

An incremental approach to verb clusters in German

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Overview

1 Verb clusters in German HPSG

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- 2 Phrasal Subconstructions

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- 3 An incremental approach to verb clusters
- 4 Implementation and discussion

Outline

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3 An incremental approach to verb clusters

4 Implementation and discussion

Verb clusters in German HPSG

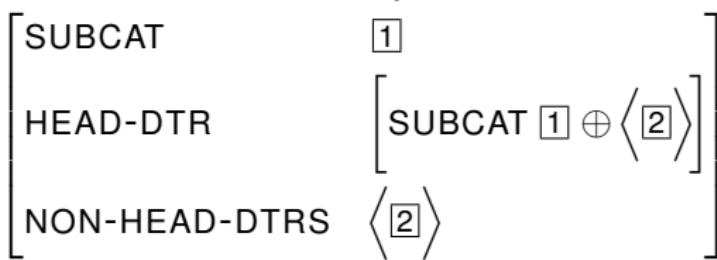
- (1) daß ich den Jungen das Buch **holen sah**
that I the boy the book fetch saw
'that I saw the boy fetch the book'

Lexical type for Acl verbs (Müller, 2007a)

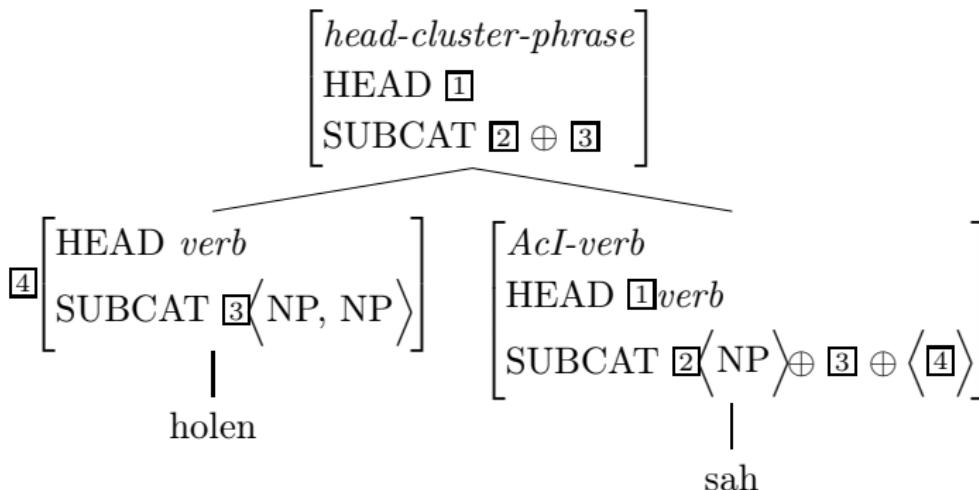
Acl-verb
[
SUBCAT ⟨NP⟩ ⊕ 1 ⊕ 2 ⊕ ⟨V [SUBJ 1
SUBCAT 2] ⟩]
]

Schema for verb clusters (Müller, 2007a, 242)

head-cluster-phrase ⇒



Clustering of verbs



Head Argument Schema (Müller, 2007a, 79)

head-argument-phrase \Rightarrow

$$\begin{bmatrix} \text{SUBCAT} & [1 \oplus 3] \\ \text{HEAD-DTR} & \left[\text{SUBCAT } 1 \oplus \langle 2 \rangle \oplus 3 \right] \\ \text{NON-HEAD-DTRS} & \langle 2 \rangle \end{bmatrix}$$

A challenge with the Head Argument Schema

- Requires a search function
 - adds complexity to the parsing algorithm
- Alternatively, the SUBCAT list can be ordered so that it matches the order of the arguments
 - need for multiple Head Cluster Rules – The German Grammar (Crysmann, 2003)
 - a large number of combinations of Head Cluster Rules if the number of embedding verbs is larger than one

A challenge with the verb cluster approach

- Presupposes that the verbs are parsed before the arguments are assigned a syntactic or semantic role
- Sentences in head-final languages do not require higher processing than sentences in head-initial languages
(Swets *et al.*, 2008)

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Müller's (2006) criticism of Goldberg (1995)

