Comprehending verb finality and case ambiguity in real time

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1. The Verb-Finality Problem

Real-time sentence comprehension is rapid, incremental, and active

- Comprehenders don't wait for bottom-up linguistic evidence – they make **predictions**

Verb-final word order seems to pose a challenge to comprehension

- The verb unlocks the meaning of a sentence
- How do comprehenders predict NPs' semantic relations before encountering the verb?
- They rely on various **grammatical cues** (case, word order, animacy, etc.)

Ferreira & Qiu 2021; Inoue & Fodor 1995

1. The Verb-Finality Problem

Some grammars make those cues **less reliable**

- Georgian: split ergative case + flexible word order + null pronouns

<table>
<tr><th></th><th>Subj_{ACT}</th><th>Subj_{NACT}</th><th>DirObj</th><th>IndObj</th><th>Subj_{EXP}</th><th>Obj_{STIM}</th></tr>
<tr><td>Series I
(FUT…)</td><td>NOM</td><td rowspan="3">NOM</td><td>DAT</td><td rowspan="2">DAT</td><td rowspan="3">DAT</td><td rowspan="3">NOM</td></tr>
<tr><td>Series II
(AOR…)</td><td>ERG</td><td rowspan="2">NOM</td></tr>
<tr><td>Series III
(PERF…)</td><td>DAT</td><td>DAT/PP</td></tr>
</table>

Harris 1985; Nash 2017; Skopeteas et al. 2009

1. The Verb-Finality Problem

Some grammars make those cues **less reliable**

- This results in many incremental **case ambiguities**!

(1) **ექიმი** **მწერალს**... ...გააჩერებს
doctor:NOM writer:DAT stop:TR:FUT
"**The doctor [AGT]** will stop **the writer [PAT]**" = S-O-V word order

...გაუჩერებია
stop:TR:PERF
"**The writer [AGT]** has stopped **the doctor [PAT]**" = O-S-V word order

1. The Verb-Finality Problem

Some grammars make those cues **less reliable**

- This results in many incremental **case ambiguities**!

(1) **ექიმი** **მწერალს**... ...გაუჩერდა
doctor:NOM writer:DAT stop:NACT:APPL:AOR
"**The doctor [THM]** will stop for **the writer [BEN]**" = S-IO-V word order

...გავუჩერე
stop:DITR:AOR:1AGT
"I stopped **the doctor [PAT]** for **the writer [BEN]**" = DO-IO-V word order

1. The Verb-Finality Problem

Today's goals

Present results of a reading-time study on Georgian **case–role ambiguities**

- Comprehenders' default predictions: NOM = Subject; DAT = Direct Object
- Indirect Objects are always hard to process
- O-S-V isn't hard; S_{DAT} isn't hard; but O_{NOM}-S_{DAT}-V is hard

Connect to **typology** and **crosslinguistic sentence processing**

- Why is verb finality so common, and so commonly associated with case morphology?
- Why are some cues more important for comprehension in some languages?

Roadmap

1. ~~The Verb-Finality Problem~~
2. **Background**
3. **Maze Experiment**
4. **Discussion**

