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Measuring Syntactic Change

Underuse and Overuse Statistics in a Multi-Layer Diachronic Corpus of German

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Plan

1. Research questions
2. Variants and Variationism
3. Underuse / overuse diagnostics
4. Multi-layer corpora
5. Two case studies:
    1. Relative clauses
    2. Periphrastic constructions

Measuring syntactic change

Historical grammars of German:

- Focus on phonological developments
- Catalogue of constructions in each language stage
- Usually no frequency information
- Relationship between the development of different constructions?

Measuring syntactic change

- We want to find out:
  - How did German syntax develop?
  - What are the most prominent changes in each period?
  - Gradual or abrupt changes?
  - How does a new construction oust an older one?
  - Concurrent use of older and newer systems?

Variationism (see e.g. Rissanen 2008)

- Variable: multiple ways of 'saying the same thing'
  - e.g. relative clauses
- Variant: one particular way
  - *The book* $_{A}$***that*** **/** $_{B}$***which*** **/** $_{C}$***Ø I read***

Variationism

- Inherently quantitative approach
- Interest in distribution of variants in each period
- Requires identification of variables (what is ‘the same thing’?)

- Diachronic corpus with uniform annotation scheme

Diachronic data

- Expensive, limited resources available
- Hard to use ‘data-driven’ methods (extrapolation from surface statistics)

- Use deeply annotated corpora to directly identify variables
- Annotate ‘everything’, since we don’t know what will be interesting

The corpora

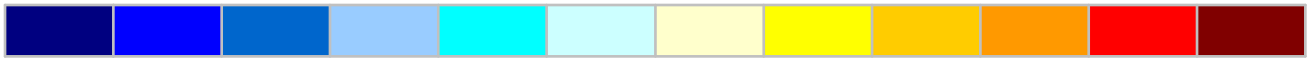
- 4 very small but deeply annotated sub-corpora, religious genres:
  - **Old High German** – Monsee Fragments (Gospel of Matthew) 2752 tokens
  - **Middle High German** – Speculum ecclesiae (Sermons) 2483 tokens
  - **Early New High German** – Sermon by Veit Nuber (written 1544) 2673 tokens
  - **New High German** – New Evangelistic Translation (Acts 1-4) 3574 tokens

The corpora

- Uniform, deep annotation scheme:
  - POS, morphology, lemma, gramm. function
  - Hyperlemmatization of top 100 forms (unified lemma for all periods, based on NHG)
  - Syntactic annotation (constituent trees with dependency edge labels)
  - Annotated frequency, its deviation from NHG and significance for POS/POS-bigrams, word forms, hyperlemmas
  - Bibliographic information (line in edition...)
  - Normalization

Using underuse/overuse diagnostics

- Search for most significant differences between stages
- compare normalized frequencies of all annotation levels and categories
- Visualize underuse as progressively colder colors, overuse as progressively warm colors



Example results – POS unigrams

pos	OHG	MHG	ENHG	NHG
PDAT	0.046131	0.011679	0.007105	0.008954
PPER	0.083545	0.052759	0.075916	0.075825
ART	0	0.07934	0.065445	0.061835
VVINF	0.01126	0.015707	0.018325	0.022104
PRELS	0.009444	0.011679	0.013837	0.016788
VAFIN	0.03705	0.035038	0.047868	0.045887
VAINF	0.001453	0.001208	0.004113	0.003078
PDS	0.023974	0.026983	0.013089	0.004757