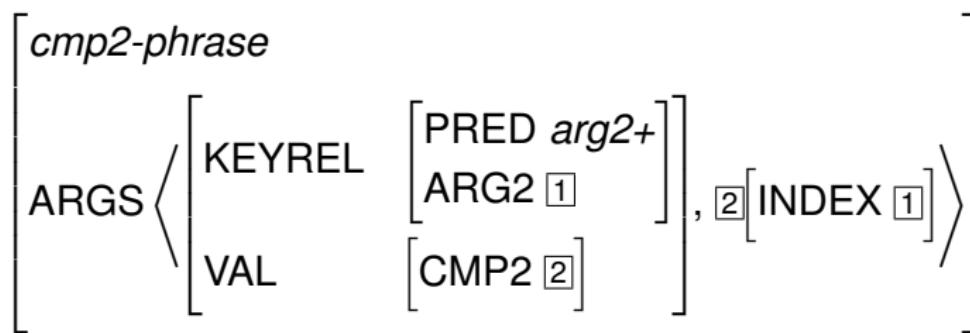
- (2) daß so grün selbst Jan die Tür nicht streicht
that that green even Jan the door not paints
[OBL SUBJ OBJ V]
'that not even Jan would paint the door that green'
- (3) daß so grün die Tür selbst Jan nicht streicht
that that green the door even Jan not paints
[OBL OBJ SUBJ V]

Müller's (2006) criticism of Goldberg (1995)

- (4) daß Jan so grün selbst die Tür nicht streicht
that Jan that green even the door not paints
[SUBJ OBL OBJ V]
- (5) daß eine solche Tür so grün niemand streicht
that a such door that green nobody paints
[OBJ OBL SUBJ V]
'that nobody paints such a door that green'

Phrasal subconstructions (Haugereid, 2007)

- **Arg1-role:** The agent or source
- **Arg2-role:** The patient
- **Arg3-role:** The benefactive or recipient
- **Arg4-role:** The goal
- **Arg5-role:** The antecedent



Decomposed binary structures in Haugereid (2007)

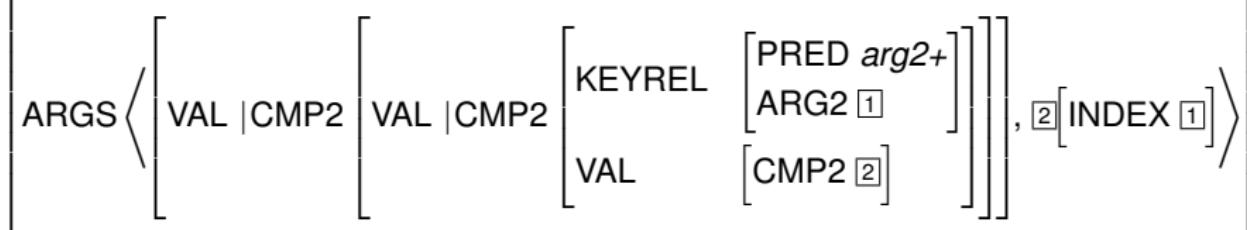
- [[[*daß* ARG4] ARG1] ARG2] V]
- [[[*daß* ARG4] ARG2] ARG1] V]
- [[[*daß* ARG1] ARG4] ARG2] V]
- [[[*daß* ARG2] ARG4] ARG1] V]

Müller's (2007b) criticism of Haugereid (2007)

- For each embedding verb in a verbal cluster a new set of valence rules is required
- The clause in (6) would require three sets:

(6) weil Hans Cecilia John das Nilpferd **füttern** **helfen** **lässt**
because Hans Cecilia John the hippo feed help let
'because Hans lets Cecilia help John feed the hippo'

cmp2-2-2-phrase



Müller's (2007b) criticism of Haugereid (2007)

- A grammar should in principle allow for an unlimited number of embeddings (limited by performance)
- ⇒ Infinitely deep linking approach inferred from Haugereid (2007) is unfeasible

