

Case, word order, and the comprehension of grammatical complexity in Georgian

Slides:
<http://tinyurl.com/foleySFU>

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1.1 Introduction

What topics interest me?

- Nature of, origin of, and limits on grammatical complexity
 - Syntax, morphology, typology, and psycholinguistics
 - **Georgian** (Shanidze 1953, Harris 1981, Aronson 1990)

Methodological & theoretical versatility

- Formal theory, fieldwork, corpus research, experimental methods
 - Experimentation is a continuum (Davidson 2020)



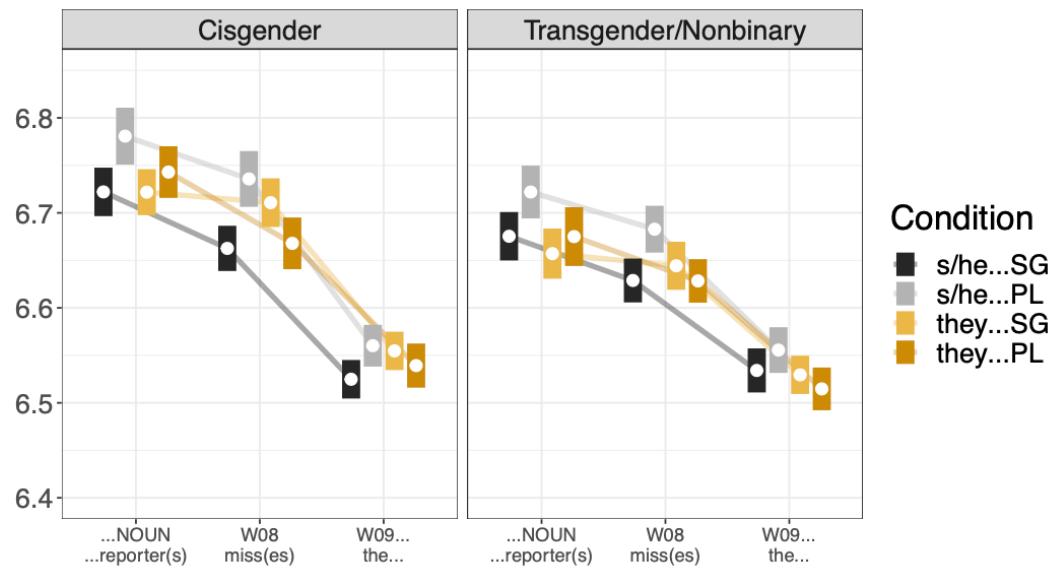
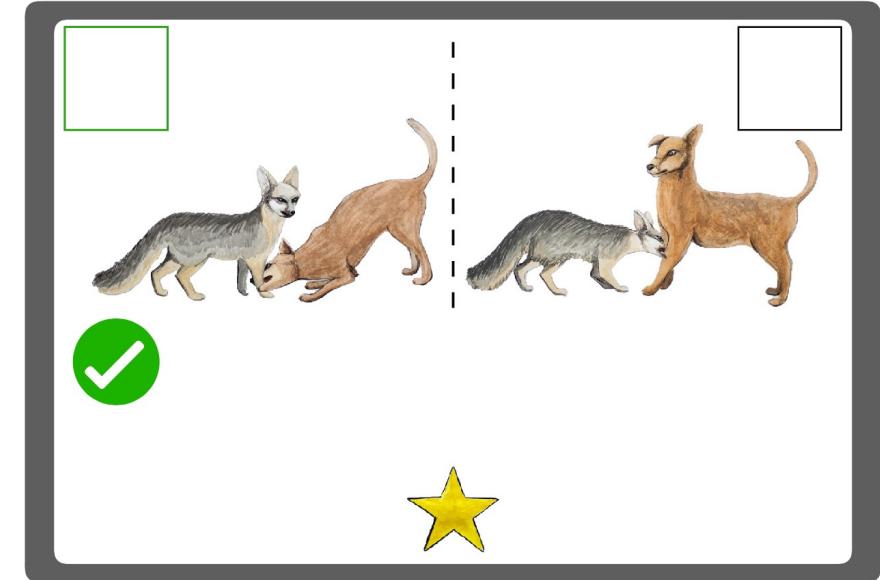
1.1 Introduction

Santiago Laxopa Zapotec (Oto-Manguean, Mexico)

- Syntax of weak-pronoun movement and animacy (Foley & Toosarvandani 2022)
- Field-psycholinguistics visual-world study on relative-clause processing (Foley et al. 2019)

Singular *they* in North American English

- Cataphora as a lens into socio-psycholinguistic variation (Foley & Ahn submitted)



1.2 Today's talk

Zoom into a complex puzzle in Georgian

- Word order is free, yet case morphology is often an ambiguous cue to grammatical role.

Present novel reading-time evidence (Foley submitted)

- Case-Order Interaction: patient-first is hard to process iff the agent has special case
- Not palpable to speakers! Real-time measures expand the empirical horizon of syntax.

Discuss theoretical perspectives

- **Relativized Minimality** (Rizzi 1990) vs. interacting prominence scales (Bornkessel-Schlesewsky & Schlesewsky 2014)

Roadmap

1. Introduction

2. Case & Word Order

3. Georgian Case & Word Order

4. Comprehending Georgian Case & Word Order

5. Theoretical Perspectives

6. Conclusion

2.1 Case in English

Distinguishes pronominal subjects & objects in finite clauses

	<u>Subject</u>	<u>Verb</u>	<u>Object</u>	
(1)	<i>The neighbors</i>	<i>stopped</i>	<i>the horses.</i>	<u>Transitive</u>
(2)	<i>The horses</i>	<i>stopped.</i>		<u>Intransitive</u>

2.1 Case in English

Distinguishes pronominal subjects & objects in finite clauses

- **They** = Intransitive (**S**) or Transitive Subject (**A**) vs. **Them** = Direct Object (**P**).

	<u>Subject</u>	<u>Verb</u>	<u>Object</u>	
(3)	They	stopped	them	<u>Transitive</u>
(4)	They	stopped.		<u>Intransitive</u>

2.2 Connecting case and word order

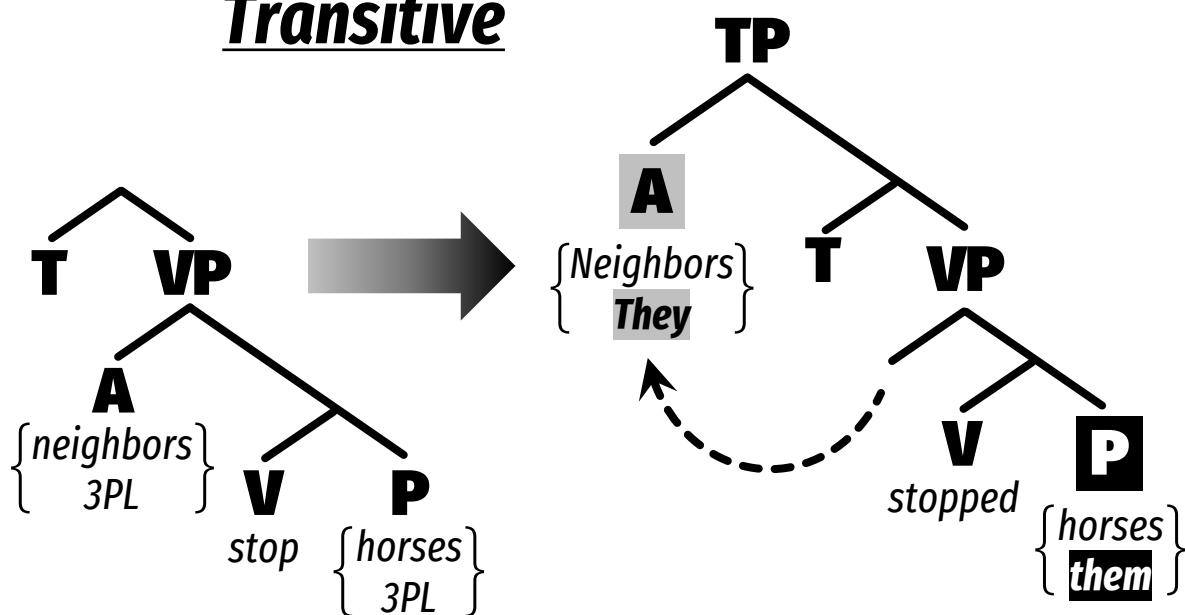
Hypothesis: Case (**they** vs. **them**) is the morphological expression of certain syntactic operations.

<u>Subject</u>	<u>Object</u>		
A	P	<u>Transitive</u>	They stopped them .
S	n/a	<u>Intransitive</u>	They stopped.