2. Background

2.1 Prominence and eADM

2.2 Previous Findings

2.3 Open Questions

2.1 Prominence and eADM

Prominence scales play central roles in **grammar and processing**

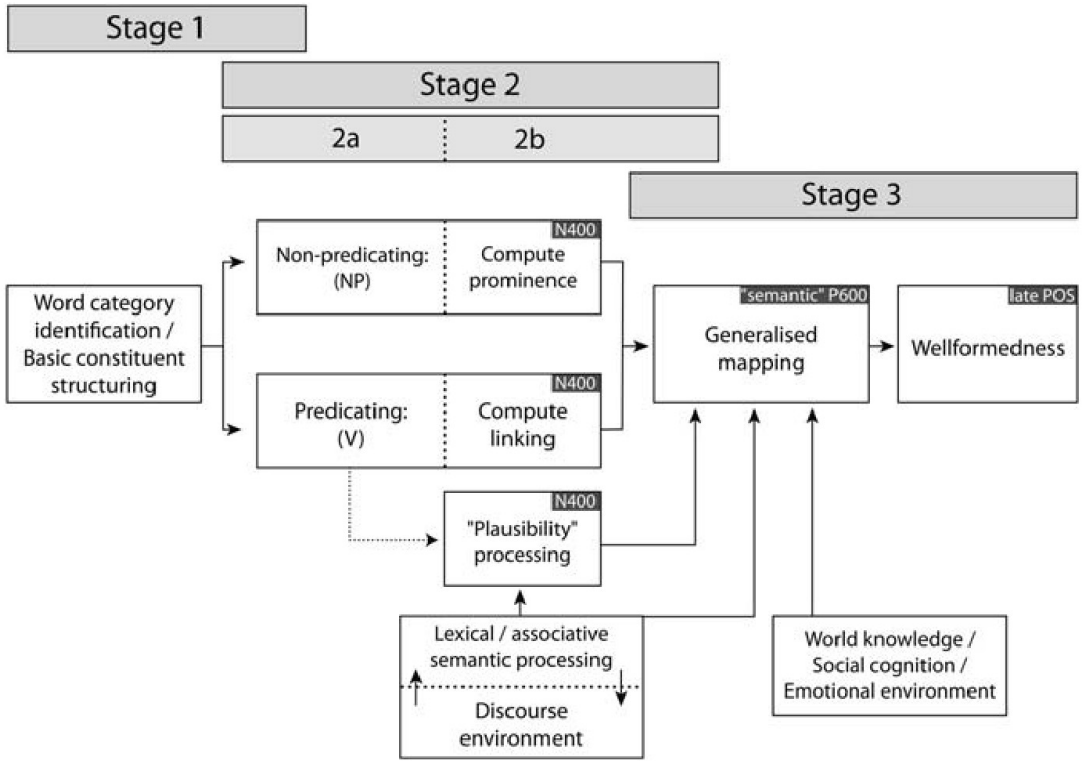
More prominent  *Less prominent*

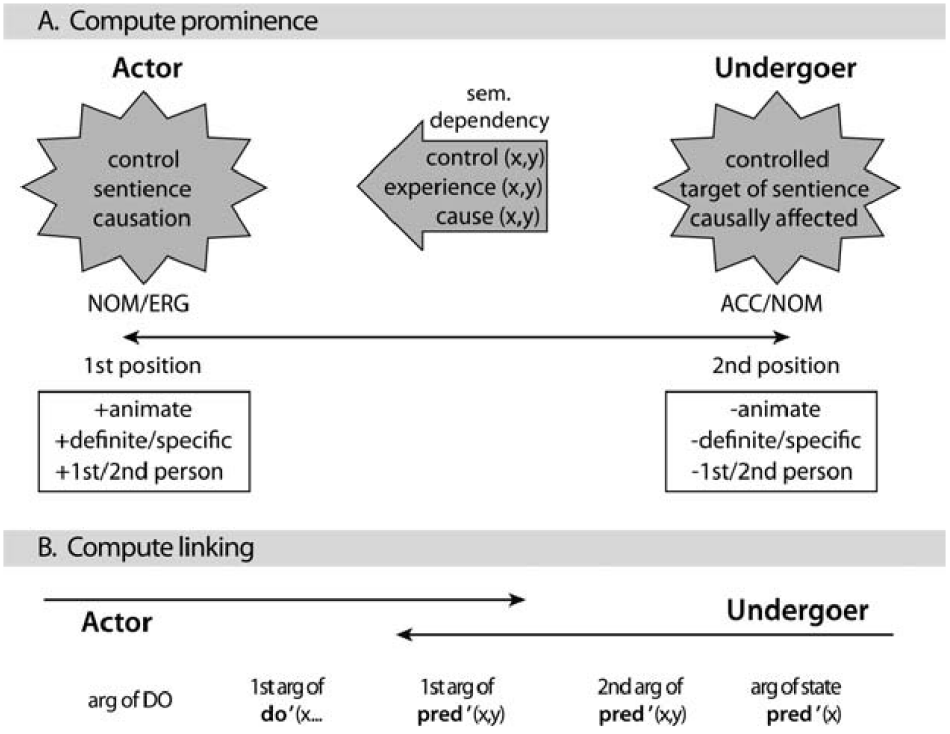
- **Animacy:** Human > Animal > Inanimate
- **Specificity:** Pronoun > Definite NP > Indefinite NP
- **Syntactic Role:** Subject > Direct Object > Indirect Object
- **Thematic Role:** Agent > Goal/Benefactor > Patient
- **Case:** Unmarked (NOM/ABS) > Dependent (ACC/ERG) > Oblique (DAT/LOC)
- **Linear Order:** Earlier > Later

