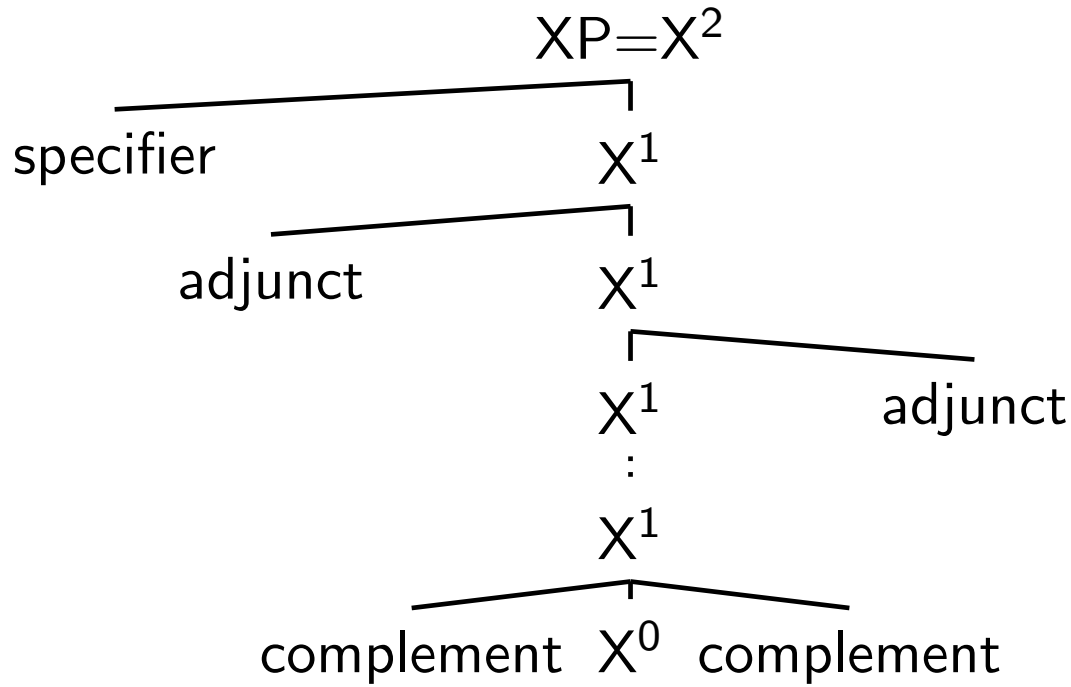
  $X^i \rightarrow YP^* \; X^i \; YP^* \qquad 0 < i \leq max$

- specifier rule

  $X^{max} \rightarrow (YP) \; X^{max-1}$

The X-bar Schema

- general phrase structure schema with $max = 2$



- object restriction:

  Subcategorised elements always appear at the transition from X^0 to X^1

The X-bar Schema

- the X-bar schema is an order free dominance schema
- clear distinction between
  - lexical nodes (X^0) and
  - phrasal nodes (X^1 and X^2)
- the head of a projection is always peripheral
- linearisation by means of a language-specific parameter
  - English: left peripheral
    - but: right peripheral noun in a noun group
  - German: right peripheral
    - but: left peripheral preposition in a prepositional group

The X-bar Schema

- the X-bar schema is universal
  - constrains the set of possible phrase structure rules
  - predicts admissible structural descriptions for *all* natural languages

The X-bar Schema

- X-bar Schema: broad structural symmetry across categories

  Hans ist $[_{NP}$ *der* Vater *von Susi].*
  Er ist $[_{AP}$ *sehr* stolz *auf seine Tochter].*
  Die Tasche steht $[_{PP}$ *gleich* hinter *der T"ur].*
  You must $[_{VP}$ *be* thinking *of her].*

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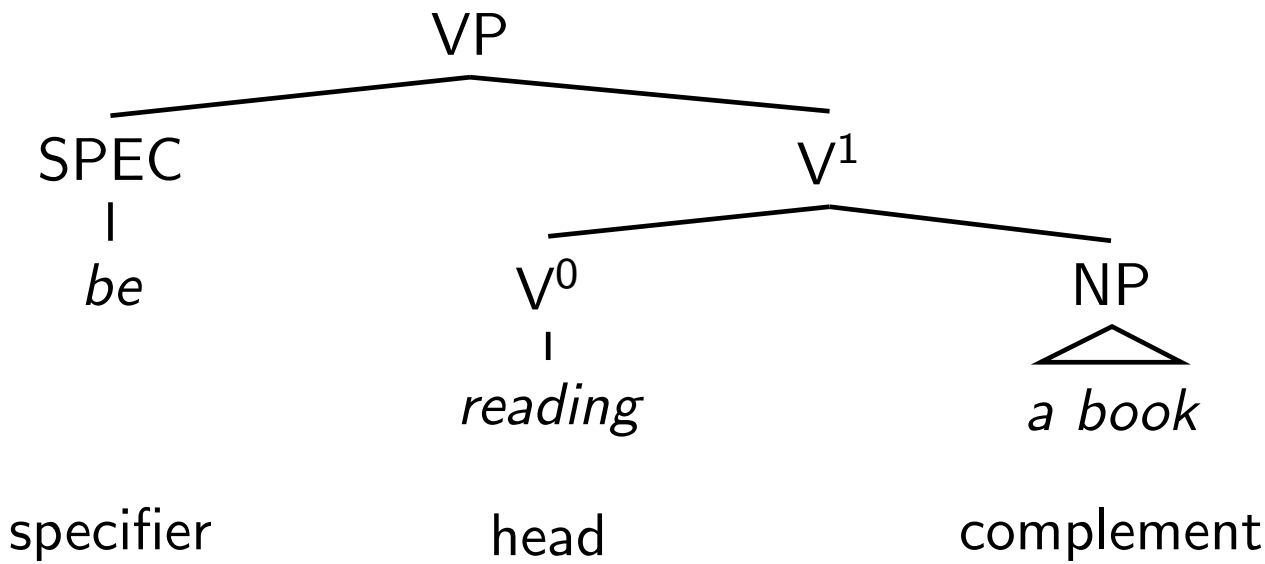
Applying the X-bar Schema

- English verb phrase
- German verb phrase
- Determiner phrase

English Verb Phrase

- basic structure of a verb phrase: aspectual auxiliary (progressive *be* and perfective *have*) as specifier (Jackendoff 1977)



English Verb Phrase

- evidence for V^1
  - only V^1 can be topicalised, VP not

    They swore that John might have been taking heroin and
    . . . [$_{V^1}$ taking heroin] he might have been!
    *. . . * [$_{VP}$ been taking heroin] he might have!*
    *. . . * [$_{VP}$ have been taking heroin] he might!*

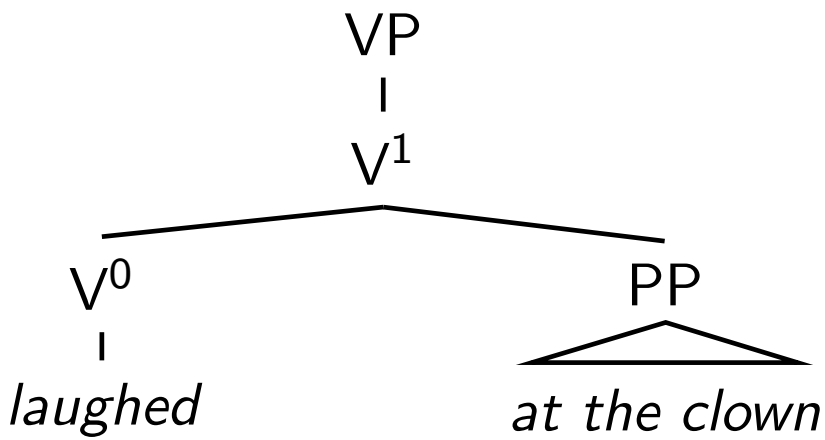
  - some verbs (e.g. *begin* and *see*) subcategorize V^1