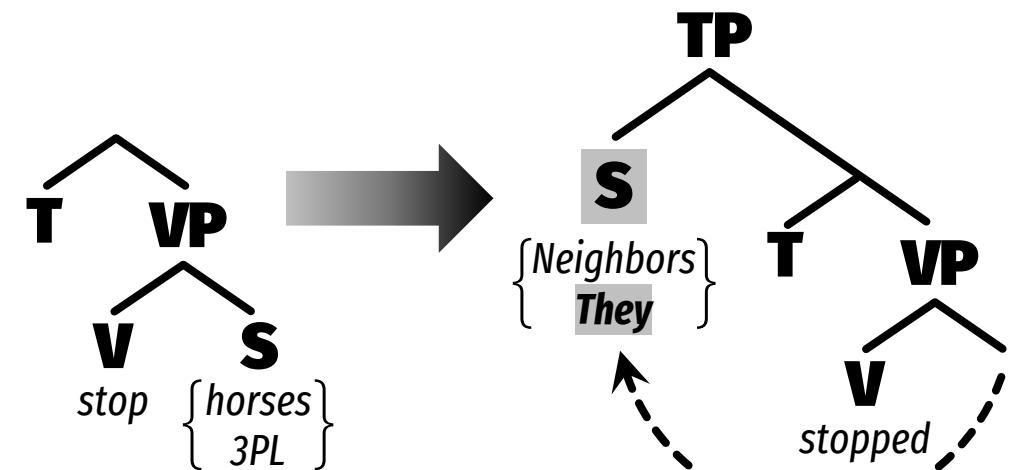
2.2 Connecting case and word order

T assigns case and moves the highest NP (Chomsky 1981, 2001), which might be the verb's complement (Perlmutter 1978, et seq.)

Transitive



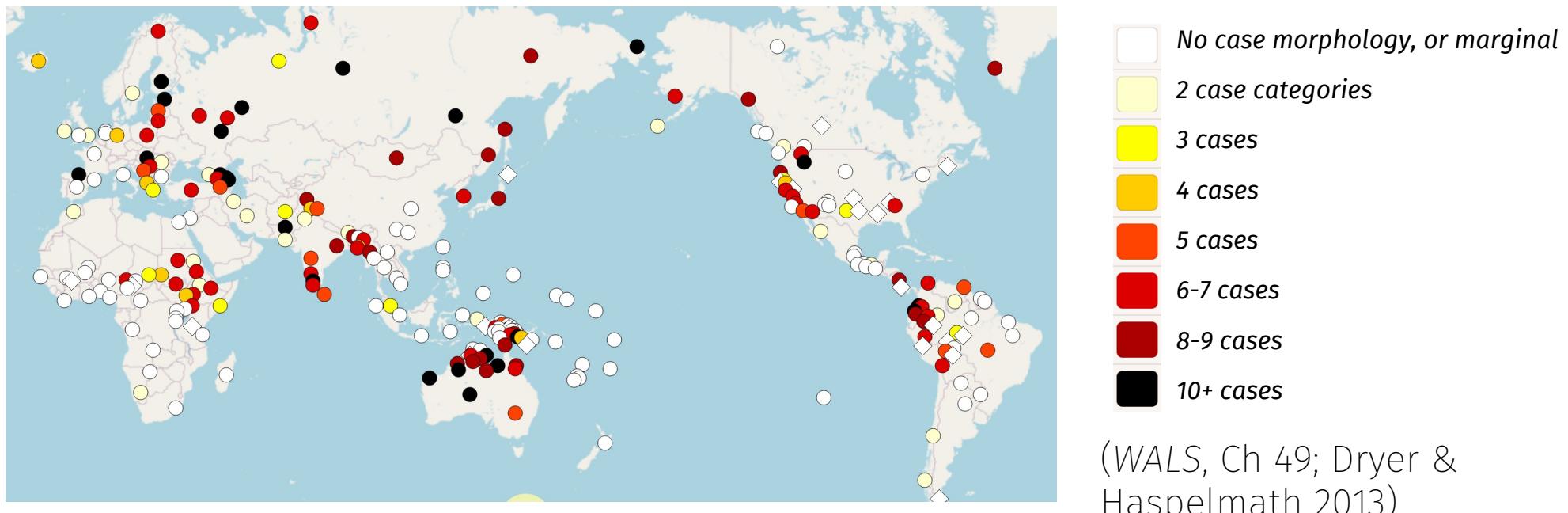
Intransitive



2.3 Why case?

Typology: Many diverse patterns, including none at all

- Rich case is correlated with flexible word order, and with verb finality. (Greenberg 1963)
- Old intuition: Case facilitates efficient communication. (Sapir 1917, Bickel et al. 2015)

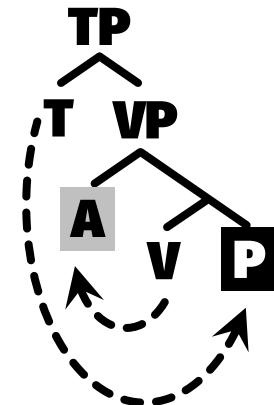


2.3 Why Case?

Syntactic Theory: The right primitives are hotly debated

- Case is the result of a **feature-exchange operation**
(Case-as-Agree; Pesetsky & Torrego 2001, Deal to appear)
- Case is the result of **semantic/thematic licensing**
(Inherent Case; Woolford 2006)
- Case is assigned via phrase-structural **configurations** (Dependent Case; e.g. Marantz 1991, Yip et al. 1987, Baker 2015)

$$\begin{aligned} \text{NP} &\rightarrow \text{Case-}\alpha / [\text{VP } _ \gg \text{NP}] \\ \text{NP} &\rightarrow \text{Case-}\beta / [\text{VP } _] \end{aligned}$$



2.3 Why Case?

Psycholinguistics: Comprehenders can't help but attend to case

- Case cues affect **real-time measures of sentence processing** – e.g. reading times (Bader & Meng 1999), eye movements (Henry et al. 2017), and neurophysiological responses (Chow et al. 2018)
- Not just L1-adults! Children (Arosio et al. 2012, Janssen et al. 2015), heritage speakers (Polinsky 2011), aphasics (Hanne et al. 2015), L2 learners (Frenck-Mestre et al. 2019).
- Theories are dealing with ever more languages (Bornkessel-Schlesewsky & Schlesewsky 2009), but widening the empirical net is still imperative (Anand et al. 2011).

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3.1 Why Georgian case?

Split ergativity conditioned by **tense** (Harris 1985, Nash 2017)

- (5) *mezobleb-i_{NOM}* *ts'xeneb-s_{DAT}* *gaat'hereben*
neighbors-NOM horses-DAT stop:TR:FUT:AGR
“The neighbors will stop the horses”

≈ **They** will stop **them**

- (6) *mezobleb-s_{DAT}* *ts'xeneb-i_{NOM}* *gaut'herebiat^h*
neighbors-DAT horses-NOM stop:TR:PERF:AGR
“The neighbors have stopped the horses”

≈ **Them** have stopped **they**

- (7) *mezobleb-ma_{ERG}* *ts'xeneb-i_{NOM}* *gaat'heres*
neighbors-ERG horses-NOM stop:TR:AOR:AGR
“The neighbors stopped the horses”

≈ **Their** stopped **they**

3.1 Why Georgian case?

Seems to be gratuitously complex – even maladaptive?

- Typologically: Classification is controversial (Hewitt 1987, Harris 1990)
- Theoretically: Analysis is challenging (Harris 1981, Marantz 1991, Legate 2008, Nash 2017)
- Psycholinguistically: Comprehension is, somehow, possible (Skopeteas et al. 2011; Foley 2020, submitted; Lau et al. 2022a,b) despite high entropy (Foley 2022)

This is an empirical goldmine!

- Worth investigating from multiple perspectives and with multiple methodologies

3.2 Future tense: Nom-A Pattern

Here case patterns like English. Subjects are marked alike.

- (8) *ts^hxeneb-i_{NOM} gat^herdebian*
horses-NOM stop:INTR:FUT:AGR
“The horses will stop”

- (9) *mezobleb-i_{NOM} ts^hxeneb-s_{DAT} gaat^hereben*
neighbors-NOM horses-DAT stop:TR:FUT:AGR
“The neighbors will stop the horses”

They will stop

They will stop **them**

A / S / P = “Nom-A” Pattern

3.2 Perfect tense: Dat-A Pattern

Transitive case functions flip. Non-agents are marked alike.

