The Subject-Object Asymmetry in Embedded Questions: Evidence from the Maze

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Today’s Talk

- Revisiting the Subject-Object Asymmetry
  - Canonical alignment configurations guide expectations during dependency processing beyond relative clauses

- Another way to analyze Maze data ➜ Incremental Error Rates

1. Subject-Object Asymmetry

- Relative clause (RC) processing in several languages is known to exhibit a *subject-advantage*: Subject RCs (SRC) are processed faster and with greater accuracy than Object RCs (ORC).

(1) The tortoise [that ___ chased the hare] was exhausted.
(2) The tortoise [that the hare chased ___] was exhausted.

1. Subject-Object Asymmetry + Animacy

- The penalty for processing ORCs is attenuated, or completely eliminated, for inanimate RC heads:

(3) The article [that ___ criticized the politician] was lengthy.

(4) The article [that the politician criticized ___] was lengthy.

- Animate nouns are more frequently modified by SRCs than ORCs in production (Gennari & MacDonald 2008) and various corpora of written texts (Roland et al. 2007).
- Processing is facilitated when semantic prominence and canonical grammatical function are aligned -- animate nouns are typically subjects, and inanimate nouns are typically objects (Traxler et al. 2005, Bornkessel-Schlesewsky & Schlesewsky, 2009, Wagers & Pendleton 2016)

1. Universal Subject-Object Asymmetry?

- The subject-object asymmetry is claimed to be a universal processing principle across languages (Lau & Tanaka 2021), though notable exceptions linger (e.g. Mandarin Chinese (Bulut et al. 2018), Basque (Carreiras et al. 2010))
- Research on this asymmetry primarily focuses on relative clauses across languages ➜ claims of universality require investigations into other kinds of constructions
- Related dependencies, even in the same language, can show distinct processing profiles, modulated by the utilization of different classes of linguistic information (Pizarro-Guevara & Wagers, 2020).

2. Preposition-Embedded Questions (EmbQs)

(5) The question of [which tortoise ___ chased the hare] was answered.

(6) The question of [which tortoise the hare chased ___] was answered.

- EmbQs are superficially similar to RCs in English: post-nominal, *wh*-dependency, allow subject/object gaps

- EmbQs are, however, necessarily distinct: prepositional complements, head noun (*tortoise*) follows the *wh*-word, canonical *wh*-movement of the entire *wh*-phrase, semantically similar to free-relatives

2. Preposition-Embedded Questions

- Both S/O EmbQs are relatively rare in CoCA (Davies, 2008), but Object EmbQs are significantly more common ($\chi^2 = 23.215$, $p < 0.001$)

Preposition Embedded Question	**Raw Frequency**
Subject	34
Object	87

Animate Head	Inanimate Head
7	27

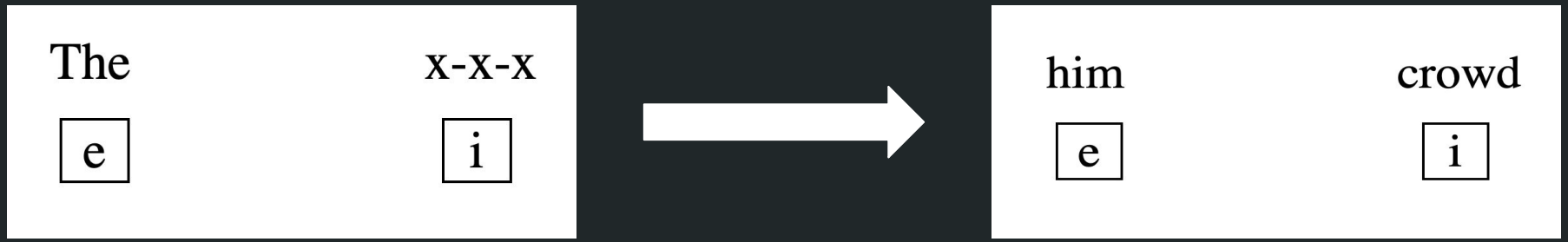
$\chi^2 = 11.765$, $p < 0.001$

Animate Head	Inanimate Head
2	85

$\chi^2 = 79.184$, $p < 0.001$

3. Maze

- Each word in the sentence is presented as a choice between two words, one of which is always a better continuation than the other.
- The task forces highly incremental processing, and RT data provides a localized measure of processing cost at each word
- Trials end prematurely when participants choose the incorrect continuation, and these error rates across trials can reflect sustained integration costs across areas of interest.

