University of Sheffield

Composition-based analysis of German three-verb clusters

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Outline

- Verb clustering
  - Word order variation in verb clusters
- Complement inheritance
- Main issues in verb clustering accounts
  - Account I: Hinrichs & Nakazawa (1994)
  - Account II: Kathol (2000)
  - Account III: Bouma & van Noord (1996)
- Proposed approach

Verb clustering

Standard German

… *dass er das Examen* ***bestehen³ können² wird¹***.

that he the exam pass be-able-to will

'… that he will be able to pass the exam.'

Standard Dutch

… *dat hij dat boek* ***moet¹ hebben² gevonden³***.

that he the book must have found

'… that he must have found the book.'

Word order variation in verb clusters

Standard German — Verb order:

… *dass er das Examen* ***bestehen³ können² wird¹****.*

that he the exam pass be-able-to will — 3-2-1

Auxiliary flip

… *dass er das Examen* ***wird¹ bestehen³ können²****.*

that he the exam will pass be-able-to — 1-3-2

Zwischenstellung (Southern German dialect)

… *dass er das Examen* ***bestehen³ wird¹ können²****.*

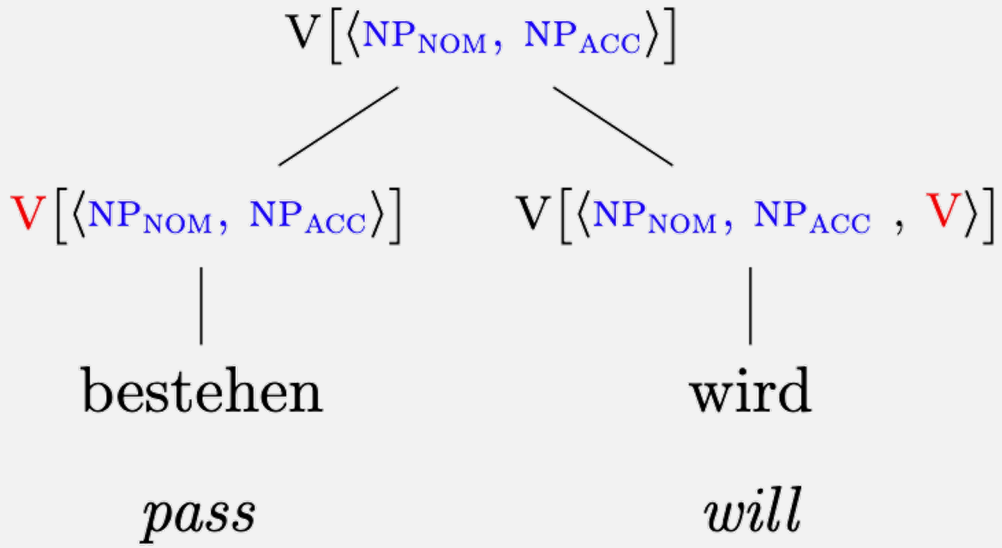
that he the exam pass will be-able-to — 3-1-2

all: '… that he will be able to pass the exam.'

Complement inheritance

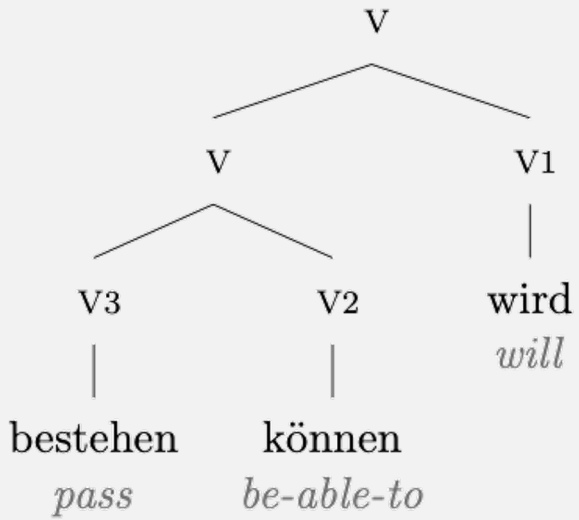
… is a fundamental append operation $\oplus$ for analyzing verb clusters where $\boxed{1}$ is used as a shared variable.

$$\text{wird } (\textit{will}) \mapsto \begin{bmatrix} \text{HEAD} & \textit{verb}\left[\textit{fin}\right] \\ \text{SUBCAT} & \boxed{1} \oplus \left\langle \begin{bmatrix} \text{HEAD} & \textit{verb}\left[\textit{inf}\right] \\ \text{SUBCAT} & \boxed{1} \\ \text{NPCOMPS} & - \end{bmatrix} \right\rangle \end{bmatrix}$$

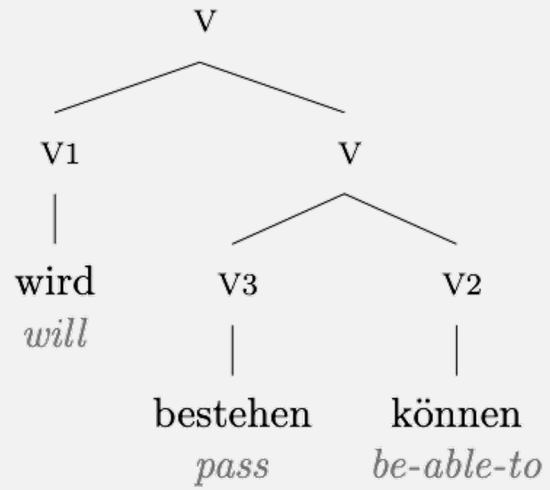


Account I: Bottom-up analysis (Hinrichs & Nakazawa 1994)

