The Locus and Nature of the Object-Extracted Relative Clause Penalty

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Rationale

The subject- and object-extracted relative clause (SRC and ORC) processing asymmetry in English:

SRC sentence:
The soldier *who roughly pushed the sailor* smashed a bottle against the bar.

ORC sentence:
The soldier *who the sailor roughly pushed* smashed a bottle against the bar.

• ORCs are more difficult to process than SRCs.

• **Why this "ORC penalty"?**
  Memory-based accounts
  • due to costs associated with retrieving the modified NP (*The soldier*) for integration at the RC verb (*pushed*), which is done over greater distance in ORCs than in SRCs [1] [2]
  Expectancy-based accounts
  • due to reanalysis of a default SRC parse, with this default attributed to structural frequency [3] or to constraints on structural processing [4] [5]
  Hybrid accounts
  • posit core roles for both of these sources of processing difficulty [6]

• **Predictions for the locus of processing difficulty**
  Memory-based   →   ORC verb (*pushed*)
  Expectancy-based →   ORC subject (*the sailor*)
  Hybrid   →   ORC subject *and* ORC verb

  • **The findings to date have not revealed a consistent locus of the ORC penalty (compare [2] [6] [7]).**

• **Purpose of the present study:**
  to test between these models by investigating the locus of the ORC penalty under different task conditions
          EX1: Eye Tracking
          EX2: L-Maze

EX1: Eye Tracking

Materials: 28 SRC/ORC sentences, 84 fillers.
**Participants:** 36 UA students, English NSs
Task: Eye tracking during single-sentence reading; Y/N comp. questions after 42 sentences

→ sentences (adapted from those in [8]) were comparable to those in Staub (2010, EX1), but included an adverb "buffer" (*roughly*) between the ORC subject (*the sailor*) and verb (*pushed*)
→ allows for clearer indications of independent processing costs at these points

EX1: Results

The soldier who…

SRC (orange) / ORC (blue)

