Using corpora in SLA research: Potential and limitations

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Introduction

- corpus linguistics is (slowly) being recognized as a useful method in SLA (Granger 2002), giving rise to a new field often called **learner corpus research**
- leading research team: Centre for English Corpus Linguistics (Louvain) → International Corpus of Learner English
- what is the potential, what are the (current) limitations of learner corpus research?

Outline

- case studies
  - genitive alternation (Wulff & Gries in progress)
  - argument structure constructions (Gries & Wulff 2005)
- discussion

Theoretical background

Construction Grammar (CxG) **(Goldberg 1995, 2006)**

- assumes that all levels of description involve form-function pairings, so-called constructions
- defines as a construction any linguistic pattern that is either non-compositional to some extent or sufficiently frequent to be entrenched in the mental lexicon
- constructions: morphemes, partially lexically-filled idioms (***the* Xer *the* Yer**, ***What's* X *doing* Y**), syntactic patterns (ditransitives: **NP V Obj_1 Obj_2**), ...
- the meaning of the ditransitive: transfer
  He sliced him a piece of cake

Case study I: The genitive alternation

Case study I: Research question

Are second language learners aware of the many factors that govern the genitive alternation?

- "alternations" are one of the most extensively studied phenomena in NS
  - dative 'movement', particle 'movement', heavy NP shift
  - genitive alternation
  - adverb placement, adjective order
  - …
- long-term research objective: provide complementary studies for L2 learners of English
  - When are the alternations acquired?
  - Which factors associated with NS's choice between two alternations do NNS pick up, and when in the course of L2 acquisition?

Case study I: Determinants of the genitive alternation in L1 English

Nick's$_{\text{NP1 POSSESSOR}}$ **eyetracker**$_{\text{NP2 POSSESSEE}}$ (**s**-genitive)

the eyetracker$_{\text{NP1 POSSESSEE}}$ **of Nick**$_{\text{NP2 POSSESSOR}}$ (**of**-genitive)

- **rhythmic alternation** (Selkirk 1984)
  - alternation of stressed and unstressed syllables preferred
    - 👎 **Remy's**$_{\text{NP1 POSSESSOR}}$ **cheese**$_{\text{NP2 POSSESSEE}}$
    - 👍 **the cheese**$_{\text{NP1 POSSESSEE}}$ **of Remy**$_{\text{NP2 POSSESSOR}}$

- **segment alternation** (Hayes 2008)
  - alternation of consonants and vowels at word boundaries preferred
    - 👎 **Ute's**$_{\text{NP1 POSSESSOR}}$ **soup**$_{\text{NP2 POSSESSEE}}$
    - 👍 **the soup**$_{\text{NP1 POSSESSEE}}$ **of Ute**$_{\text{NP2 POSSESSOR}}$

Case study I: Determinants of the genitive alternation in L1 English

- **number** (Altenberg 1982, Plank 1985)
  - plural possessors prefer **of**, irregular plurals prefer **s**
    - 👎 **the sailors**$_{\text{NP1 POSSESSOR}}$**'s traveling**$_{\text{NP2 POSSESSEE}}$
    - 👍 **the traveling**$_{\text{NP1 POSSESSEE}}$ **of the sailors**$_{\text{NP2 POSSESSOR}}$
    - 👎 **the cheese**$_{\text{NP1 POSSESSEE}}$ **of the mice**$_{\text{NP2 POSSESSOR}}$
    - 👍 **the mice**$_{\text{NP1 POSSESSOR}}$**'s cheese**$_{\text{NP2 POSSESSEE}}$

- **specificity** (Rosenbach 2002)
  - specific referents > non-specific referents
    - 👎 **research interests**$_{\text{NP1 POSSESSEE}}$ **of Carmen**$_{\text{NP2 POSSESSOR}}$
    - 👍 **Carmen**$_{\text{NP1 POSSESSOR}}$**'s research interests**$_{\text{NP12POSSESSEE}}$
    - 👍 **the research interests**$_{\text{NP1 POSSESSEE}}$ **of Carmen**$_{\text{NP2 POSSESSOR}}$

Case study I: Determinants of the genitive alternation in L1 English

- **animacy** (Leech, Francis & Xu 1994, Biber et al. 1999)
  - human possessors prefer **s**, non-human possessors **of**
    - 👎 **the book**$_{\text{NP1 POSSESSEE}}$ **of John**$_{\text{NP2 POSSESSOR}}$
    - 👍 **John**$_{\text{NP1 POSSESSOR}}$**'s book**$_{\text{NP2 POSSESSEE}}$
    - 👎 **the study**$_{\text{NP1 POSSESSOR}}$**'s outcome**$_{\text{NP2 POSSESSEE}}$
    - 👍 **the outcome**$_{\text{NP1 POSSESSEE}}$ **of the study**$_{\text{NP2 POSSESSOR}}$
- **meaning/function** (Rosenbach 2002, Stefanowitsch 2003)
  - meanings are differently strongly associated with **s** and **of**
    - 👎 **the coffee mug**$_{\text{NP1 POSSESSEE}}$ **of Ute**$_{\text{NP2 POSSESSOR}}$
    - 👍 **Ute**$_{\text{NP1 POSSESSOR}}$**'s coffee mug**$_{\text{NP2 POSSESSEE}}$
    - ⇨ possession prefers **s**
    - 👎 **the oil spill**$_{\text{NP1 POSSESSOR}}$**'s pictures**$_{\text{NP2 POSSESSEE}}$
    - 👍 **the pictures**$_{\text{NP1 POSSESSEE}}$ **of the oil spill**$_{\text{NP2 POSSESSOR}}$
    - ⇨ depiction prefers **of**

Case study I: Determinants of the genitive alternation in L1 English

- **syntactic branching** (Rosenbach 2002, Quirk et al. 1985)
  - postmodified possessees prefer **s**, expanded (postmodified) possessors prefer **of**
    - 👎 **the book on attention$_{\text{NP1 POSSESSEE}}$ of Nick$_{\text{NP2 POSSESSOR}}$**
    - 👍 **Nick$_{\text{NP1 POSSESSOR}}$'s book on attention$_{\text{NP2 POSSESSEE}}$**
    - 👎 **Nick's, who is at UM, $_{\text{NP1 POSSESSOR}}$ book$_{\text{NP2 POSSESSEE}}$**
    - 👍 **the book$_{\text{NP1 POSSESSEE}}$ of Nick, who is at UM$_{\text{NP2 POSSESSOR}}$**

- **length/weight** (Cooper & Ross 1975, Bock 1982)
  - shorter/less heavy NP > longer/heavier NP

- **complexity** (Behagel 1909, Hawkins 1993)
  - less complex NP > more complex NP

Case study I: Determinants of the genitive alternation in L1 English

- **givenness/topicality/identifiability** (Rosenbach 2002)
  - given referents > new referents
    - 👎 **a new study**$_{\text{NP1 POSSESSEE}}$ **of this researcher**$_{\text{NP2 POSSESSOR}}$
    - 👍 **this researcher**$_{\text{NP1 POSSESSOR}}$**'s newest study**$_{\text{NP2 POSSESSEE}}$

- **horror aequi** (Rohdenburg 2003)
  - formally identical structures in immediate adjacency are dispreferred
    - 👎 **Steffi**$_{\text{NP1 POSSESSOR}}$**'s brother**$_{\text{NP2 POSSESSOR}}$**'s dog**$_{\text{NP3 POSSESSEE}}$
    - 👍 **the dog**$_{\text{NP1 POSSESSEE}}$ **of Steffi**$_{\text{NP2 POSSESSOR}}$**'s brother**$_{\text{NP3 POSSESSOR}}$

- **text type/variety/formality**
  - informal speech/writing associated with s, formal with of

Case study I: L2 Data

- extraction of all sentences containing **'s** or **of** from G-ICLE
- (semi-)manual identification of true hits of genitive constructions (2,864/7,921)
- random sample of 1,000 attestations
  - does not contain non-alternating genitive constructions:
    a mountain of money (partitive construction)
    the teaching of foreign languages (ablative construction)

Case study I: Data annotation

- **rhythmic alternation**

  Remy's cheese ⇨ uss

  the cheese of Remy ⇨ usuus

- **segment alternation**
  - CV: 0; CC/VV: 1; identical CC/VV:

    Ute's soup ⇨ 0_2

    the soup of Ute ⇨ 0_0

- **number:** singular; plural; irregular plural
- **specificity:** specific; non-specific
- **animacy:** human; animate; inanimate

Case study I: Data annotation

- **meaning/function**

attribute-holder	**the smell of petrol**
part-whole	**all parts of the world**
event-participant	**the meeting of the editors**
personal relation	**Steffi's brother**
possession	**Ute's coffee mug**
subcategory-category	**today's kids**
time-event	**next week's cocktail party**

- **syntactic branching:** none; pre-modified; post-modified; pre-and post-modified