- (10) *ts^hxeneb-i_{NOM}* *gatf^herebulan*
horses-NOM stop:INTR:PERF:AGR
“The horses have stopped”

- (11) *mezobleb-s_{DAT}* *ts^hxeneb-i_{NOM}* *gautf^herebiat^h*
neighbors-DAT horses-NOM stop:TR:PERF:AGR
“The neighbors have stopped the horses”

They have stopped
Them have stopped ***they***

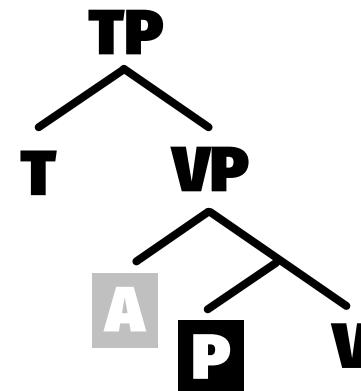
A / S / P = “*Dat-A*” Pattern

3.2 Perfect tense: Raising to Dative

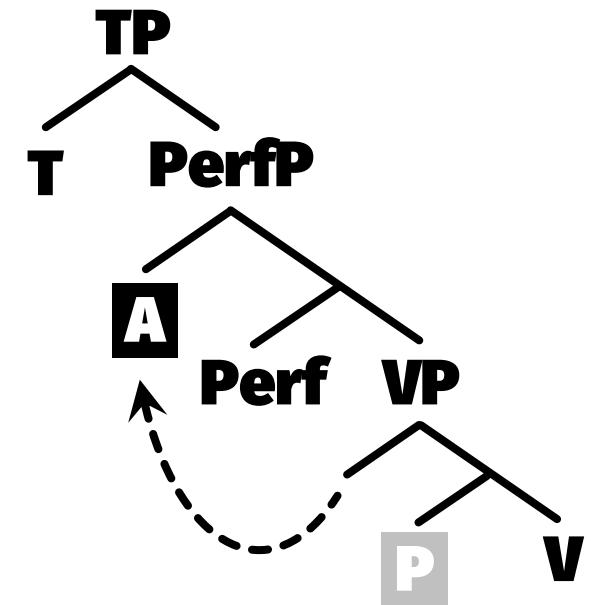
Morphosyntactic evidence points to a **special structure** for Dat-A tenses

- Participle+Aux morphology/ diachrony, “inverted” agreement, no indirect objects (Harris 1981, 1985)
- Complex predicate analysis: **A raises** to get dative case (Marantz 1987, Lomashvili & Harley 2011, Bondarenko & Zompi to appear)

Nom-A tenses:
Ordinary syntax



Dat-A tenses:
Complex syntax w/ raising



3.3 Georgian word order is flexible

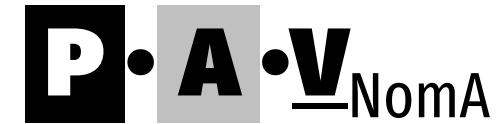
Overt NP arguments often scramble (Skopeteas et al. 2009)

- Despite structural differences, Nom-A and Dat-A clauses have identical word order patterns. Speakers report no differences, and the literature notes none (Vogt 1971).

(12)	<i>mezobleb-i</i> _{NOM}	<i>ts'xeneb-s</i> _{DAT}	<u><i>gaatf'reben</i></u> <u><i>stop:TR:FUT:AGR</i></u>
	neighbors-NOM	horses-DAT	
“The neighbors will stop the horses”			



(13)	<i>ts'xeneb-s</i> _{DAT}	<i>mezobleb-i</i> _{NOM}	<u><i>gaatf'reben</i></u> <u><i>stop:TR:FUT:AGR</i></u>
	horses-DAT	neighbors-NOM	
“The neighbors will stop the horses”			



3.3 Georgian word order is flexible

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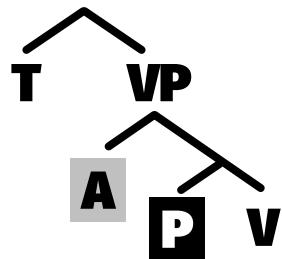
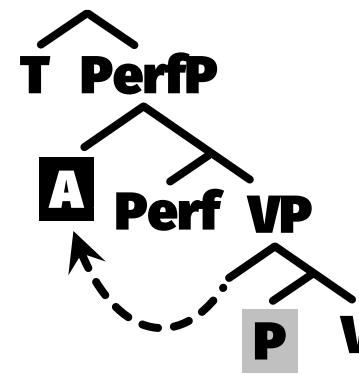
(12)	<i>mezobleb-s_{DAT}</i>	<i>ts^hxeneb-i_{NOM}</i>	<i><u>gautʃerebiat^h</u></i>	A • P • V	_{DatA}
neighbors-DAT horses-NOM <u>stop:TR:PERF:AGR</u>					

“The neighbors have stopped the horses”

(13)	<i>ts^hxeneb-i_{NOM}</i>	<i>mezobleb-s_{DAT}</i>	<i><u>gautʃerebiat^h</u></i>	P • A • V	_{DatA}
horses-NOM neighbors-DAT <u>stop:TR:PERF:AGR</u>					

“The neighbors have stopped the horses”

3.4 Summary of key facts

<u>Tense</u>	<u>Word Order</u>	<u>Case Pattern</u>	<u>Pseudo-English</u>	<u>Structure</u>
Future	Free	Nom-A A / S / P	<i>They'll stop</i> <i>They'll stop them</i>	 <pre> graph TD T --- VP VP --- A VP --- P A --- V P --- V </pre>
Perfect	Free	Dat-A A / S / P	<i>They've stopped</i> <i>Them've stopped they</i>	 <pre> graph TD T --- PerfP PerfP --- A PerfP --- Perf Perf --- VP VP --- V VP --- P </pre>

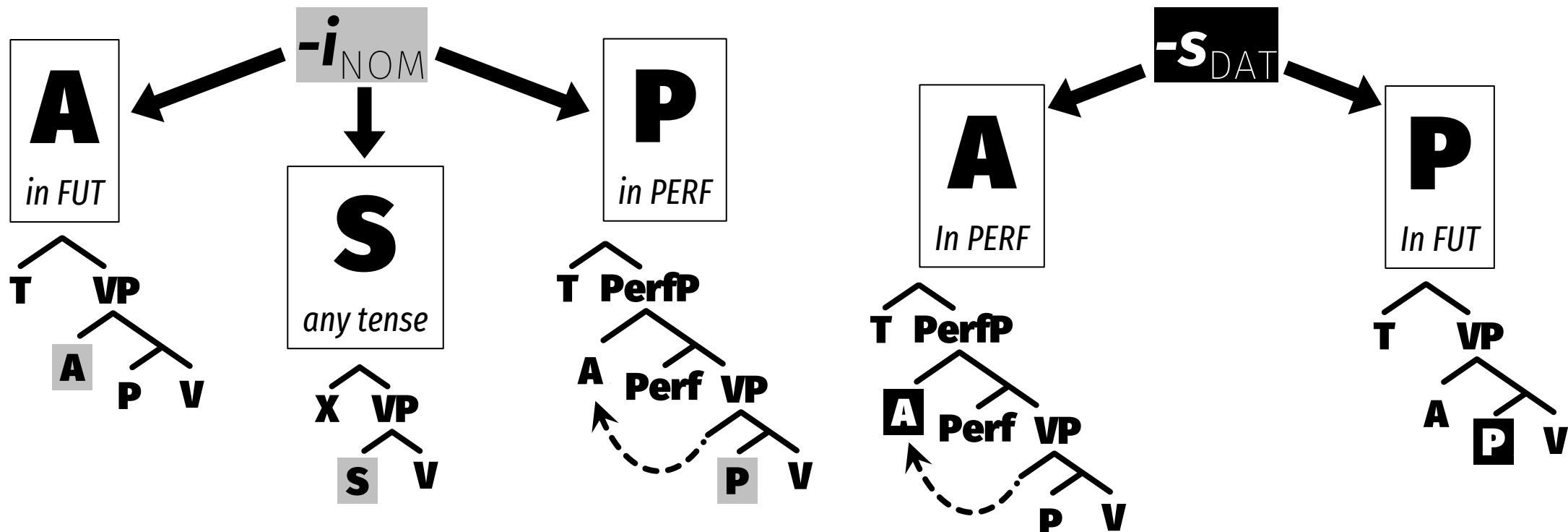
Roadmap

1. Introduction
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3. Georgian Case & Word Order
- 4. Comprehending Georgian Case & Word Order**
- 5. Theoretical Perspectives**
- 6. Conclusion**

4.1 The comprehension puzzle

Incremental case–role ambiguities are pervasive in Georgian.

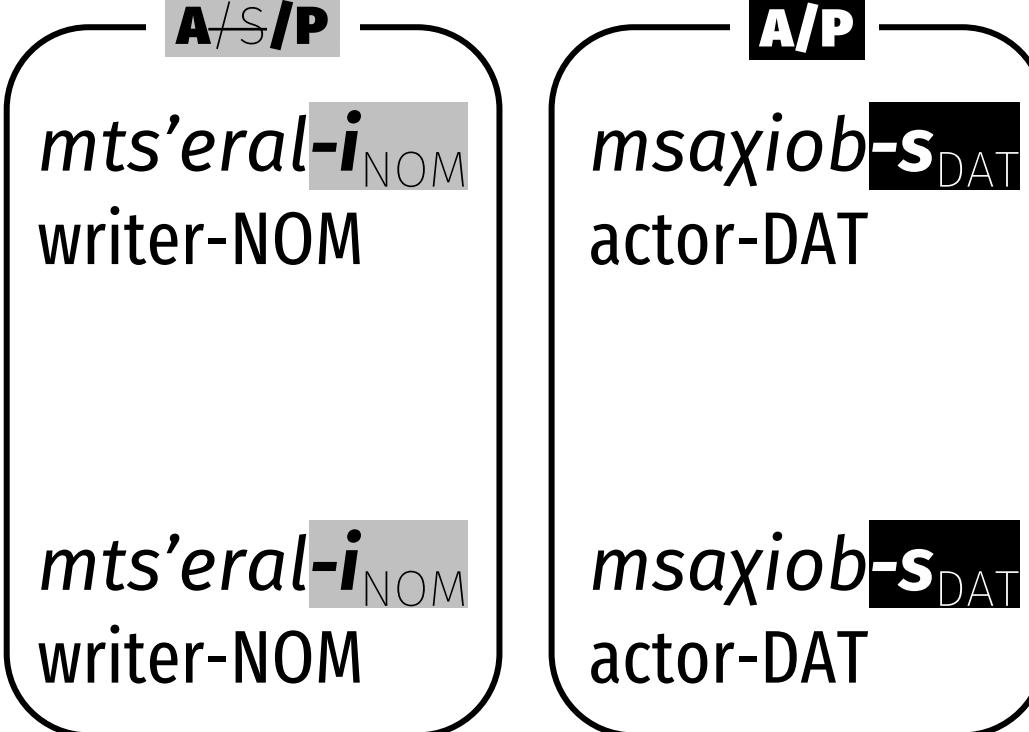
- The crucial disambiguator is verbal morphology, indicating tense/transitivity.