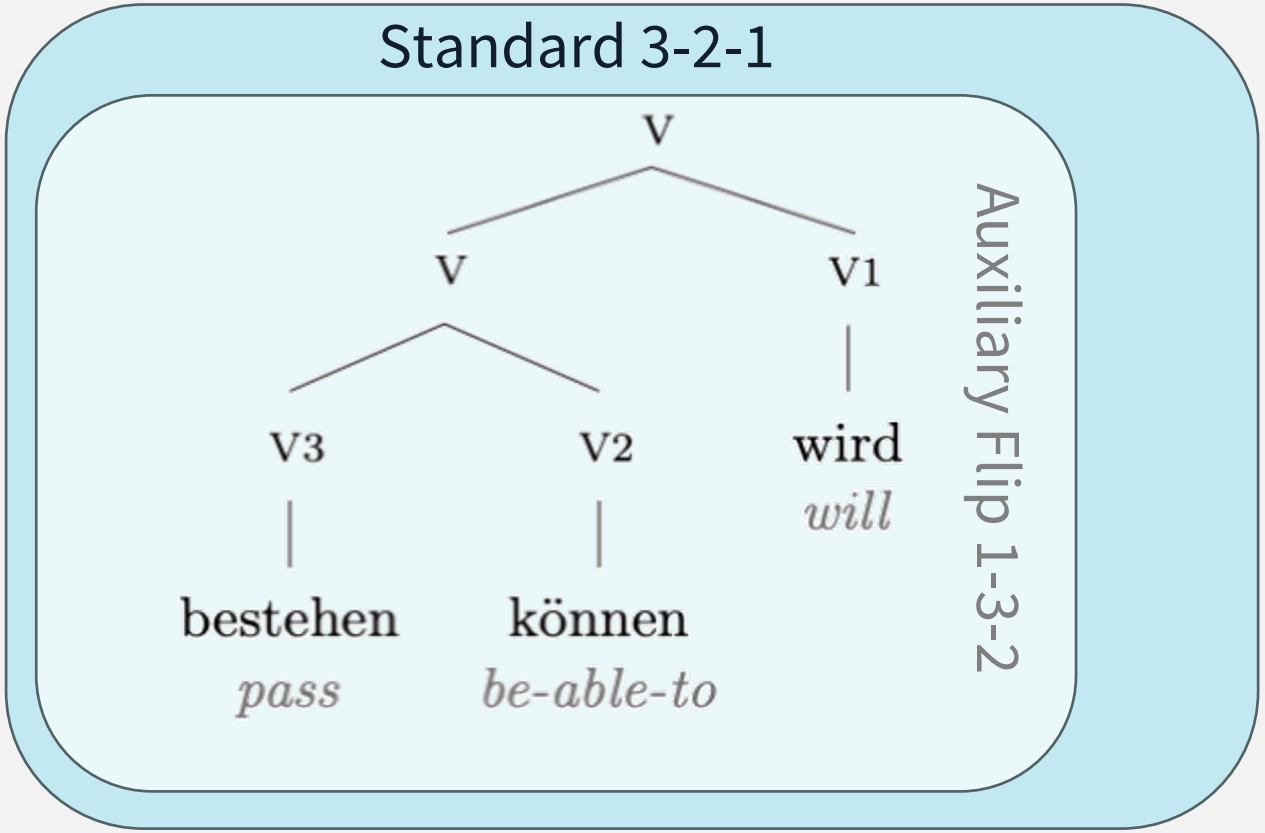
Standard 3-2-1



Auxiliary Flip 1-3-2



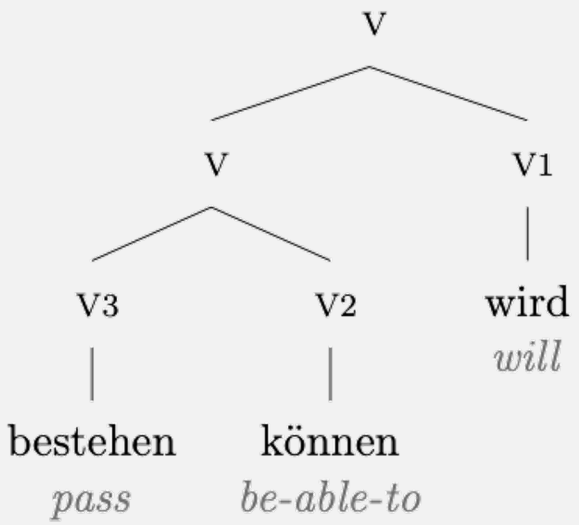
Account I: Bottom-up analysis (Hinrichs & Nakazawa 1994)



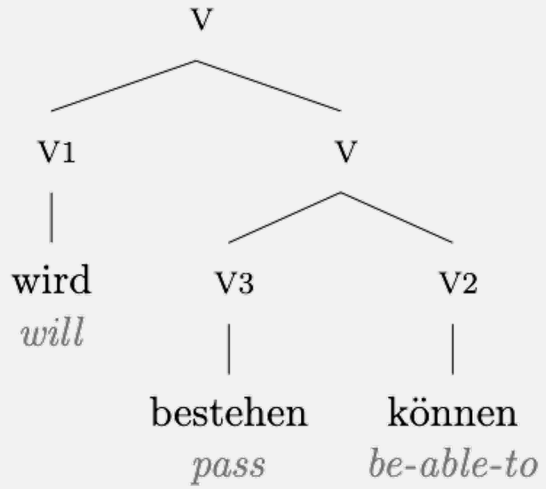
(animated slide)

Account I: Bottom-up analysis (Hinrichs & Nakazawa 1994)

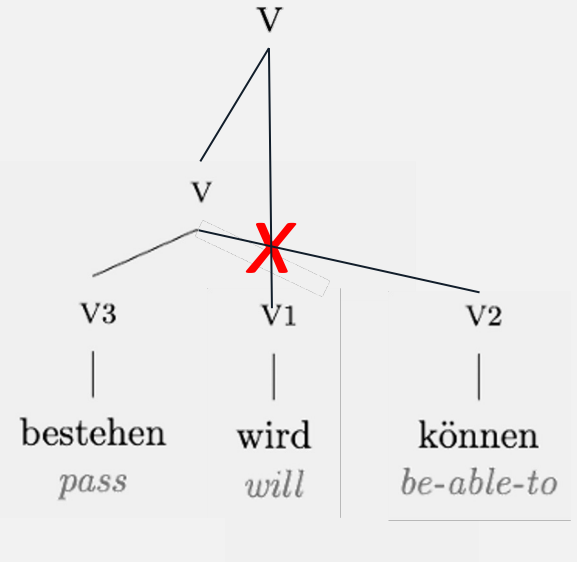
Standard 3-2-1



Auxiliary Flip 1-3-2



Intermediate 3-1-2

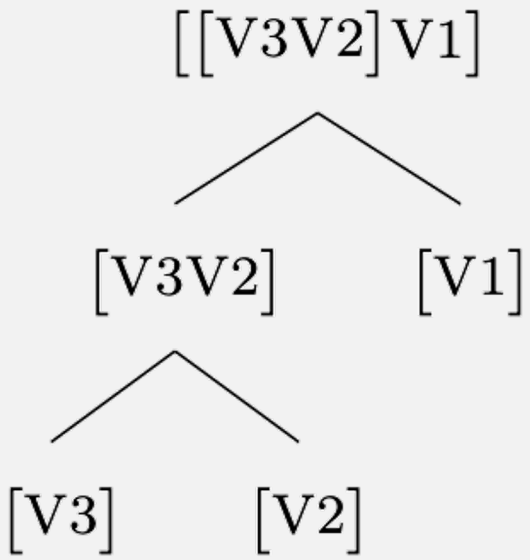


No analysis for the intermediate order

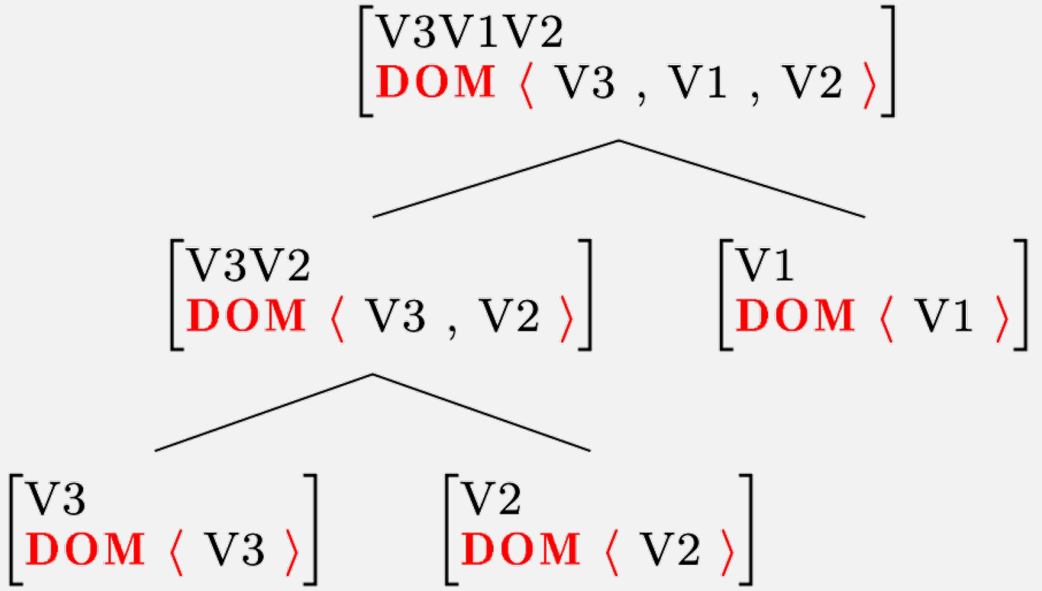
Account II: Linearization-based approach (Kathol 2000)

Introduction of ***word order domains*** **(DOM)** from Mike Reape (1993)

Previous analysis:



Kathol's approach:



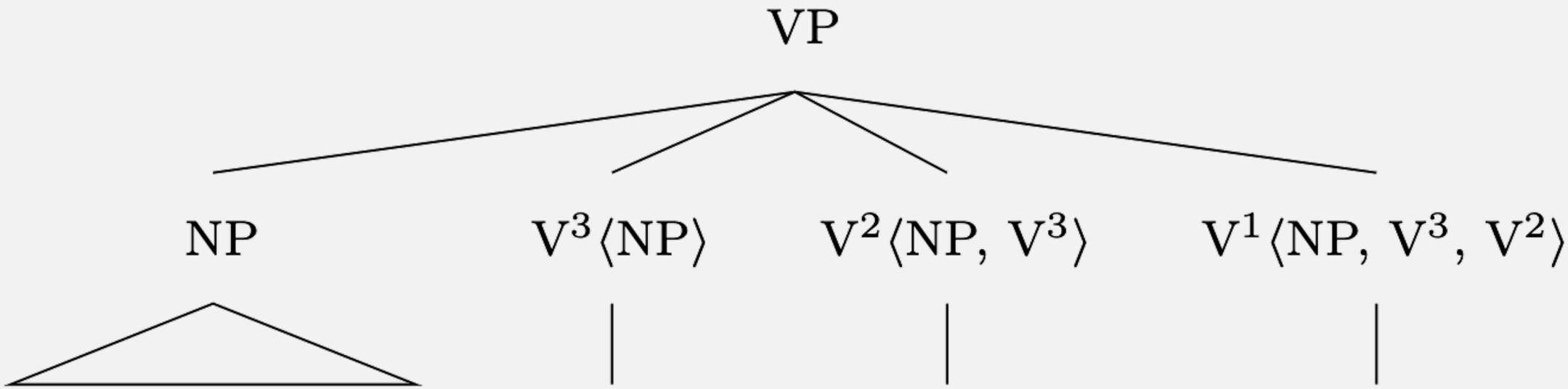
Account II: Linearization-based approach (Kathol 2000)

Complicated apparatus

Use of ordering domains (DOM) is a significant augmentation of the HPSG approach

- DOM significantly modifies the relation between how structures are built and the word order that results.