- **length/weight:** number of syllables

Case study I: Data annotation

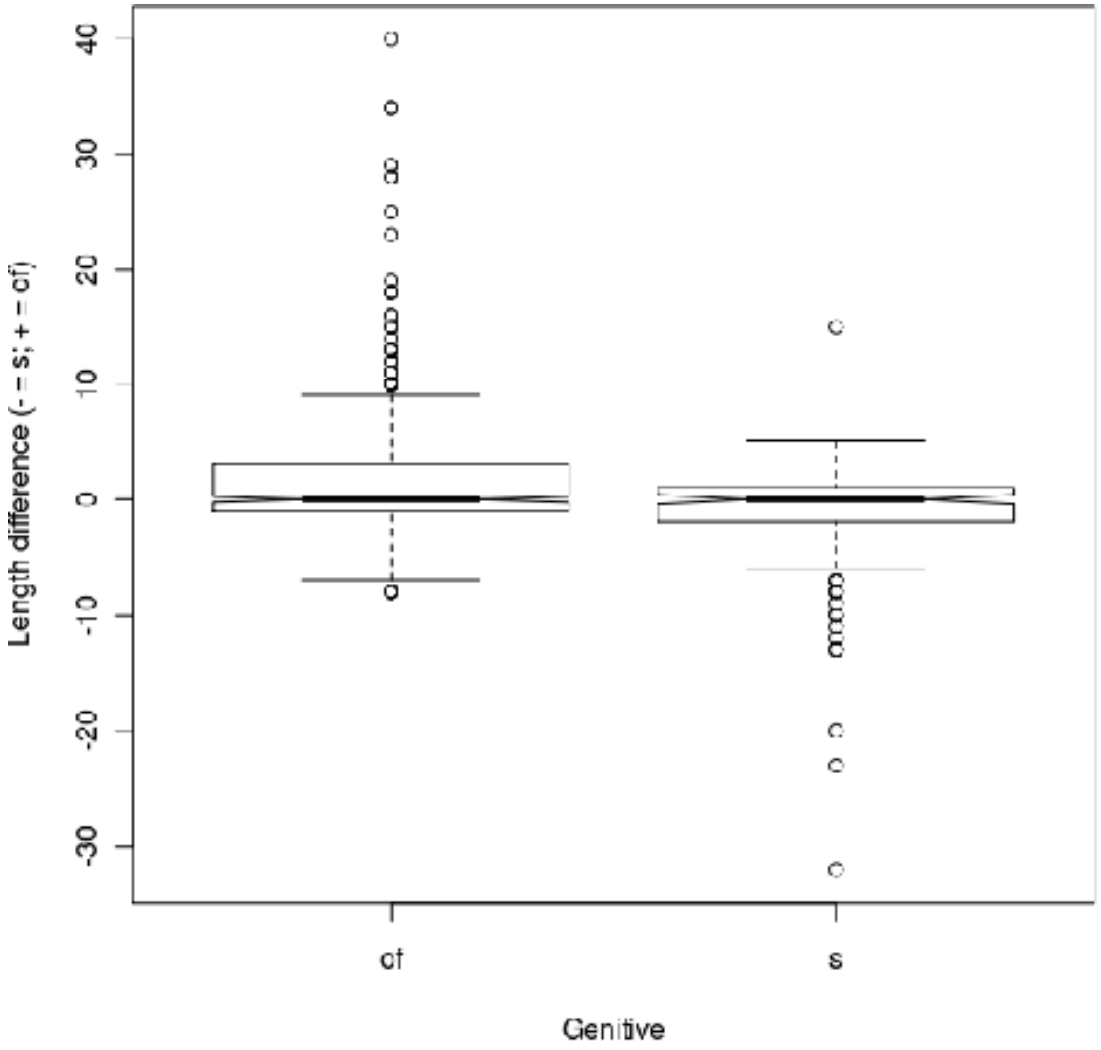
- **complexity**
  - simple (no modification)
    the eyetracker
  - intermediate (non-clausal modification)
    the new eyetracker
  - complex (clausal modification)
    the eyetracker that Nick and Kausar built together

- **givenness:** times of preceding mention NP referent

- **horror aequi:** X's X's=s; of X of=of; X's of/of X's=mixed

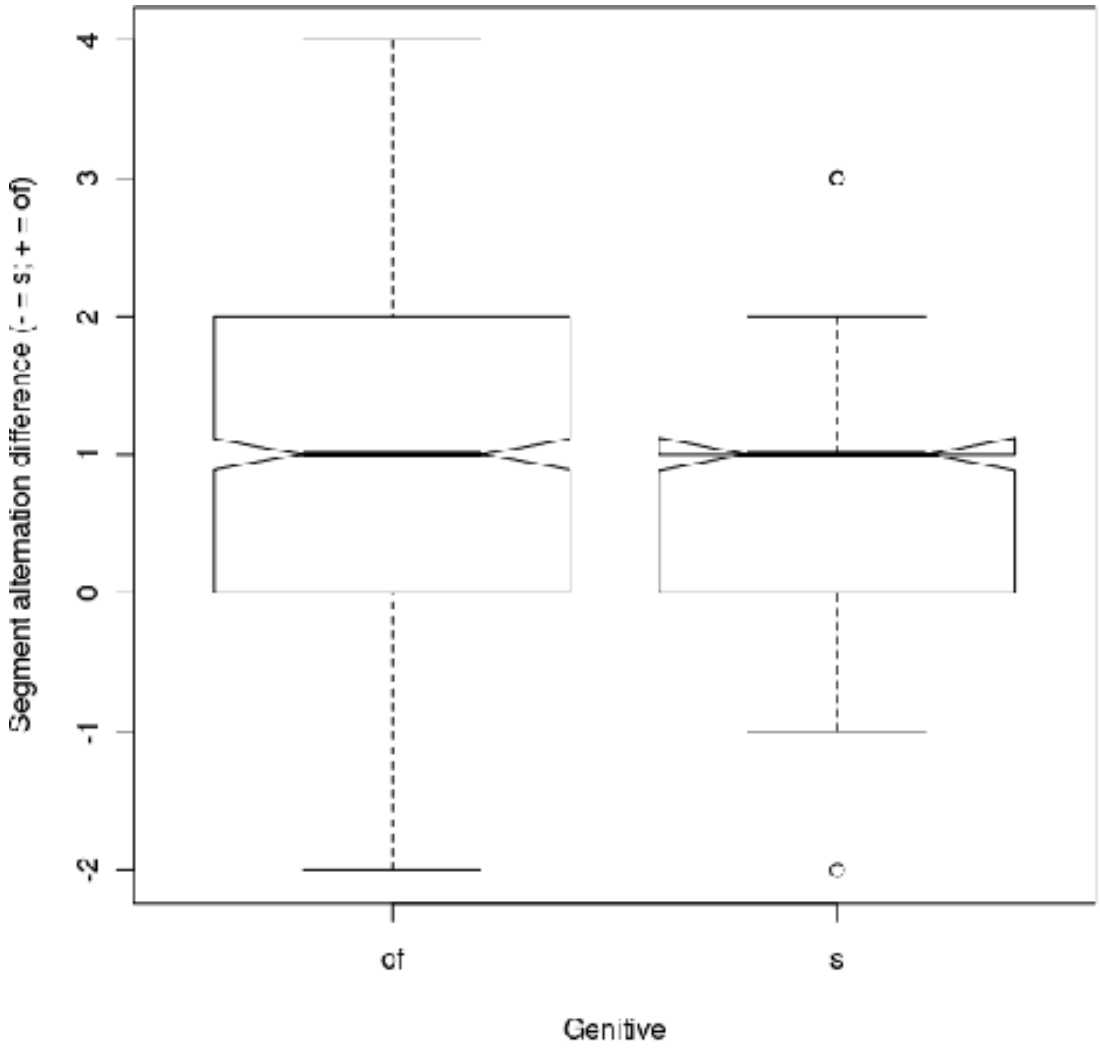
Case study I: Monofactorial results

Length (D_{KS}=0.183; p=8.97E-05)