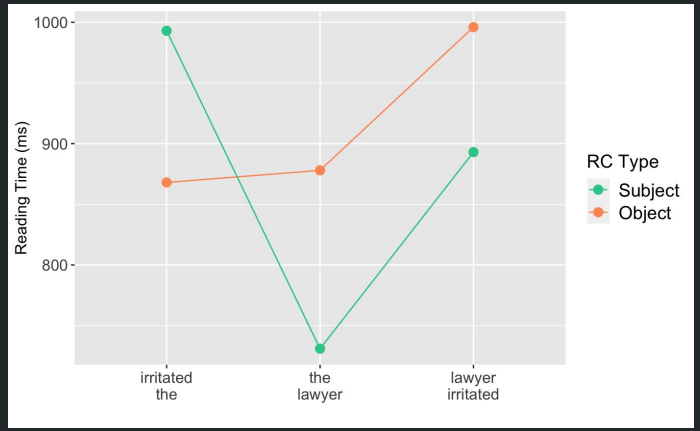


3. The Subject-Object Asymmetry in the Maze

- Using the Maze task, Forster et al. (2009) replicate the Subject-Object Asymmetry in RCs, and find that Object RCs are more difficult to process than Subject RCs.
- A word-by-word analysis reveals that the locus of difficulty in Object RCs is the determiner *the*, whereas the following noun and verb show no significant RT differences across RC type:

Table 2
Mean Selection Time for Each Word in the Relative Clause (in Milliseconds) for Subject and Object Relatives (Experiment 1)

	Word Type		
	Article	Noun	Verb
Subject relatives	731	893	993
Object relatives	868	878	996
Difference	137	−15	3



4. Present Study

Does the Subject-Object Asymmetry emerge in constructions with which we have relatively little linguistic experience?

YES: Canonical thematic alignment configurations drive the expectations that guide dependency processing

NO: Construction specific probabilities drive the expectations that guide dependency processing

4. Design and Materials

- 40 participants (3 removed due to low accuracy; 37 remain for analysis)
- 40 items crossing {Animate, Inanimate} x {Subject, Object} in the Maze task
- 60 fillers with similar embedded complexity (SRC, ORC, *wh*-clauses)

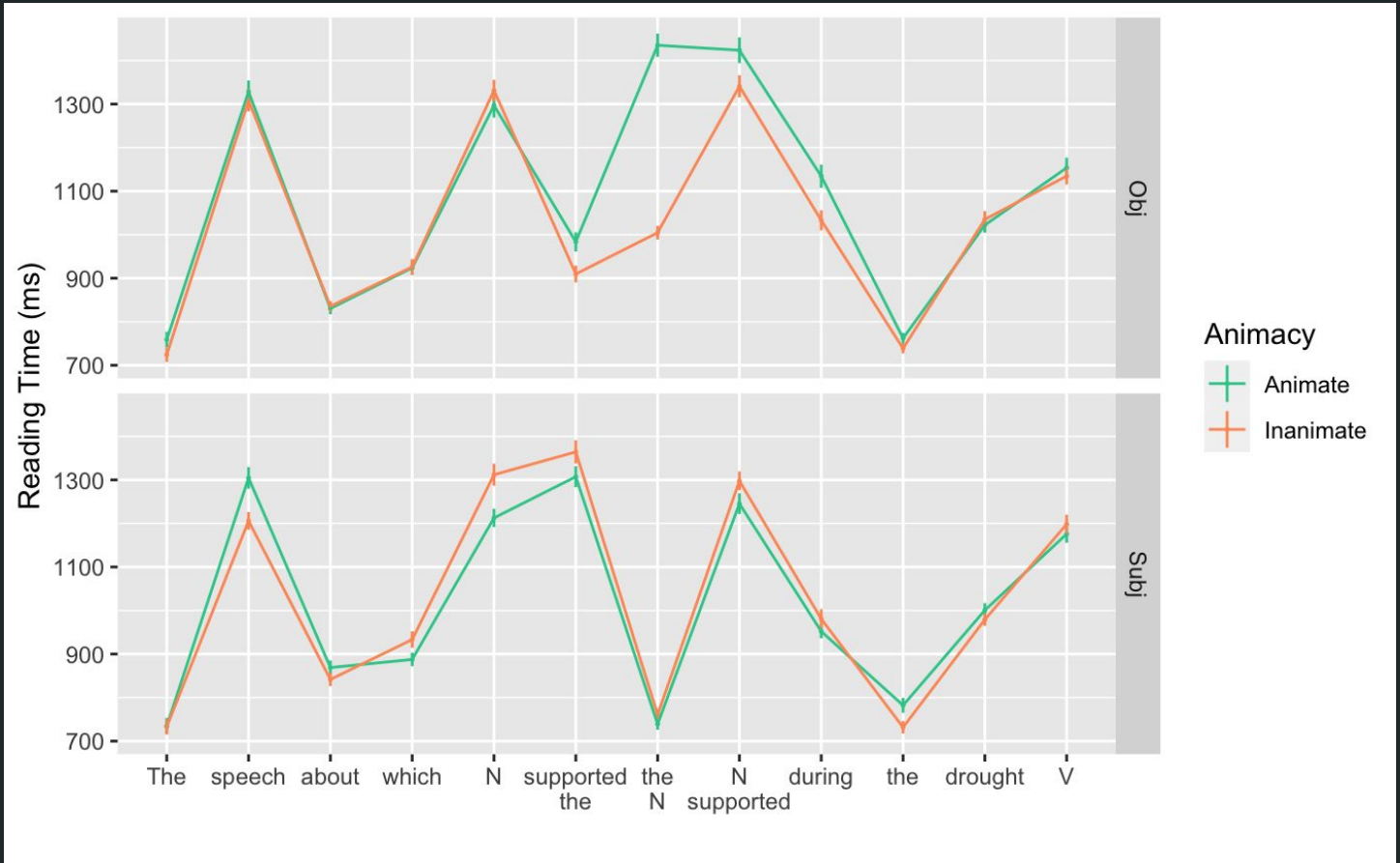
(7a) The speech about [which farmer ___ supported the policy] ... went viral ...