Interpreting results

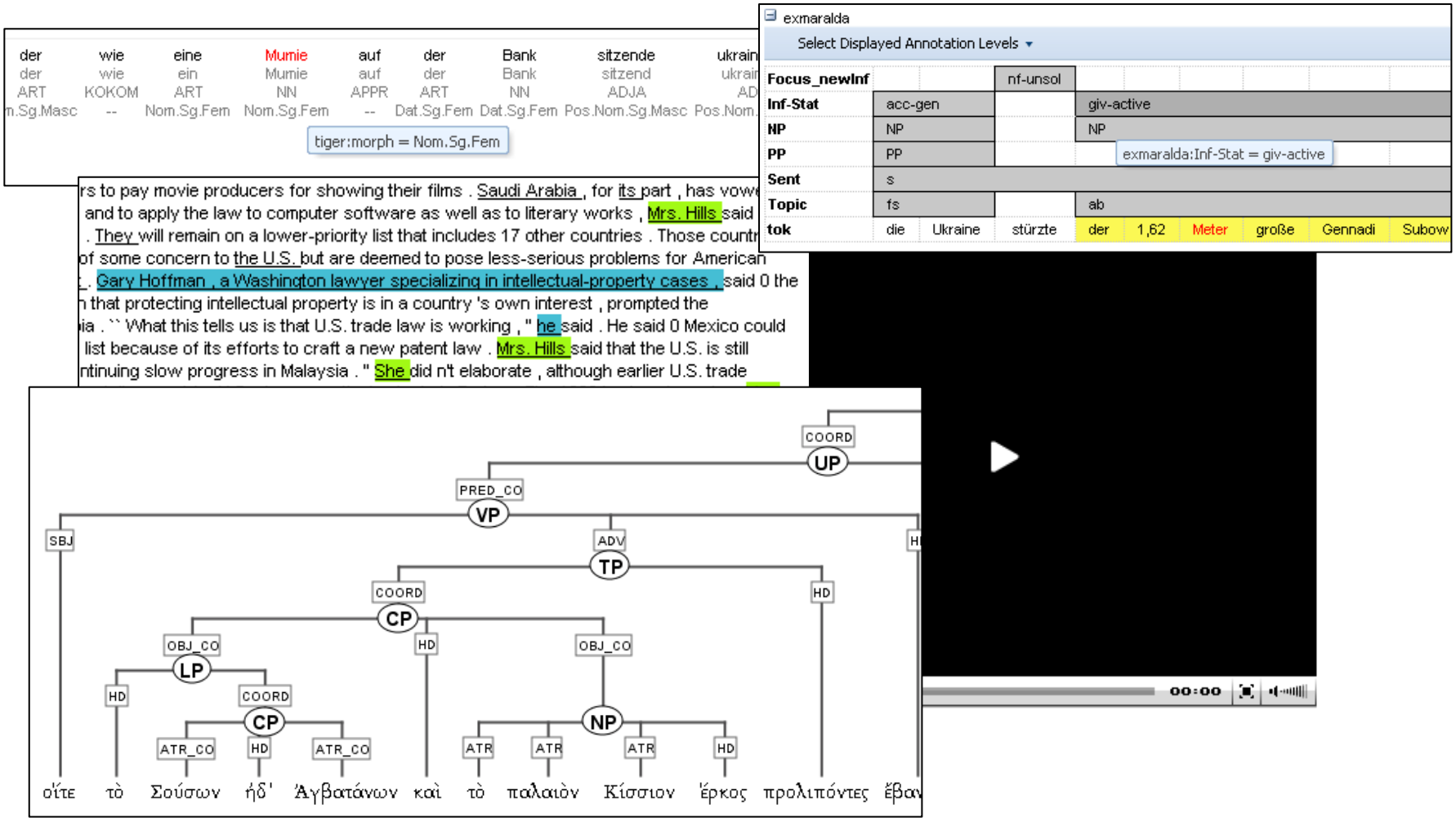
- Are there simply fewer relative clauses in OHG?
- Or are sentences simply longer? (fewer sentences > fewer PRELS)
- Do all relative clauses have a PRELS?

- Need for more accurate queries, syntactic annotation

Querying multiple layers with ANNIS2

- ANNIS: Annotation of Information Structure
- Multi-layer corpus search architecture
- Developed in SFB 632 “Information Structure”
- Search and visualization of complex annotation graphs, spans, relations, metadata and RegEx thereof