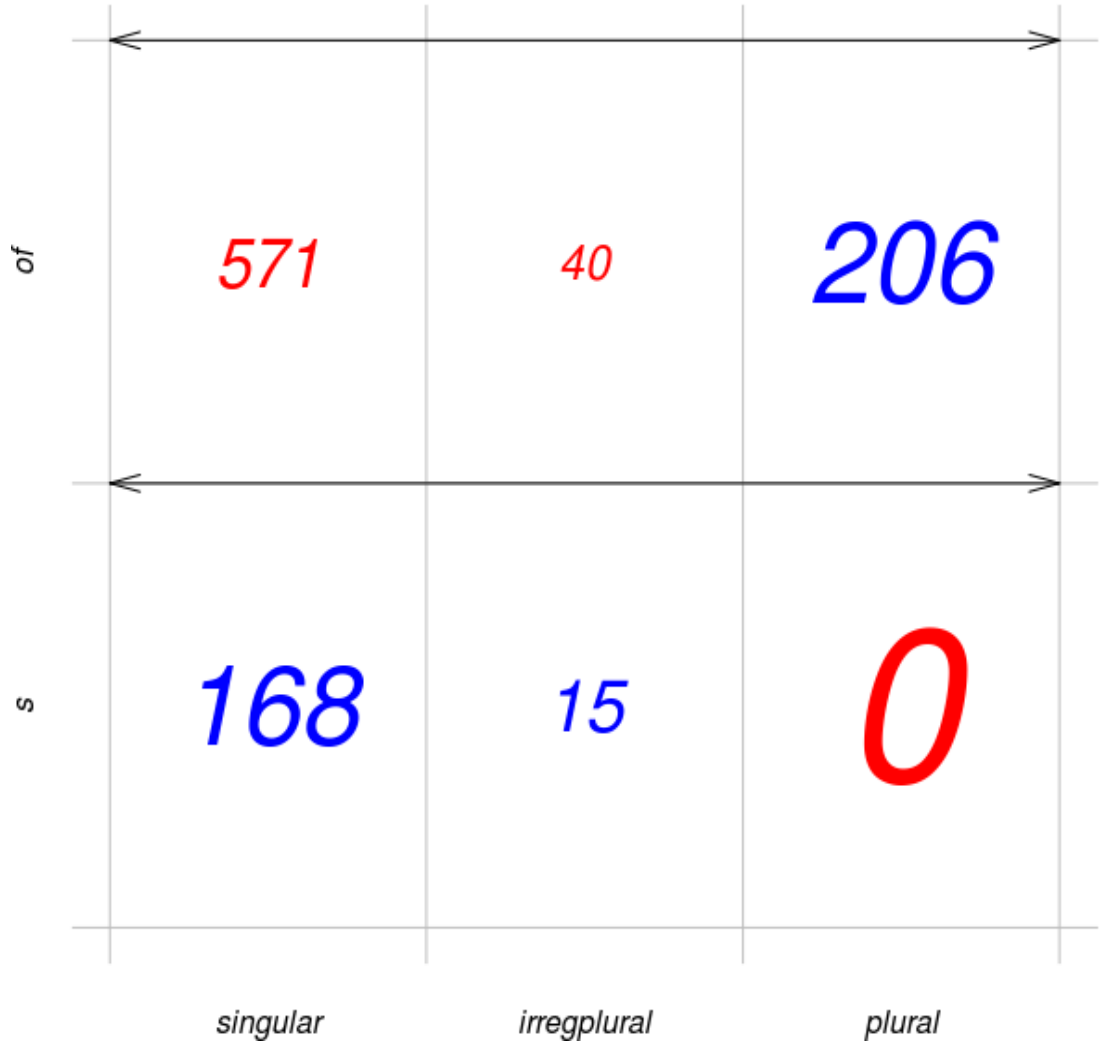
Case study I: Monofactorial results

Segment alternation (D_{KS}=0.183; p=9.50E-05)



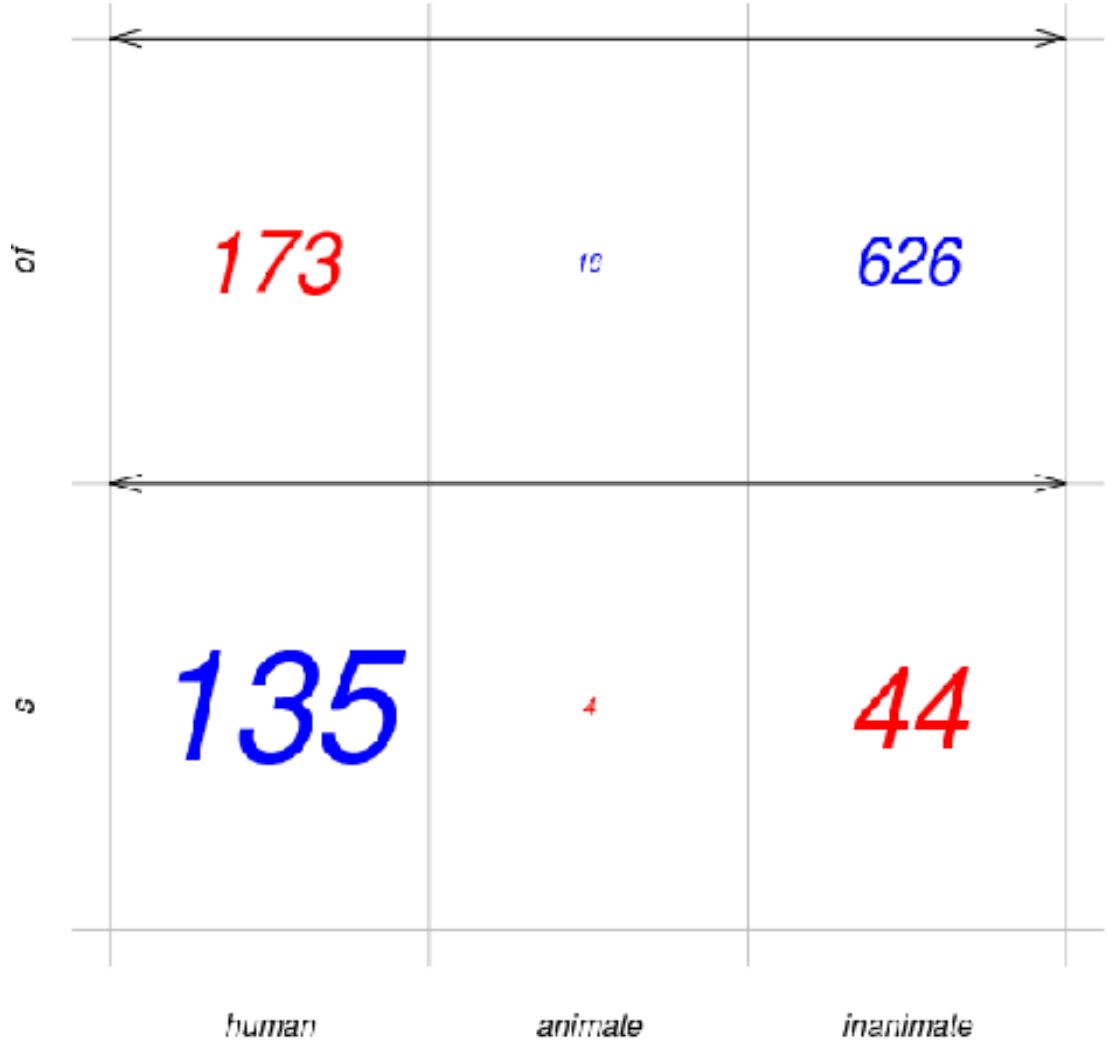
Case study I: Monofactorial results

$Number_{POSSESSOR}$ (χ^2 =58.818; p=1.69E-13)