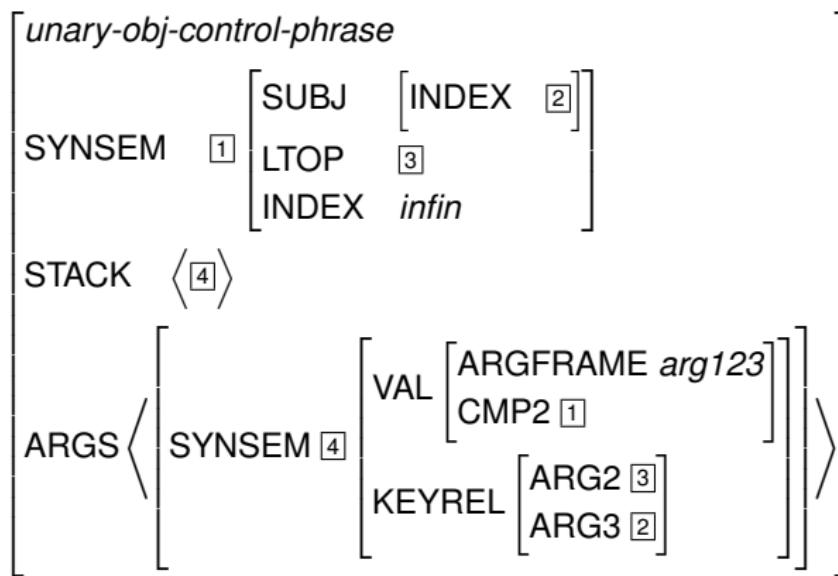
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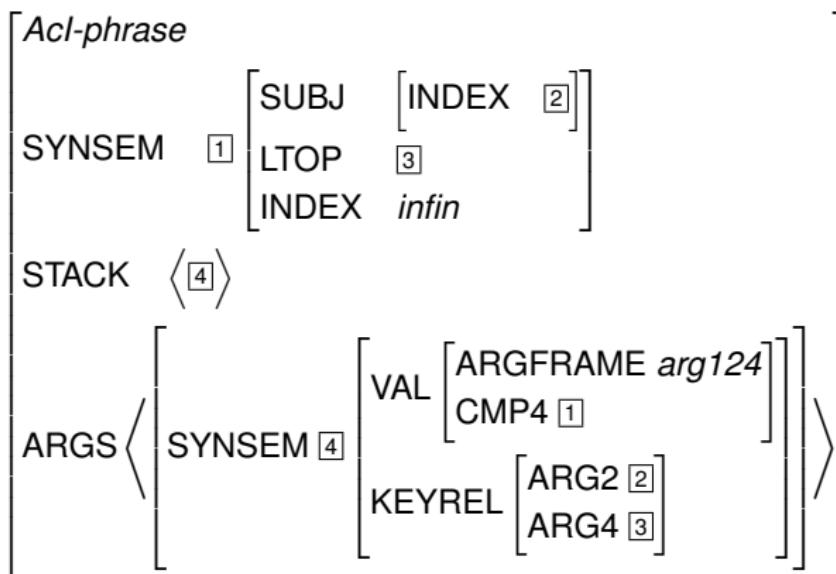
Three unary rules for embedding verbs

- A stacking and popping mechanism is used to attach words at the appropriate level in the constituent structure
- Similar to parsing approach in Güngördü (1997, Chapter 6)
- Three unary rules for embedding verbs
 - Subject raising/control
 - Object control
 - Acl verbs