Account III: Alternative flat structure analysis (Bouma & van Noord 1996)



'...*will be able to pass the exam*'

Account III: Alternative flat structure analysis (Bouma & van Noord 1996)

☹

No hierarchical structure

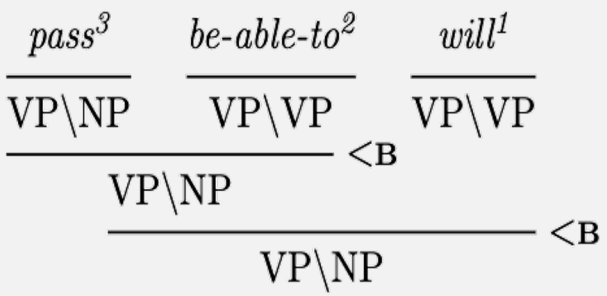
Dubious analysis for linguists (evidence for hierarchical structure)

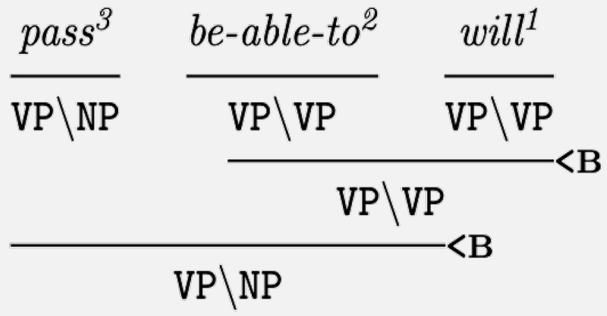
Proposed analysis

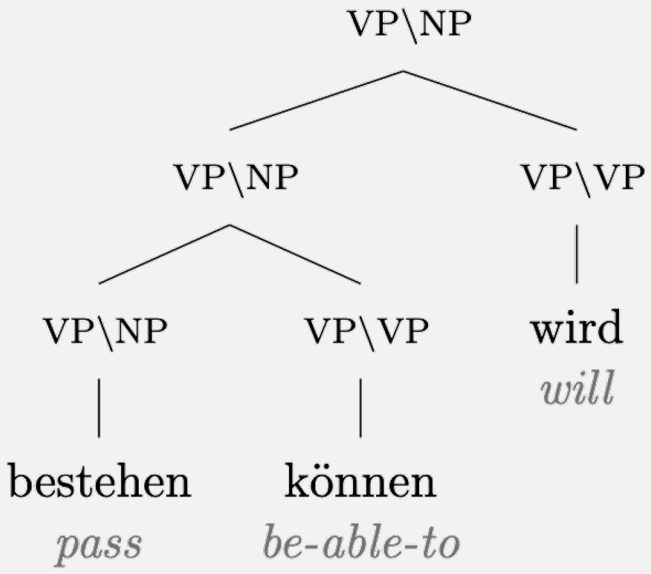
Development of a **simpler yet effective** HPSG-based account of verb clustering

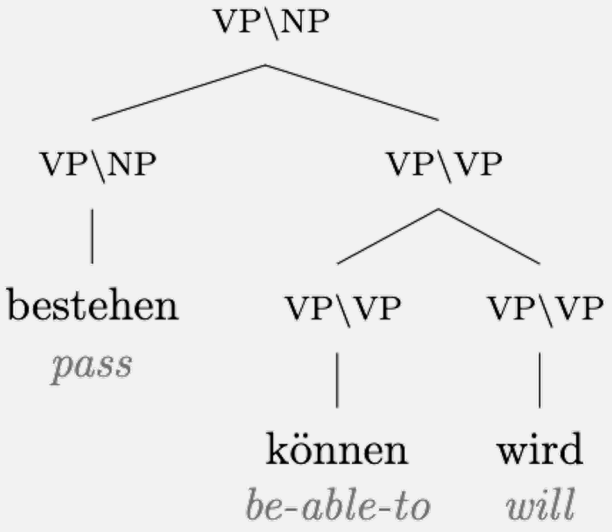
Allowing flexible structure assignment within verb cluster

Flexible combination in Flexible Categorial Grammar (FCG)



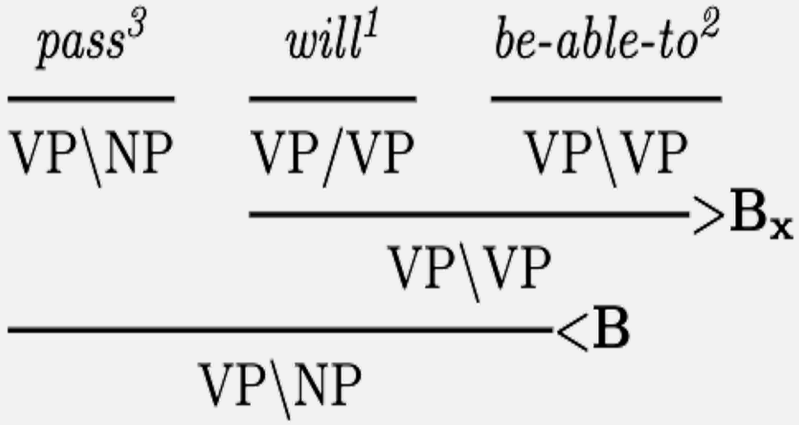


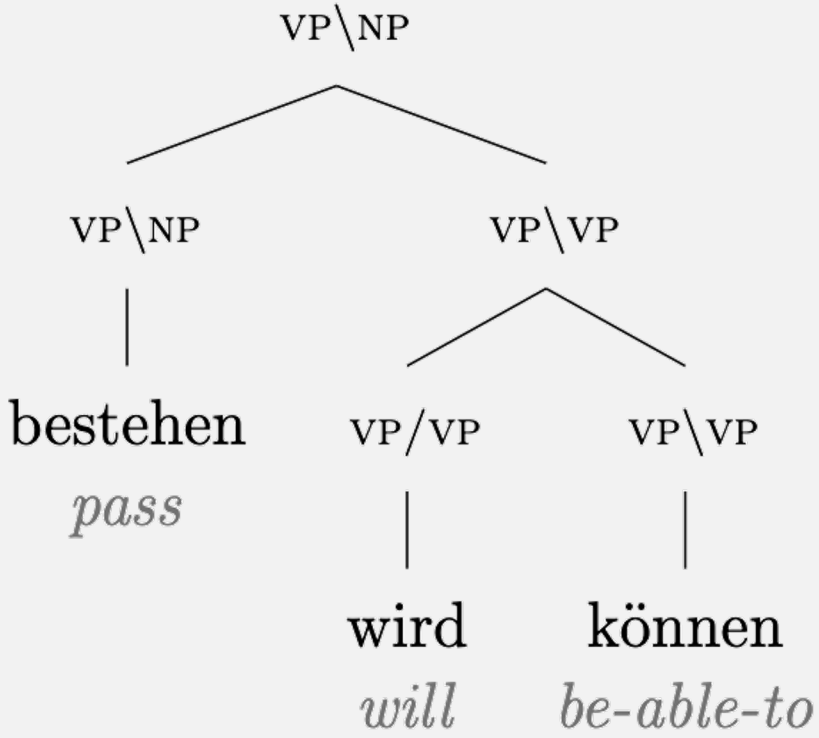




Flexible combination in Flexible Categorial Grammar (FCG)

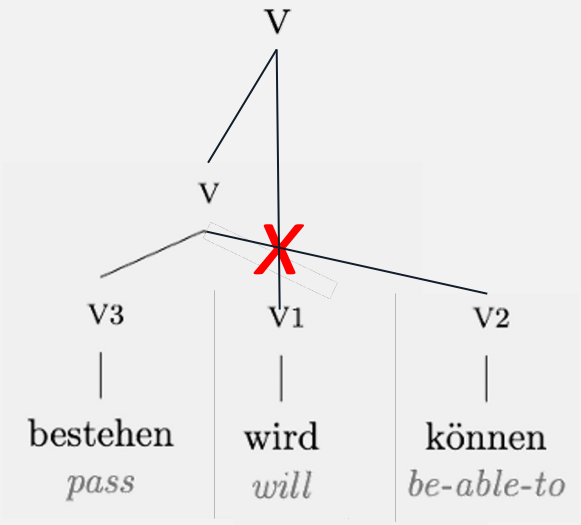
… *dass er das Examen* ***bestehen*** ^{3} ***wird*** ^{1} ***können*** ^{2}.
that he the exam pass be-able-to will
'… that he will be able to pass the exam.'