    I saw John [$_{V^1}$ running down the road].
    ** I saw him [$_{VP}$ be running down the road].*
    ** I saw him [$_{VP}$ have finished his work].*

English Verb Phrase

- structural distinction between complements and adjuncts
- complement:

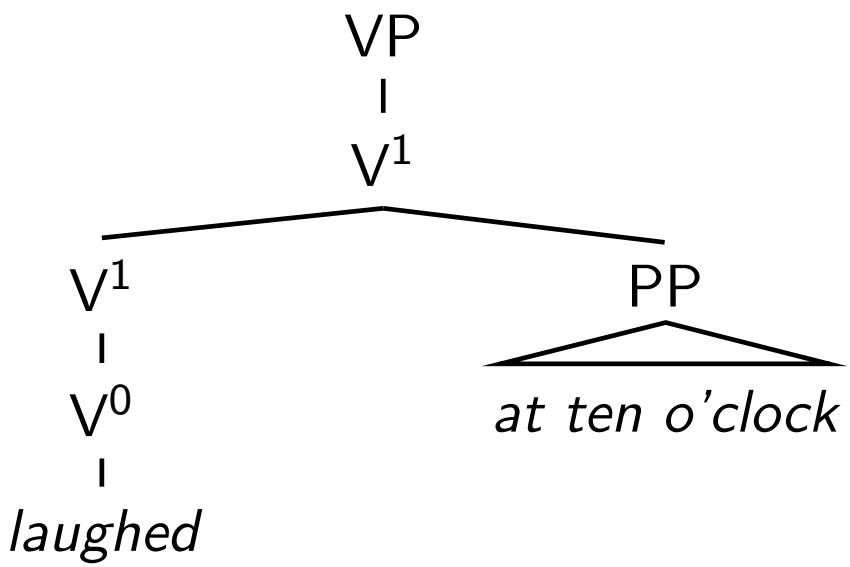
  He will work at the job.
  He laughed at the clown.



English Verb Phrase

- adjunct:

  He will work at the office.
  He laughed at ten o'clock.

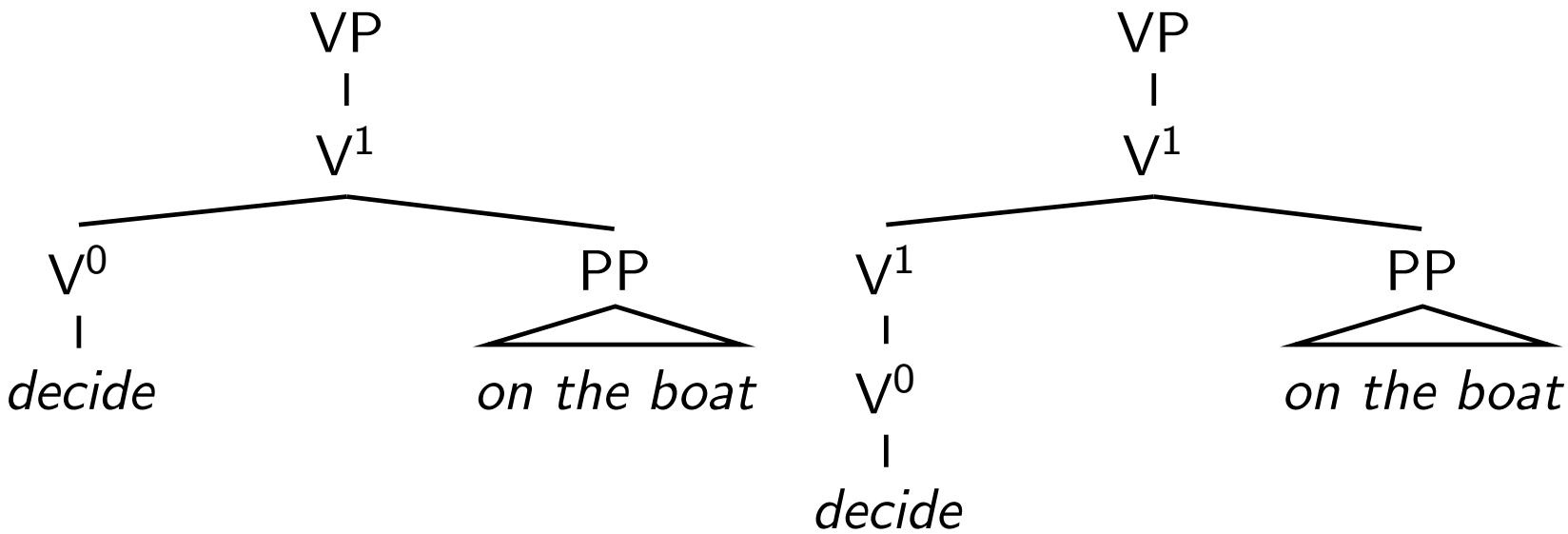


English Verb Phrase

evidence for the distinction between complements and adjuncts

1. structural ambiguity:

   He may decide on the boat.
   He couldn't explain last night.



English Verb Phrase

2. passive possible with PP complements, not with PP adjuncts

   [This job] needs to be worked at by an expert.
   ** [This office] is worked at by a lot of people.*

   [The clown] was laughed at by everyone.
   ** [Ten o'clock] was laughed at by everyone.*