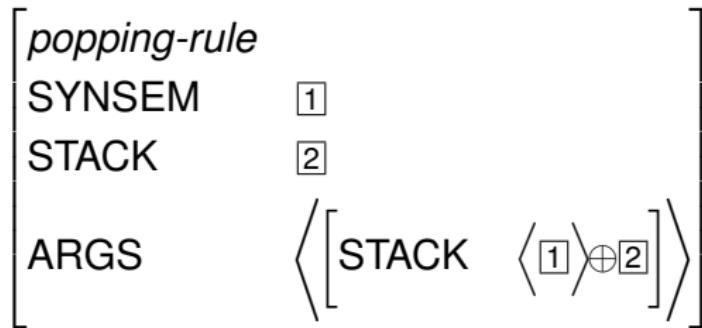
Object control



Accusative and Infinitive



Popping rule



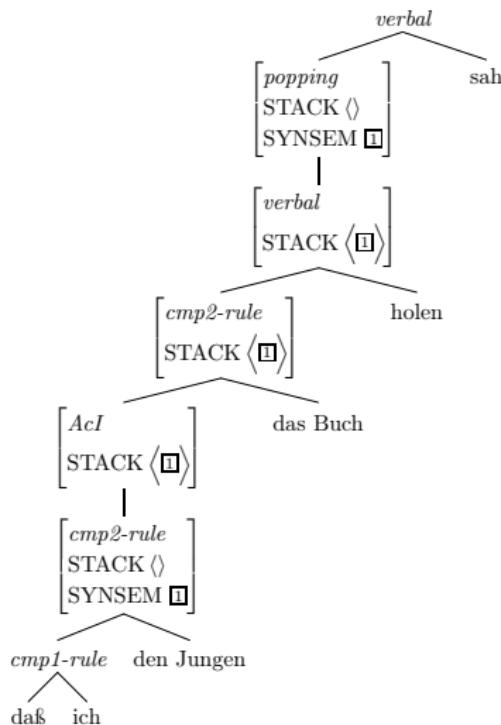
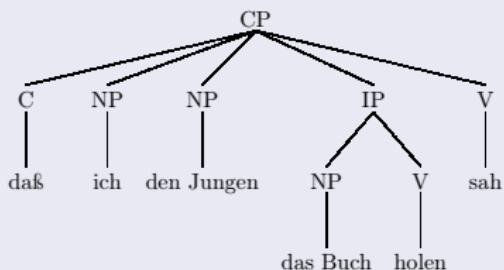
Constituent tree and parse tree for example (1)

Clause with embedding verb

daß ich den Jungen das Buch holen sah
that I the boy the book fetch saw

'that I saw the boy fetch the book'

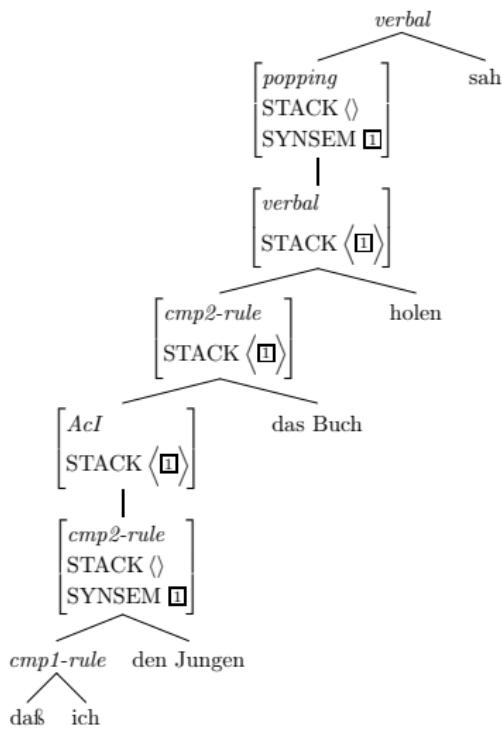
Constituent structure



AVM and parse tree for example (1)