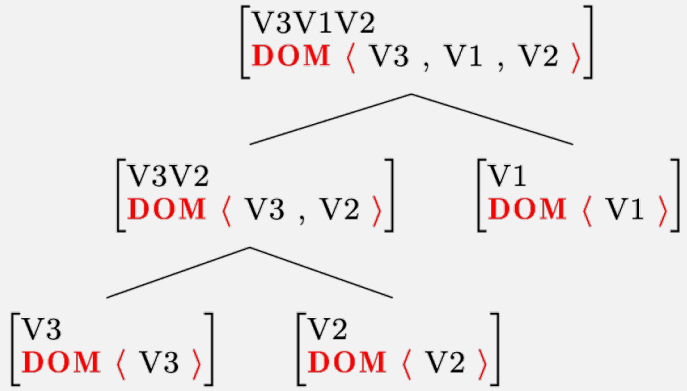


Analysis of intermediate verb order in HPSG vs FCG

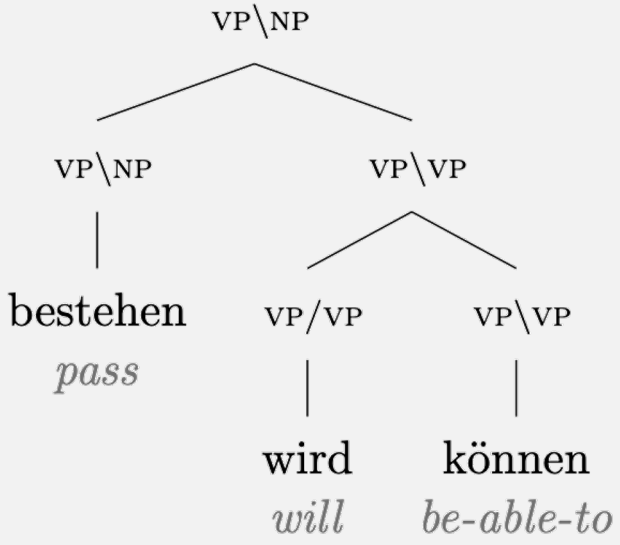
HPSG (H&N 1994)



HPSG (Kathol 2000)

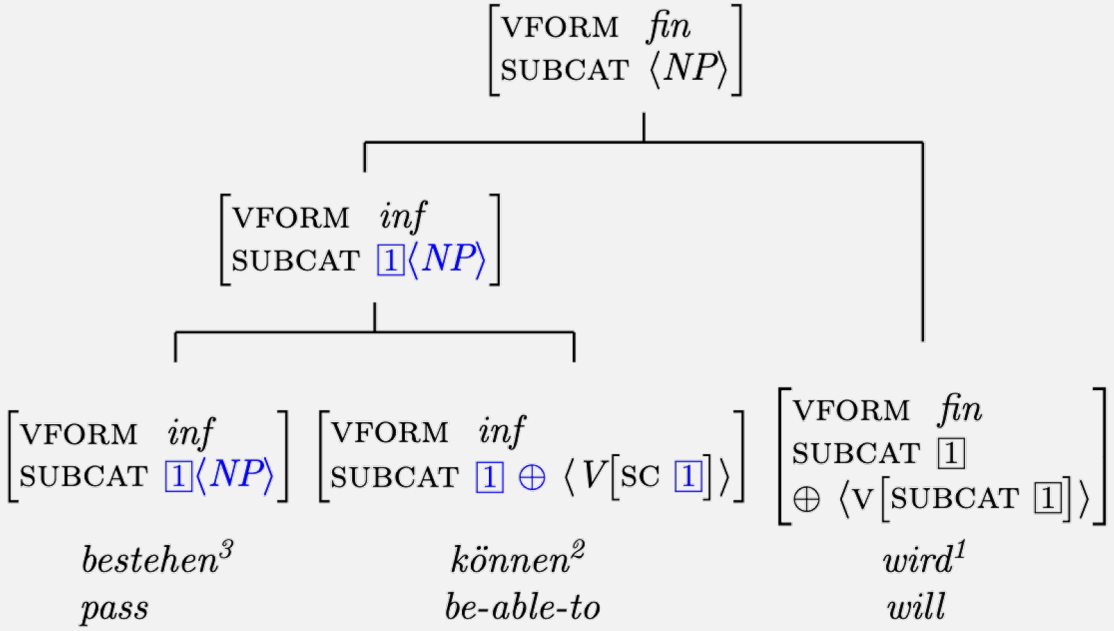


FCG

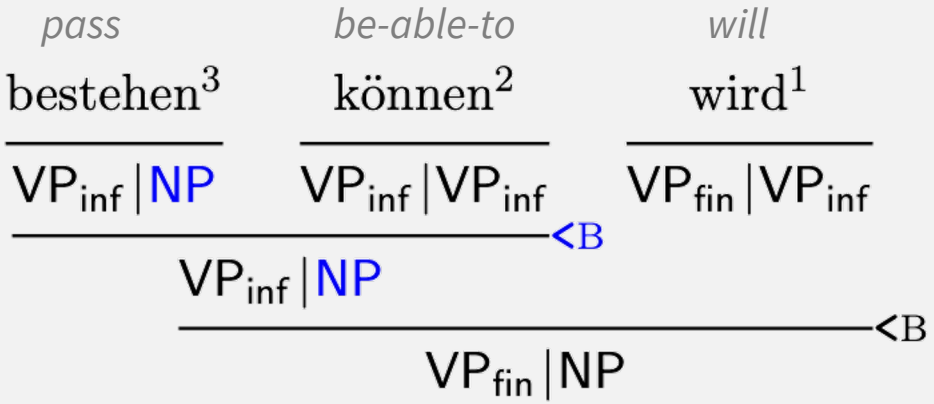


Composition

Complement inheritance (HPSG)



Function composition (FCG)

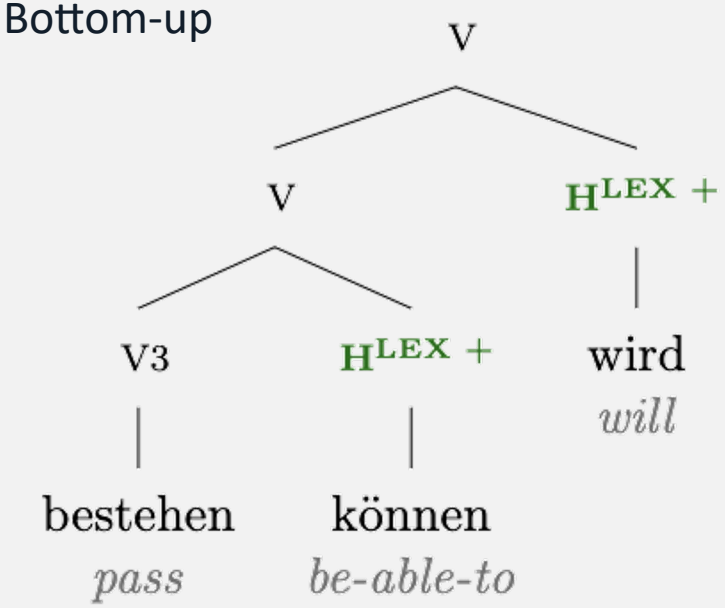


where **B** denotes composition

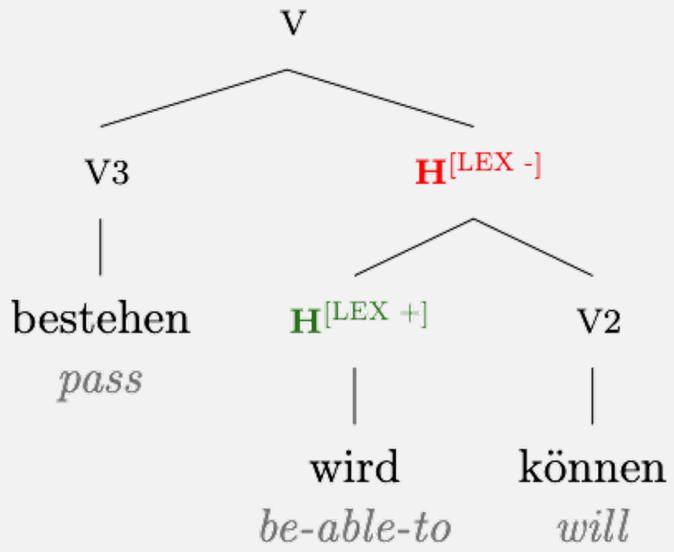
Lexical constraint blocks flexible structure assignment

