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Semantics drives analogical change in Germanic strong verb paradigms: A phylogenetic study

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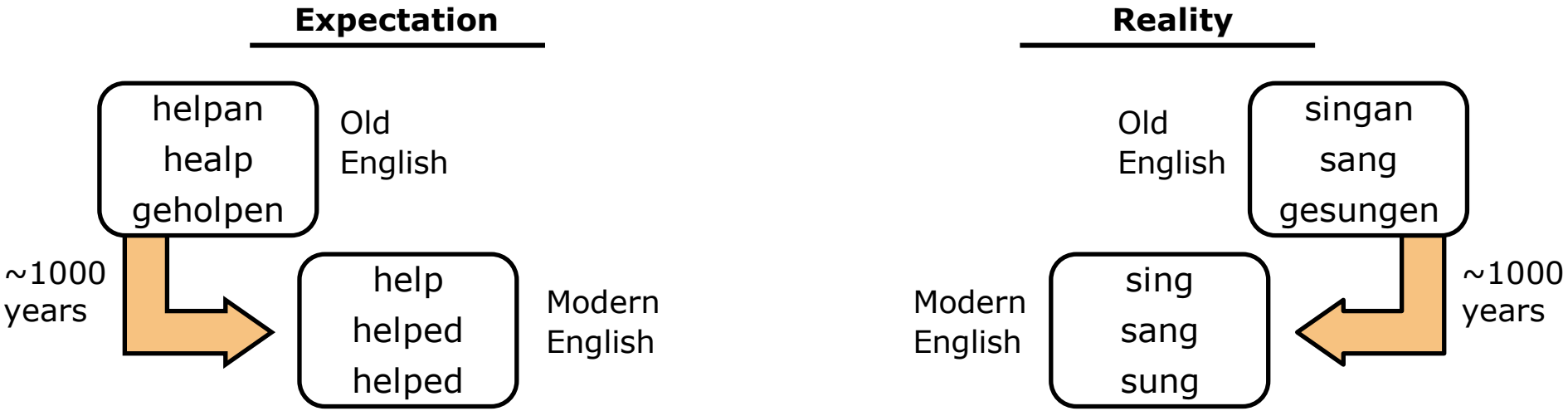
Uniformity in language



What **factors** or **mechanisms** allow certain non-uniform structures to **resist leveling** and survive despite the apparent benefits of uniformity?

Germanic strong verbs

- Strong verbs have been widely studied and well documented and represent a **perfect empirical showcase** for the study on non-uniformity in language, specifically in verbal paradigms

- Strong verbs in Germanic signal the change in Tense-Aspect-Mood (TAM) by **changing the stem vowel**, not by adding a dental suffix:
  - Dr**i**nk – dr**a**nk – dr**u**nk | *Strong verb*
  - H**e**lp – h**e**lped – h**e**lped | *Weak verb*

- These verbs have certain alternation patterns that **stem from PIE** and are maintained across the whole clade up to this day (over 2000 years). Some verbs, like *help,* have been **levelled**

Capturing paradigms

Principal parts represent a set of forms from which all the other forms of a verb can be inferred

Old High German

Indicative	**Present**	**Past**
INF.	singan	—
1SG	singu	sang
2SG	singis	sungi
3SG	singit	sang
1PL	singem	sungum
2PL	singet	sungut
3PL	singant	~~sungun~~
Participle	singanti	gisungan

Principal Parts

Infinitive	s**i**ngan	**A**
3SG Past	s**a**ng	**B**
Past Part.	gis**u**ngan	**C**

Pattern examples

Dutch *bring*

Infinitive	br**e**ngen	**A**
3SG Past	br**a**cht	**B**
Past Part.	gebr**a**cht	**B**

Swedish *write*

Infinitive	skr**i**da	**A**
3SG Past	skr**e**d	**B**
Past Part.	skr**i**dit	**A**

