

Winograd-schema without World Knowledge: Minimal Post-pronoun Semantics modulate the Implicit Causality Pronoun Bias



Amanda Rose Yuile & Joshua K. Hartshorne

Communication Sciences and Disorders
MGH Institute of Health Professions



Background

In causally-dependent clauses, pronoun interpretation is systematically affected by the main verb [1].

Implicit Causality:

1. Josh criticized Paul because he...[he=Paul]
2. Josh angered Paul because he...[he=Josh]

Implicit causality pronoun biases correlate with syntactic (Levin [2,3]) verb class [4,5].

These effects can be **overridden by the semantics of the second clause** [6]:

3. The city council denied the demonstrators a permit because they feared/advocated violence.

Does information that follows the pronoun affect its interpretation only when it involves detailed event semantics, or can more abstract cues also play a role?

4. The city council denied the demonstrators a permit because...
 - a. they were daxes.
 - b. they daxed.
 - c. they daxed them.

Preliminary Evidence:

- Hartshorne et al. (2015) found **more object interpretations using sentences like (4b)** than Hartshorne & Snedeker (2013) using contexts like (4a).

Method

- 319 native English speakers
- 32 trials (see Task, top right)
- 503 verbs from 8 Levin verb classes

Table 2
Verb Classes.

Class	N	Examples
31.1	190	amuse, baffle, disappoint
31.2	39	admire, dislike, fear
31.3	61	agonize over, care about, fear for
31.4	3	appeal to, grate on, jar on
33	72	blame, forgive, praise
45.4	95	animate, mellow, popularize
59	41	dare, deceive, influence

References:

1. Garvey, C. & Caramazza, A. (1974). Implicit causality in verbs. *Linguistic Inquiry*, 5(3), 459-464.
2. Levin, B. (1993). *English verb classes and alternations: A preliminary investigation*. University of Chicago Press.
3. Kipper, K., Korhonen, A., Ryant, N., & Palmer, M. (2006). Extending VerbNet with Novel Verb Classes. In *LREC* (pp. 1027-1032).
4. Hartshorne, J.K. & Snedeker, J. (2013). Verb argument structure predicts implicit causality: The advantage of finer-grained semantics. *Language and Cognitive Processes*, 28(10), 1474-1508.
5. Hartshorne, J.K., O'Donnell, T.J., & Tenenbaum, J.B. (2015). The causes and consequences explicit in verbs. *Language, Cognition, and Neuroscience*, 30(6), 716-734.
6. Winograd, T. (1972). Understanding natural language. *Cognitive Psychology*, 3(1), 1-191.

Method Continued

Task: choose a continuation for the sentence (32 total)

Albert frightened Beatrice because...

option 1: he is a dax

option 2: she is a dax

Table 1

Conditions.

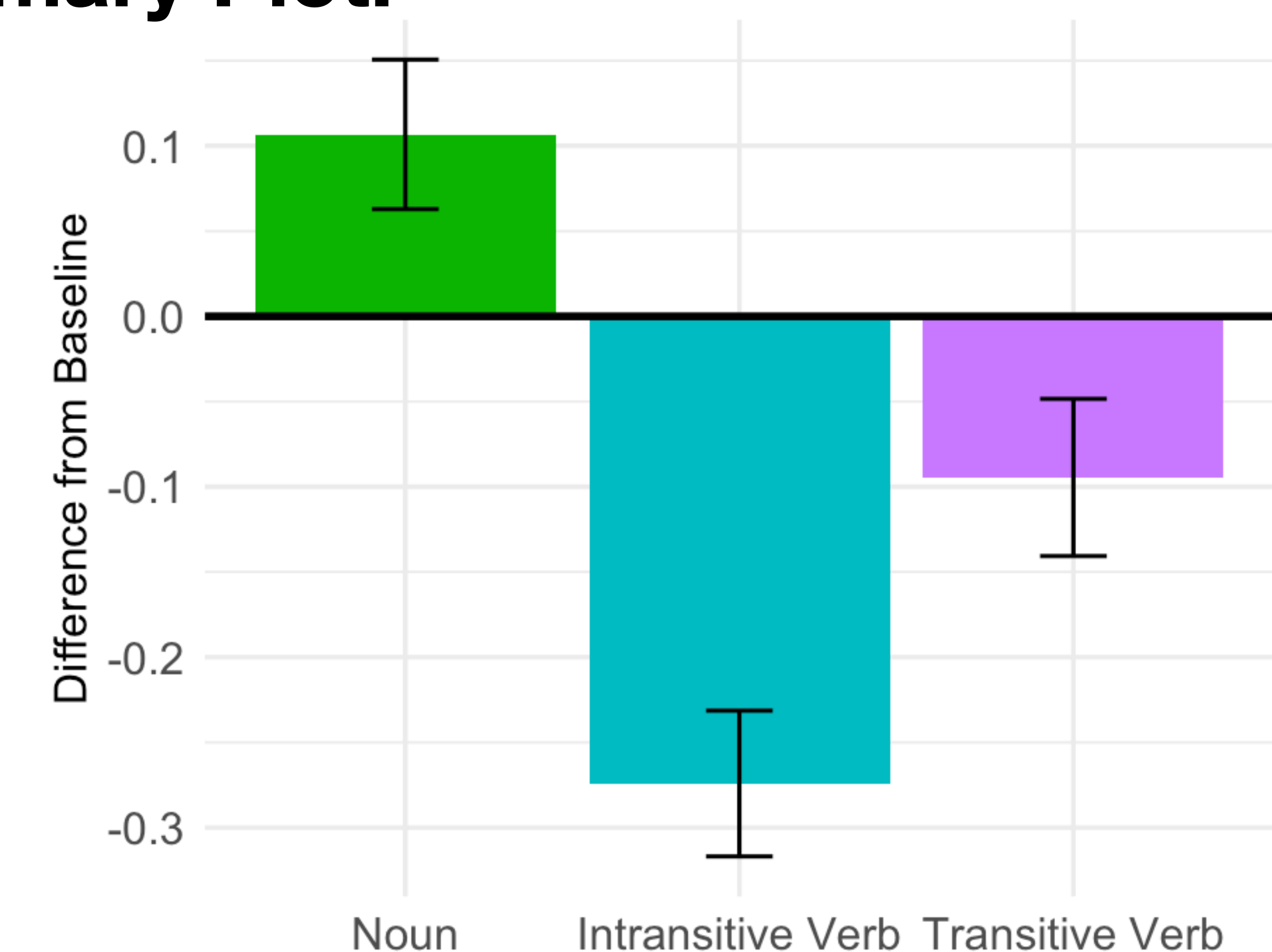
Condition	Option 1	Option 2
Truncated	he...	she...
Noun	he was a dax.	she was a dax.
Intransitive Verb	he daxed.	she daxed.
Transitive verb	he daxed her.	she daxed him.