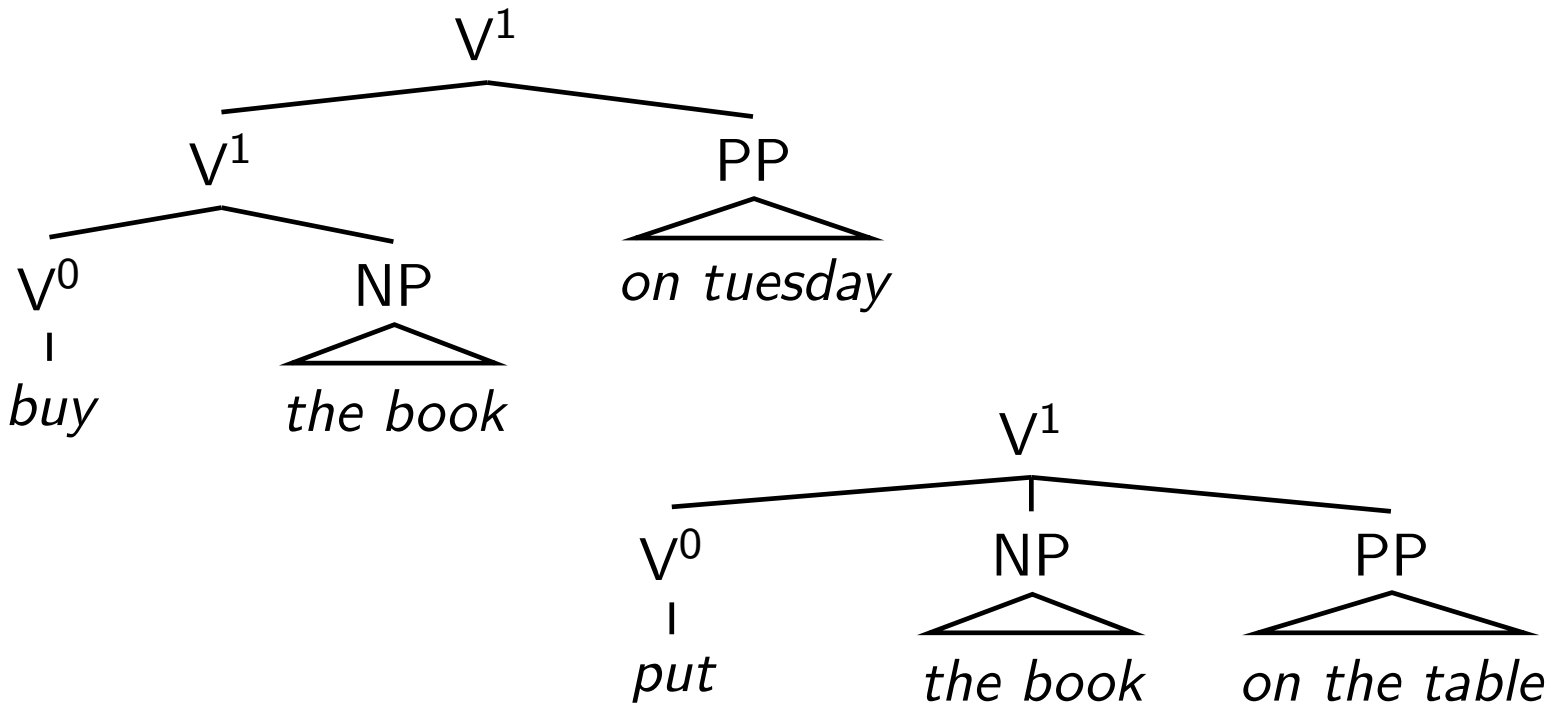
adjunct reading disappears with with passive

[The boat] was decided on after lengthy deliberation.
[Last night] couldn't be explained by anyone.

English Verb Phrase

4. pronominalisation

John will buy [$_{NP}$ the book] [$_{PP}$ on Tuesday].
John will put [$_{NP}$ the book] [$_{PP}$ on the table].



English Verb Phrase

pronominalisation

John will $[_{VP}$ *buy the book on Tuesday]*
and Paul will do so *as well.*
John will $[_{VP}$ *buy the book] on Tuesday*
and Paul will do so *on Thursday.*

John will $[_{VP}$ *put the book on the table]*
and Paul will do so *as well.*
* *John will* $[_{??}$ *put the book] on the table*
and Paul will do so *on the chair.*

English Verb Phrase

5. order restrictions

   He laughed [at the clown] [at ten o'clock].
   ** He laughed [at ten o'clock] [at the clown].*

6. missing constraints for the subcategorisation of adjuncts

   John died / sneezed / wept / exploded / apologised /
   laughed / escaped / defected / slept [yesterday afternoon].

   *John asked/*inquired [the man next door].*

English Verb Phrase

7. complements are often (bur not always) obligatory
   adjuncts are always optional.

8. ellipsis is only possible for phrases
   has to include all complements

   Who will put the book where?
   ** John will [~~put the book~~ on the table].*

English Verb Phrase

9. gapping (e.g. omission of a verb in coordinated clauses)

   John sells trucks on Thursdays,
   and Mary [~~sells~~ cars] on Fridays.
   ** John put Fido in the doghouse,*
   and Sam [~~put Spot in the yard~~].

   gapping must not leave more than a complement in V^1
   (Culicover and Wilkins 1984)

10. insertion of emphatic reflexives is possible between adjuncts, but never between complements

    John will bake [the cake] himself [for the party].
    ** John will put [the candles] himself [on the cake].*

English Verb Phrase

- left attributes show a structural parallelism to left left attributes in a noun phrase (Radford 1988)

  his $[_{AP}$ *desperate]* *search for her.*
  He $[_{ADVP}$ *desperately]* *searched for her.*

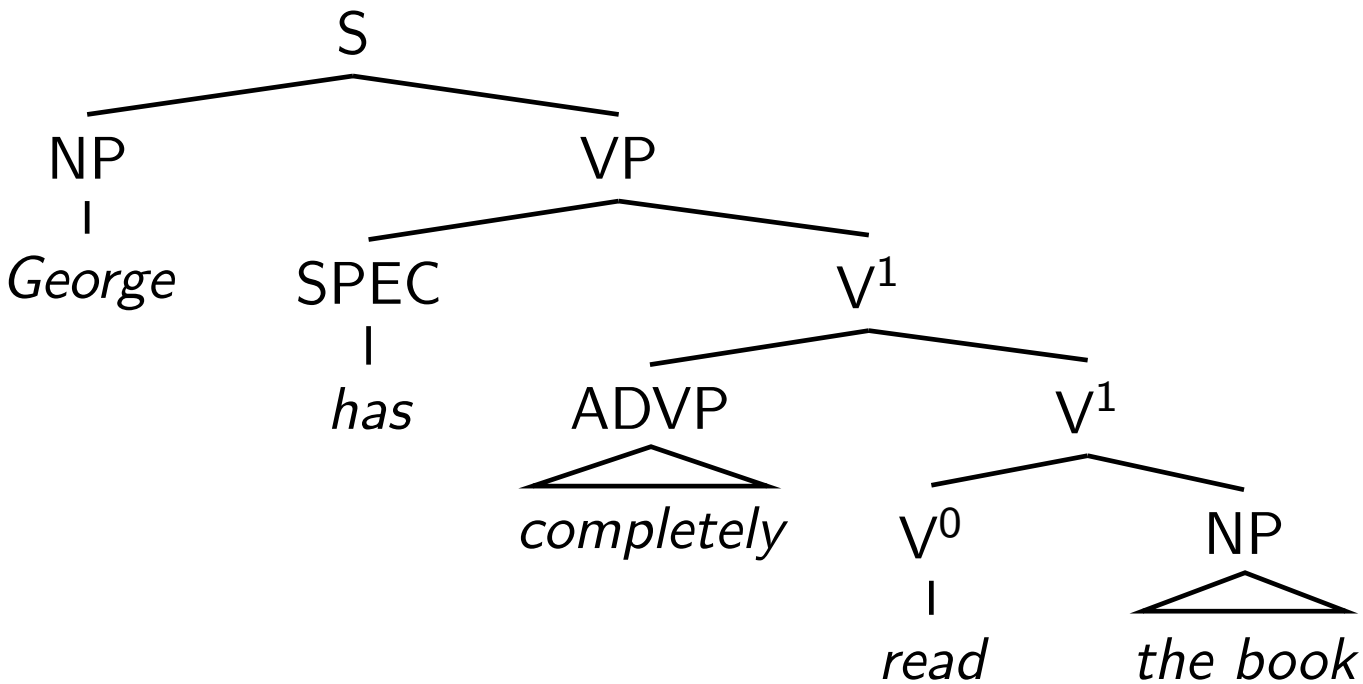
  his $[_{AP}$ *complete]* *adoration of her.*
  He $[_{ADVP}$ *completely]* *adores her.*

English Verb Phrase

- Why is the specifier special?
  - left modifiers cannot appear left of the specifier

    George has completely read the book.