Icelandic *sink*

Infinitive	s**ö**kkva	**A**
3SG Past	s**ö**kk	**A**
Past Part.	s**o**kkið	**B**

English *help*

Infinitive	h**e**lp	**A**
3SG Past	h**e**lped	**A**
Past Part.	h**e**lped	**A**

The Semantic Drive: Extended Past Participles

English: Non-extended

I ate pasta yesterday ≠ ?? I have eaten pasta yesterday

German: Extended

Ich aß gestern Pasta ≡ Ich habe gestern Pasta gegessen

In form and meaning:
Present ≠ Past tense = Past participle

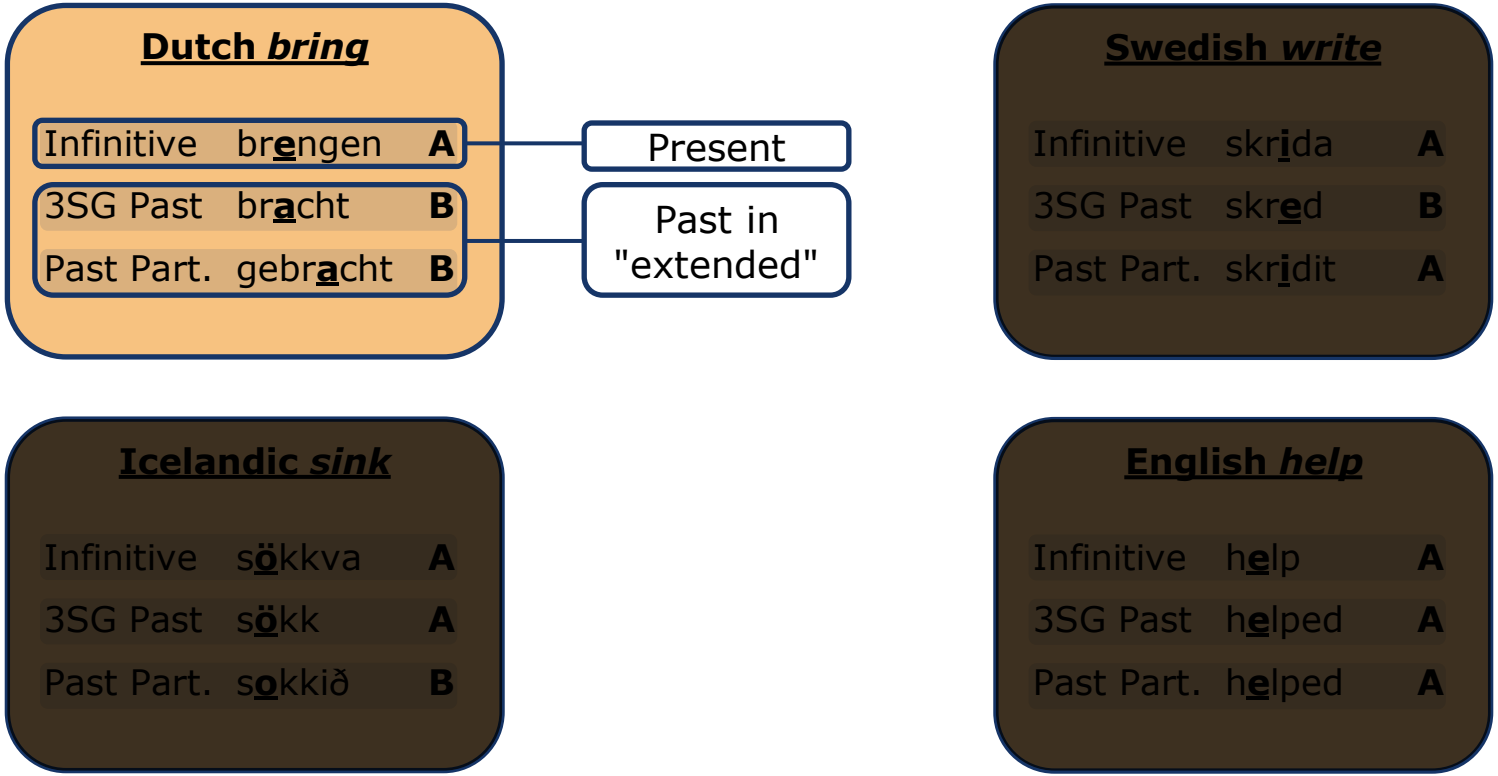
Semantic overlap
Past participle gains past tense function