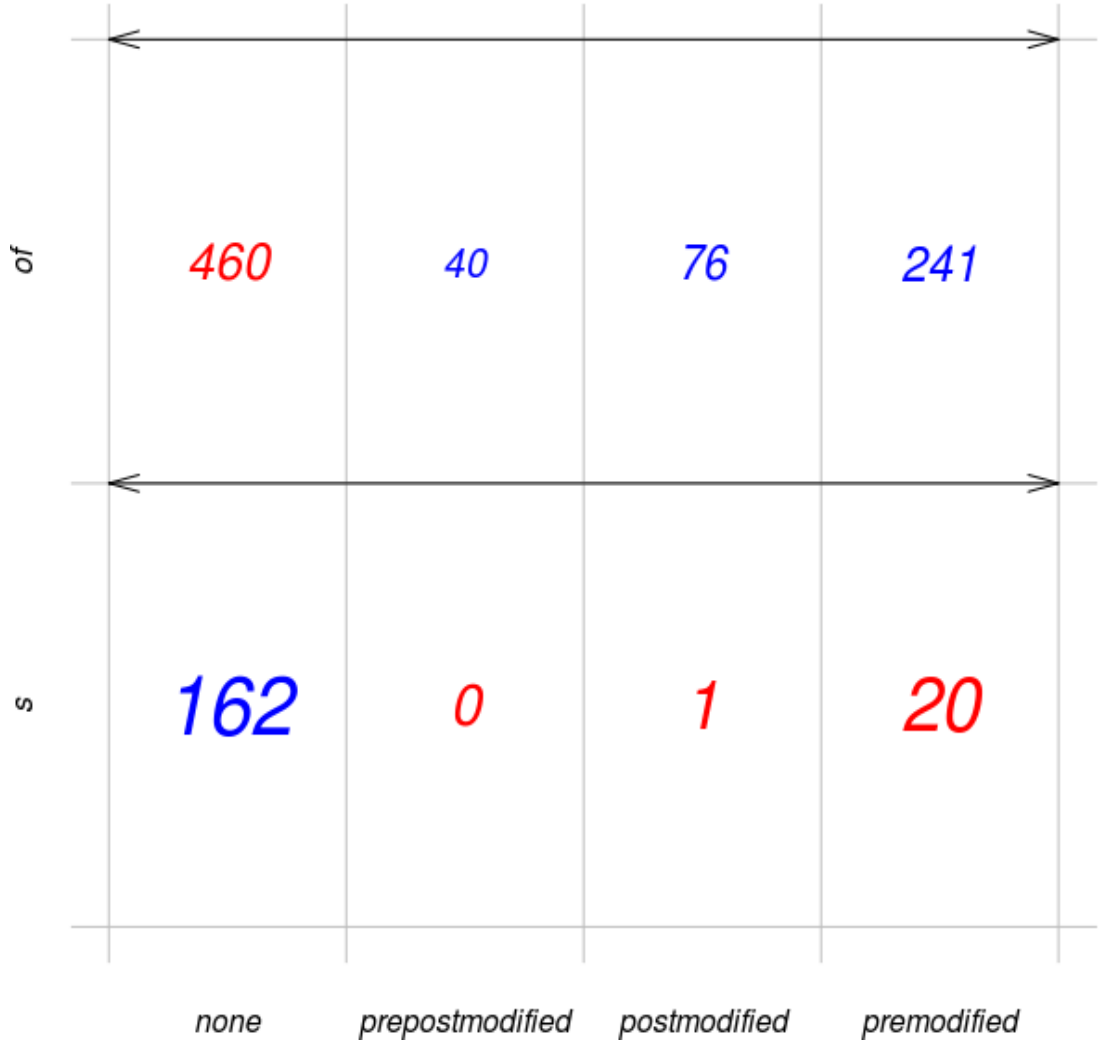
Case study I: Monofactorial results

Animacy$_{POSSESSOR}$ (χ^2 =195.972; p=2.79E-43)



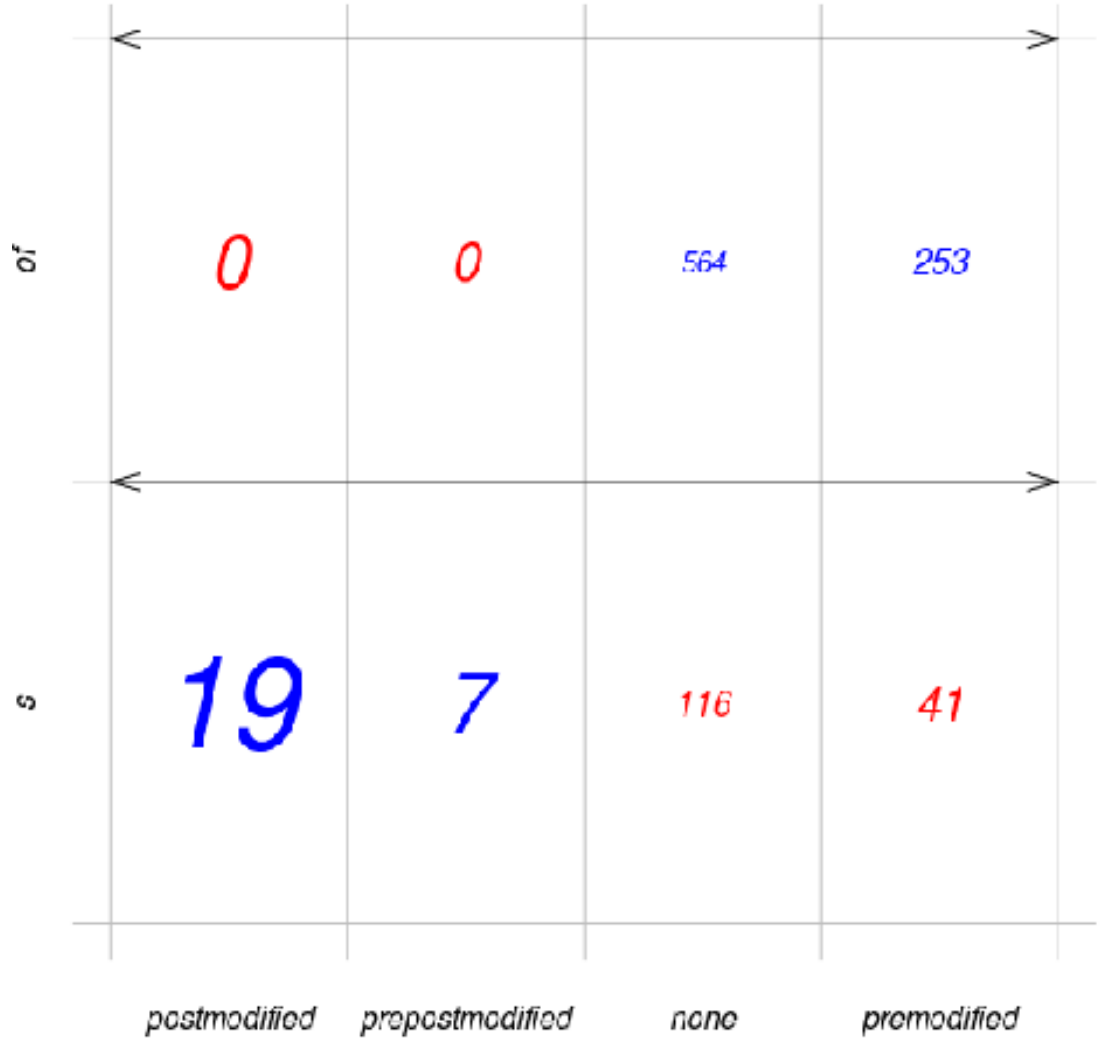
Case study I: Monofactorial results

Syntactic branching$_{POSSESSOR}$ (χ^2 =68.553; p=8.71E-15)



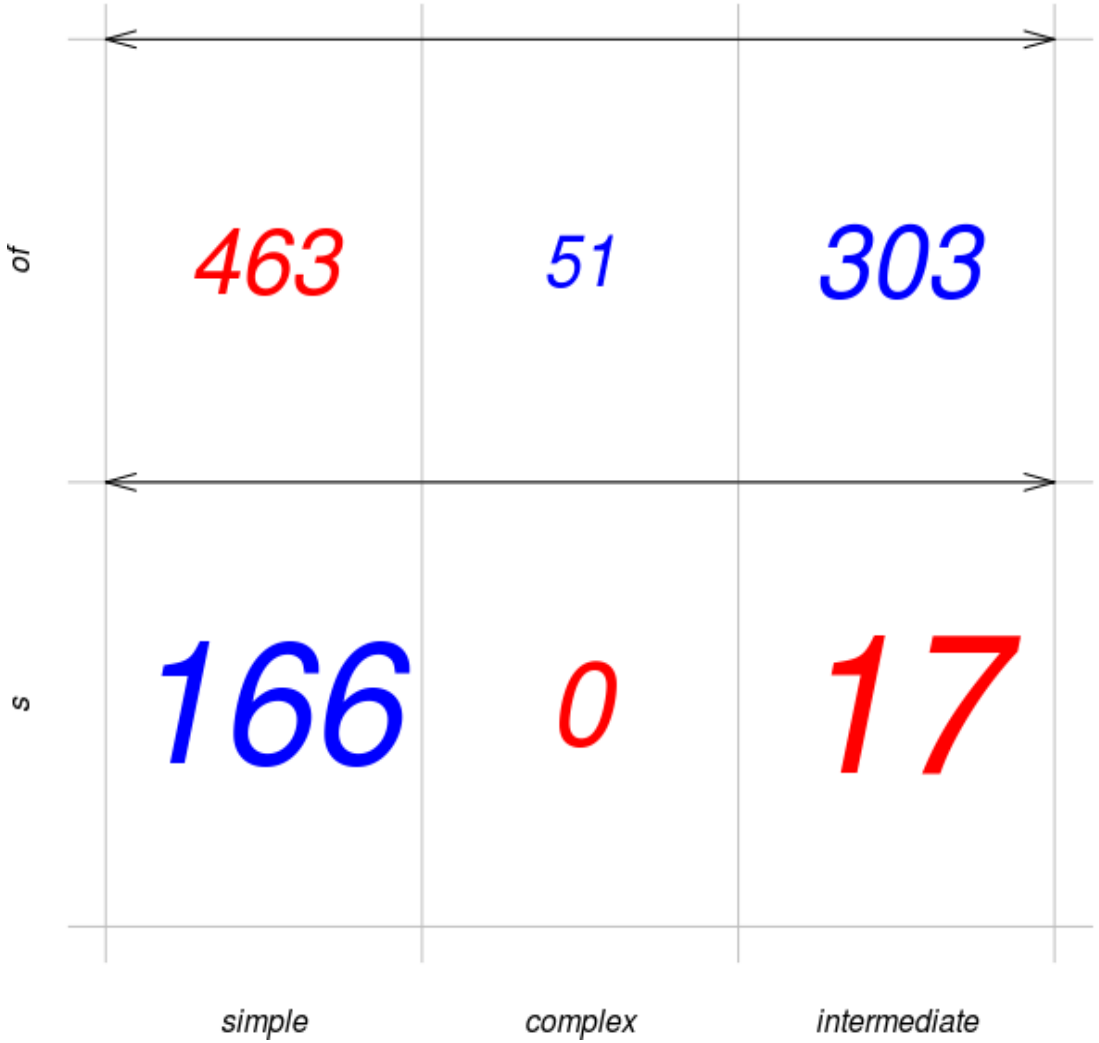
Case study I: Monofactorial results

Syntactic branching$_{POSSESSEE}$ (χ^2 =120.506; p=6.01E-26)