Aissen 2001; Bornkessel-Schlesewky & Schlesewsky 2009

2.1 Prominence and eADM

eADM = a theory of sentence processing incorporating prominence scales





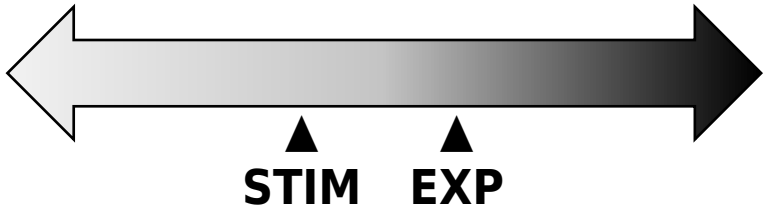
Bornkessel-Schlesewsky & Schlesewsky 2009

2.1 Prominence and eADM

Some crosslinguistic predictions of eADM, given ambiguous case marking

- Comprehenders are eager to identify **canonical (high-prominence) agents**
- Scales might be **weighted differently** across languages (Why/How?)
- When arguments are **more distinct** across scales, a sentence will be **easier** to process

We$_{[AGT]}$ slapped them$_{[PAT]}$

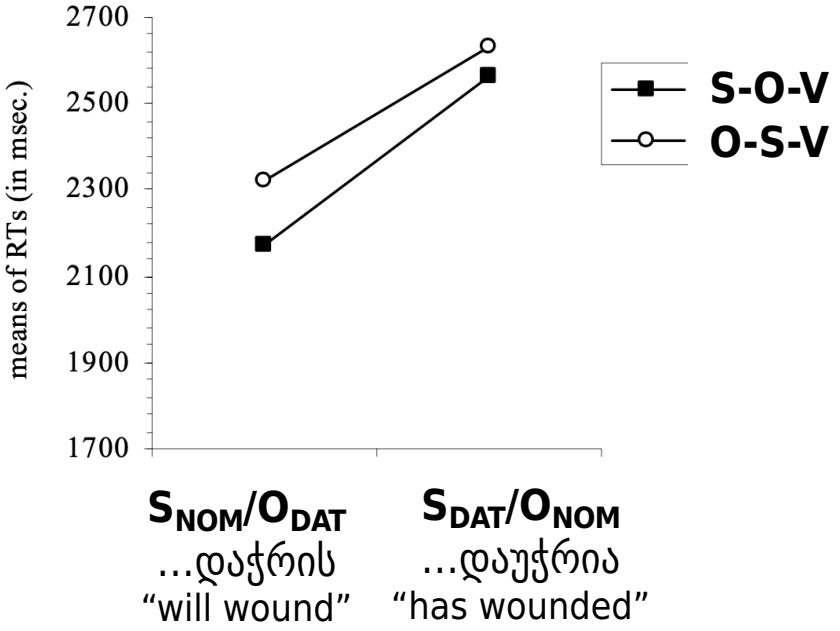


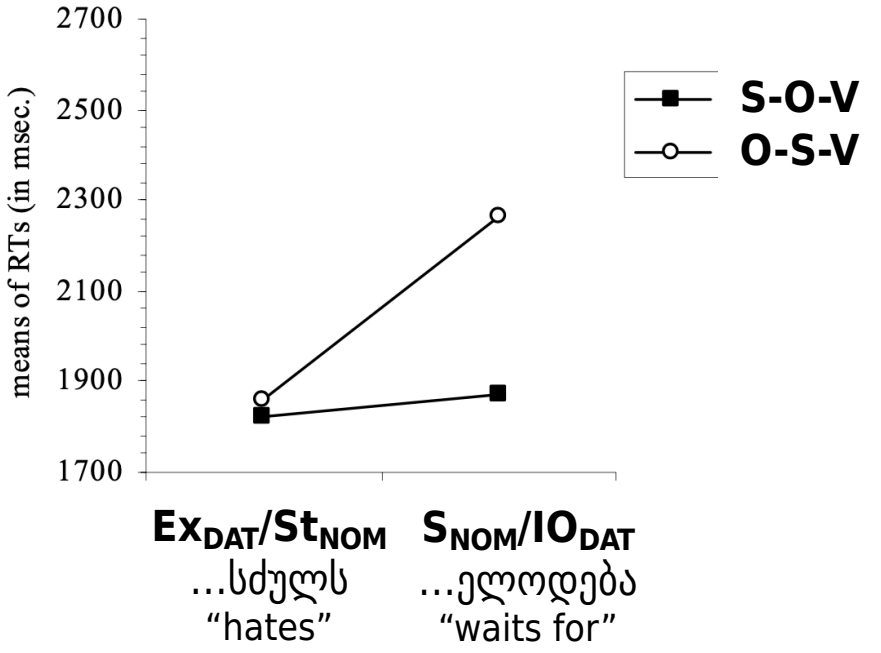
We$_{[STIM]}$ intrigued them$_{[EXP]}$

2.2 Previous Findings

Skopeteas et al. 2012 on **NOM/DAT ambiguities** in Georgian

- Two acceptability judgement experiments manipulating word order and case; Dep. Var. = RT
- **Exp1**: {S_{NOM}/O_{DAT}, S_{DAT}/O_{NOM}}×{S-O-V, O-S-V}; **Exp2**: {$Exp_{DAT}/Stim_{NOM}$, S_{NOM}/IO_{DAT}}×{S-O-V, O-S-V}