Morphological response
Same vowel in past tense & past participle and opposed to present

Result
Enhanced marking of present vs. past opposition in paradigm

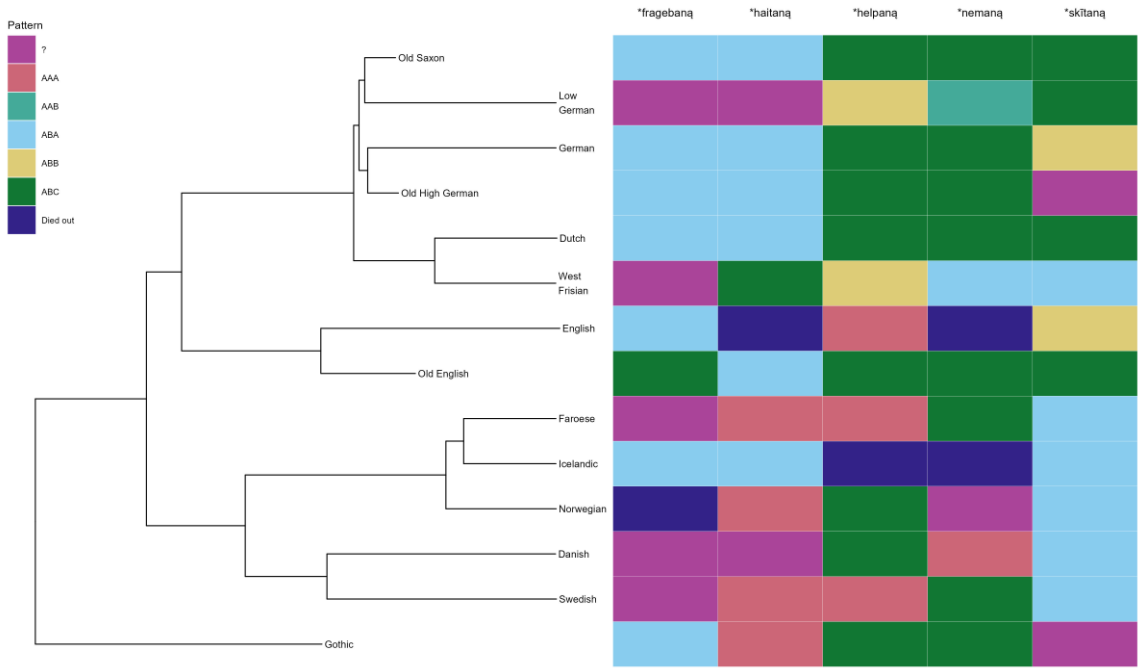
Dammel et al. (2010); De Smet and Van de Velde (2019)

ABB pattern


Dutch *bring*
Infinitive brengen A
3SG Past bracht B
Past Part. gebracht B
Present
Past in "extended"
Swedish *write*
Infinitive skrida A
3SG Past skred B
Past Part. skridit A
Icelandic *sink*
Infinitive sökkva A
3SG Past sökk A
Past Part. sokkið B
English *help*
Infinitive help A
3SG Past helped A
Past Part. helped A