4.2 Processing word by word

- (14) **A/S/P**
*mts'eral-i*_{NOM}
writer-NOM
- (15) *mts'eral-i*_{NOM}
writer-NOM

4.2 Processing word by word

- (14)  *mts'eral-i_{NOM}*
writer-NOM
- (15) *msaxiob-s_{DAT}*
actor-DAT

4.2 Processing word by word



“The writer will see the actor”



“The actor has seen the writer”

4.2 Processing word by word

- (16)
A/P → A/S/P → Data → A·P·V
- mts'eral-s*_{DAT}
writer-DAT
- msaxiob-i*_{NOM}
actor-NOM
- unaxavs*
see:TR:**PERF**:AGR

“The writer has seen the actor”

- (17)
A/P → A/S/P → NomA → P·A·V
- mts'eral-s*_{DAT}
writer-DAT
- msaxiob-i*_{NOM}
actor-NOM
- naxavs*
see:TR:**FUT**:AGR

“The actor will see the writer”

4.3 Description of experiment

Guiding empirical questions

- Upon observing combinations of **role-ambiguous** nouns in **-i_{NOM}** and **-s_{DAT}**...
- ...what types of **disambiguations** (i.e. verbal cues) are **easiest** to process, and **why?**

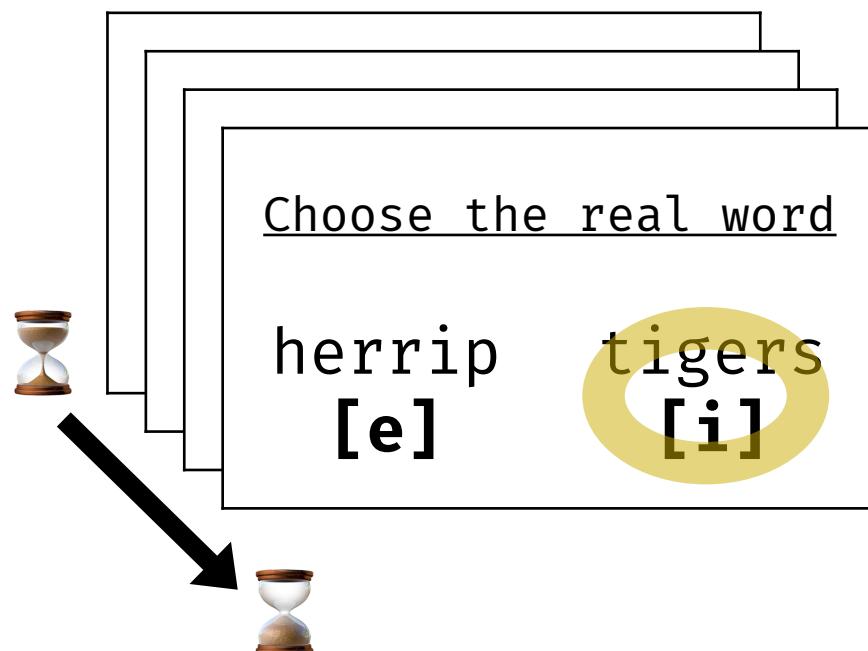
Methods, materials, participants

- **L-Maze** (Freedman & Forster 1985, Boyce et al. 2020); conducted over two sessions on the **internet** via **PClubex** (Zehr & Schwarz 2018); 56 native speakers in Georgia
- **2×2 design**: Order (**A•P•V, P•A•V**) × Case (**Nom-A, Dat-A**); 16+16 itemsets
- What's presented here are subparts of a larger, more complex study (Foley submitted)

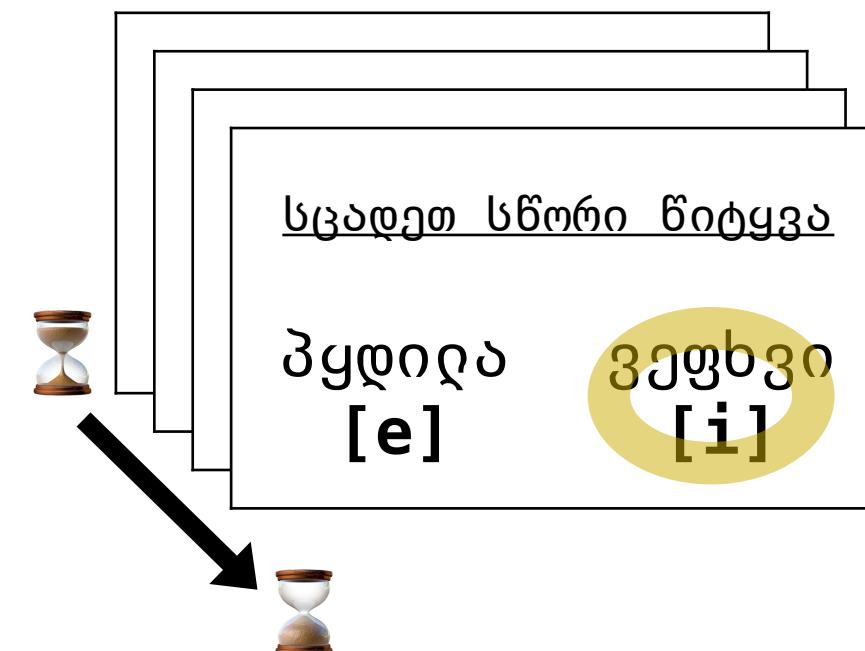
4.4 Lexicality Maze (L-Maze)