(7b) The speech about [which farmer the policy supported ___] ... went viral ...

(7c) The speech about [which policy ___ supported the farmer] ... went viral ...

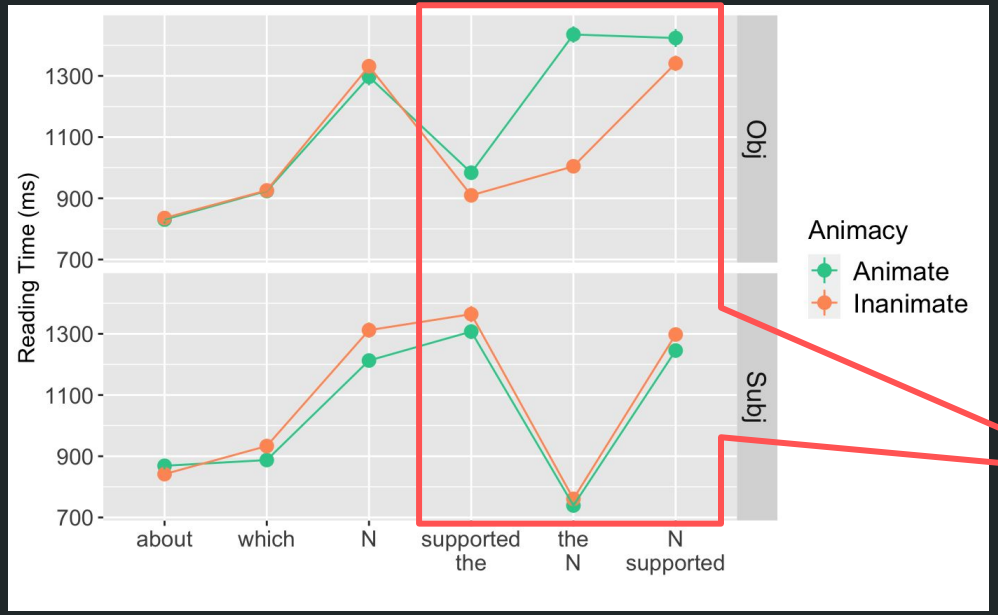
(7d) The speech about [which policy the farmer supported ___] ... went viral ...