The data

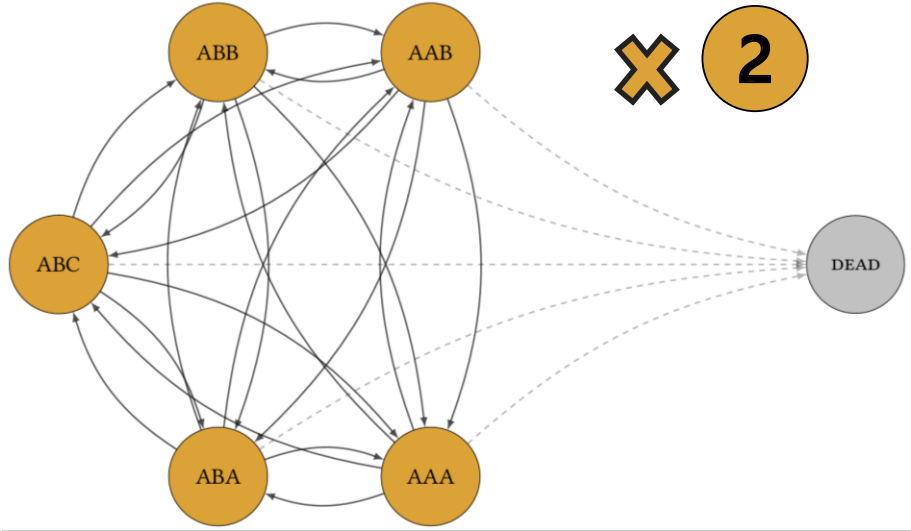
- Scrape relevant Germanic verbs from Wiktionary
- Combine it with UniMorph
- Code the alternations for each verb
- Map the data to the trees from Chang et al. (2015)
- After some filtering, we are left with **107 strong verbs** for **14 Germanic languages**



The hierarchical model

- Typically, we infer the evolutionary dynamics by estimating the transition rates between the states

- To capture the difference in dynamics, we instead estimate two sets of transition rates (two regimes):
  - For time spent in **non-extended state** of past participle: Q^N
  - For time spent in **extended state** of past participle: Q^E



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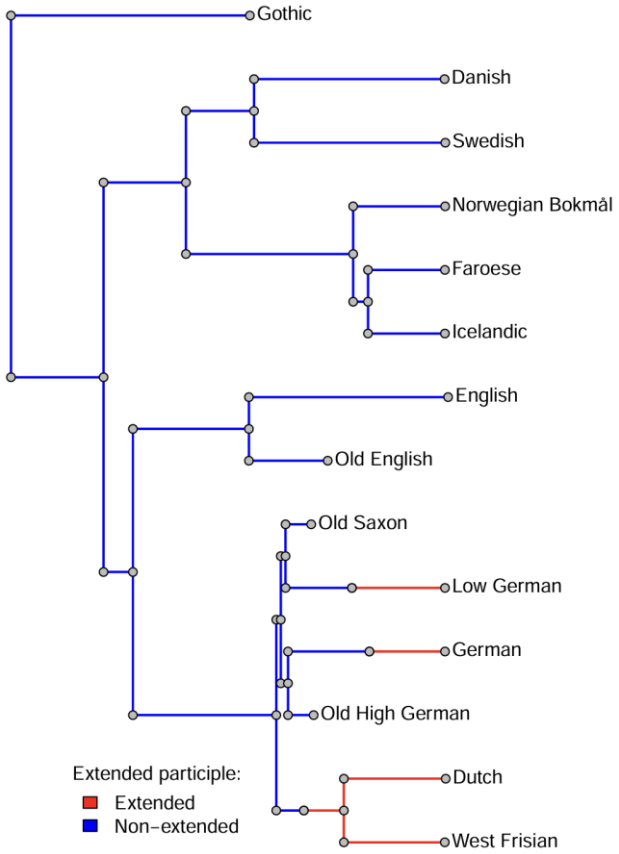
- We use hierarchical model to accommodate verb-level idiosyncrasies and decouple them from lexical idiosyncrasies