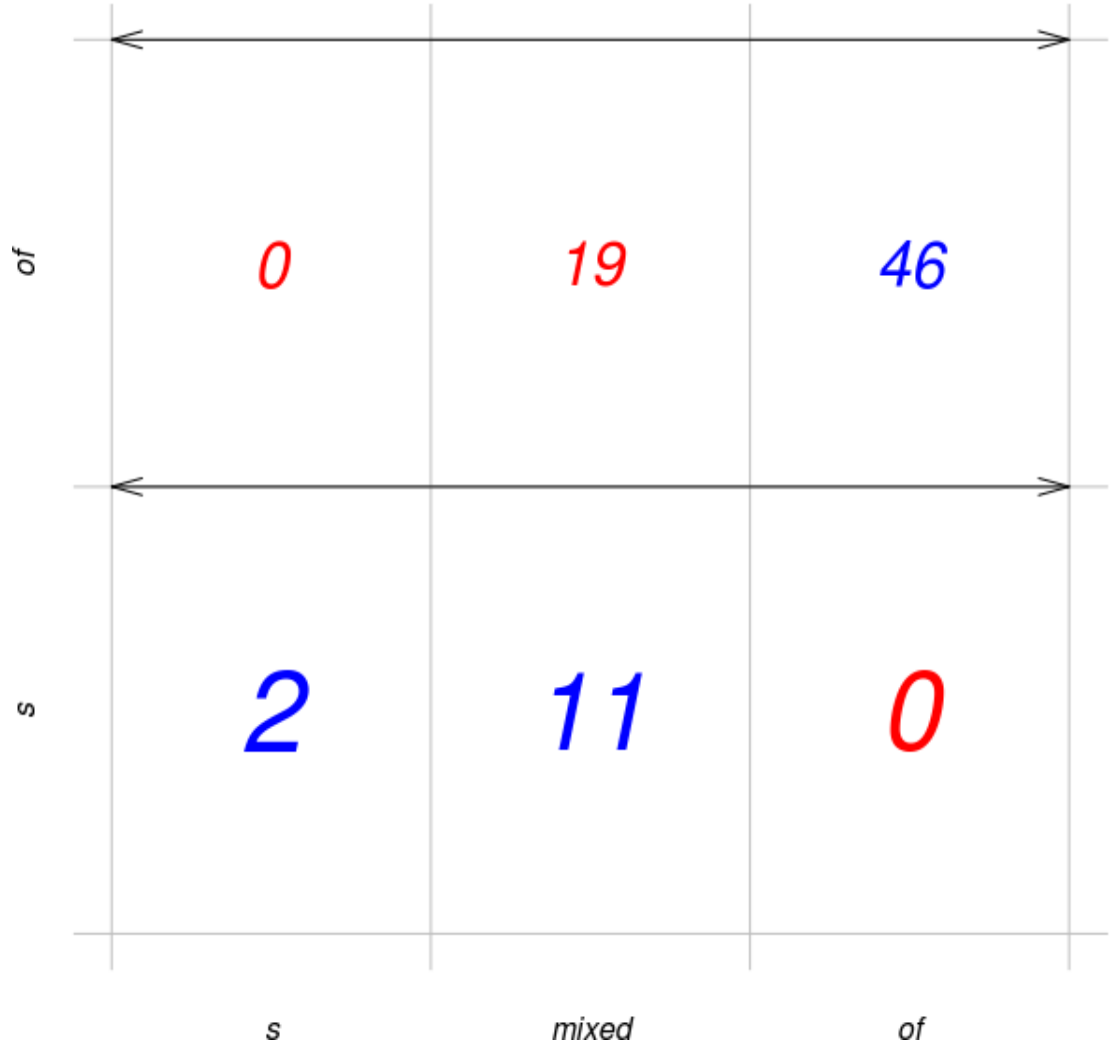
Case study I: Monofactorial results

$Complexity_{POSSESSOR}$ (χ^2 =75.067; p=5.00E-17)



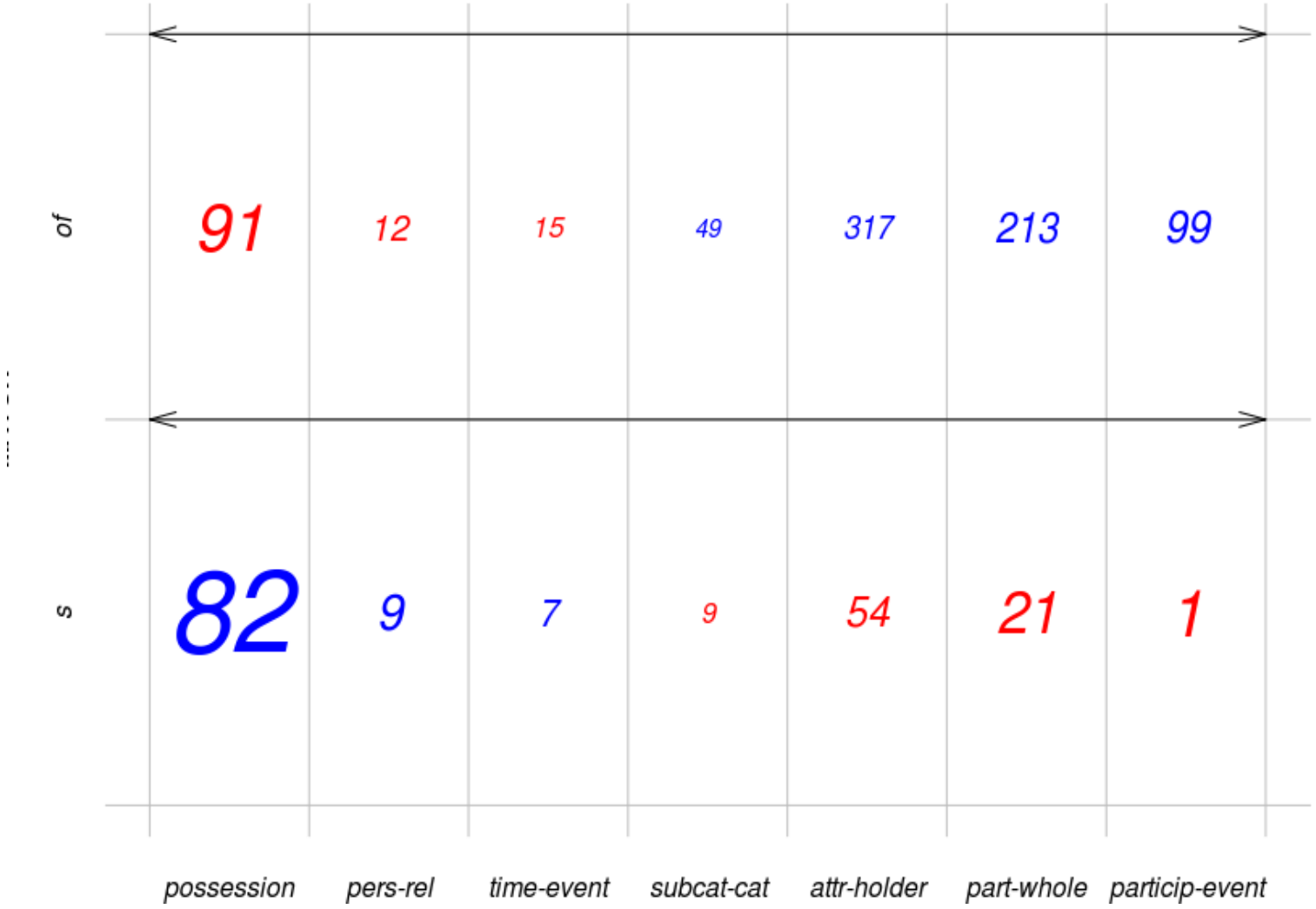
Case study I: Monofactorial results

Horror aequi (χ^2 =27.84; p=9.01E-07)