Querying multiple layers with ANNIS2



Putting it together

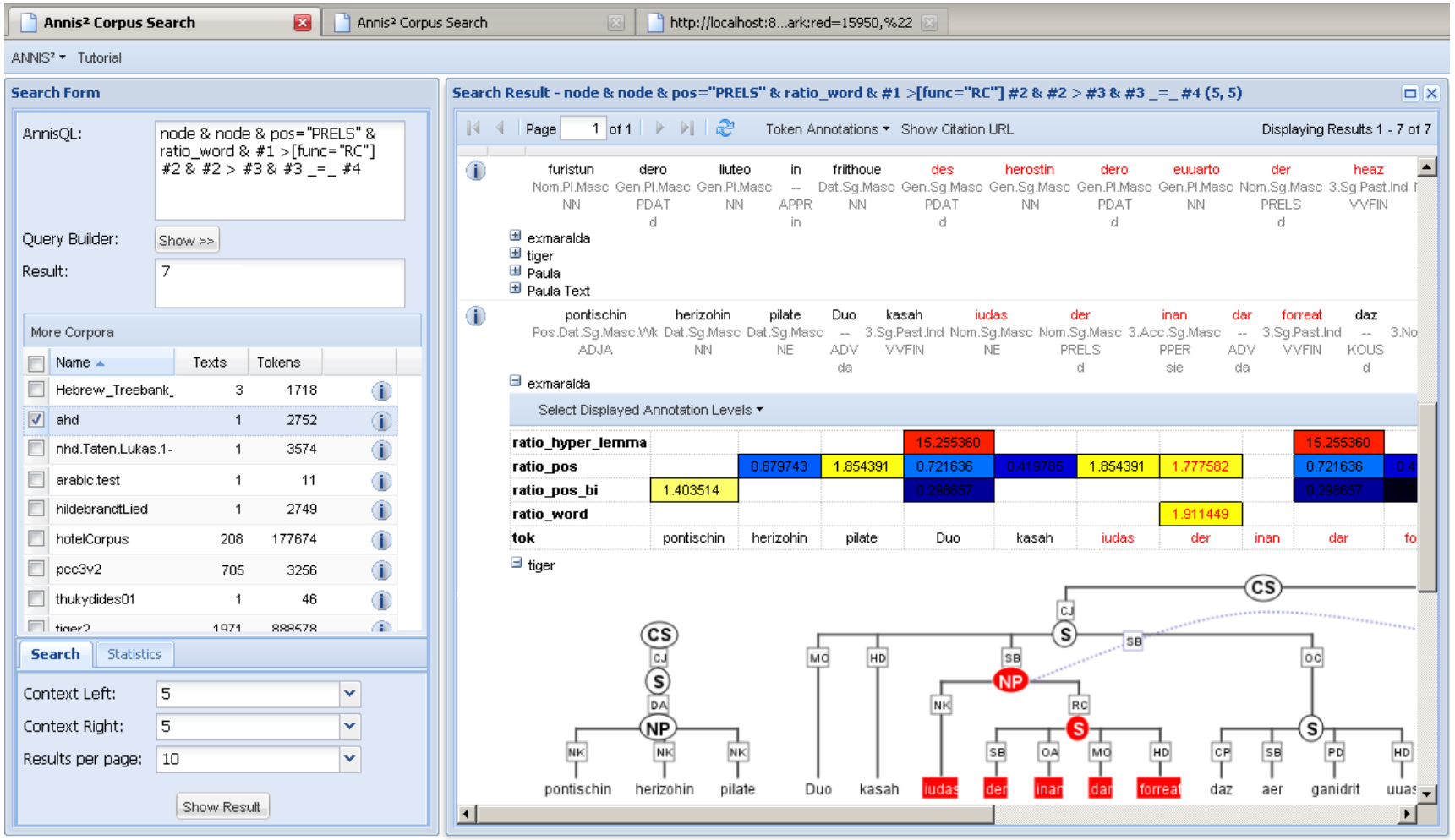
- Two case studies:
  1. Diagnostic: gradient underuse of PRELS
     - Increase in relative clauses?
  2. Diagnostic: underuse of VAFIN/VAINF
     - Development of periphrastic constructions?