V[NPCOMP −] → H[**LEX +**], V

Bottom-up



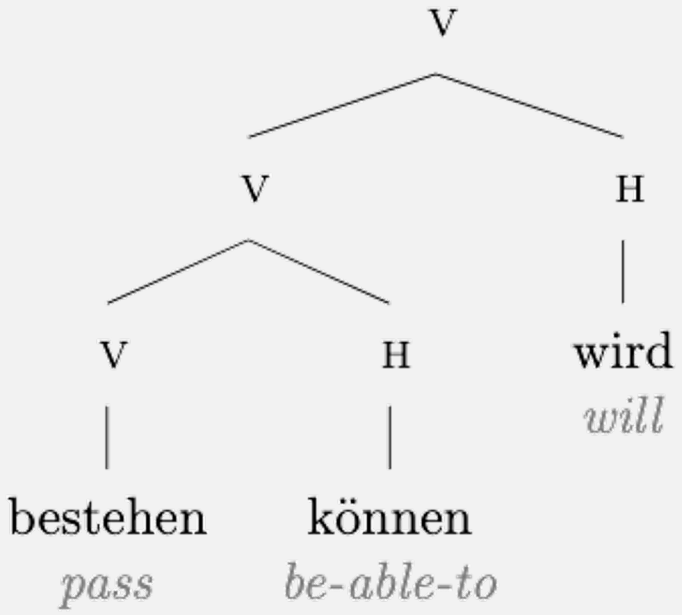
Top-down



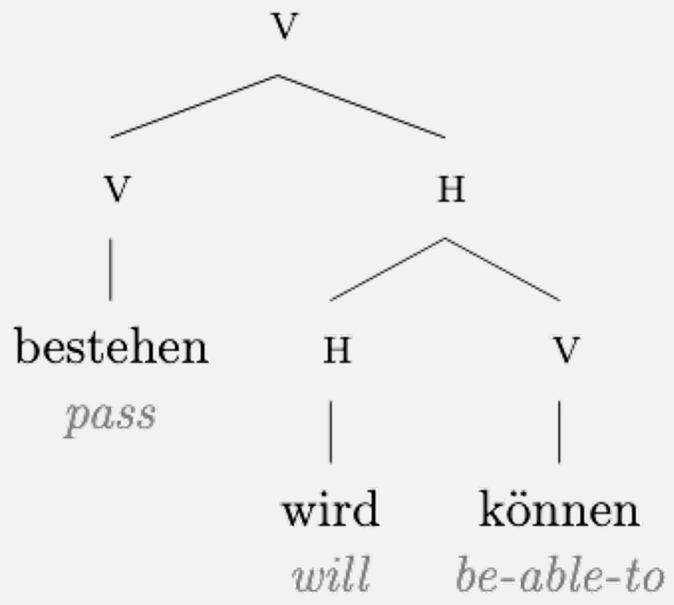
Lexical constraint blocks flexible structure assignment