2.2 Previous Findings

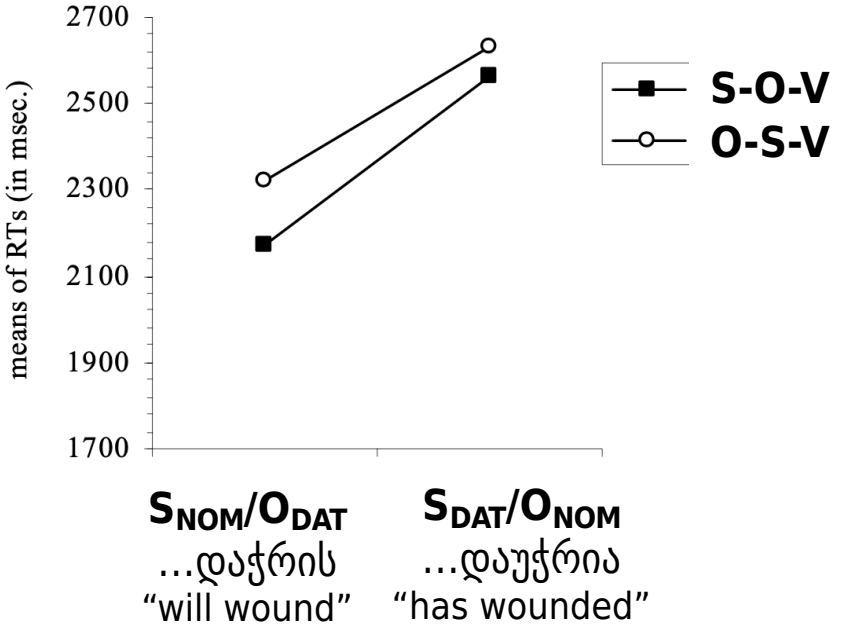
Findings of Skopeteas et al. 2012

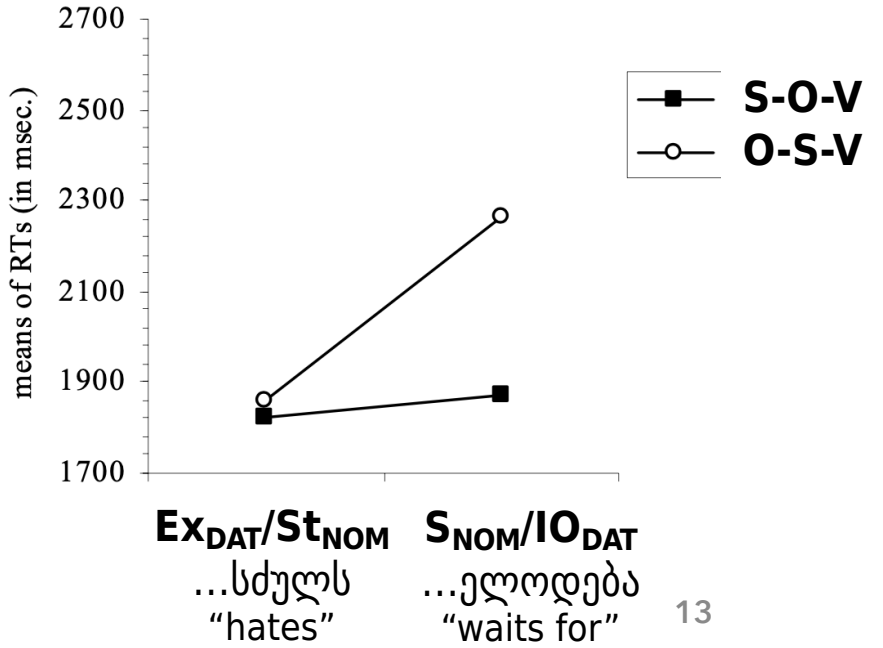
Experiment 1: Series I vs. Series III

- Main effect of case: RT(S_{DAT}/O_{NOM}) > RT(S_{DAT}/O_{NOM})
- No effect of order: RT(S-O-V) ≈ RT(O-S-V)

Experiment 2: Class IV vs. Class II

- Class–Order interaction: RT(IO_{DAT}-S_{NOM}-V) > RT(others)





2.3 Open Questions

Methodological

- Can previous results be replicated with an on-line measure (e.g., in **reading times**)?

Theoretical

- What about across a wider array of argument structures (**passives**, **ditransitives**)?
- Interacting **order, case, & theta-role scales** – why do they influence processing?

3. Maze Experiment

3.1 Design & Methods

3.2 Reading-Time Results

3.1 Design & Methods

Experiment overview

- Three substudies: (i) **NOM–VERB**; (ii) **NOM–DAT–VERB**; (iii) **DAT–NOM–VERB**
- 24 (i) or 32 (ii, iii) itemsets with 4-condition designs manipulating case & argument structure
- L-Maze methodology: SPR plus lexicality decisions
- 56 Georgians participated remotely, online via PCIbex