1 Relative clauses

1. Use syntactic annotation to normalize to clauses:
2. PRELS=?RC
3. Find relative clauses in **syntactic** annotation

Sub-corpus	PRELS per 100 clauses
OHG	**4.62** (sig. p<7.844e-06)
MHG	10.25
ENHG	12.85
NHG	13.35

ANNIS2 browser interface

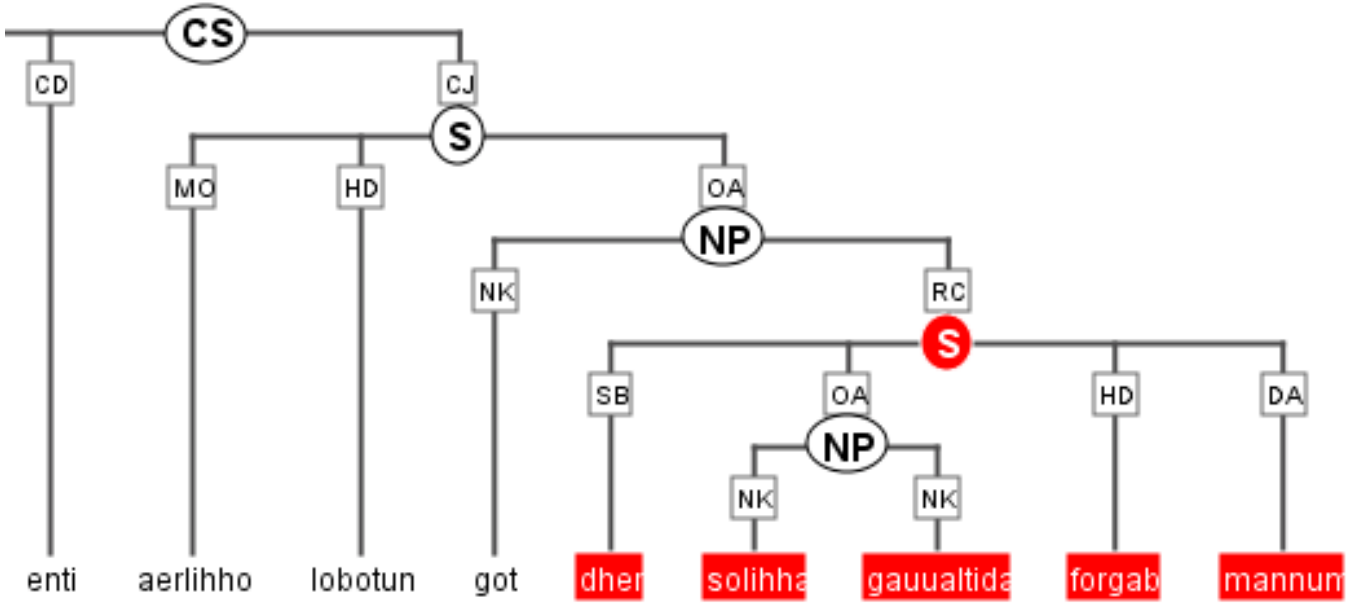


Type 1: PRELS

- and praised God, **who** gave men such power

	enti	aerlihho	lobotun	got	dher	solihha	gauualtida	forgab	mannum
.Neut	--	--	3.Pl.Past.Ind	Acc.Sg.Masc	Nom.Sg.Masc	Acc.Sg.Fem	Acc.Sg.Fem	3.Sg.Past.Ind	Dat.Pl.Masc
:	KON	ADV	VVFIN	NN	PRELS	PIAT	NN	VVFIN	NN
	und								Mensch