V[NPCOMP −] → H, V

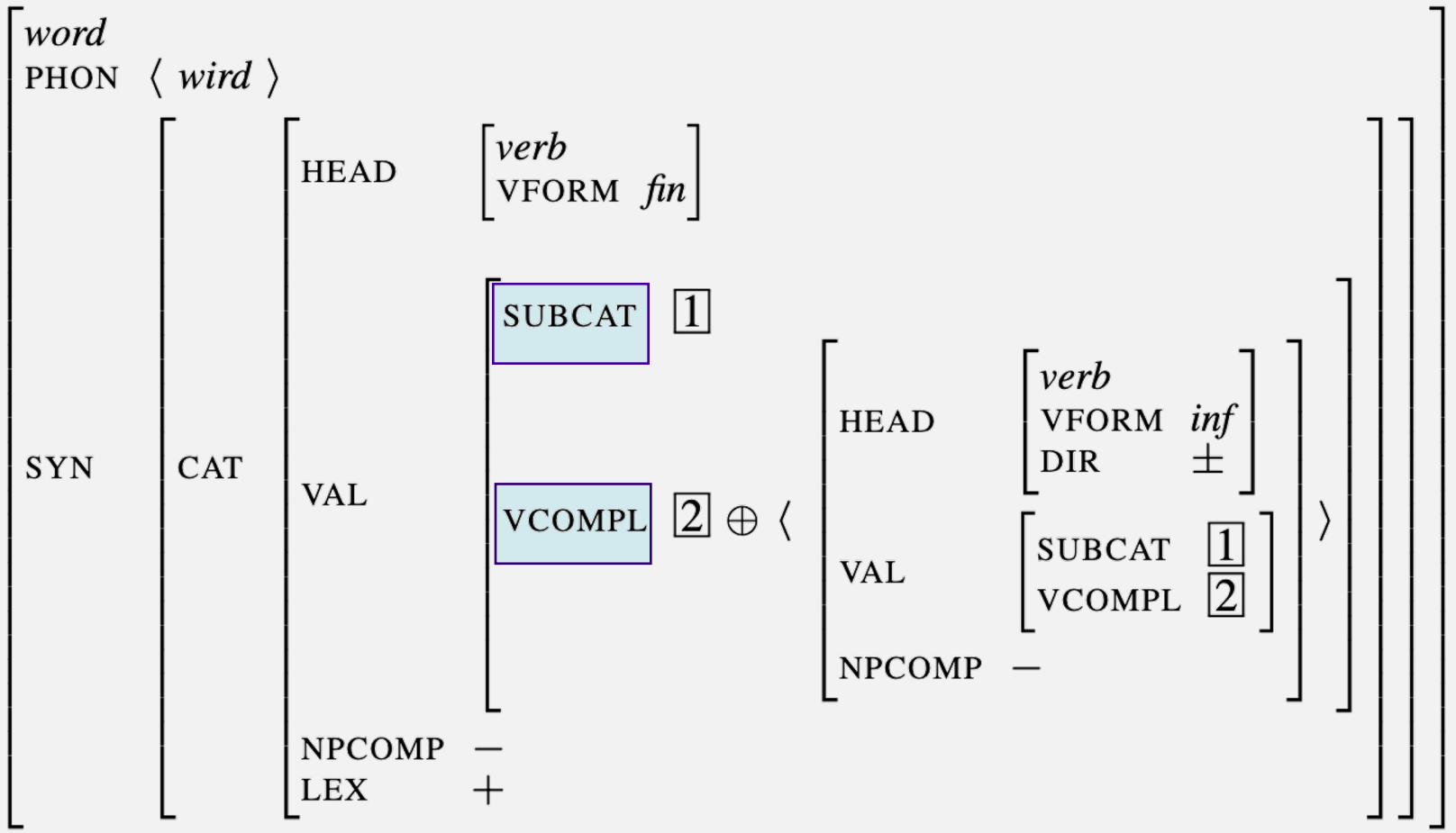
Bottom-up



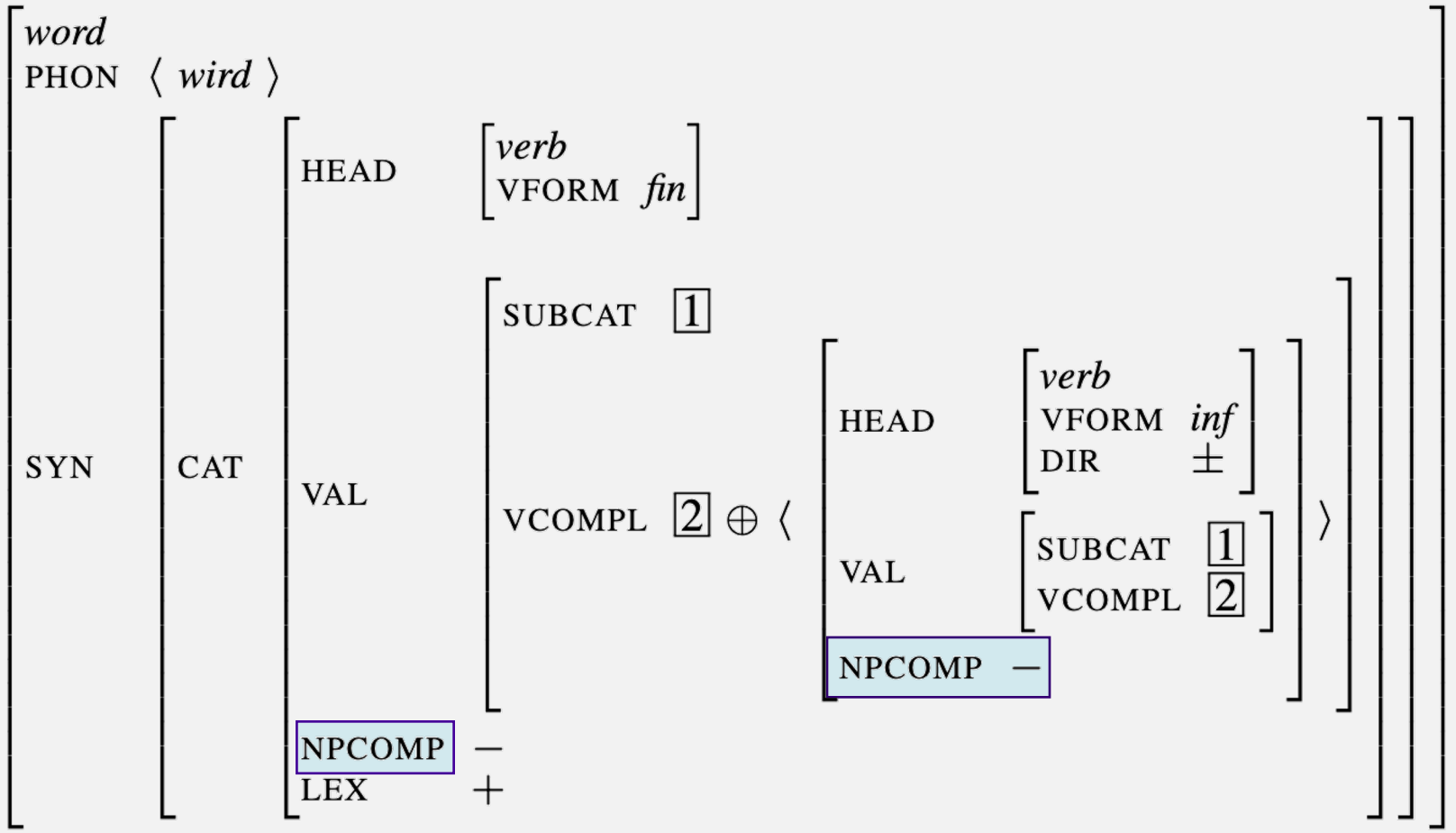
Top-down



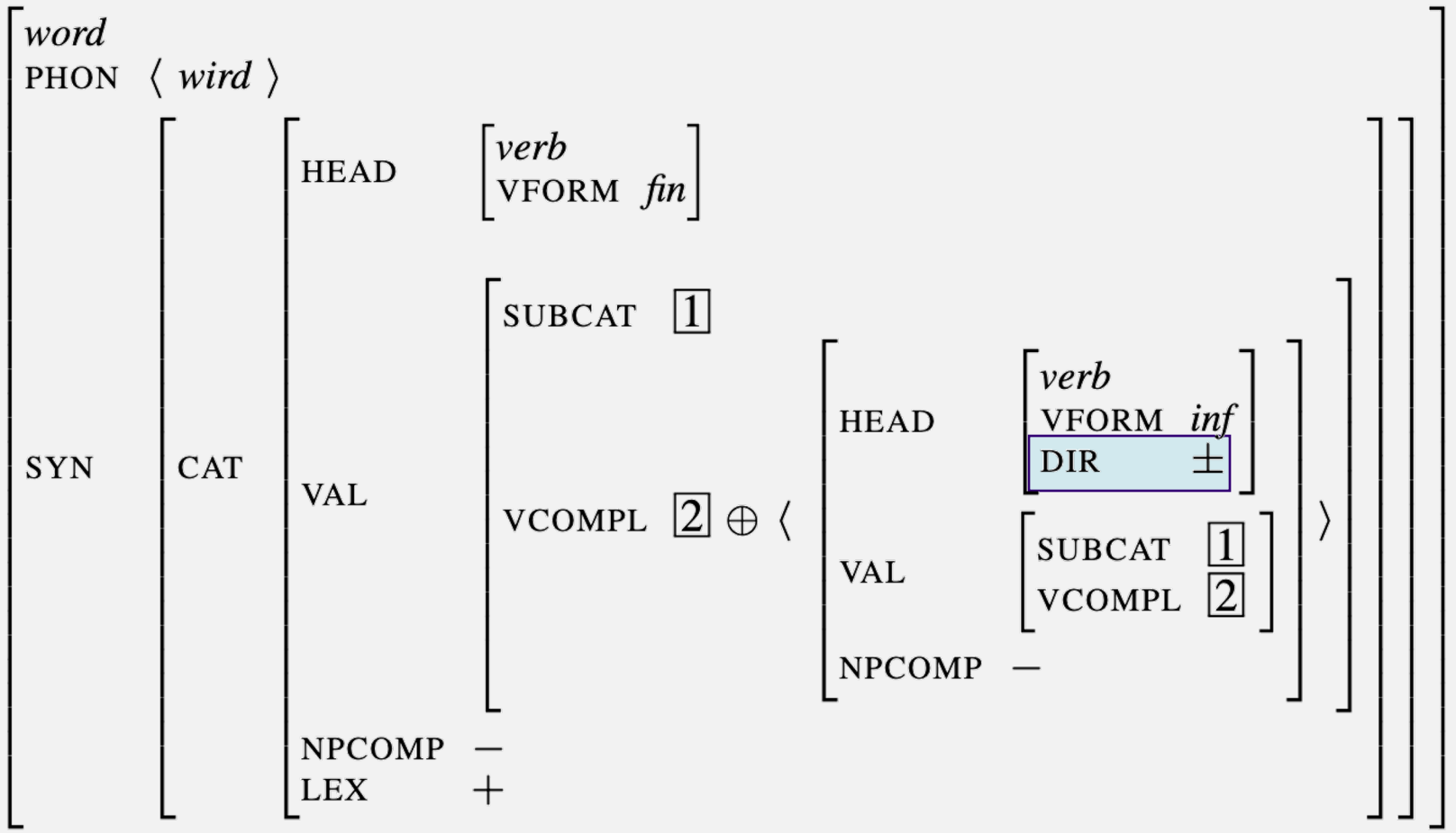
Feature geometry



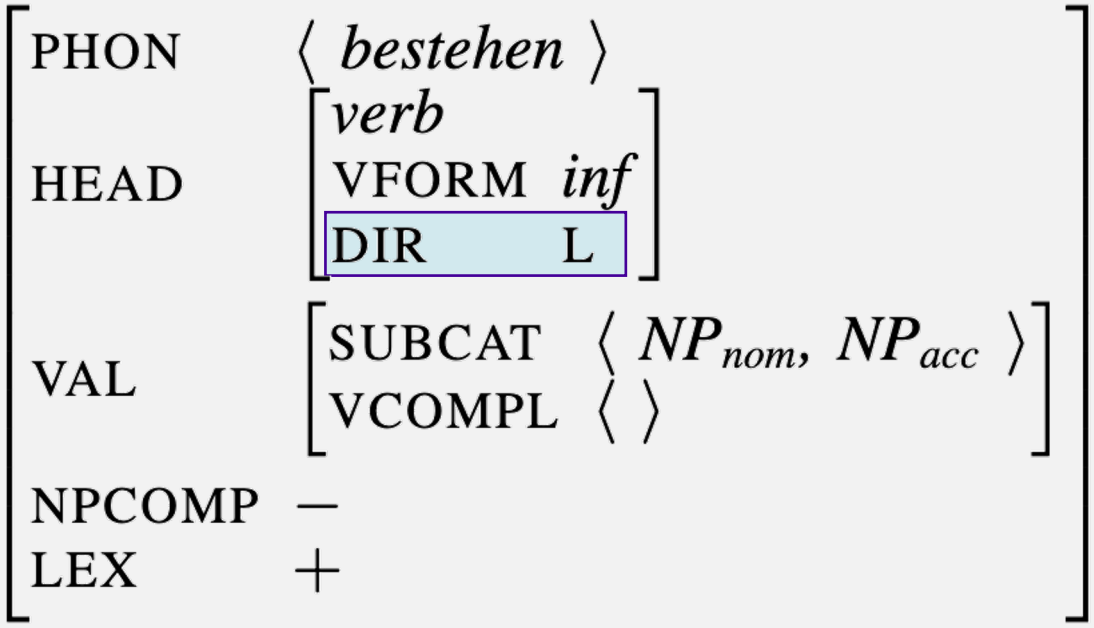
Feature geometry



Feature geometry



Directionality



… *dass er das Examen* ***bestehen***[DIR L] ***wird***.
that he the exam pass will
'… that he will pass the exam.'