* *p* <.05
** *p* < .01
*** *p* < .001

the sailor

roughly
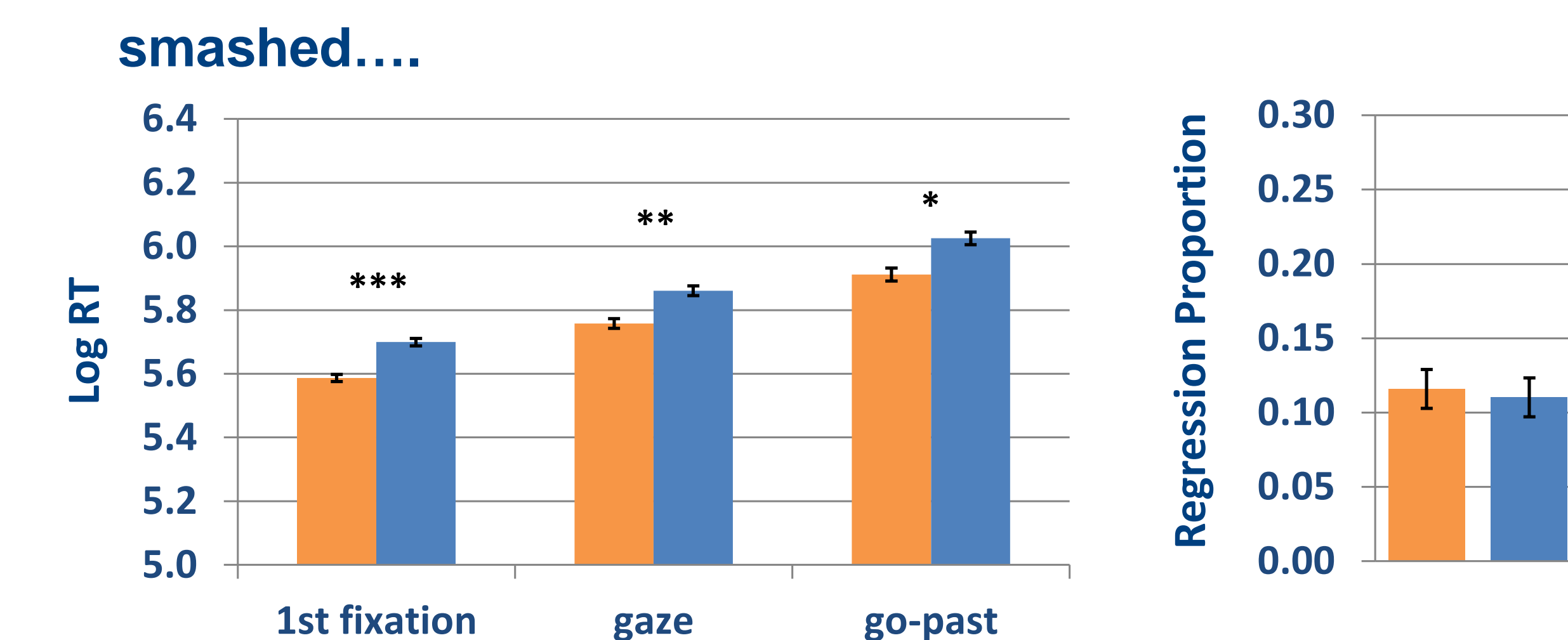