    ** George completely has read the book.*



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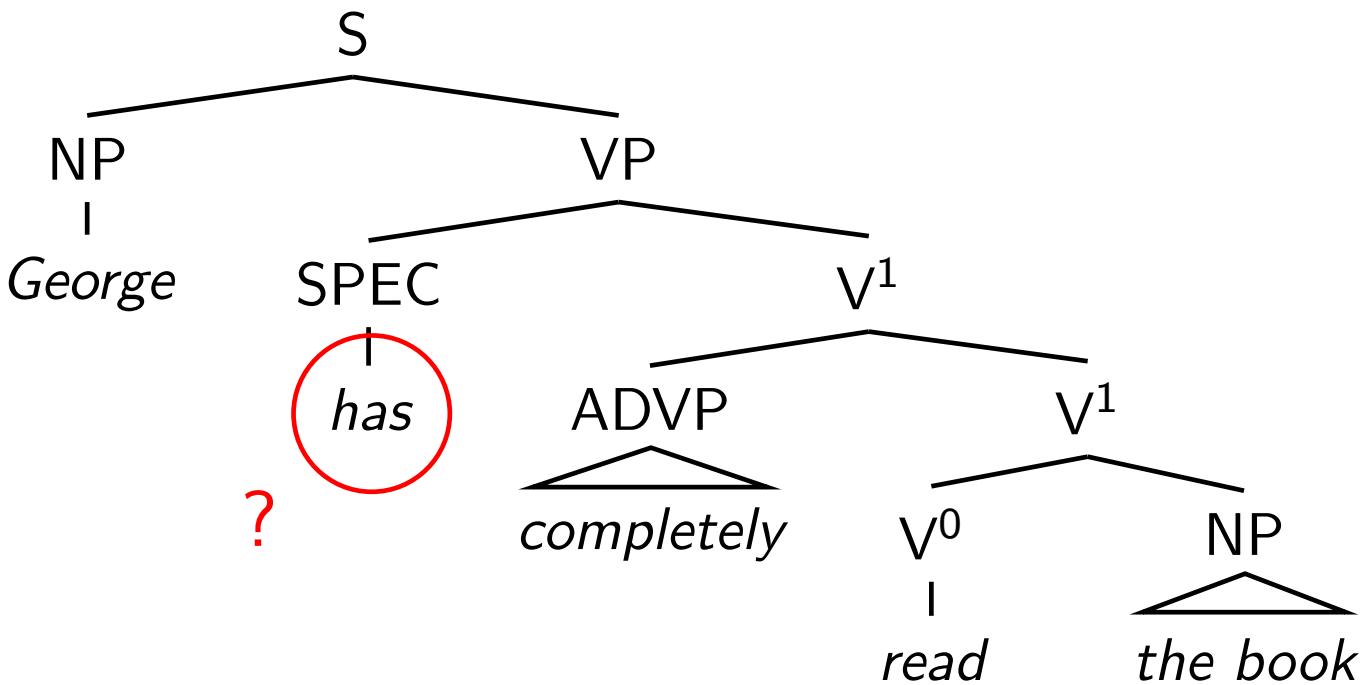


German Verb Phrase

- unmarked ordering in the English VP
  - main clause word order (head initial)
    to give someone something
- unmarked ordering in the German VP:
  - word order of the subordinate clause (verb final)
    jemandem etwas geben
- specifier position no longer available for the auxiliary
  - head agrees with the subject, not the specifier
- additional evidence: first language acquisition

  Hanni Ball spielt $\rightarrow$ *Hanni spielt Ball*

Determiner Phrase

structural arguments

1. prenominal genitives are similar to determiners

   die Einleitung für das Buch
   Susis Einleitung für das Buch
   ** die Susis Einleitung für das Buch*
   ** Susis die Einleitung für das Buch*

   - both could be specifiers
     - but *die* is a lexical, *Susis* a phrasal category
     - and SPEC only allows for phrasal categories

2. in Hungarian an NP may contain a determiner and a possessor phrase

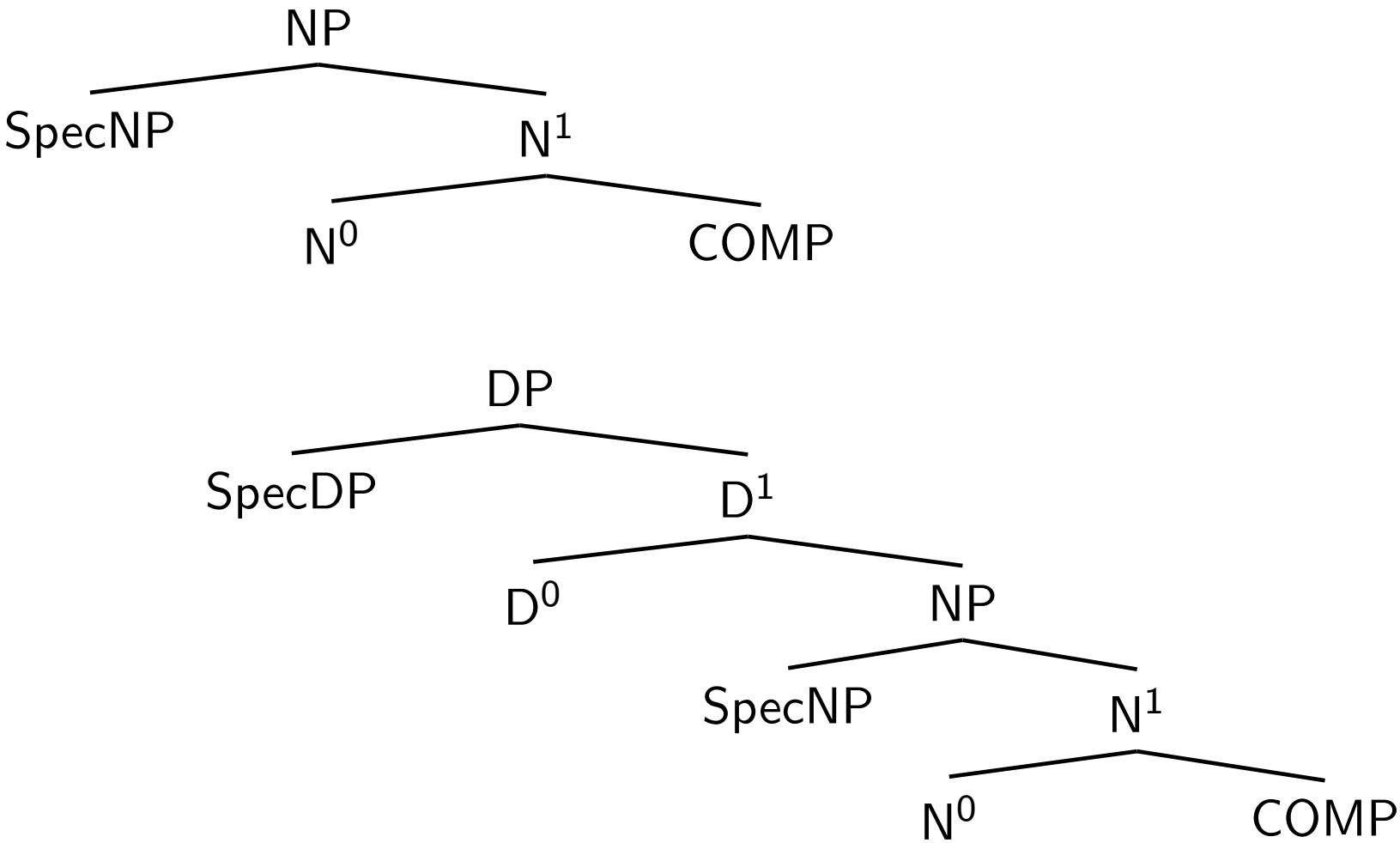
3. topicalization occurs also within noun phrases

   von Hans die Oma

4. ...