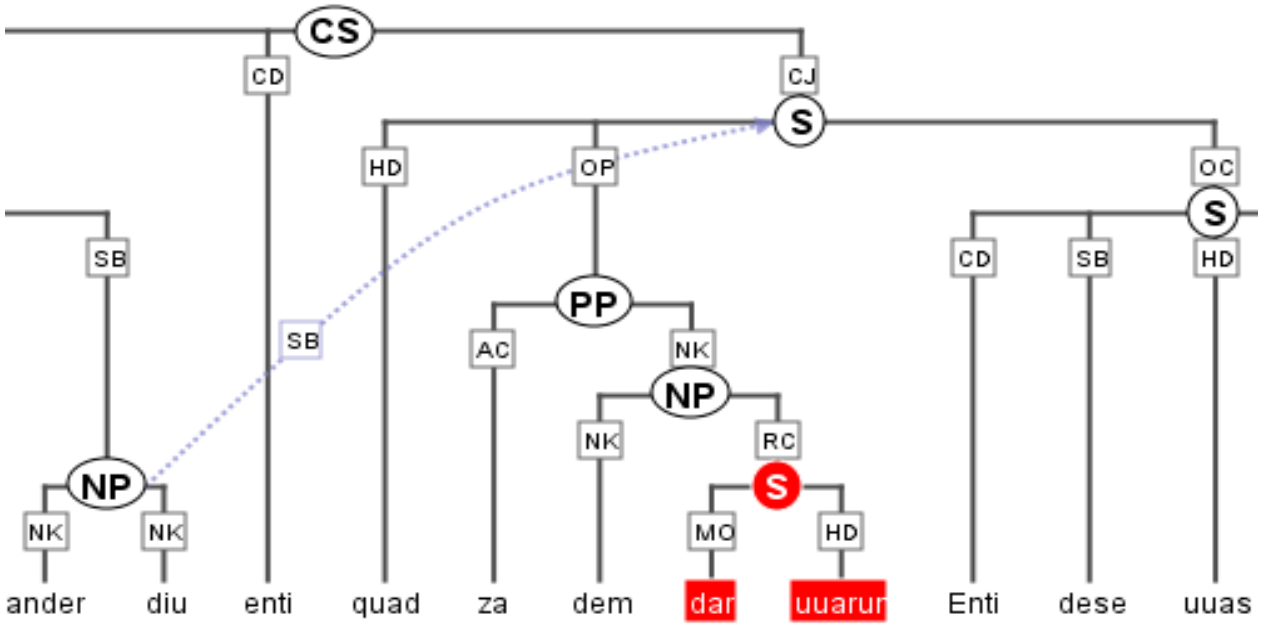
ła



Type 2: Asyndetic

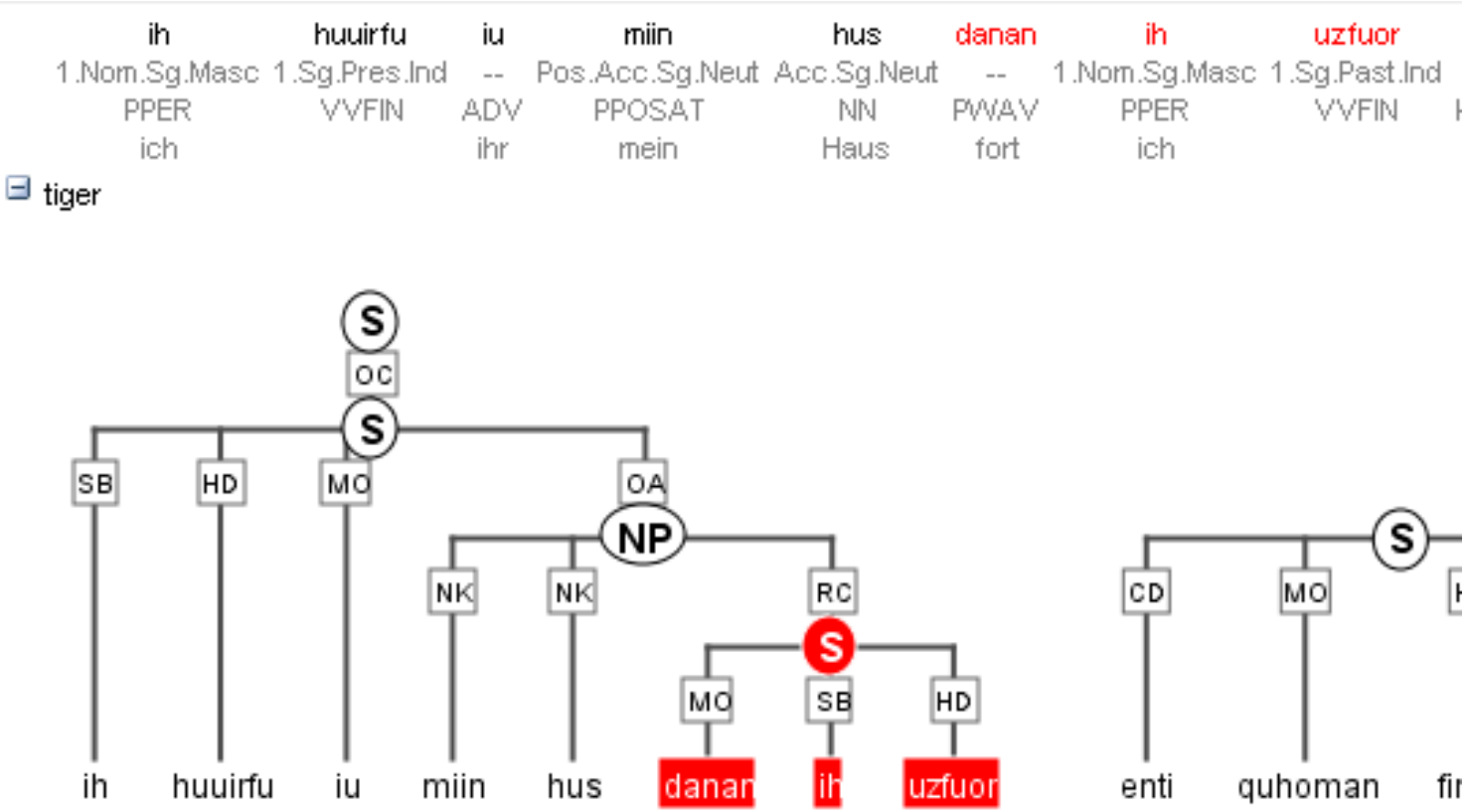
- and said to them **were there**

inan	ander	diu	enti	quad	za	dem	dar	uuarun
3.Acc.Sg.Masc	Pos.Nom.Sg.Fem.St	Nom.Sg.Fem	--	3.Sg.Past.Ind	--	Dat.Pl.*	--	3.Pl.Past.Ind
PPER	ADJA	NN	KON	VVFIN	APPR	PDS	ADV	VAFIN
sie		d	und	sagen	zu	d	da	sein



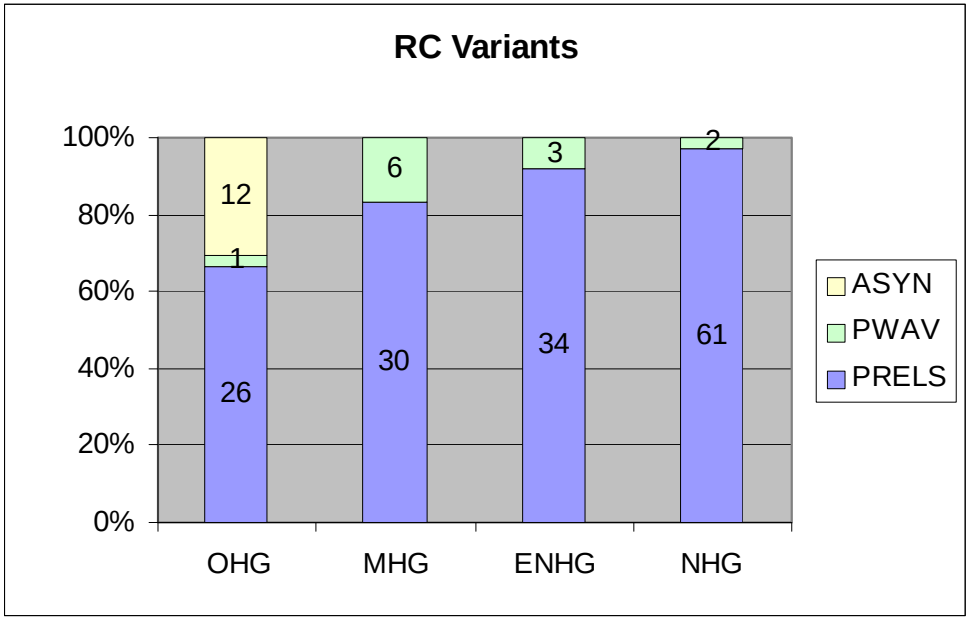
Type 3: PWAV

- I return now to my house, **whence** I departed



Relative clauses - Overview

	with PRELS	with PWAV	Asyndetic	total RC
OHG	**26 (4.62)**	**1 (0.18)**	**12 (2.13)**	**39 (6.93)**
MHG	**30 (10.60)**	**6 (2.12)**	**0**	**36 (12.72)**
ENHG	**34 (11.81)**	**3 (1.04)**	**0**	**37 (12.85)**
NHG	**61 (13.35)**	**2 (0.44)**	**0**	**63 (13.79)**