4. RT Results


Reading Time (ms)
1300
1100
900
700
Obj
Subj
The
speech
about
which
N
supported
the
the
N
N
supported
during
the
drought
V
Animacy
Animate
Inanimate

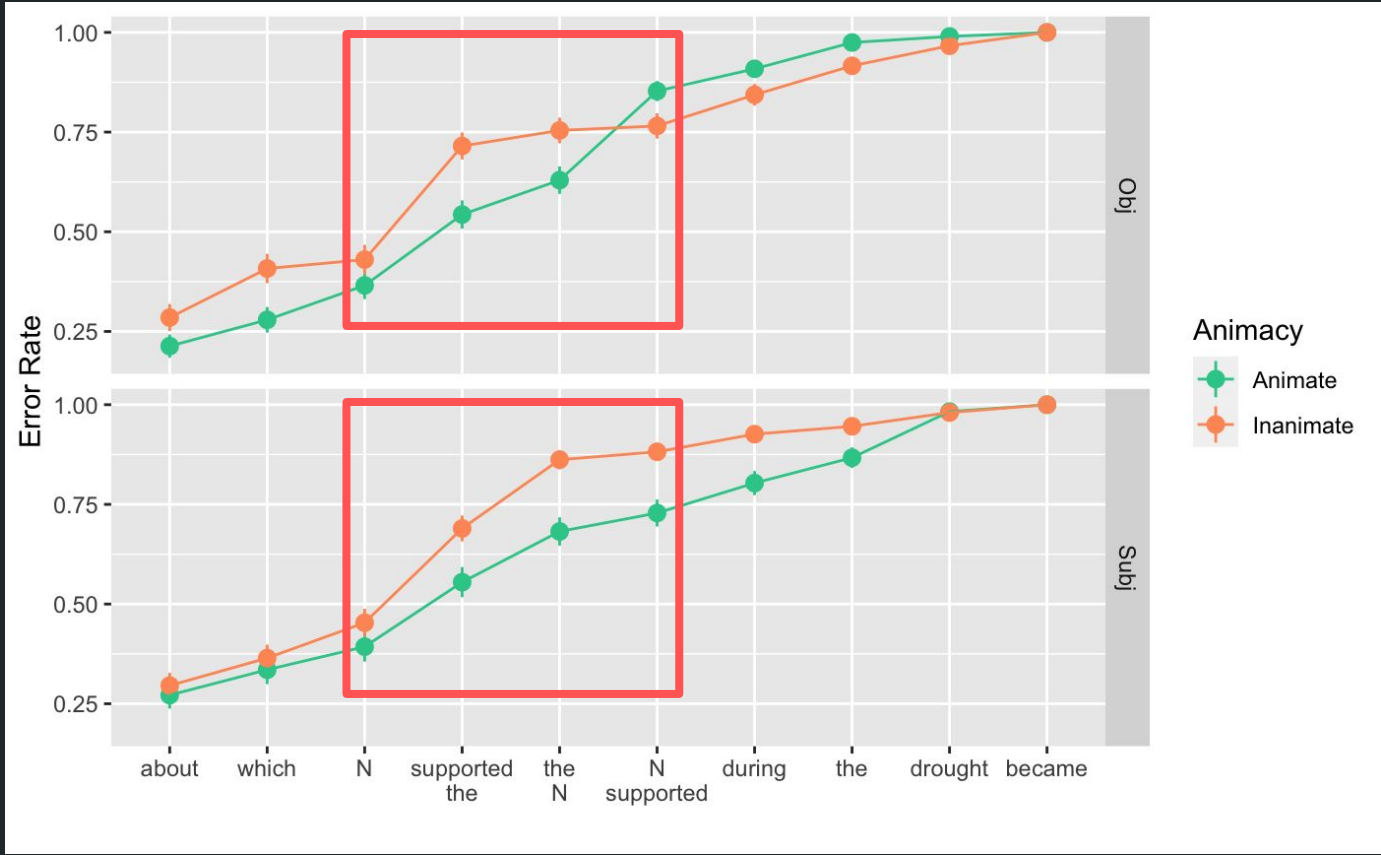
4. RT Results

- Across, the EmbQ region, linear mixed-effects regression of RTs on EmbQ type and Animacy revealed a two-way interaction: Object EmbQs were read slower than Subject EmbQs, but *only* in the animate conditions (t = 3.5; p < 0.001).