Determiner Phrase

- alternative structure: determiner as the head of the phrase (Abney 1987)



Determiner Phrase

- benefits:
  - restrictions of the X-bar schema are fully met
  - additional structural position for topicalization available
  - separat positions for determiner and possessive phrases
  - syntactic constraints for the modification of pronouns can be explained
  - structural parallelism with the sentence structure

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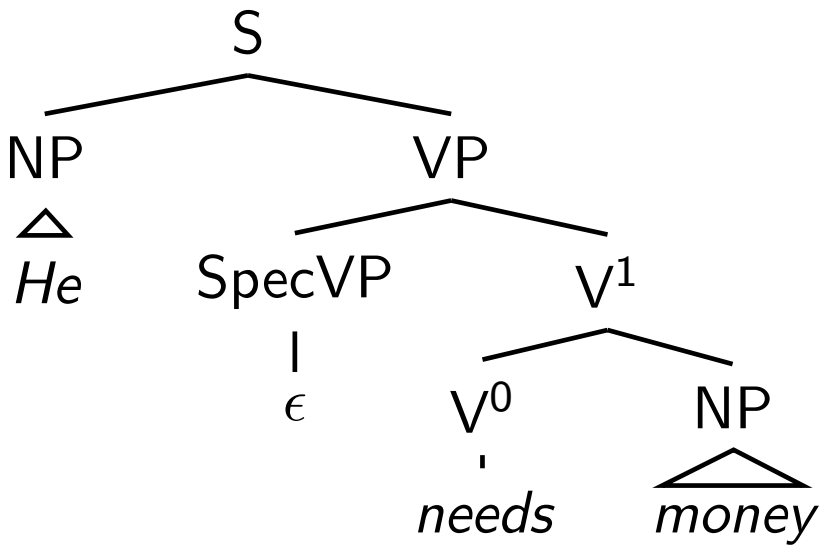
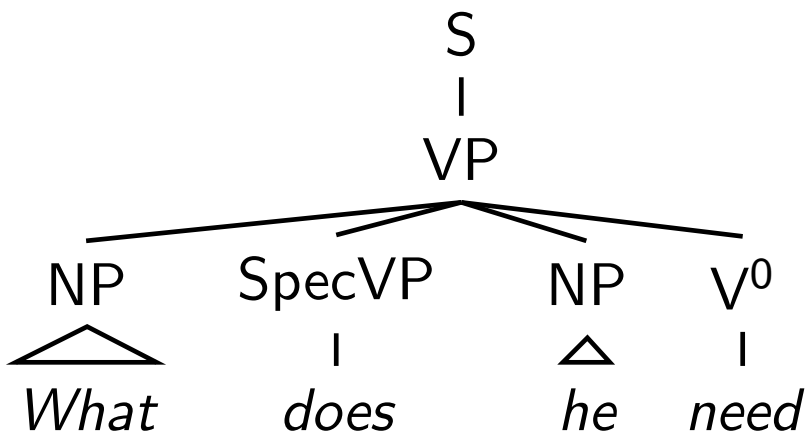
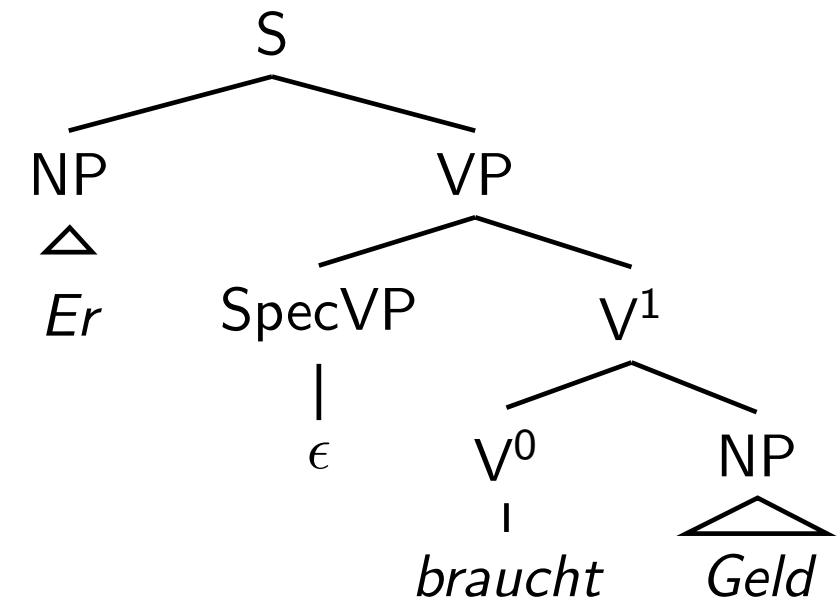
Sentence Structure

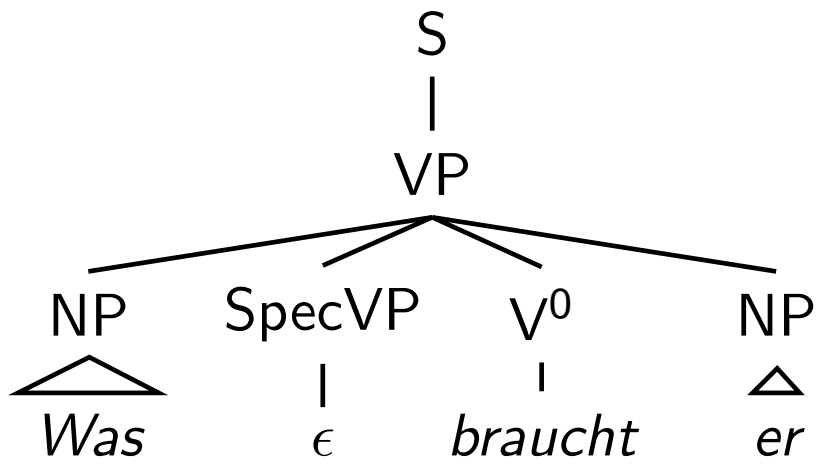
- Can the X-bar schema be extended to the sentence level?
- difficulties with an immediate constituent analysis, e.g. in case of topicalization, passivization, extraposition or questioning
  - subcategorized objects have to be attached as complement