- A long experiment! Split into two sessions

Forster et al. 2009; Zehr & Schwartz 2018

3.1 Design & Methods

Sample itemset: NOM–DAT–VERB substudy

(2a) **ექიმი** **მწერალს** გააჩერებს მსახიობის ეზოში. = $S_{NOM} – DO_{DAT} – V_{TR} – X_{GEN}$
doctor:NOM writer:DAT stop:TR:FUT actor:GEN garden:in
"**The doctor** will stop **the writer** in the actor's garden."

(2b) **ექიმი** **მწერალს** გაუჩერებს **მსახიობს** ეზოში. = $S_{NOM} – O_{DAT} – V_{DITR} – O_{DAT}$
doctor:NOM writer:DAT stop:DITR:FUT actor:DAT garden:in
"**The doctor** will stop {**the writer**} for {**the actor**} in the garden."

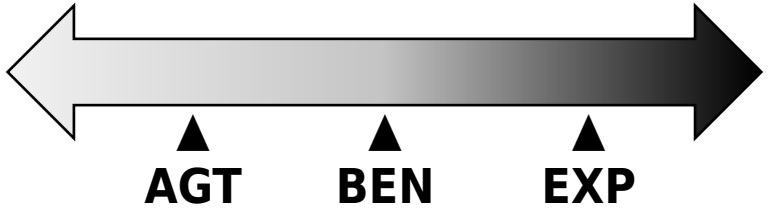
(2c) **ექიმი** **მწერალს** გაუჩერებია მსახიობის ეზოში. = $DO_{NOM} – S_{DAT} – V_{TR} – X_{GEN}$
doctor:NOM writer:DAT stop:TR:PERF actor:GEN garden:in
"**The writer** has stopped **the doctor** in the actor's garden."

(2d) **ექიმი** **მწერალს** გავუჩერე მსახიობის ეზოში. = $DO_{NOM} – IO_{DAT} – V_{DITR} – X_{GEN}$
doctor:NOM writer:DAT stop:DITR:AOR:1 actor:GEN garden:in
"I stopped **the doctor** for **the writer** in the actor's garden."