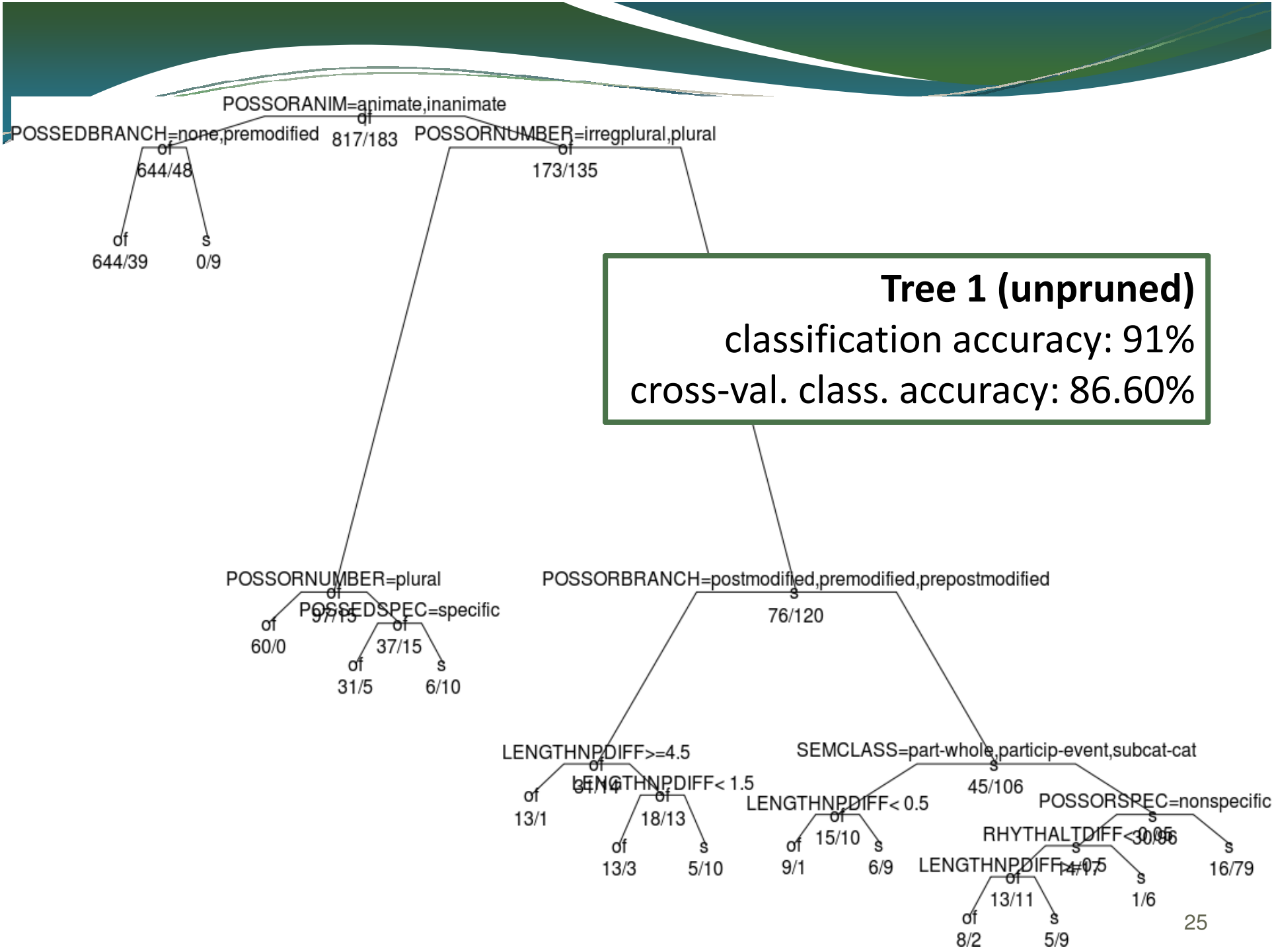
Case study I: Monofactorial results

Meaning/function (χ^2 =144.062; p=1.39E-28)



Case study I: Multifactorial results

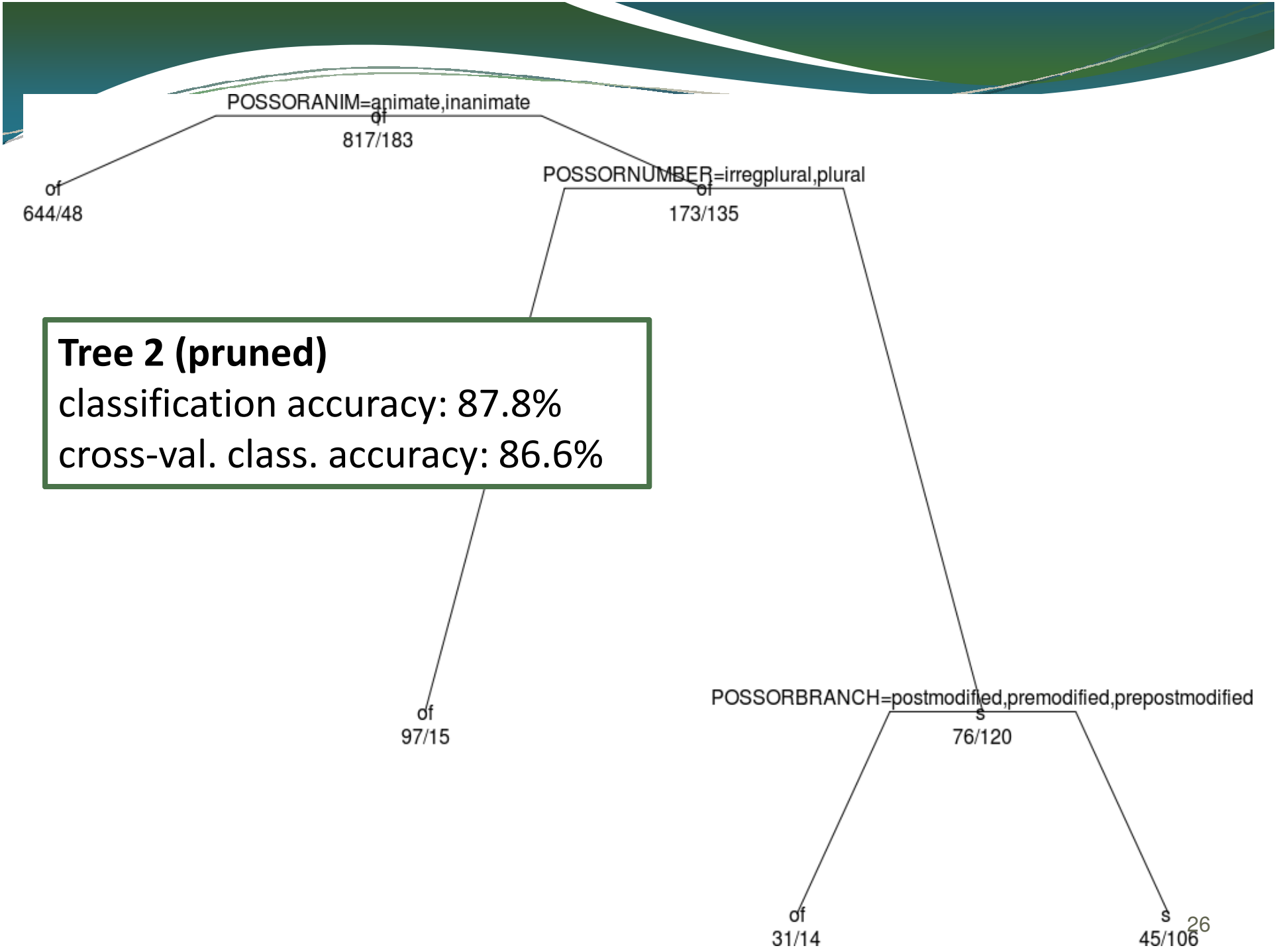
CART (Classification and Regression Tree)



Tree 1 (unpruned)

classification accuracy: 91%

cross-val. class. accuracy: 86.60%



Tree 2 (pruned)

classification accuracy: 87.8%

cross-val. class. accuracy: 86.6%

Case study I: Discussion and outlook

- overall, the German ESL learners are well-attuned to the factors governing the genitive alternation
- the multifactorial analyses helped identify the most important predictors; suggest a much less complex picture
  - heavy hitters: **animacy, number, and syntactic branching**
  - interesting deviation from previous (experimental) studies with NSs: **givenness** does not seem to play a role

Case study I: Outlook

- exhaustive data annotation
- logistic regression analysis (interactions!)
- systematic comparison with (multifactorial!) NS results
- reaction time and production experiments to complement corpus findings
- expansion to NS with different L1 backgrounds (currently working on Chinese data)
- …

Case study II: Argument structure constructions

Case study II: Research question

Do second language learners have constructions?