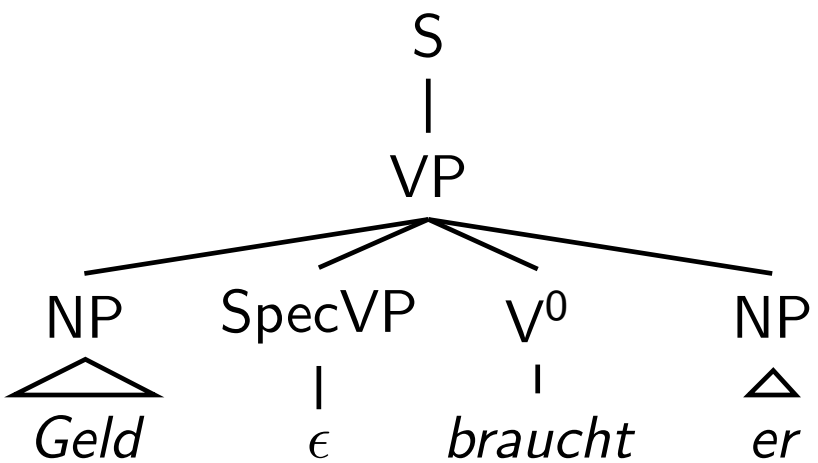


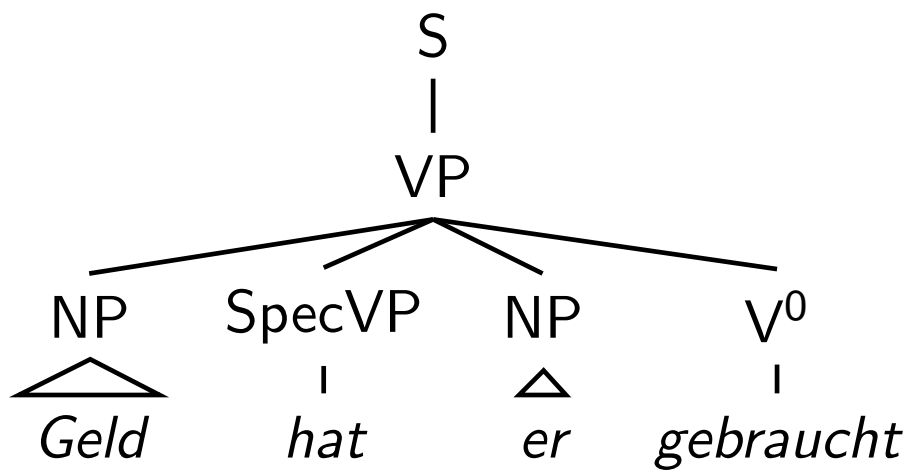


Sentence Structure







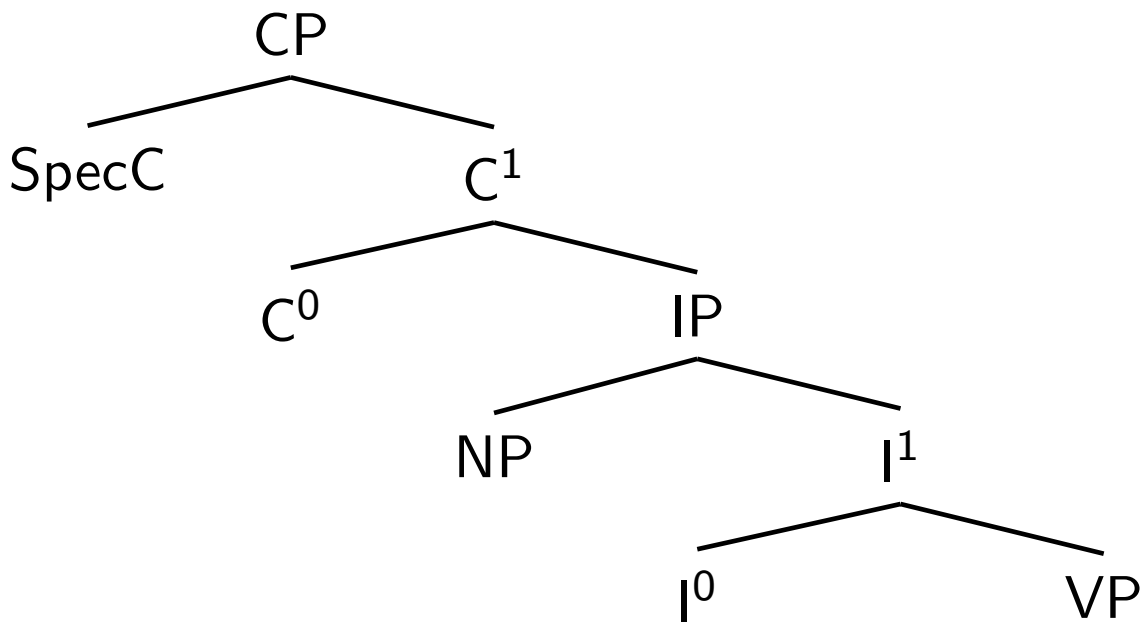


Sentence Structure

- radically different structures for highly related constructions
- principles of the X-bar schema are violated
  - non-maximum projections as complement
  - modifiers left of SPEC
- German: split verb group (Satzklammer)
  - analytical verbs: *hat . . . gestanden*
  - detachable verb prefixes: *gibt . . . auf*
- solution: extrapolation of the X-bar schema upwards
  - provides new structural positions for topicalized phrases and auxiliaries

Sentence Structure

- extended structure schema for sentences



- How to assign linguistic meaning to the new positions (SpecC, C^0, I^0)?