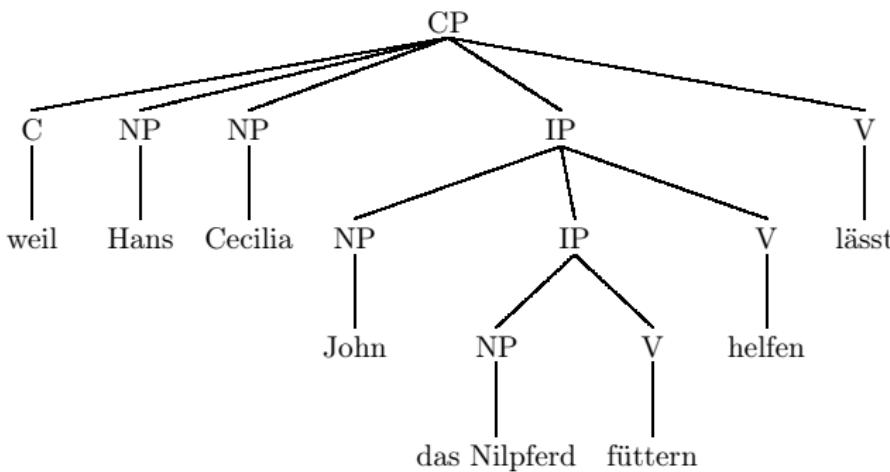
AVM for Acl clause

KEYREL	PRED _sehen_124_ip_rel	event	ARG0	1
	ARG1			
VAL	ARG2	2	INDEX	2
	ARG4			
CMP1	KEYREL PRED ich	INDEX	1	1
	INDEX			
CMP2	KEYREL PRED Junge	INDEX	2	2
	INDEX			
LTOP	3	3	INDEX	3
	4			
CMP4	PRED _holen_12_rel	INDEX	4	4
	LBL			
KEYREL	ARG1	INDEX	2	2
	ARG2			
VAL	VAL	INDEX	4	4
	CMP2			
	KEYREL PRED Buch			
	INDEX			



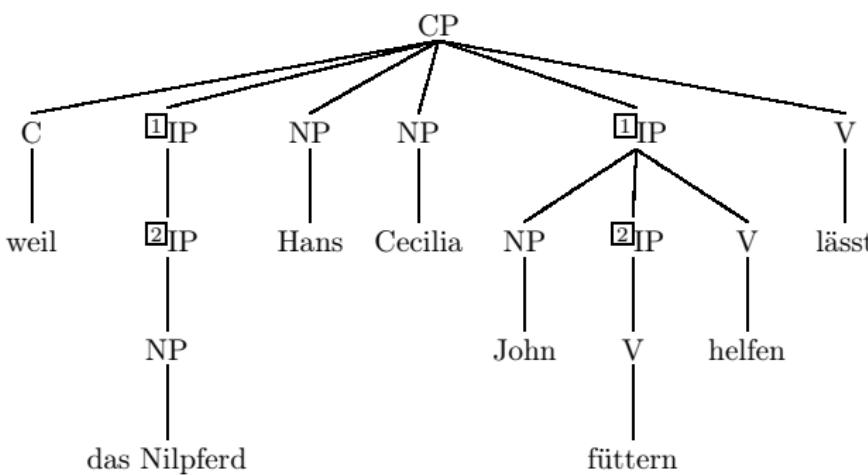
Constituent analysis of clause with two embeddings

- (7) weil Hans Cecilia John das Nilpferd füttern helfen lässt
because Hans Cecilia John the hippo feed help let
'because Hans lets Cecilia help John feed the hippo'

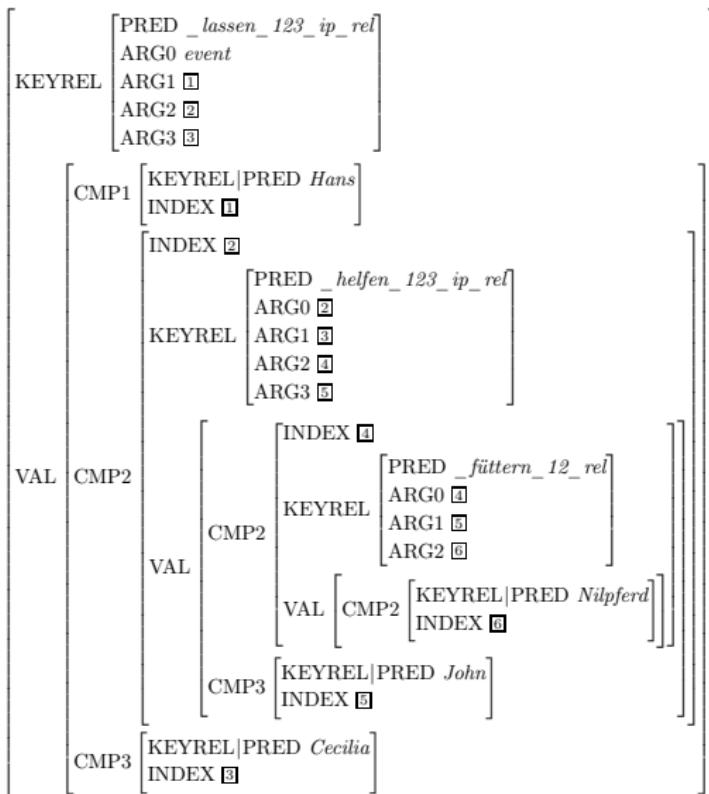


Analysis of embeddings and permutations in German

- (8) weil das Nilpferd Hans Cecilia John füttern helfen lässt
because the hippo Hans Cecilia John feed help let
'because Hans lets Cecilia help John feed the hippo'