- If…
  … FLL's have constructional knowledge similar to that of native speakers of a language,
- and if…
  … constructions do have a formal component and a meaning,
- then…
  … the linguistic behavior of FLL's should be similar to that of native speakers both…
    … with respect to linguistic form, i.e. morphosyntax
    … with respect to the meaning/function of linguistic form(s)

Case study IIa (syntactic priming)

- replication of Pickering & Branigan's (1998) syntactic priming experiment
- participants: 64 advanced German learners of English (mean number of years of English teaching: 11.1, interquartile range: 2.6 years)
- subjects were asked to "complete sentence fragments such that the result is a grammatically correct sentence"
- primes:

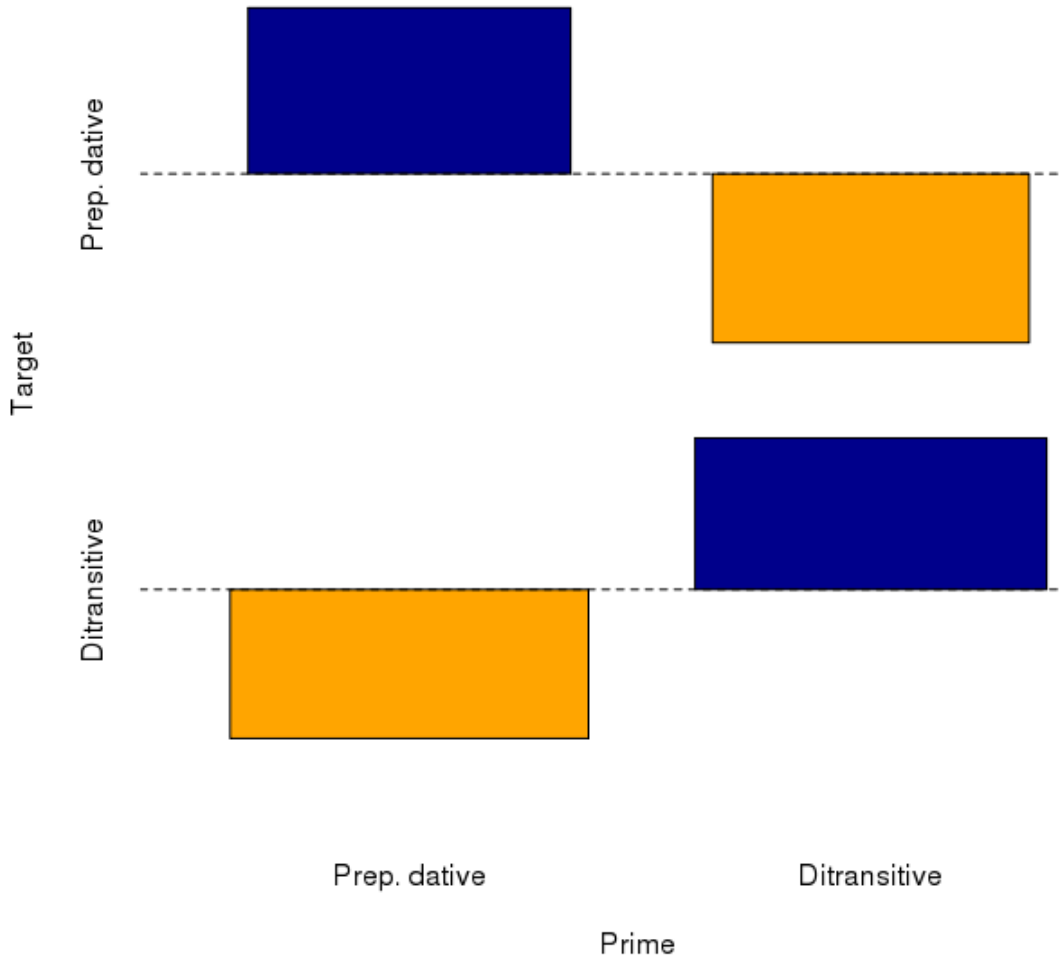
  The racing driver showed the helpful mechanic ...

  ⇨ primes ditransitives

  The racing driver showed the torn overall …

  ⇨ primes prepositional datives
- target fragments: **The policeman gave …**

Case study IIa (syntactic priming): Syntactic priming results

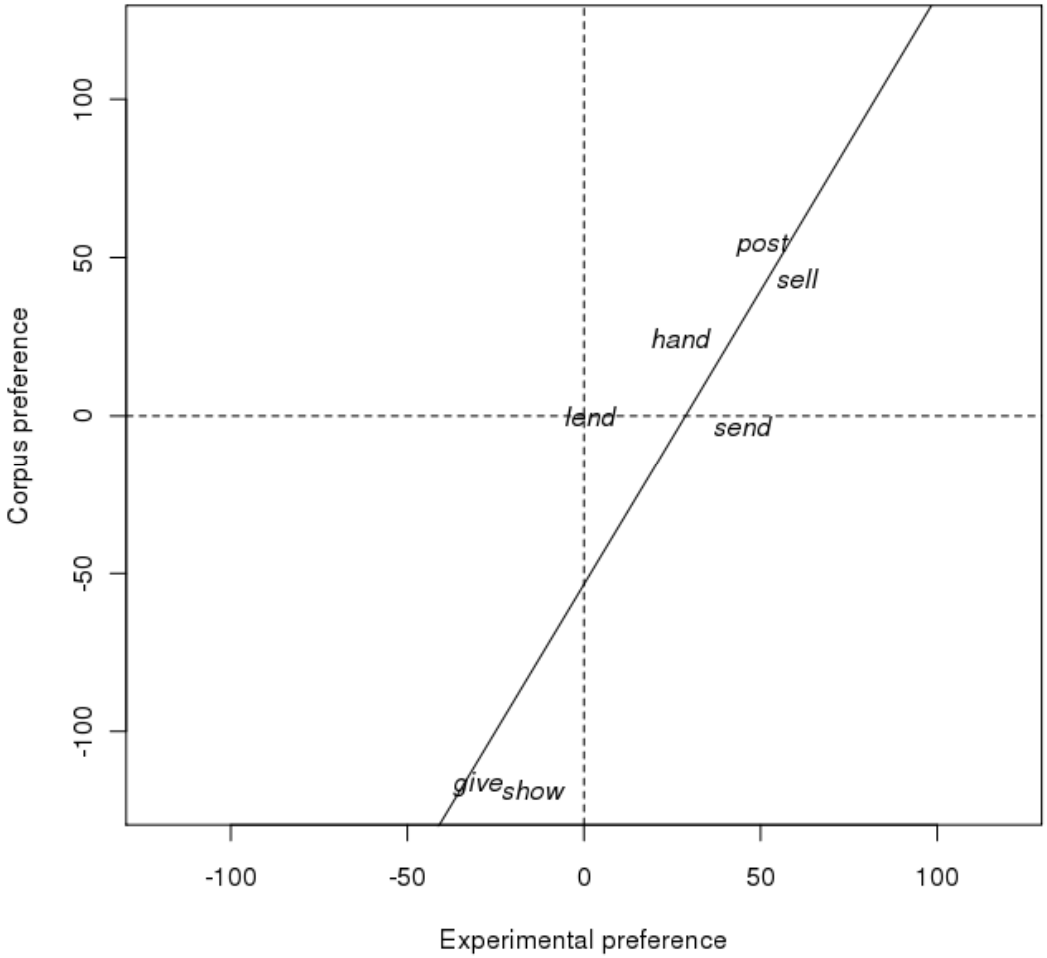


χ^2=34.55; *df*=1; *p*<.001

Case study IIa (syntactic priming): Correlation with corpus data

- a distinctive collexeme analysis (DCA; Stefanowitsch and Gries 2003; Gries and Stefanowitsch 2004) helps us to identify the **specific verbs** that are statistically significantly associated with the ditransitive/prepositional dative construction (in direct contrast) in NS corpus data (ICE-GB)
- each verb gets a value between -∞ and + ∞:
  - values<0 indicate a preference for ditransitives
  - values≈0 indicate the lack of a preference
  - values>0 indicate a preference for prepositional datives

Case study IIa (syntactic priming): Correlation with corpus data



r^2=.8; t=-4.47; df=5; p<.01

Case study IIa (syntactic priming): Correlation with corpus data

- there is a highly significant correlation between
  - the corpus-linguistic preferences of native speakers and the experimental preferences of the FLL's:
  - r^2=0.8; t=-4.47; df=5; p=0.007
- note: this cannot be explained away as effects from German translational equivalents:
  - r^2=0.05; df=6; p=0.577
- that is,
  - the former correlation is eight times as large as the latter
  - the difference between the two is significant: $p_{one\text{-}sided}$=0.0439

Case study IIa (syntactic priming): Interim summary

- FLL's have some **representations** of the syntactic structures instantiated in the experimental sentences
- these representations are **similar to those of native speakers** since the priming effects exhibited by the FLL's
  - are of the same **kind** as that of the native speakers
  - are of about the same **size** as that of the native speakers
  - exhibit the same **verb-specificity effects** as do corpus data from native speakers

FLL's have the (probabilistic) **formal knowledge** required for constructions

Case study IIb (semantic sorting)

- when asked to sort items, subjects exhibit a tendency to use **perceptually simple and unidimensional strategies**
- two extreme sorting styles are possible
  - a perceptually simple verb-based sorting
  - a more complex construction-based sorting

Which one do the subjects use?