Results and Discussion

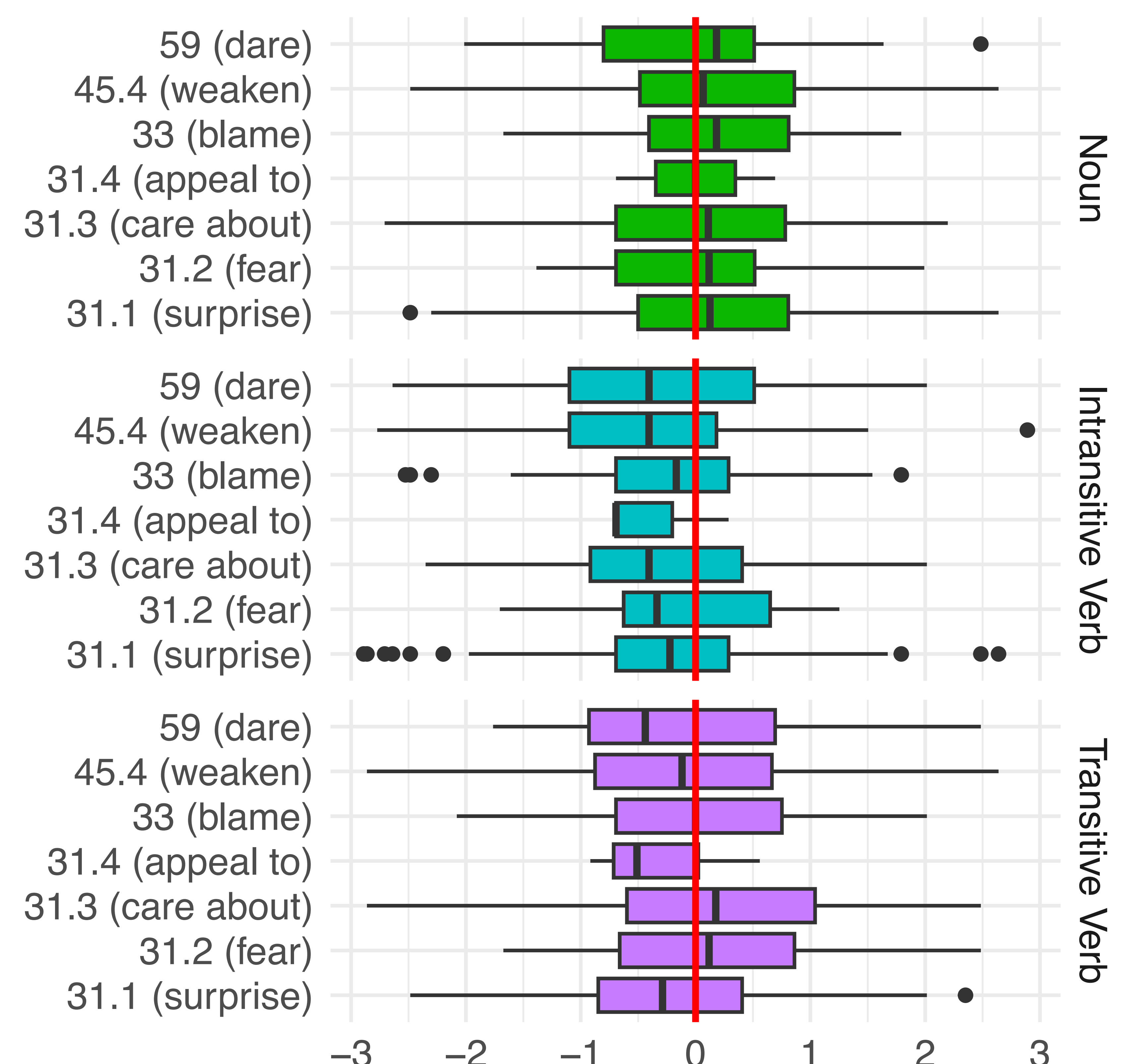
Compared with the truncated condition...

- the noun condition was more subject-biased
 - $\beta = 0.15$, $p = .026$
- the verb conditions were more object-biased
 - intransitive: $\beta = -0.50$, $p < .001$
 - transitive: $\beta = -0.19$, $p = .007$

Summary Plot:



Detail Plot:



CONCLUSION:

Predicate form influences pronoun interpretation even without detailed lexical or world knowledge.