Ordering constraints

a. $\text{HEAD} < \text{COMP} \begin{bmatrix} verb \\ \text{DIR} \quad \text{R} \end{bmatrix}$

b. $\text{COMP} \begin{bmatrix} verb \\ \text{DIR} \quad \text{L} \end{bmatrix} < \text{HEAD}$

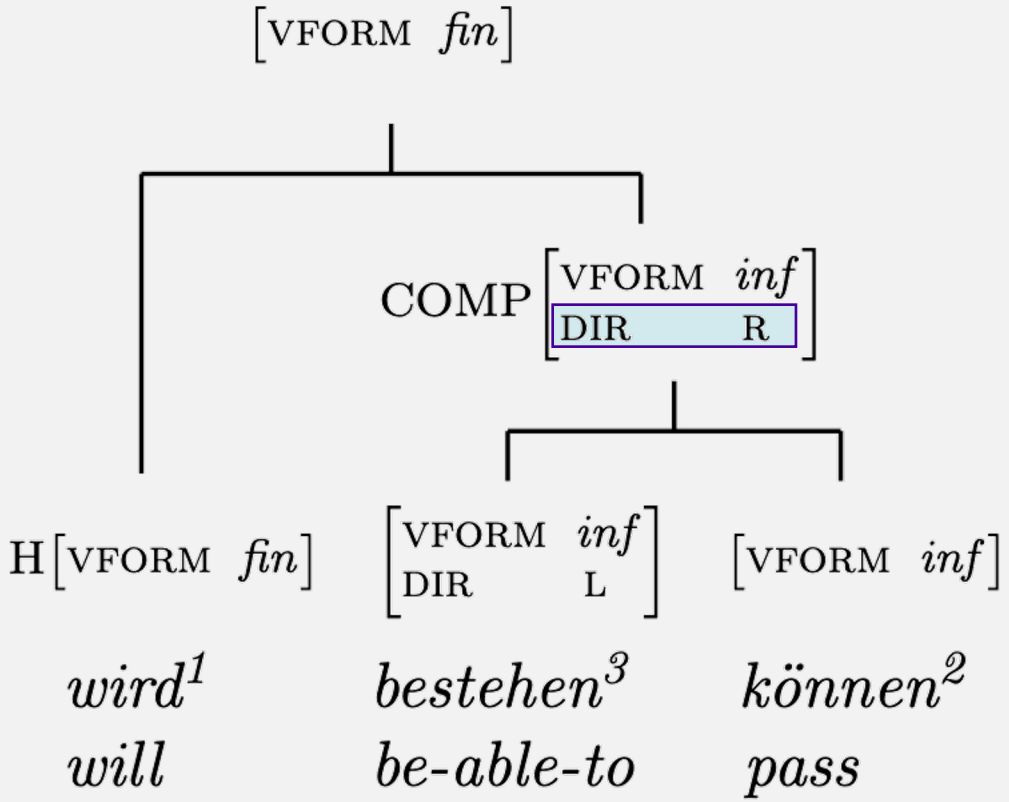
Ordering constraints arise from various sources:

- A verb's lexical entry may specify its DIR value (as in previous slide).
- A verb seeking a verbal complement may define its DIR value.
- If neither of these sources specifies the DIR value, an LP rule will establish it during analysis.

Ordering constraints

Lexicon:

$$\begin{bmatrix}
\text{PHON} & \langle\ \textit{können}\ \rangle \\
\text{HEAD} & \begin{bmatrix} \textit{verb} \\ \text{VFORM} \quad \textit{inf} \\ \text{DIR} \quad \pm \end{bmatrix} \\
\text{SUBCAT} & \boxed{1} \\
\text{VCOMPL} & \boxed{2} \oplus \langle \begin{bmatrix} \text{HEAD} & [\text{VFORM} \quad \textit{inf}] \\ \text{SUBCAT} & \boxed{1} \\ \text{VCOMPL} & \boxed{2} \\ \text{NPCOMP} & - \end{bmatrix} \rangle \\
\text{NPCOMP} & - \\
\text{LEX} & +
\end{bmatrix}$$

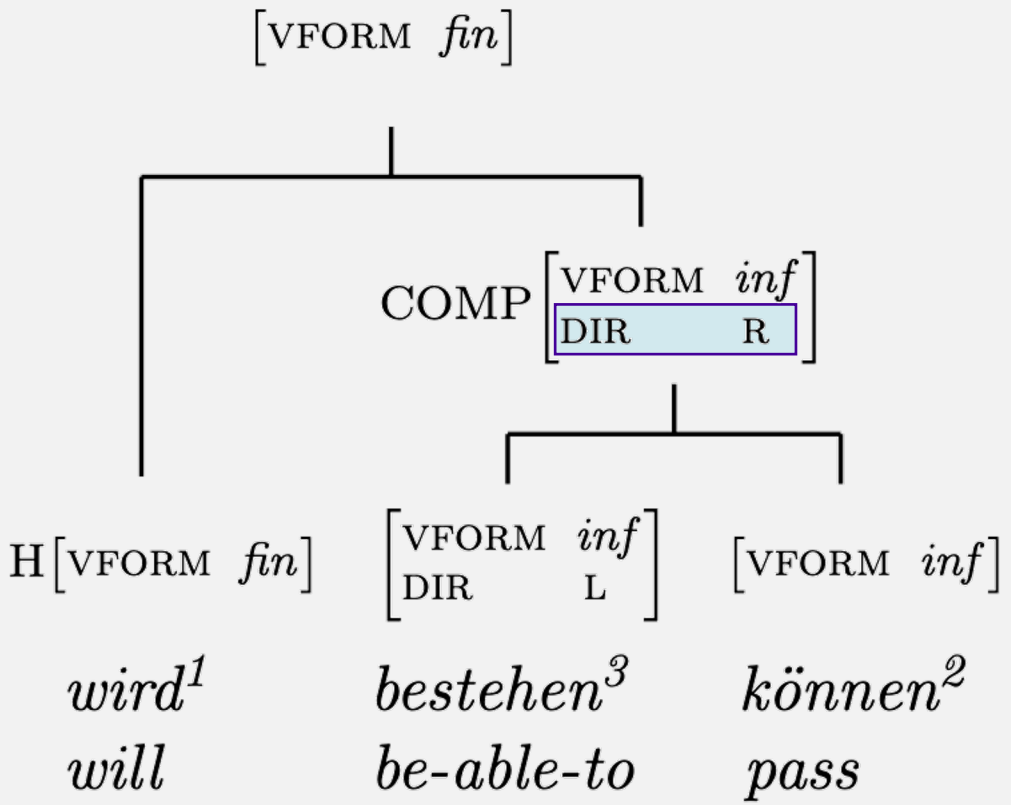


Ordering constraints

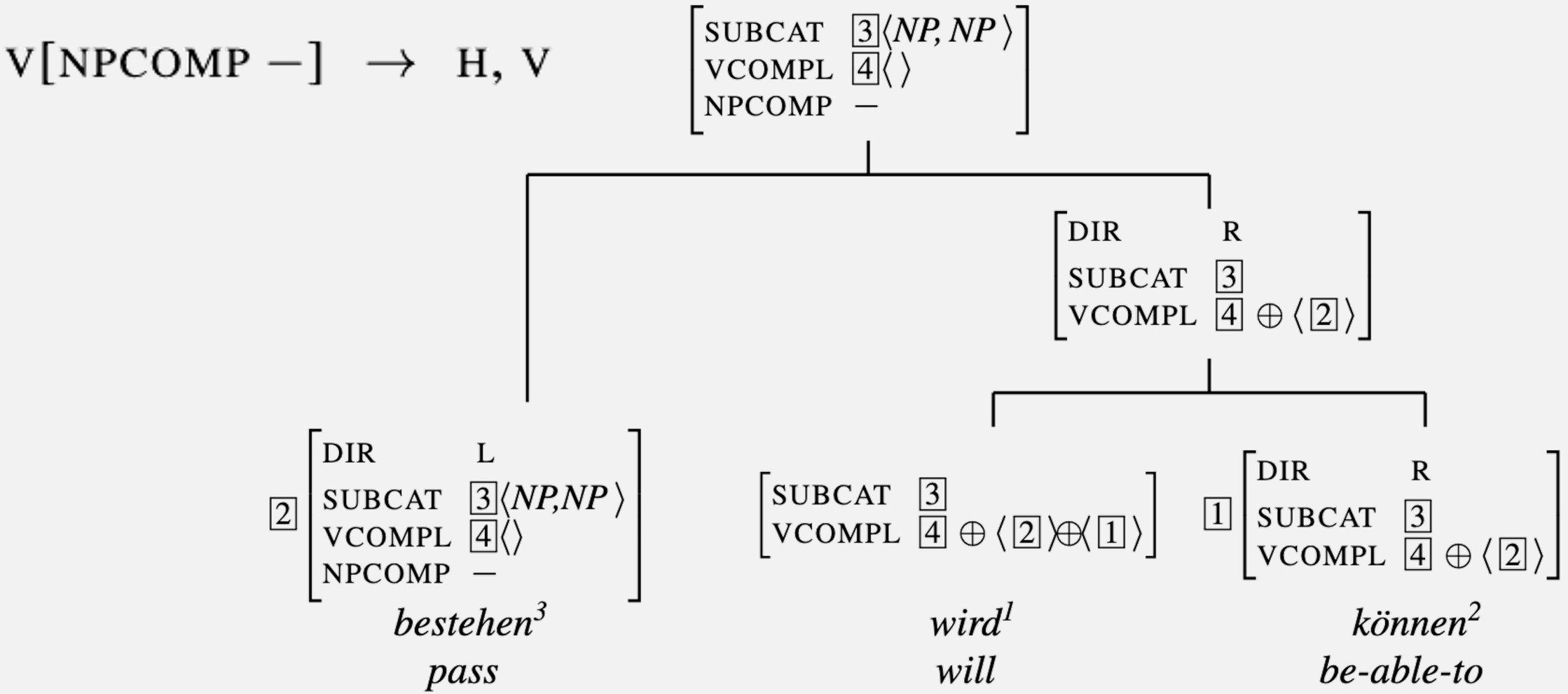
LP rules:

a. $\text{HEAD} < \text{COMP} \left[\begin{array}{l} \textit{verb} \\ \text{DIR} \quad \text{R} \end{array} \right]$

b. $\text{COMP} \left[\begin{array}{l} \textit{verb} \\ \text{DIR} \quad \text{L} \end{array} \right] < \text{HEAD}$



Zwischenstellung



Permutations

Possible orders	Analysis	German	Dutch	Afrikaans	…
a) 123	1[23] and [12]3	✗	✓	✓	
b) 132	1[32]	✓	✓	✓	
c) 213	[21]3	✗	✗	✗	
d) 231	[23]1	✗	✓	✓	
e) 312	3[12]	✓	✓	✓	
f) 321	[32]1 and 3[21]	✓	✓	✗	

Source: Wurmbrand, 2017

Bottom-up derivations

	Possible orders	Analysis	German	Dutch	Afrikaans	…
a)	123	1[23] and [12]3	✗	✓	✓	
b)	132	1[32]	✓	✓	✓	
c)	213	[21]3	✗	✗	✗	
d)	231	[23]1	✗	✓	✓	
e)	312	3[12]	✓	✓	✓	
f)	321	[32]1 and 3[21]	✓	✓	✗	

Source: Wurmbrand, 2017

Top-down derivations

Possible orders	Analysis	German	Dutch	Afrikaans	…
a) 123	1[23] and [12]3	✗	✓	✓	
b) 132	1[32]	✓	✓	✓	
c) 213	[21]3	✗	✗	✗	
d) 231	[23]1	✗	✓	✓	
e) 312	3[12]	✓	✓	✓*	
f) 321	[32]1 and 3[21]	✓	✓	✗	

* 3-1-2 is only possible when 3 is a passive participle.

Source: Wurmbrand, 2017

Spurious ambiguity

	Possible orders	Analysis	German	Dutch	Afrikaans	…
a)	123	1[23] and [12]3	✗	✓	✓	
b)	132	1[32]	✓	✓	✓	
c)	213	[21]3	✗	✗	✗	
d)	231	[23]1	✗	✓	✓	
e)	312	3[12]	✓	✓	✓	
f)	321	[32]1 and 3[21]	✓	✓	✗	

Source: Wurmbrand, 2017

Dutch three-verb clusters

Type of cluster	Word order
$Modal_1$ $Modal_2$ $Verb_3$	1-2-3
e.g. *moet kunnen werken*	1-3-2
'must can work'	* 2-1-3
	* 2-3-1
	3-1-2
	3-2-1
$Modal_1$ $Auxiliary_2$ $Verb_3$	1-2-3
e.g. *moet hebben gemaakt*	1-3-2
lit. 'must have made'	* 2-1-3
	* 2-3-1
	3-1-2
	3-2-1
$Auxiliary_1$ $Aspectual/Modal_2$ $Verb_3$	1-2-3
e.g. *is gaan zwemmen*	1-3-2
lit. 'is go swim'/	* 2-1-3
heeft kunnen zwemmen	2-3-1
lit. 'has can swim'	* 3-1-2
	3-2-1

Figure adapted from Augustinus, E. (2015)

Key observations from the SAND study (Barbiers, S. et al. 2008):

- Five out of six possible verb orders are found in the Dutch language area.
    - The 213 order is excluded in all investigated constructions.
- Verb order depends on construction type and geographical region.

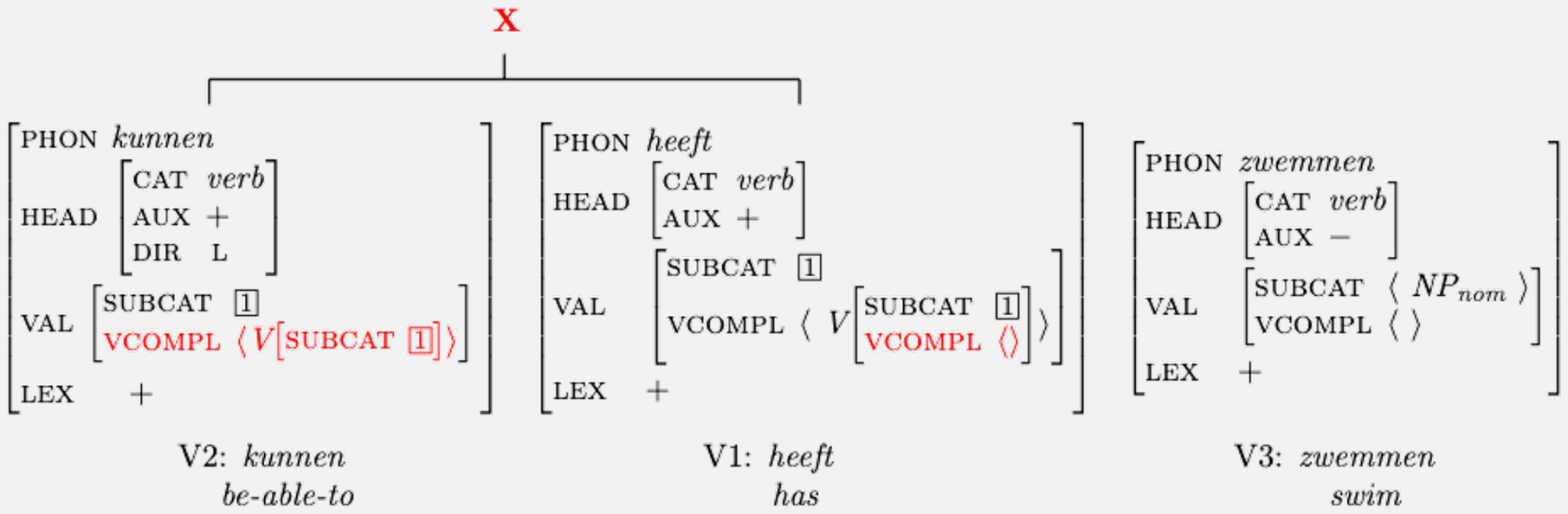
The case for VCOMPL

The use of VCOMPL feature allows us to **block flexible combination** by specifying within the finite verb that the VCOMPL list of its complement is empty.

$$\begin{bmatrix} \text{PHON} & \langle\ \textit{heeft}\ \rangle \\ \text{HEAD} & \begin{bmatrix} \textit{verb} \\ \text{VFORM}\ \textit{fin} \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SUBCAT}\ \boxed{1} \\ \text{VCOMPL}\ \langle\ V \begin{bmatrix} \text{SUBCAT}\ \boxed{1} \\ \text{VCOMPL}\ \langle\rangle \end{bmatrix} \rangle \end{bmatrix} \\ \text{NPCOMP} & - \\ \text{LEX} & + \end{bmatrix}$$

The case for VCOMPL

*Ik weet dat hij **kunnen[2] heeft[1] zwemmen[3]**.
I know that he be-able-to has swim



Summary and Conclusion

Key points

- Flexible combination within verb clusters allows derivation of broadly attested verb orders in German.
- This approach addresses challenges faced by standard constituency without the need for additional ordering domains.

Implications

- Provides a less complex analysis of verb cluster.
- Simplifies the process by avoiding additional mechanisms.

Next steps

- Further research to test this approach with more linguistic data.
- Potential refinement of the framework to address any uncovered limitations.

Thank you
for your attention