Hybrid of self-paced reading and lexical decision task

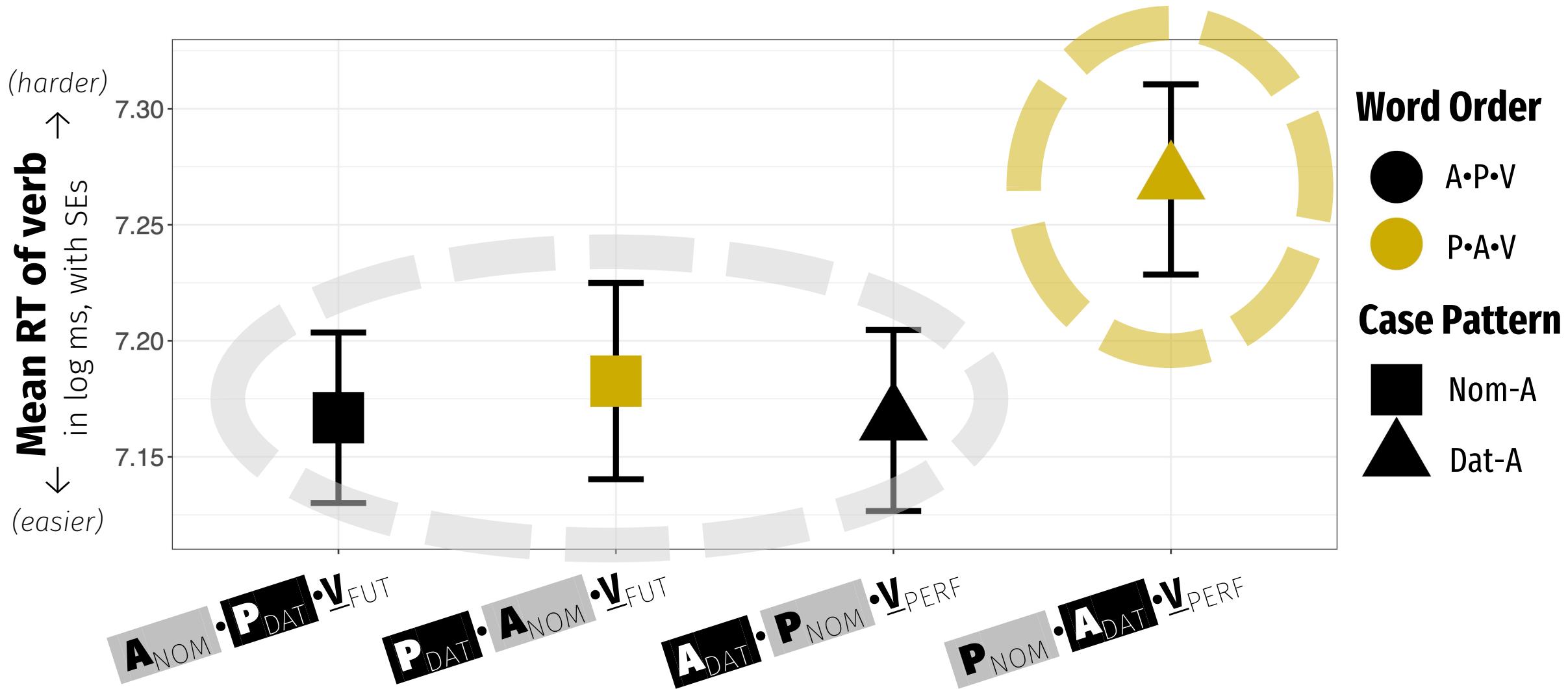
English Mock-Up



Georgian Mock-Up



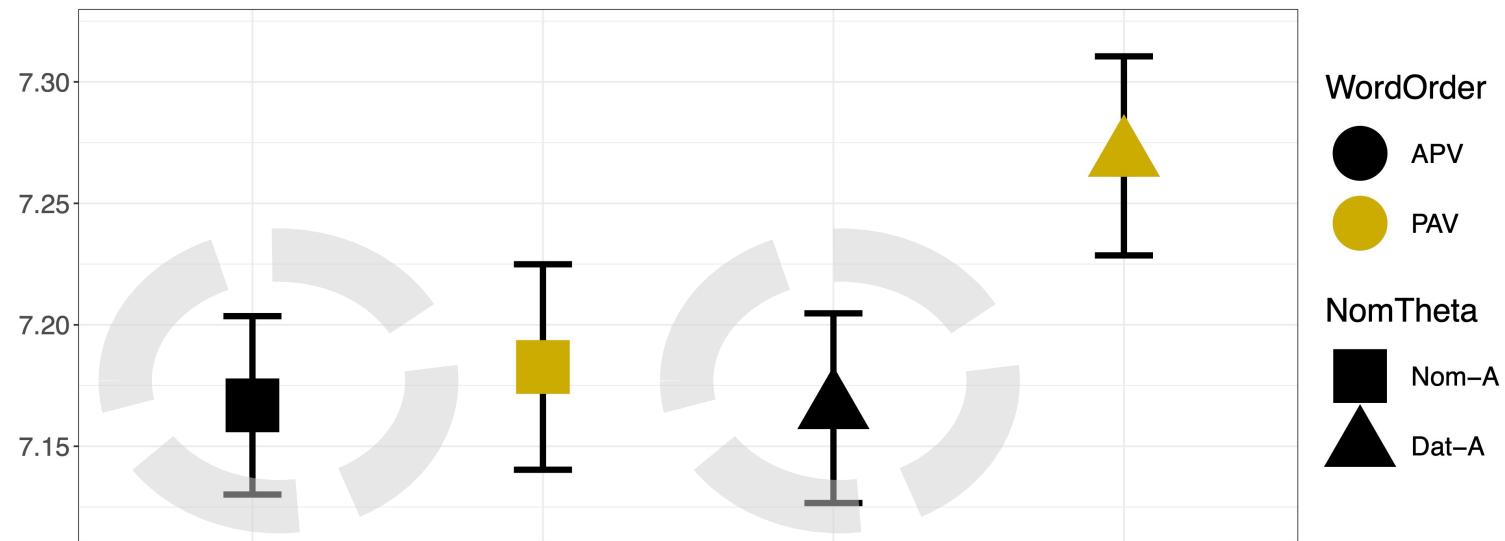
4.5 RTs of disambiguating verbs



4.6 Key finding: Case–Order Interaction

No main effects of Word Order or Case on RTs

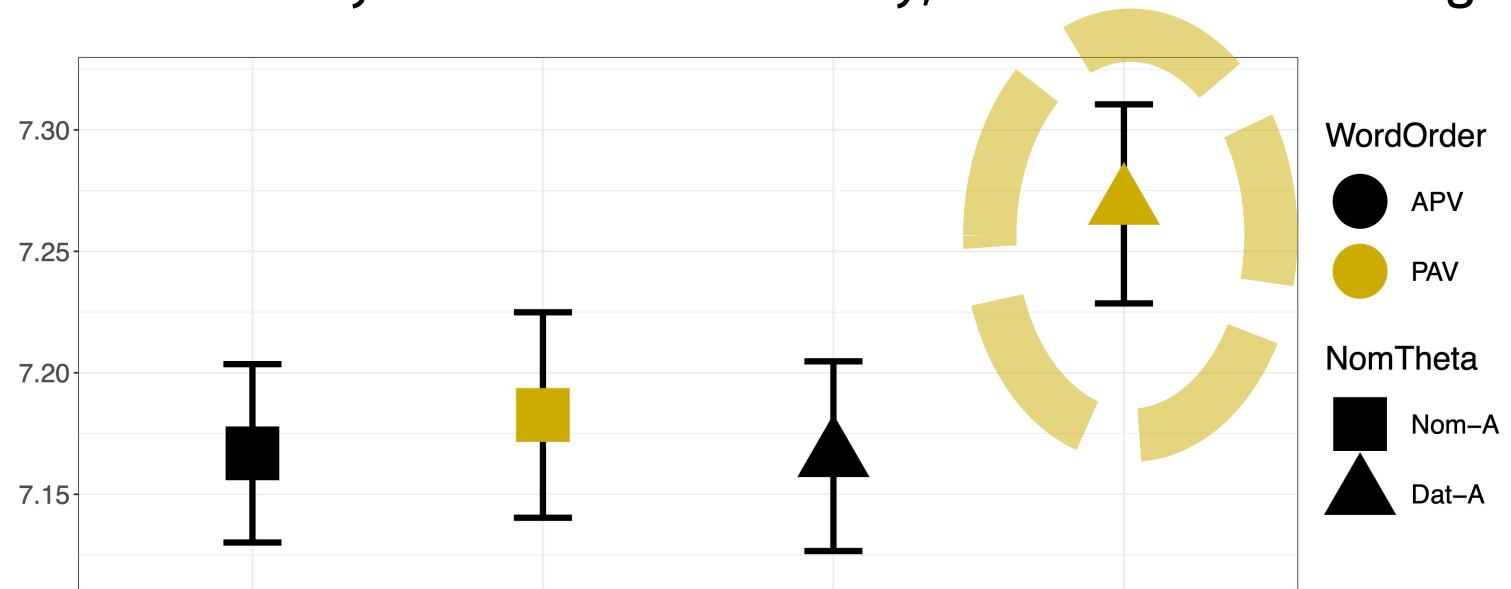
- **Patient-first** order (P•A•V) is not inherently difficult relative to agent-first (A•P•V)
- Nor is the **Dat-A** case pattern (in the perfect) relative to Nom-A (in the future)



4.6 Key finding: Case–Order Interaction

But Word Order and Case interact¹

- Sentences are relatively difficult if they have **patient-first order and Dat-A case**.
- Speakers aren't consciously aware of the difficulty, and it doesn't affect grammaticality.



¹By post-hoc pairwise comparison: $\beta = 0.098$, $SE = 0.043$, $t(107) = 2.2$, $p < 0.05$

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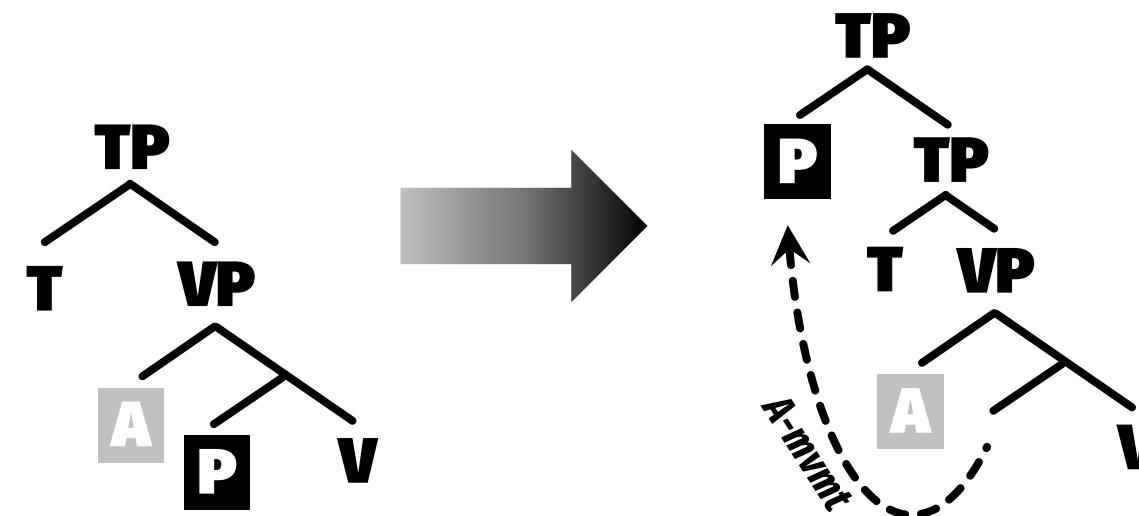
5. Theoretical Perspectives

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5.1 Syntactic explanation

Intuition: Scrambling and dative-raising are too similar.