Case study IIb (semantic sorting): Experimental data

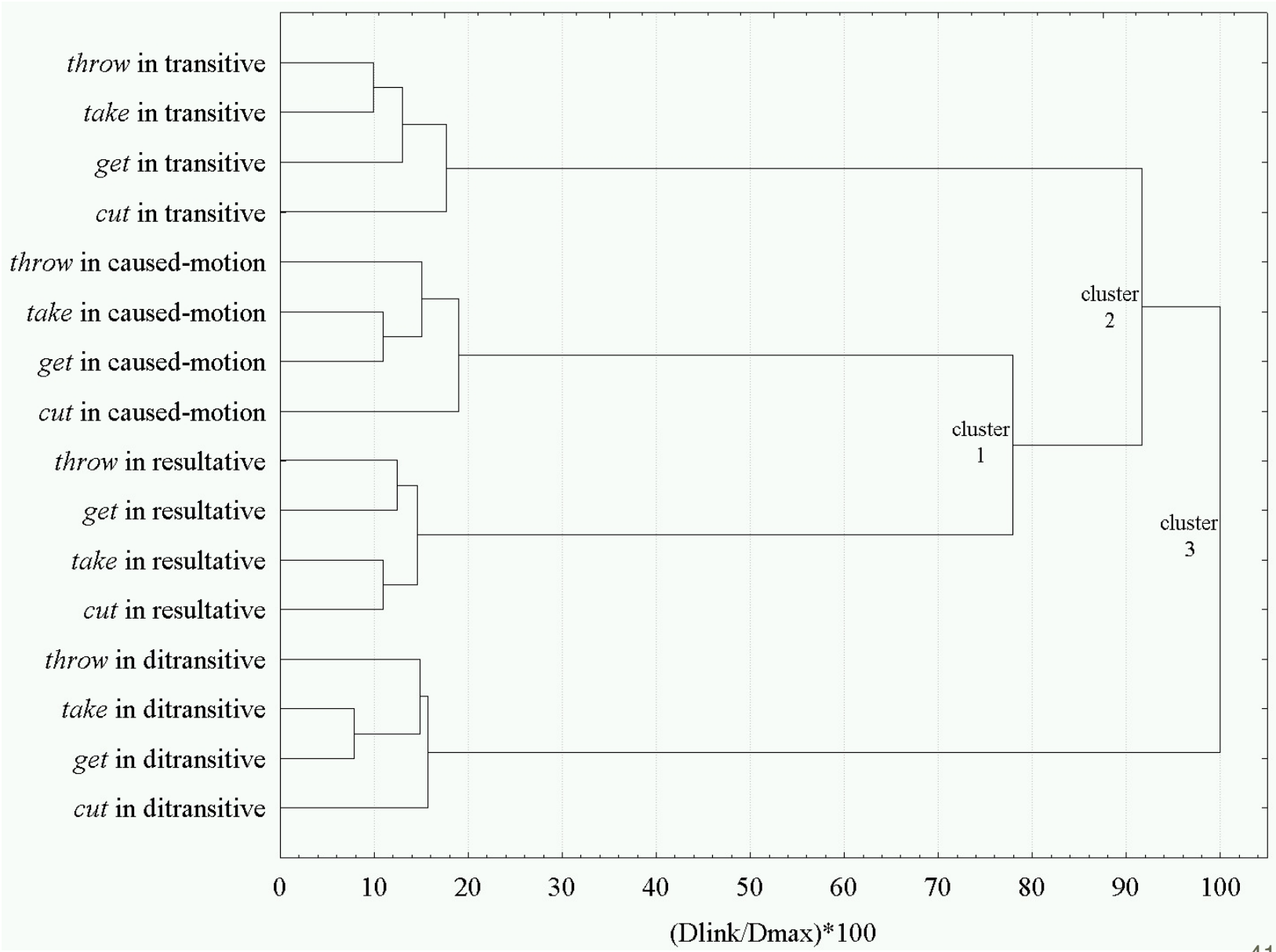
- replication of Bencini & Goldberg's (2000) semantic sorting study
- participants: 22 advanced German learners of English (mean number of years of English teaching: 11.1, interquartile range: 2.5 years)
- subjects were instructed to sort 16 cards into 4 piles of 4 cards "based on the overall meaning of the sentence"
  - randomly shuffled set of 16 cards, each with a different sentence printed on it
  - the 16 sentences crossed 4 different verbs (*cut*, *get*, *take*, *throw*) with 4 different argument structure constructions (caused-motion, ditransitive, resultative, and transitive)

Case study IIb (semantic sorting): Experimental data

throw + ditransitive	*throw* + caused-motion	*throw* + transitive	*throw* + resultative
take + ditransitive	*take* + caused-motion	*take* + transitive	*take* + resultative
cut + ditransitive	*cut* + caused-motion	*cut* + transitive	*cut* + resultative
get + ditransitive	*get* + caused-motion	*get* + transitive	*get* + resultative

Case study IIb (semantic sorting): Results

- average number of reclassifications
  - necessary for a verb-based sorting:
    mean: 8.85 (median=11)
  - necessary for a construction-based sorting:
    mean: 3.45 (median=1)
    [t=2.86; df=19; p=0.0099 (V=153.5; p=0.0143]


throw in transitive
take in transitive
get in transitive
cut in transitive
throw in caused-motion
take in caused-motion
get in caused-motion
cut in caused-motion
throw in resultative
get in resultative
take in resultative
cut in resultative
throw in ditransitive
take in ditransitive
get in ditransitive
cut in ditransitive
cluster 2
cluster 1
cluster 3
0
10
20
30
40
50
60
70
80
90
100
(Dlink/Dmax)*100

Case study II: Conclusions

Overall, both studies add to the growing body of literature that testifies to **item-specific knowledge** in general and **learners' verb-specific knowledge** in particular.

The priming results are fully compatible with

- studies in L1 acquisition in which corpus analyses reveal similar **strong lexico-constructional associations** (Kidd, Lieven and Tomasello 2006), supporting **constructionist approaches**
- exemplar-/usage-based models of language representation (Pierrehumbert 2001)

Case study II: Conclusions

These findings can be elegantly integrated into existing models of language production: we propose to extend Pickering & Branigan's (1998) model by positing that

- combinatorial nodes (representing knowledge of syntactic patterns) are not just syntactic in nature but **constructional**
- the links between verb lemmas and the combinatorial nodes are **differently weighted** depending on
  - the language in which the connection exists
  - how strongly each verb is associated to each construction

Discussion: Potential and limitations of using corpora in SLA research

Discussion: Potential of using corpora in SLA research

- corpus linguistics is inherently compatible with studies adopting a **usage-based perspective** on (S)LA that are gaining attention
  - Complex Dynamic Systems Theory/Emergentism (Gregg 2003)
  - Exemplar Theory (Pierrehumbert 2005)
  - Construction Grammar (Goldberg 1995, 2006; Tomasello 2003)
  - Cognitive Linguistics (Robinson & Ellis 2008)
  - …

- (dense) corpus data can provide evidence for **gradual** (as opposed to categorical) **language development**, and license analysis of overlapping non-target-like and target-like L2 language use (Wulff & Gries to appear)

Discussion: Potential of using corpora in SLA research

- (quantitative) corpus linguistics provides the researcher with a range of methodologies that can **enhance methodological rigor and sophistication** (significance testing, effect sizes, multifactorial designs, interactions,…) (Plonsky & Gass in press)

- corpora can provide the data for **experimental design and cross-validation of experimental results** (Gries & Wulff 2005, 2009; Gilquin & Gries 2009; Wulff et al. 2009)

- corpora ideally lend themselves for **longitudinal, contrastive, input-oriented, and cross-learner studies of L2 development** and **proficiency assessment** (Chapelle 2001; Gries & Stoll 2009; Stoll & Gries 2009)

Discussion: Limitations of using corpora in SLA research

Inherent limitations

- corpus data are **offline data**: aspects of language processing are difficult/impossible to examine
- corpus data are (like any other method/data source) **descriptive, not explanatory**
- learner corpus data need to be evaluated carefully as far as **representativity and authenticity** are concerned

Current practical limitations

- only **few (representative) learner corpora are available** (esp. spoken L2 language)
- available corpora are mainly focused on **L2 English**
- **few (SLA) graduate programs** (in the U.S.) promote corpus linguistics

Thank you!

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Appendices

A. The genitive alternation: Index calculation for rhythmic alternation, segment alternation, length, and givenness

- basic logic: negative value=**s**; positive value=**of**

Obs.	Alt.	Length NP1	Length NP2	Difference	Preference	Final index
s	of	1	3	-2	s	-2
s	of	2	2	0	no pref	0
s	of	3	1	2	of	2
of	s	1	3	-2	of	2
of	s	2	2	0	no pref	0
of	s	3	1	2	s	-2