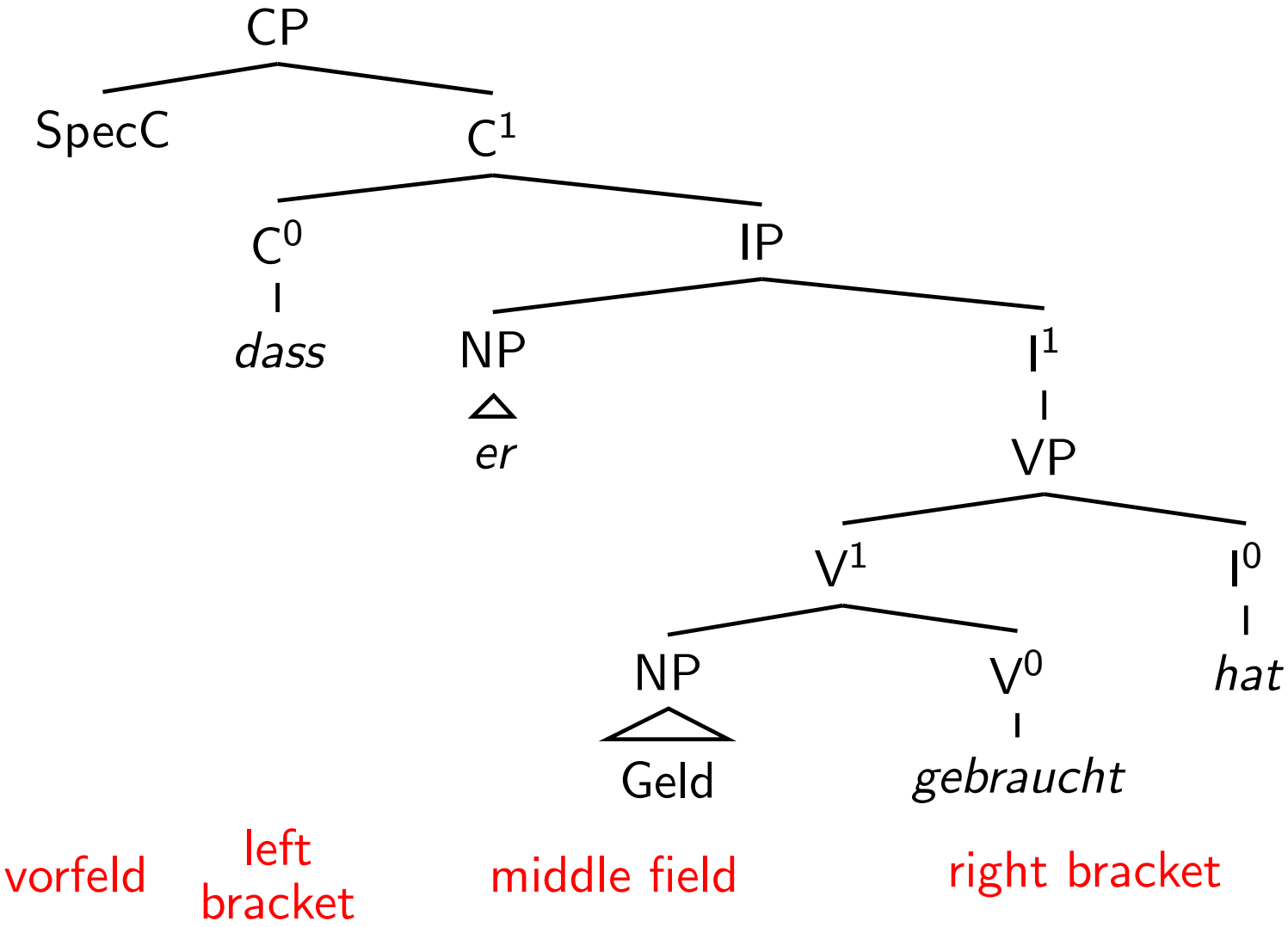
Topological Fields

Vorfeld	linke Klammer	Mittelfeld	rechte Klammer	Nachfeld
Hans	*hat*	*die Wurst*	*gegessen*	*als er draußen war.*
Hans	*hat*	*die Wurst*	*gegessen?*	
Gestern	*hat*	*Hans die Wurst*	*gegessen.*	
Hans	*isst*	*die Wurst.*		
Was	*isst*	*Hans?*		
	Hat	*Peter die Wurst*	*gegessen,*	*als er draußen war?*
	Iss	*die Wurst*	*auf!*	
	Hätte	*ich doch die Wurst*	*gegessen!*	
	Ob	*Hans die Wurst*	*gegessen hat,*	*als er draußen war?*
	dass	*Hans die Wurst*	*gegessen hat.*	
	ohne	*auch nur einen Happen*	*zu essen.*	
	wenn	*Hans die Wurst*	*gegessen haben wird.*	

- goal: integration of the topological fields into the sentence structure

Topological Fields

- topological interpretation of the schema for German sentences



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Movement

- the structural positions need to be filled by means of movement operations
  - additional formal mechanism
  - context-free rules alone are no longer sufficient
- base structure (deep structure)
  - English: main clause order

    the boy does read the book
  - German: subordinate clause order

    (weil) er Geld gebraucht hat

Movement

- filling the left clause bracket: verb fronting
  - English: subject-auxiliar inversion (questions)

    <u>does</u> the boy [$_{I^0}$ ___] *read the book*

  - German: generating verb second constructions

    <u>hat</u> eine Vase auf dem Tisch gestanden [$_{I^0}$ ___]

    <u>stand</u> eine Vase auf dem Tisch [$_{V^0}$ ___]

- problem: two different kinds of verb movements (auxiliary or not)
  - $I^0 \rightarrow C^0$
  - $V^0 \rightarrow C^0$

Movement

- general solution: verb is always moved to INFL and receives its inflectional features there, either
  - by inflection

    $[_{VP}$ *auf dem Tisch* $[_{V^0}$ ___ $]\,]\,[_{I^0}$ *stand* $]$

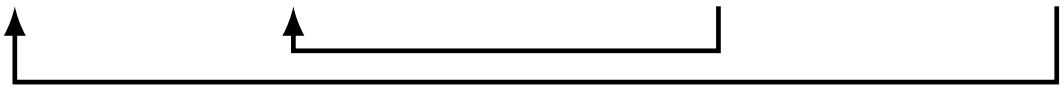
    
  - if inflection is not possible:
    generation of a suitable auxiliary in I^0

    $[_{VP}$ *auf dem Tisch* $[_{V^0}$ *gestanden* $]\,]\,[_{I^0}$ *hat* $]$
- every finite verb can be moved from I^0 to C^0
  - verb fronting starts always at I^0
  - I^0 is only a "functional node"
- yet another additional mechanism external to context-free grammar!

Movement

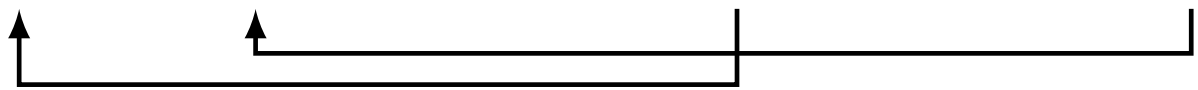
- filling the vorfeld (English): WH movement

  $[_{SpecC}$ *What* $]$ $[_{C^0}$ *does* $]$ *the boy* $[_{I^0}$ __ $]$ *read* $[_{NP}$ __ $]$

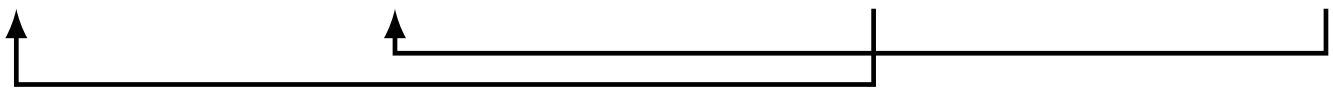


- filling the vorfeld (German):
  all forms of topicalization (fronting of various phrases)

  $[_{SpecC}$ *Wo* $]$ $[_{C^0}$ *hat* $]$ *eine Vase* $[_{PP}$ __ $]$ *gestanden* $[_{I^0}$ __ $]$



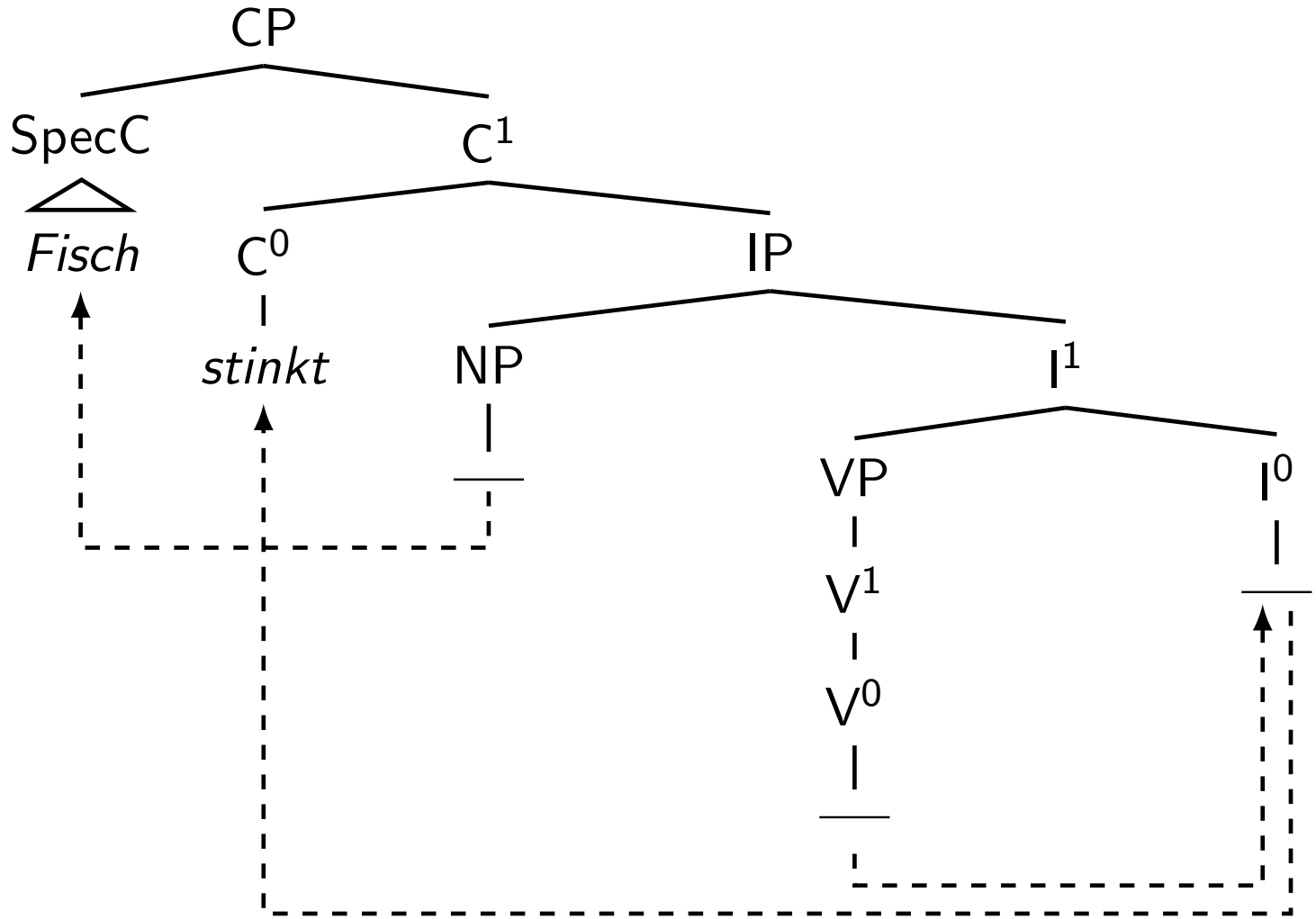
  $[_{SpecC}$ *Auf dem Tisch* $]$ $[_{C^0}$ *hat* $]$ *eine Vase* $[_{PP}$ __ $]$ *gestanden* $[_{I^0}$ __ $]$