- Scrambling is widely taken to be A-movement (Mahajan 1990; cf. Miyagawa 1997)

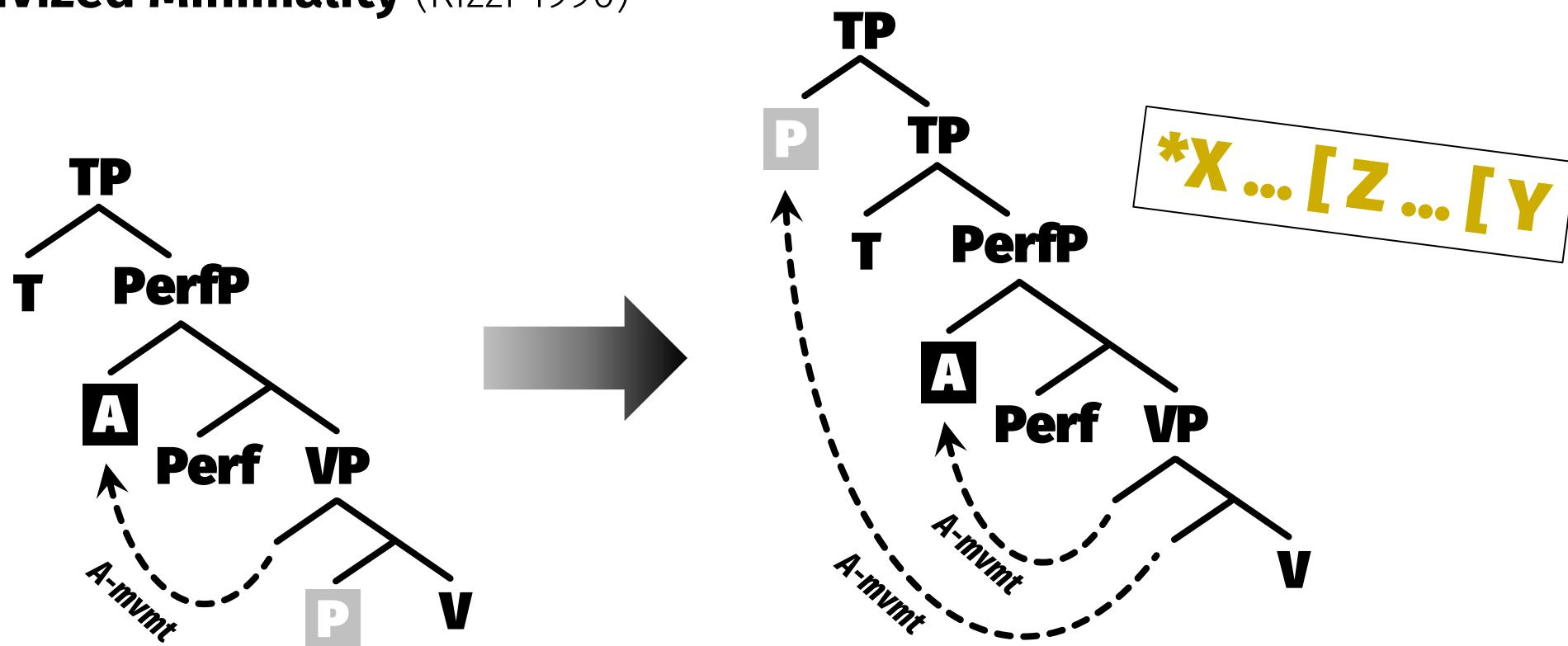


Step 1: Build normal future-tense A-P-V clause

Step 2: P undergoes scrambling, adjoining to TP

5.1 Syntactic explanation

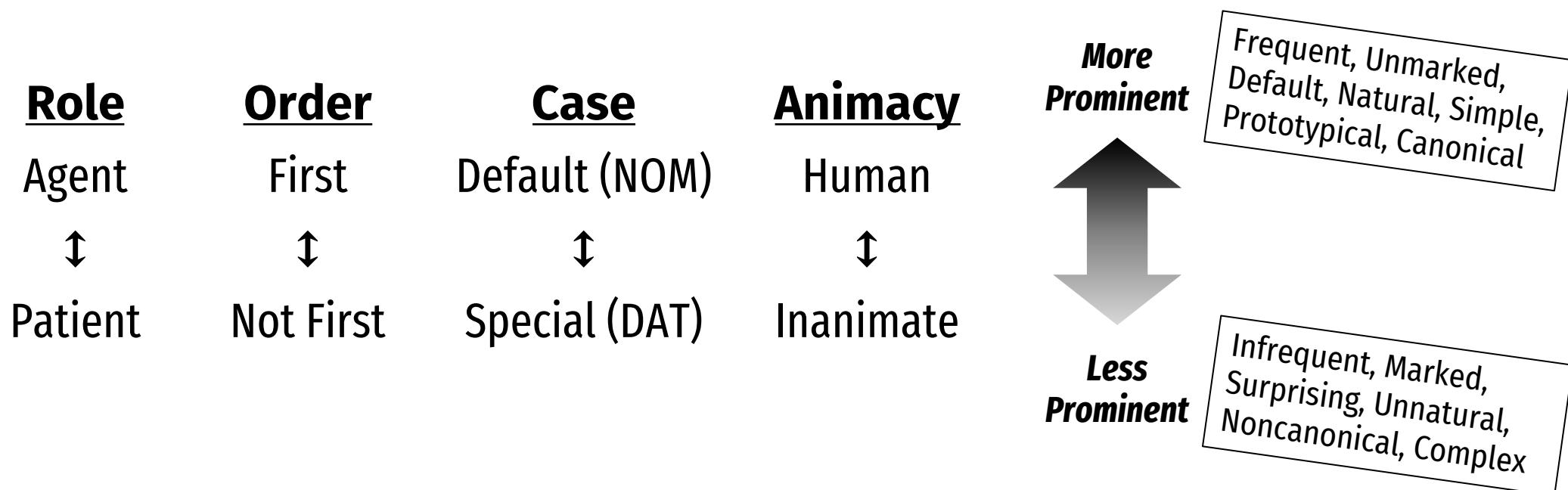
- Since dative-raising is A-movement too, scrambling in Dat-A tenses will violate **Relativized Minimality** (Rizzi 1990)



5.2 A psycholinguistic explanation

Intuition: Prominence scales guide real-time comprehension.

- Faced with ambiguities, parsers assign grammatical roles by aligning prominence scales (eADM; Bornkessel-Schlesewsky & Schlesewsky 2014)



5.2 A psycholinguistic explanation

Perhaps **First+Human+NOM** leads to a strong prediction of **A**.

- Rhymes with previous sentence-processing generalizations about V-final Georgian (Skopeteas et al. 2011) and V-Initial Tagalog (Pizarro-Guevara & Garcia 2024).

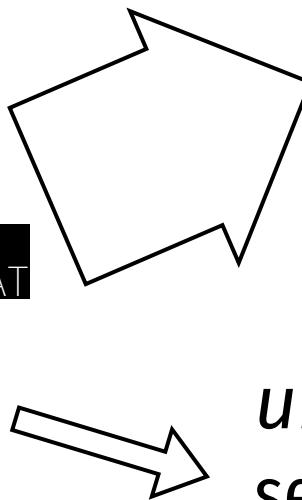
(18) *mts'eral-i*_{NOM} *msaxiob-s*_{DAT}
writer-NOM actor-DAT

5.2 A psycholinguistic explanation

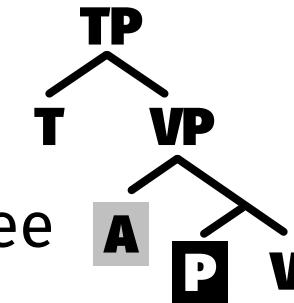
Perhaps **First+Human+NOM** leads to a strong prediction of **A**.

(18) *mts'eral-i_{NOM}*
writer-NOM

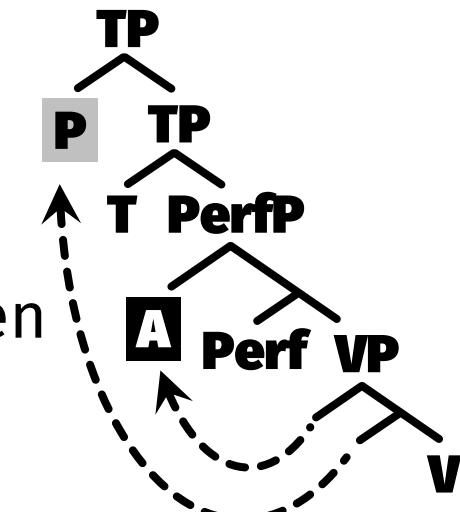
msaxiob-s_{DAT}
actor-DAT



naxavs
see:TR:FUT:AGR
“The writer will see
the actor” [A•P•V]



unaxavs
see:TR:PERF:AGR
“The actor has seen
the writer” [P•A•V]



5.3 Teasing the theories apart

There are other operations that can target the patient, including **wh-movement** – e.g. in relative clauses (Foley 2013)

- (19) *mts'erali, [_{RC} *romel-its^h*_{NOM} msaxiob-s_{DAT} naxavs*
writer which-NOM actor-DAT see:TR:FUT:AGR
“the writer [_{RC} who __ will see the actor]”

A undergoes
wh-mvmt

- (20) *mts'erali, [_{RC} *romel-its^h*_{NOM} msaxiob-s_{DAT} unaxavs*
writer which-NOM actor-DAT see:TR:PERF:AGR
“the writer [_{RC} who the actor has seen __]”

P undergoes
wh-mvmt

5.3 P-extracted RCs in Dat-A tenses

Relativized Minimality predicts no special processing difficulty.