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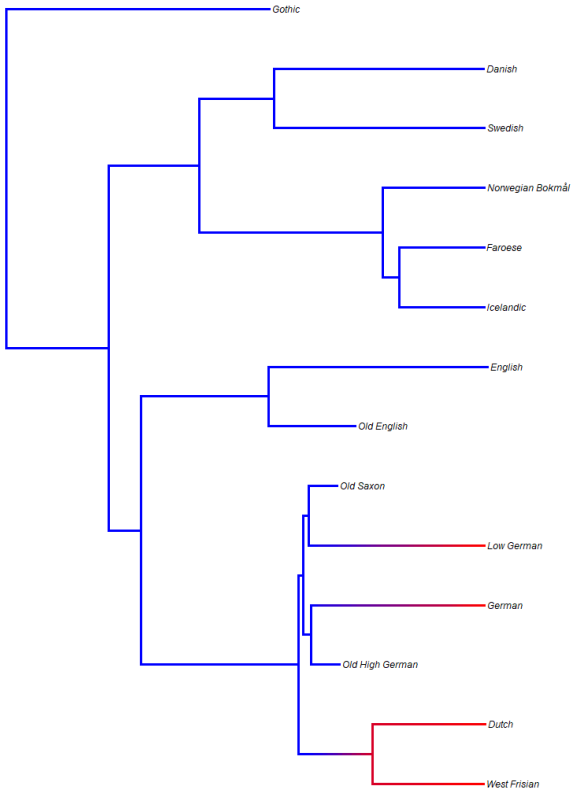
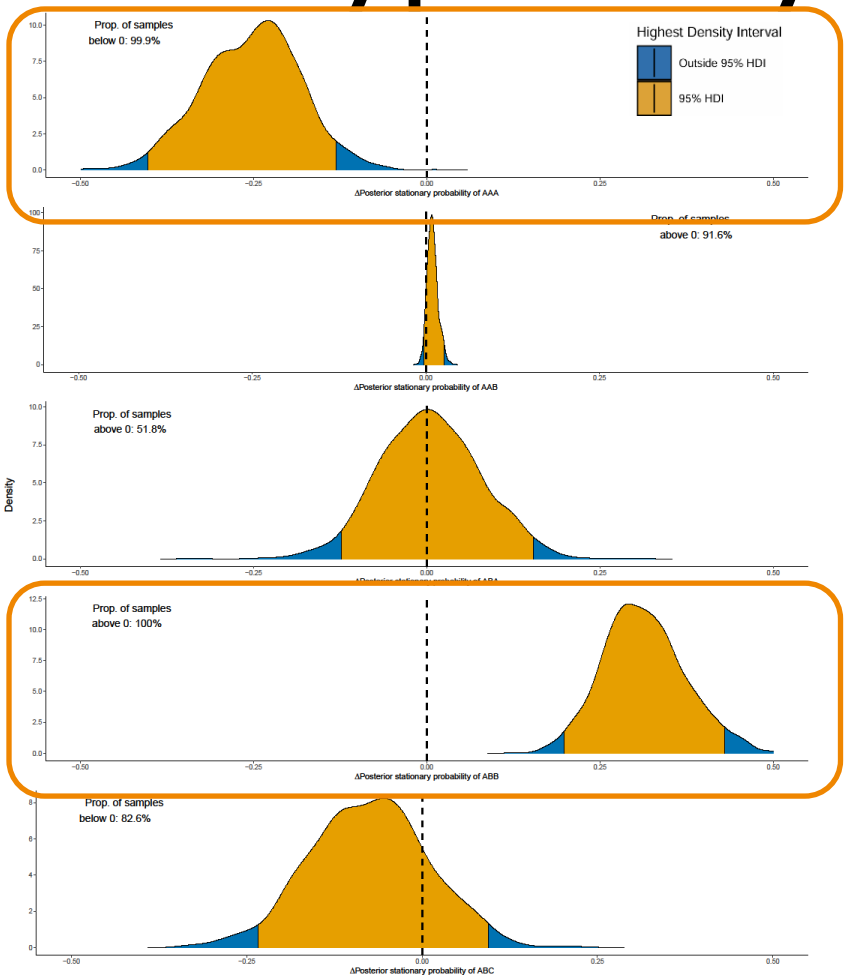


Hypothesis checking and results

- **Formal hypothesis:** **Extended** regime will show **higher stationary probability** for **ABB** than non-extended regime.
- The difference in stationary probability may come from:
  1) Higher entry (gain) rates to a state
  2) Lower exit (loss) rates from a state
- Depending on (1) or (2), there may be different mechanisms at play