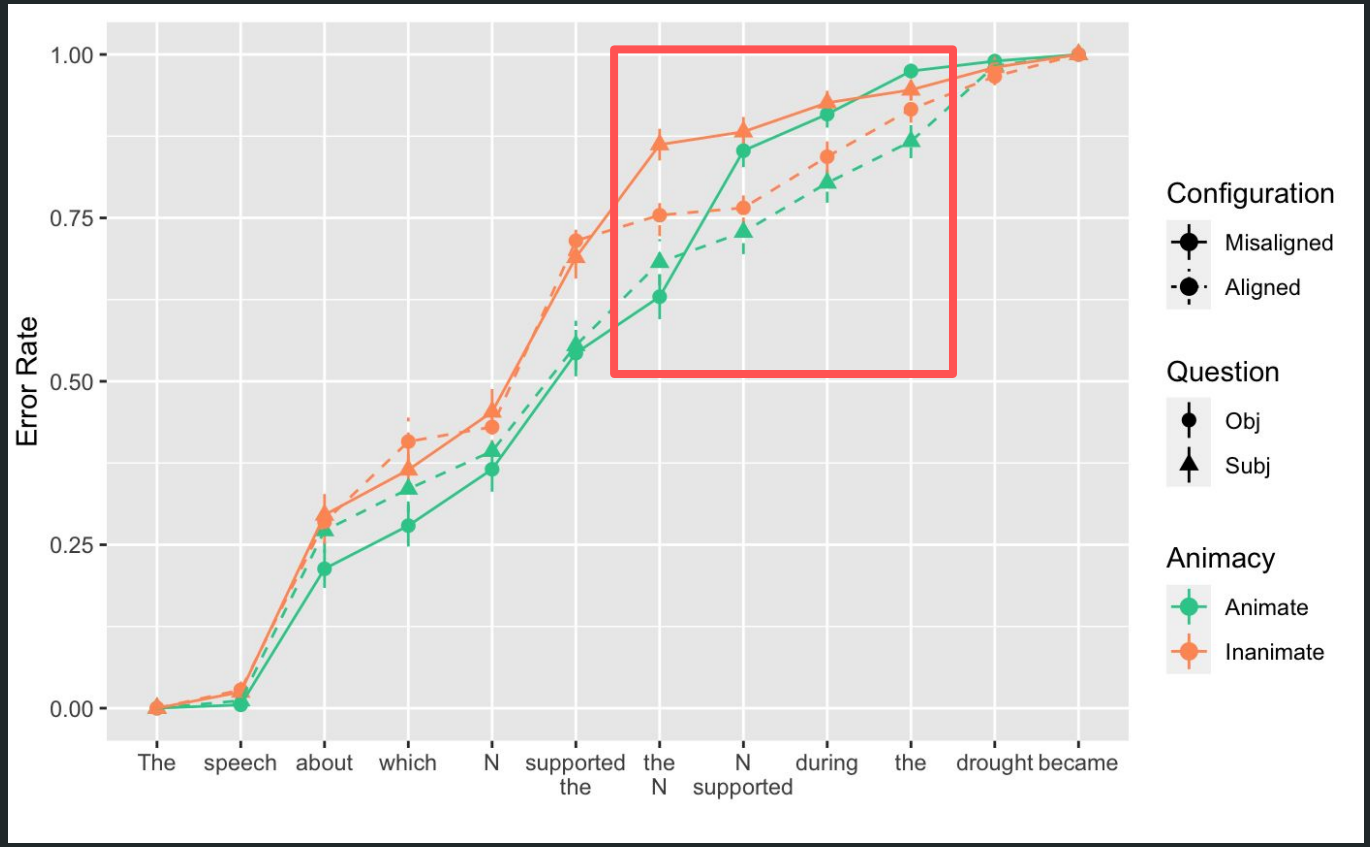


Question x Animacy interaction:
t = 3.5, p < .001

4. Normed Error Rates Across Trials



4. Normed Error Rates Across Trials



4. Normed Error Rates Across Trials

- Immediately following the point at which the RT asymmetry emerges in the EmbQ region, a trend in incremental error rates emerges according to typical alignment of animacy and thematic roles:

  Animate Subject EmbQs and Inanimate Object EmbQs (**aligned configurations**) elicit a smaller error rate than Inanimate Subject EmbQs and Animate Object EmbQs (**misaligned configurations**)

- No significant effects or interactions across the EmbQ region.

	Anim-Subject	**Inan-Subject**	**Anim-Object**	**Inan-Object**
Error Rate	72 %	88 %	85 %	76 %

5. Conclusions

- Replication of the animacy-conditioned Subject-Object Asymmetry using Preposition Embedded Questions: Object EmbQs are read slower than Subject EmbQs, but *only* when the EmbQ head is animate
- Trend in incremental error rates patterns with canonical thematic role configurations: Inanimate Subject EmbQs and Animate Object EmbQs (aligned) drive a greater increase in errors than do Animate Subject EmbQs and Inanimate Object EmbQs (misaligned)

❖ Processing is facilitated in when semantic prominence and grammatical roles are aligned, and inhibited in misaligned configurations ➜ the Subject-Object Asymmetry reflects construction-general expectations regarding animacy and thematic/grammatical function

Thank you!

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