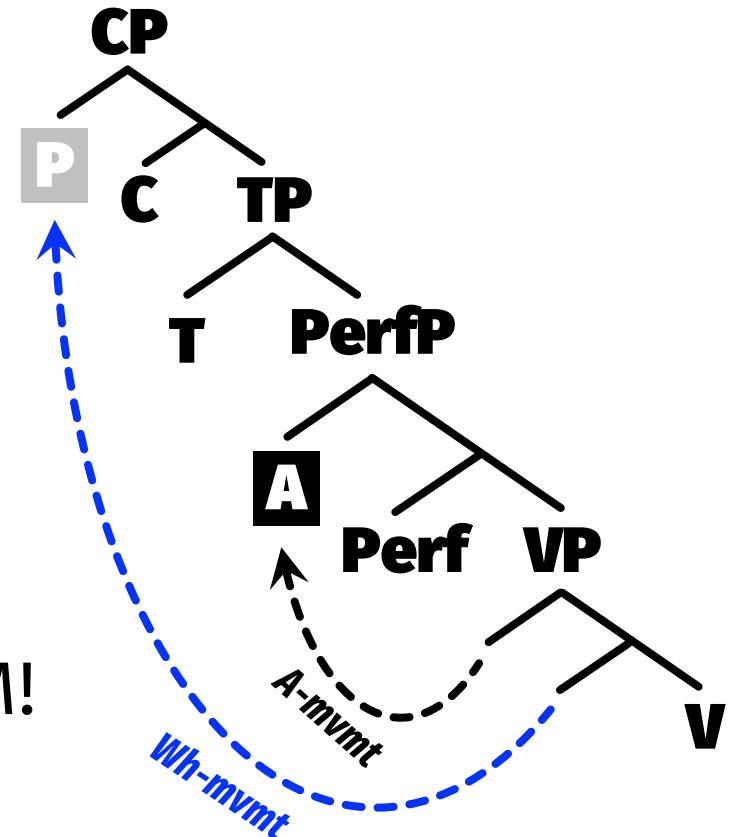
- *Wh*-movement is sufficiently distinct from dative-raising.

Prominence Scales do predict processing difficulty.

- Initial NOM should always cause a garden path.

Previous work (Foley 2020) seems to support RM!

- *Wh*-movement of P causes processing difficulty in Nom-A, but not Dat-A tenses.



5.4 Future directions

Low-hanging fruit

- Targeted experimental comparison between **scrambling and relativization**
- Targeted fieldwork on the **syntax of datives** (cf. Belletti & Rizzi 1989, Gerdts & Jhang 1995, Boneh & Nash 2017)
- Return to ergative case (Foley 2020), which is as effective a disambiguator as the verb.

(21)	<p>A/S/P</p> <p><i>mts'eral-i</i>_{NOM} writer-NOM</p>	<p>A</p> <p><i>msaxiob-ma</i>_{ERG} actor-ERG</p>	<p><i>naxa</i> see:TR:AOR:AGR</p>
“The actor saw the writer”			

5.4 Future directions

Higher-hanging fruit

- Other **methods**: visual world (Foley et al. 2019), acceptability (Foley & Amiridze, in prep)
- Parallels **within the word** – How are Georgian's incrementally ambiguous agreement morphemes (Lomashvili & Harley 2011; Foley 2017, 2021) processed?

(21)	<i>ga-v-a-t^hb-ob</i>	<i>ga-m-a-t^hb-ob-s</i>	<i>ga-m-i-t^hb-i-a</i>	<i>ga-v-u-t^hb-i-var</i>
	warm:TR:FUT:1>3	~ warm:TR:FUT:3>1	~ warm:TR:PERF:1>3	~ stop:TR:PERF:3>1
	“ I ’ll warm 3rd”	“3rd’ll warm me ”	“ I ’ve warmed 3rd”	“3rd’s warmed me ”

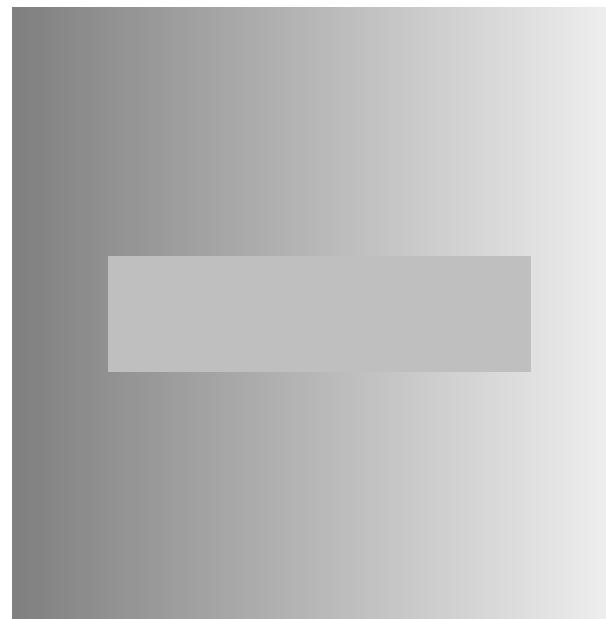
- **Comparative experimental syntax** in other languages: large, medium, or small.

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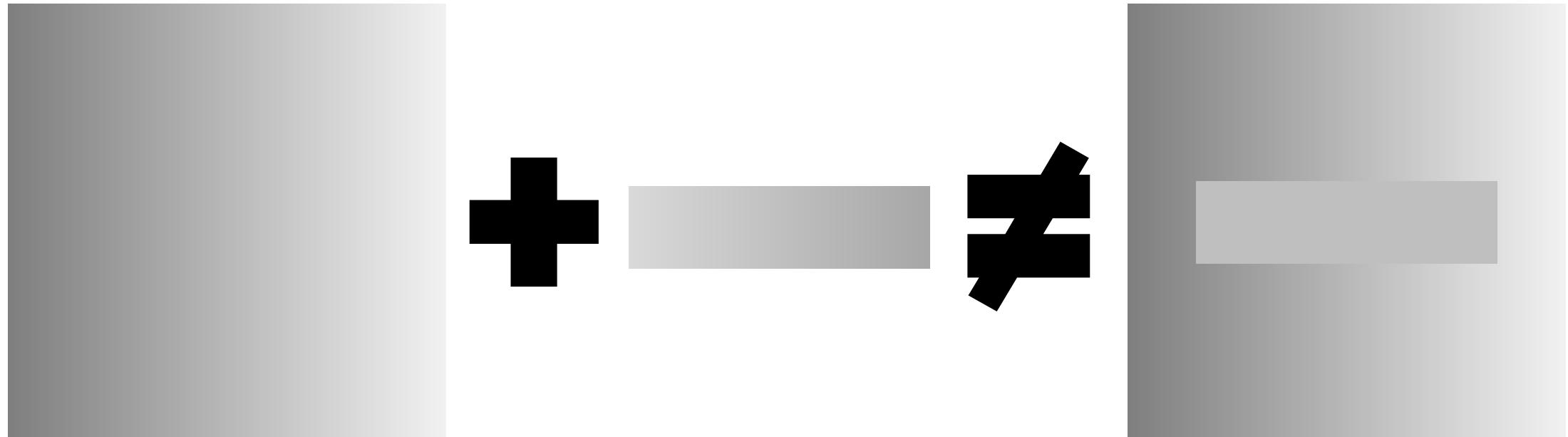
6.1 A visual illusion

The simultaneous contrast illusion (Gilchrist 1988)



6.1 A visual illusion

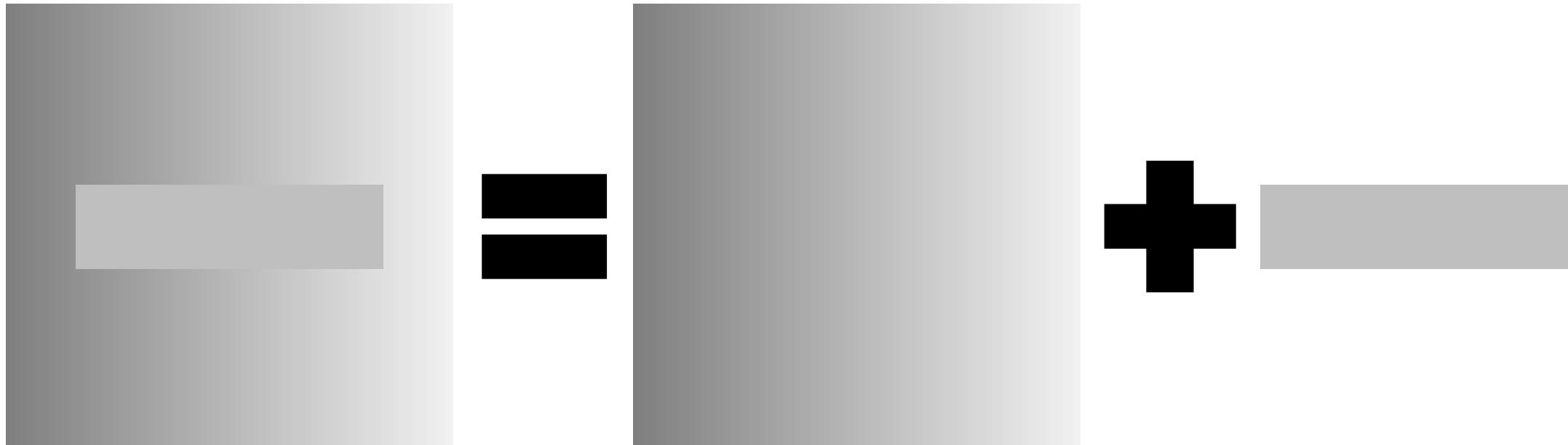
The simultaneous contrast illusion (Gilchrist 1988)



6.1 A visual illusion

The simultaneous contrast illusion (Gilchrist 1988)

- On gradient background, a solid grey bar will appear to have a contrasting gradient.