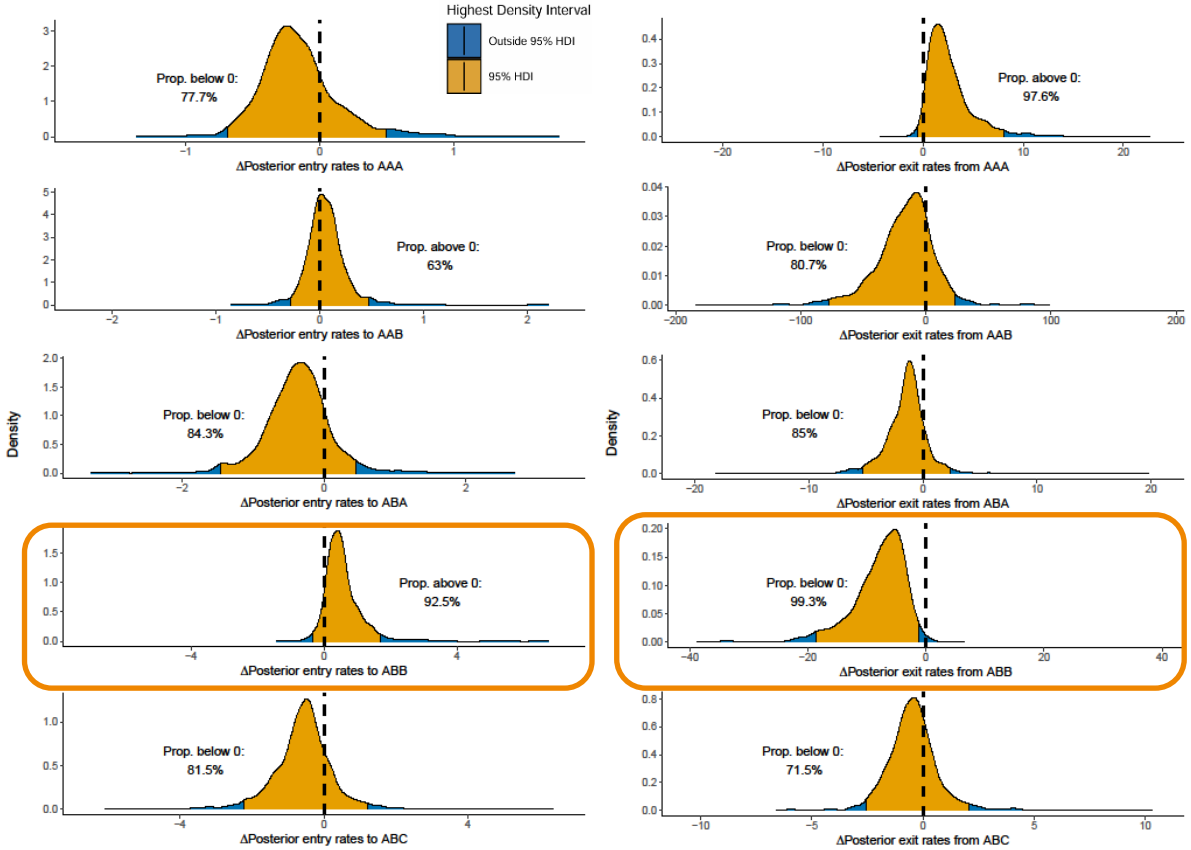
Stationary probability



- The results display stationary probability of $Q^E - Q^N$
- There is **decisive support** in preference for **ABB** under **extended past participle**
- Due to cumulative nature of probability, **increase in ABB** leads to **decrease in AAA**

Entry and exit rates

- The results display entry/exit rates differences of $Q^E - Q^N$
- Higher stationary probability for ABB comes from **preservation of irregular patterns**
- And **not** from **irregularization**



Conclusion

- We observe higher preference for alignment of form and meaning: **Present ≠ Past tense = Past participle**
- For paradigms, this alignment is achieved by **preserving the aligning state (ABB)**
- We propose a new method that allows robust check of **correlated evolution** that can be extended to multiple applicable scenarios

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