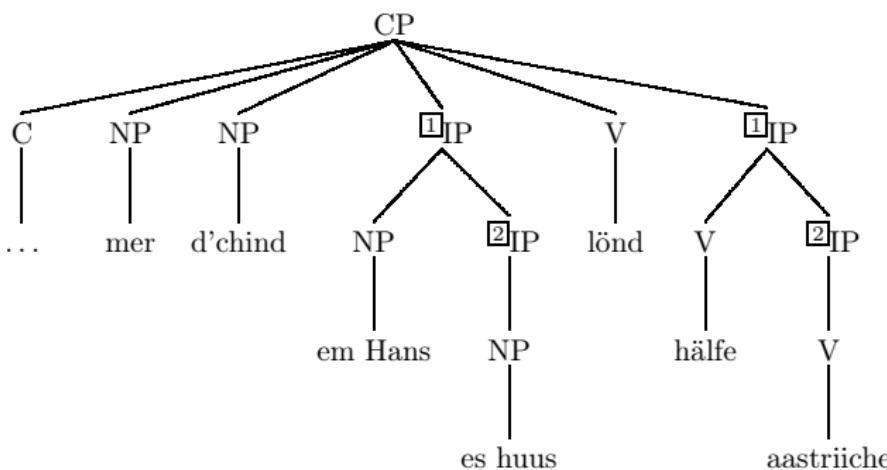


AVM for examples (7) and (8)



Cross-serial dependencies in Swiss-German

- (9) ... mer d'chind em Hans es huus lönd hälfē aastriiche
 we the children-ACC Hans-DAT the house-ACC let help paint
 '... we let the children help Hans paint the house.' (Shieber, 1985)



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Implementation

- The analysis is implemented with the LKB system (Copestake, 2002)
- The examples in (1)–(6), without cross-serial dependencies, are analyzed

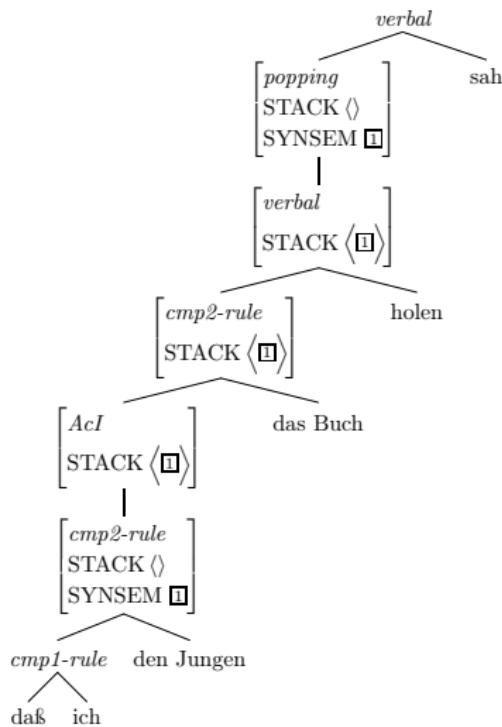
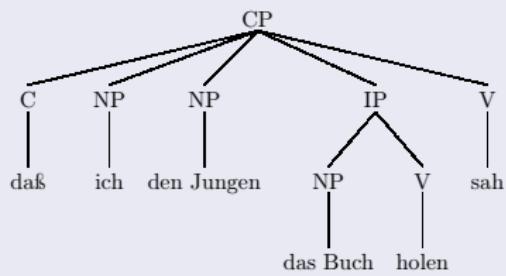
Constituent tree and parse tree for example (1)

Clause with embedding verb

daß ich den Jungen das Buch holen sah
that I the boy the book fetch saw

'that I saw the boy fetch the book'

Constituent structure



Future work

- In order to account for cross-serial dependencies, the embedding rules need to be able to take themselves as input → loops
- In order to avoid infinite loops, a feasible approach would be to let the parser for each step be guided by a statistical model, and allow for backtracking and reanalysis if the parse fails
- This would be in line with psycholinguistic findings of garden-path effects

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