6.2 A perspective on syntax

Syntactic theory predicts whether the figure is solid or gradient.



- Syntactic judgements are perceived sensations, akin to color vision.
- Important aspects of that perception might be fleeting, subliminal, or prone to illusion.

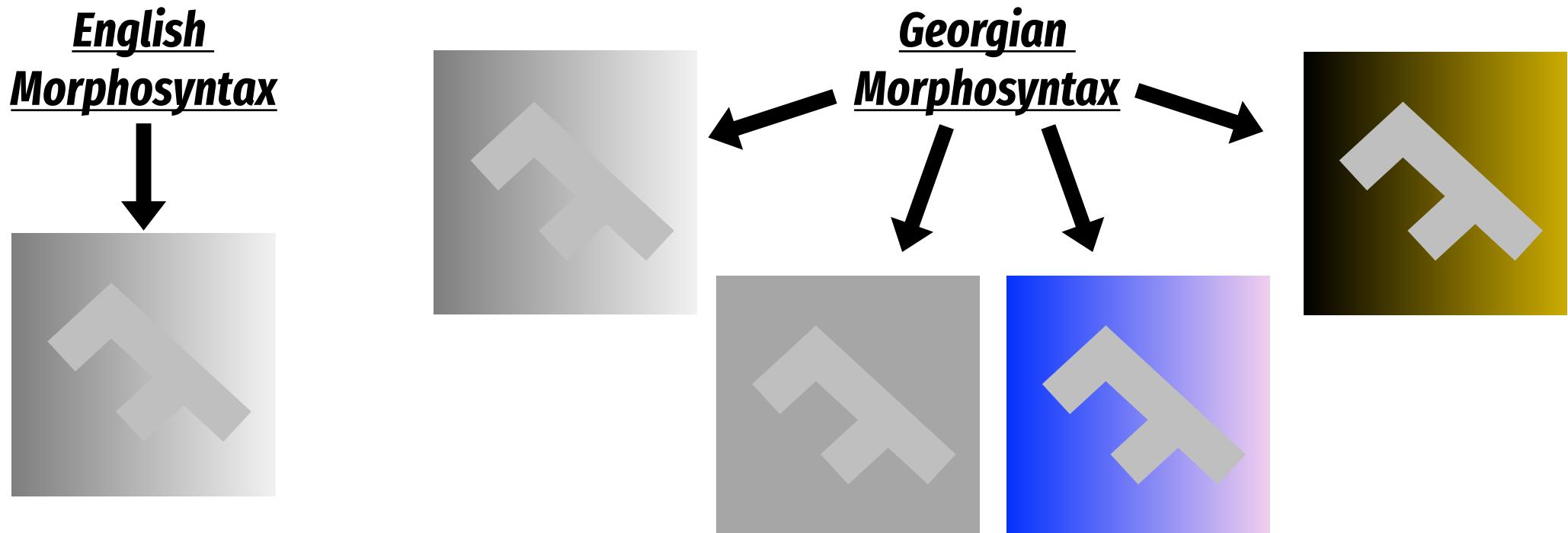
Extra-grammatical factors (e.g. prominence?) change the colors of the background.

- Real-time methods are sensitive and temporally rich – potentially capable of abstracting away from those distracting colors.

6.2 A perspective on syntax

Grammatical complexity contrasts more “color palettes”.

- Languages like Georgian offer a crucial lens into the nature of language.



Special thanks

To my research assistants in Georgia:



Lizi Baramidze
(Independent scholar)



Tamar Kalkhitashvili
(Ilia State University)



Natia Poniava
(Tbilisi State University)



Irakli Salia
(Tbilisi State University)

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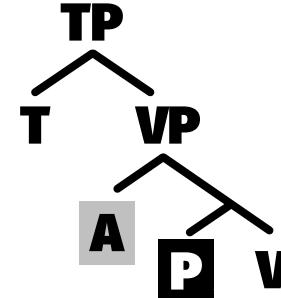
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Summary

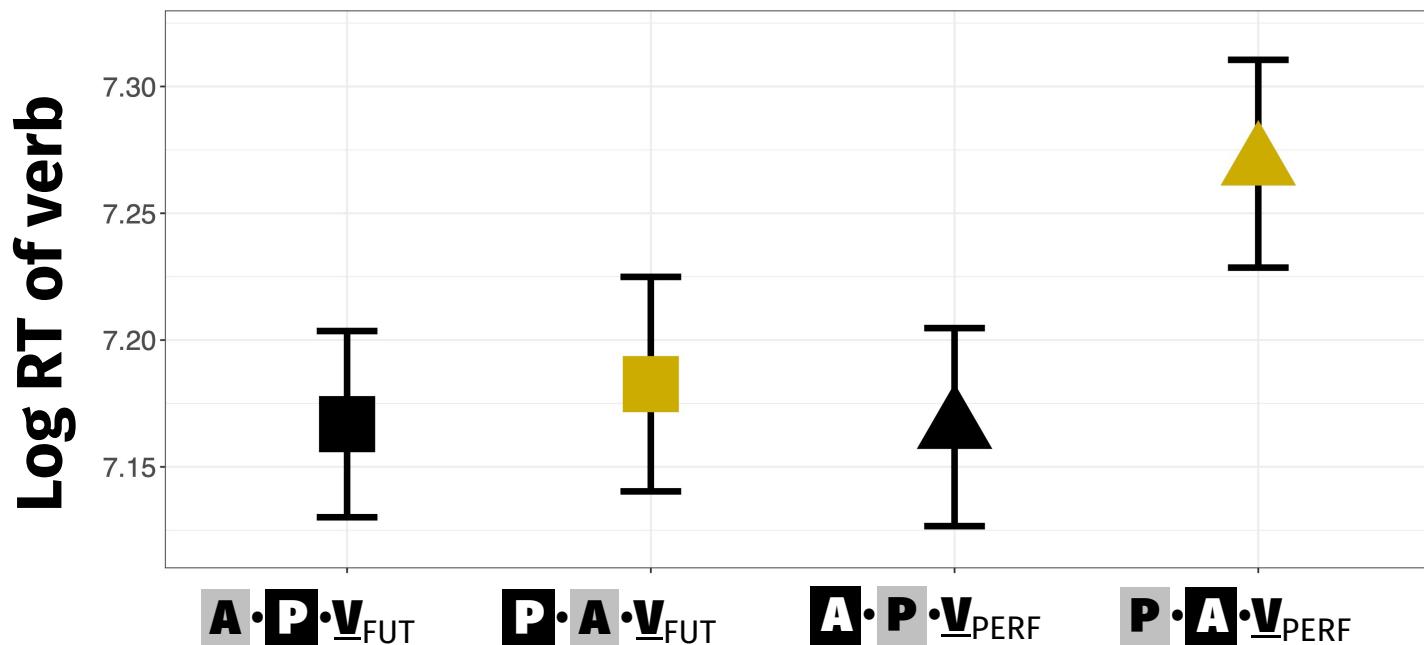
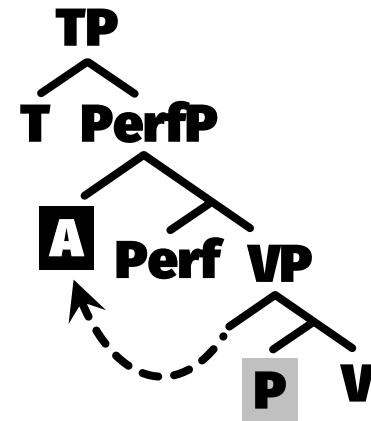
$-i_{\text{NOM}}$
 $-s_{\text{DAT}}$
 $-ma_{\text{ERG}}$

	FUT (Nom-A)	A / S / P
	PERF (Dat-A)	A / S / P
	AOR (Erg-A)	A / S / P

Nom-A Structure



Dat-A Structure



- WordOrder
 - APV
 - PAV
- NomTheta
 - Nom-A
 - Dat-A