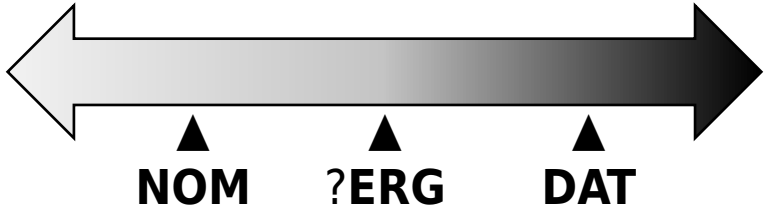
3.2 Reading-Time Results

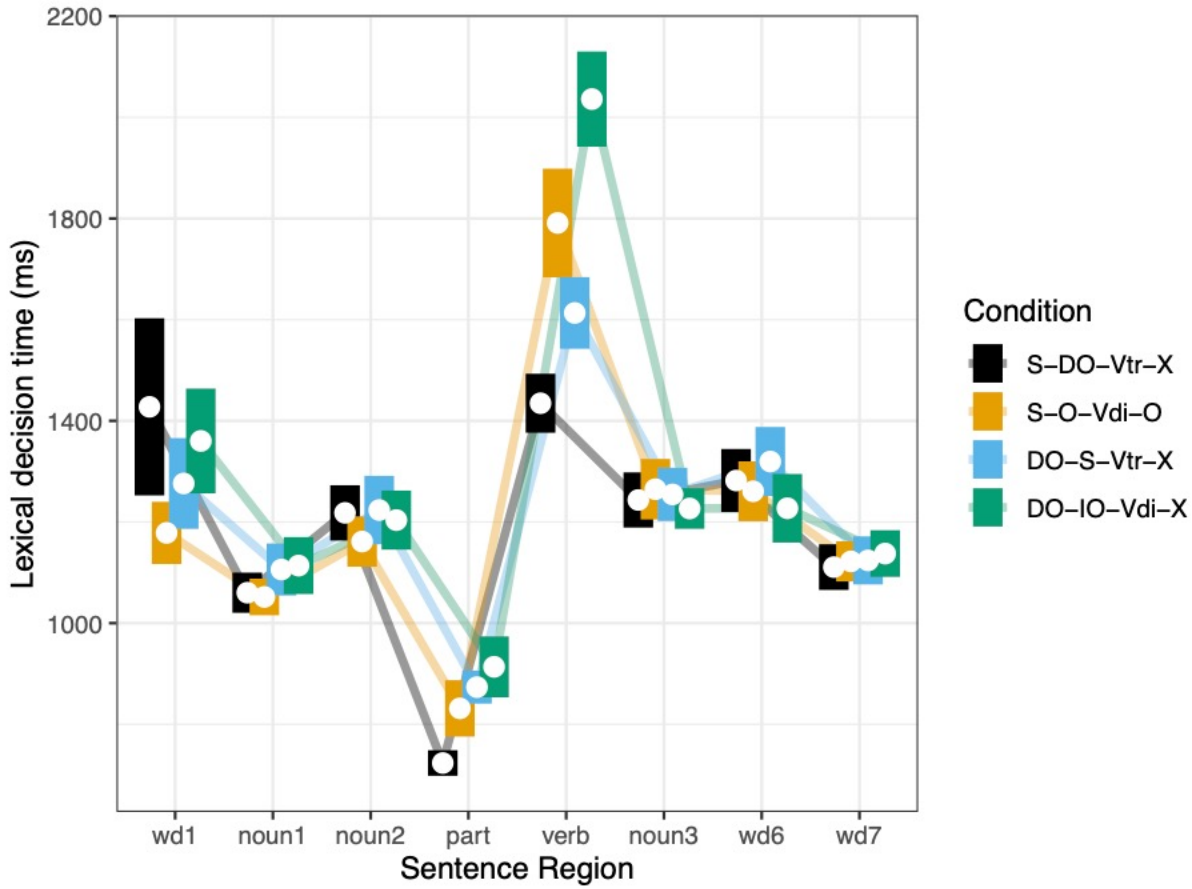
Key results

- Main effect of Argument Structure:
  RT(DITR) > RT(TR) – verbs with IOs are hard



- Main effect of Case Mapping:
  $RT(DO_{NOM}) > RT(S_{NOM})$ – If N1 is NOM, verbs licensing S_{DAT} are hard





4. Discussion

4.1 Implications for Typology

4.2 Future Directions

4.1 Implications for Typology

SOV languages on WALS with…

- "No case" or "Exclusively borderline case" = **31**
- at least 2 cases = **70**

Is verb-finality **prohibitively difficult** to process without case morphology?