- structural closeness despite topological distance

Movement

- derivations lack plausibility, intuitively difficult to understand



Movement

- similar movements to fill the nachfeld (extraposition)
- X-bar schema can also be used to structure the sentence level
  - base generated sentences
  - universal movement operator: move-α
  - complexity levels are maintained (before and after movement)

    $X^0 \rightarrow Y^0$

    $XP \rightarrow YP$
  - additional constraints on when and where to move
- move-α is not a real movement
  - abstract relationship between two structural positions

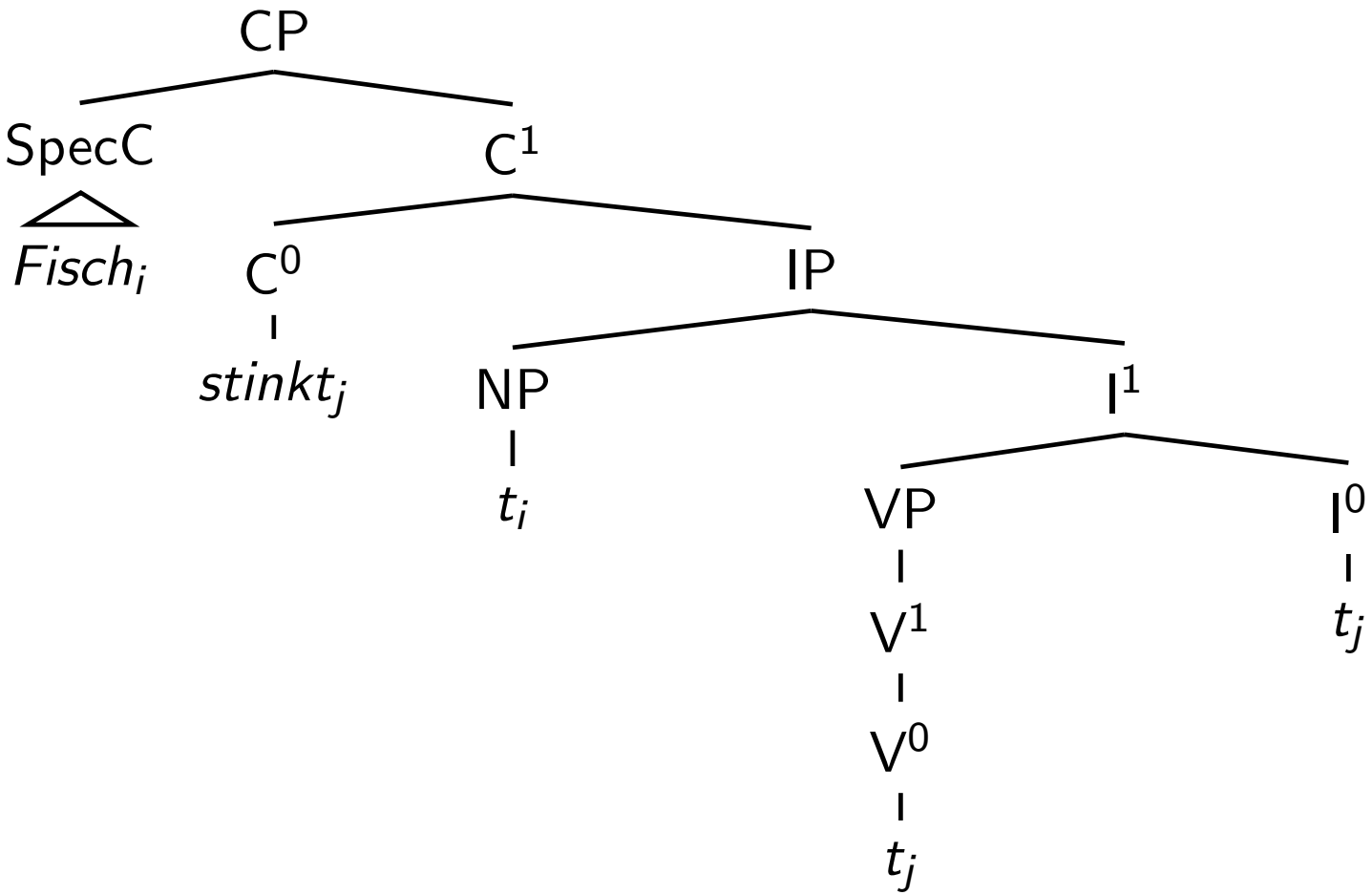
Movement

- not all possible movements are permitted: principle-based constraints

what
where to
how far } to move

Traces

- every movement leaves a trace in its origin position
- a position containing a trace cannot be filled again



Traces

- phonological evidence for traces

  Do you want to leave?
  Do you wanna leave?

  Do you want him to leave?
  Who$_i$ do you want t_i to leave?
  **Who do you wanna leave?*

Phrase structure

- context-free grammars alone are not sufficient to model syntactic structure with a high level of adequacy
  - problem case: non-projectivity caused by discontinuous constituents
- additional mechanisms required
- movement can be emulated in unification-based grammars
  - but is a serious source of efficiency problems
- traces
  - also pose efficiency problems
  - might even cause termination problems in bottom-up parsing
    - How many empty categories have to be assumed and where?

Phrase structure

- X-bar structures provide a fine grained prediction of many syntactic phenomena
  - well-formedness of word order variants
- prediction of the accessibility of antecedents for (sentence-internal) pronominal reference
  - reflexives
  - personal pronouns
  - relative pronouns