(contrast significant at p-value < 2.2e-16 for all parameters, and within MHG-NHG for PRELS/PWAV)

Summary

- Variable: RC
  - PRELS dominant in all periods
  - Asyndetics present in OHG but completely absent later
  - PWAV in all periods, but decreasing
  - Progressively limited to adverbial usage though also known dialectally (not discussed)

2 Periphrastic constructions

pos	OHG	MHG	ENHG	NHG
PDAT	0.046131	0.011679	0.007105	0.008954
PPER	0.083545	0.052759	0.075916	0.075825
ART	0	0.07934	0.065445	0.061835
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2 Periphrastic constructions

- Categories VAFIN/VAINF too coarse
- Include all forms of *haben* ‘have’, *sein* ‘be’, *werden* ‘become’
- Use hyper lemmatization to distinguish:

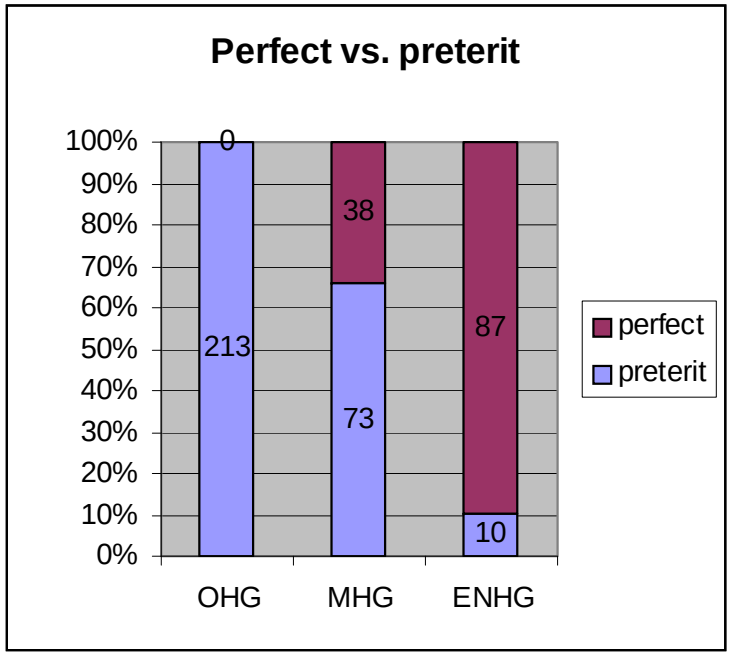
	OHG	MHG	ENHG	NHG
haben	0.0021802	0.00362465	0.016455	0.020145
sein	0.0308166	0.02698349	0.028048	0.024902
werden	0.0043143	0.00161095	0.013089	0.01455

2 Periphrastic constructions

- 4 Uses for VAFIN/VAINF:
  1. Periphrastic perfect
  2. Periphrastic passive
  3. Copula
  4. Full lexical verb
- Concentrate on cases 1 & 2
- Compare to synthetic preterit (morphological annotation)

2 Periphrastic constructions

	preterit	perfect	passive
OHG	213 (37.83)	0 (0.00)	33 (5.86)
MHG	73 (25.80)	38 (13.42)	15 (5.30)
ENHG	10 (3.47)	87 (30.21)	17 (5.90)



Summary

- Variable: Periphrasis
  - No periphrastic tenses in OHG
  - Perfect encroaches on preterit gradually, parallel development of future periphrasis
  - Passive use develops independently, represents different variable

Conclusion

- Annotation scheme determines variables and variants we find
- Decision ‘what is the same thing’ crucial in diachronic corpora
- Need to code and examine multiple (independent) annotation levels

Conclusion

- Uniform scheme across periods
- Underuse / overuse statistics as a diagnostic for interesting phenomena
- Closer look at all annotation levels for more fine-grained categorization
- Quantitative interplay of variants shapes diachronic syntax

Thank you for your attention!

- ANNIS:
  http://www.sfb632.uni-potsdam.de/d1/annis/
- Underuse/overuse add-in for Excel:
  http://korpling.german.hu-berlin.de/~amir/uoaddin.htm