- Georgian shows that case need not be be a particularly reliable cue
- Proto South Caucasian case: just as wacky as Georgian – no strong pressure to simplify

4.2 Future Directions

Many more case & argument-structure ambiguities in Georgian to test

(3)

ექიმი	მე…	…გამაჩერებს	/ …გავაჩერე	/ …გამიჩერეს
doctor:NOM	1SG	stop:TR:FUT:1DO	stop:TR:AOR:1S	stop:DITR:AOR:3PL.S:1IO
		"The doctor'll stop me"	"I stopped the doctor"	"They stopped the doc for me"

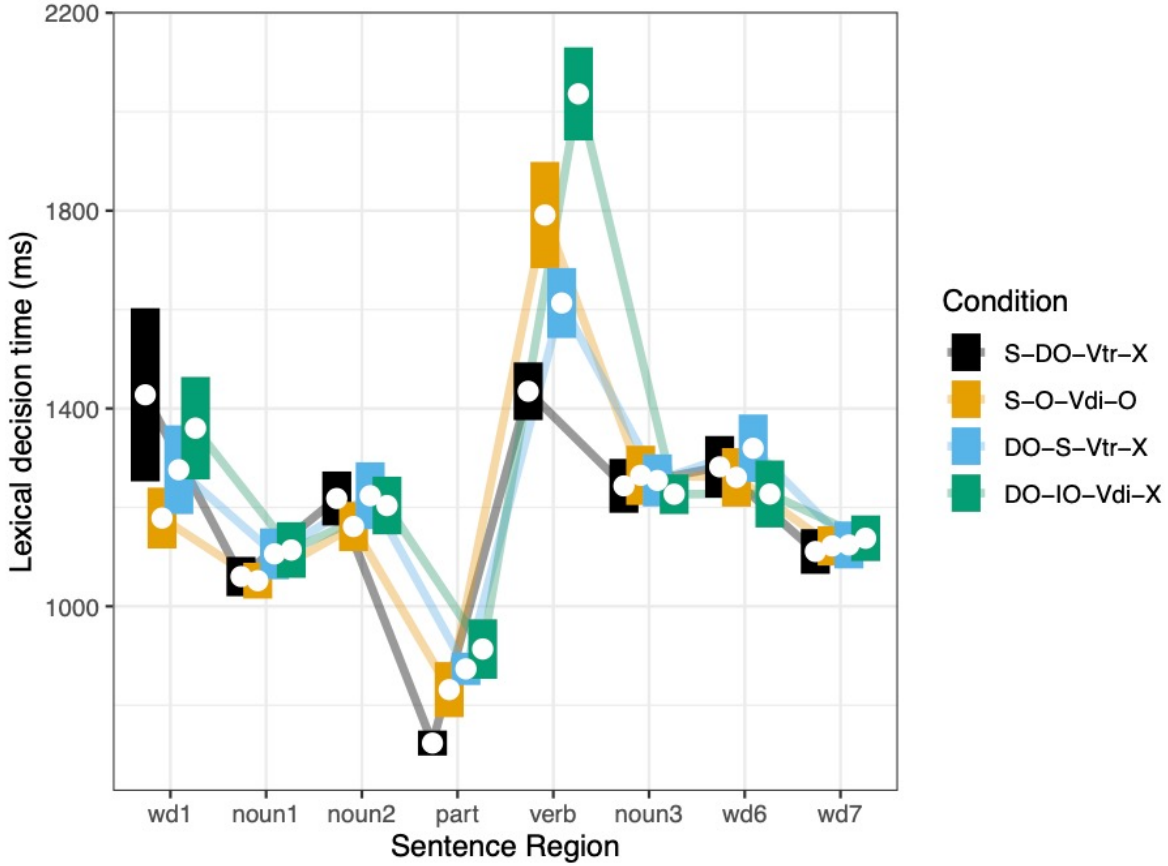
Is case processed differently in simple clauses compared to relative clauses?

(4)

ექიმს	მწერალი	გააჩერებს	/ …რომელსაც	მწერალი	გააჩერებს
doctor:DAT	writer:NOM	stop:TR:FUT	which:DAT:REL	writer:NOM	stop:TR:FUT
"The writer will stop the doctor"			"…who the writer will stop _"		

Conclusion

Key findings



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