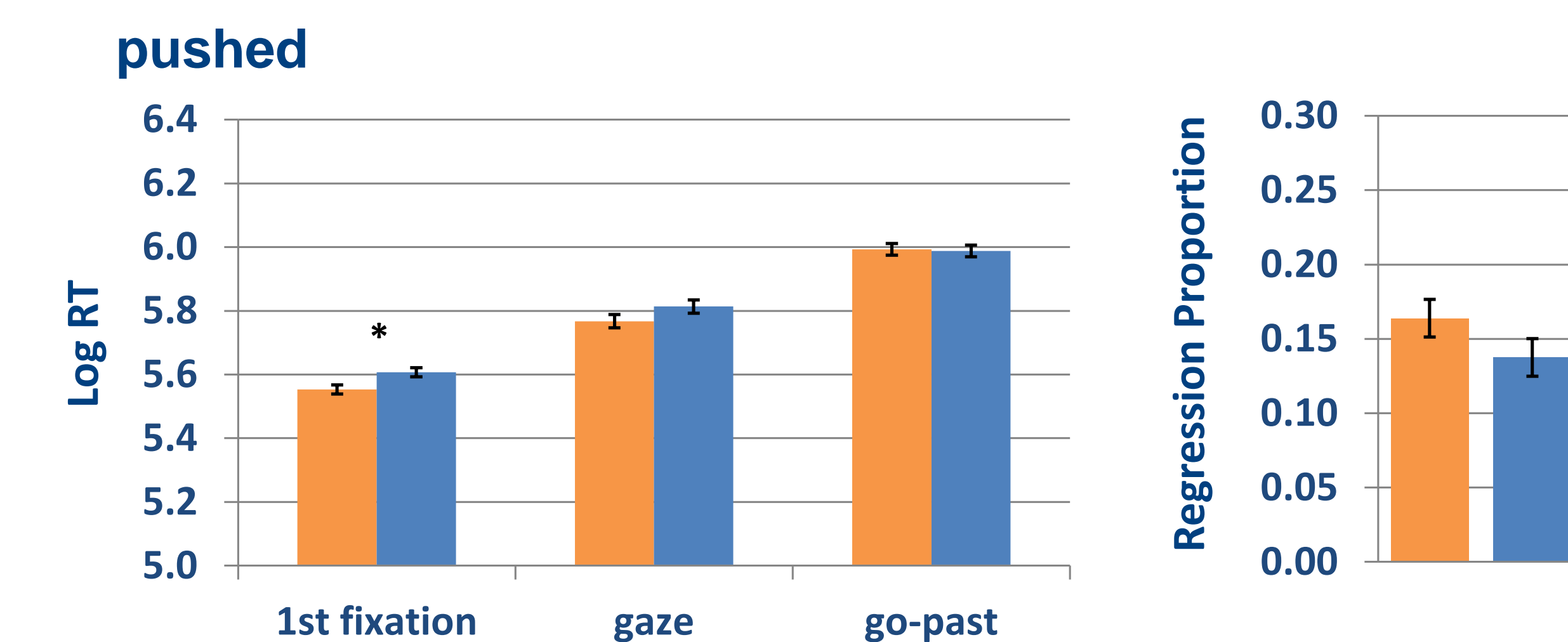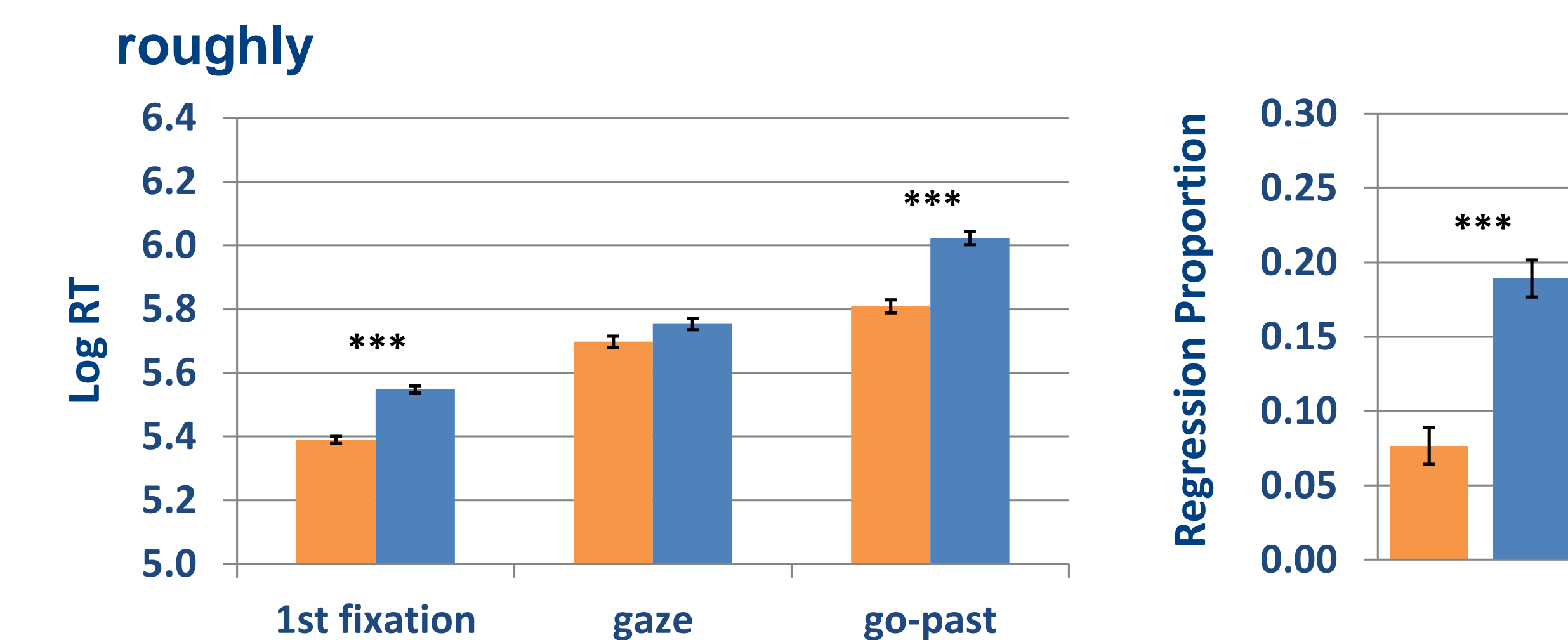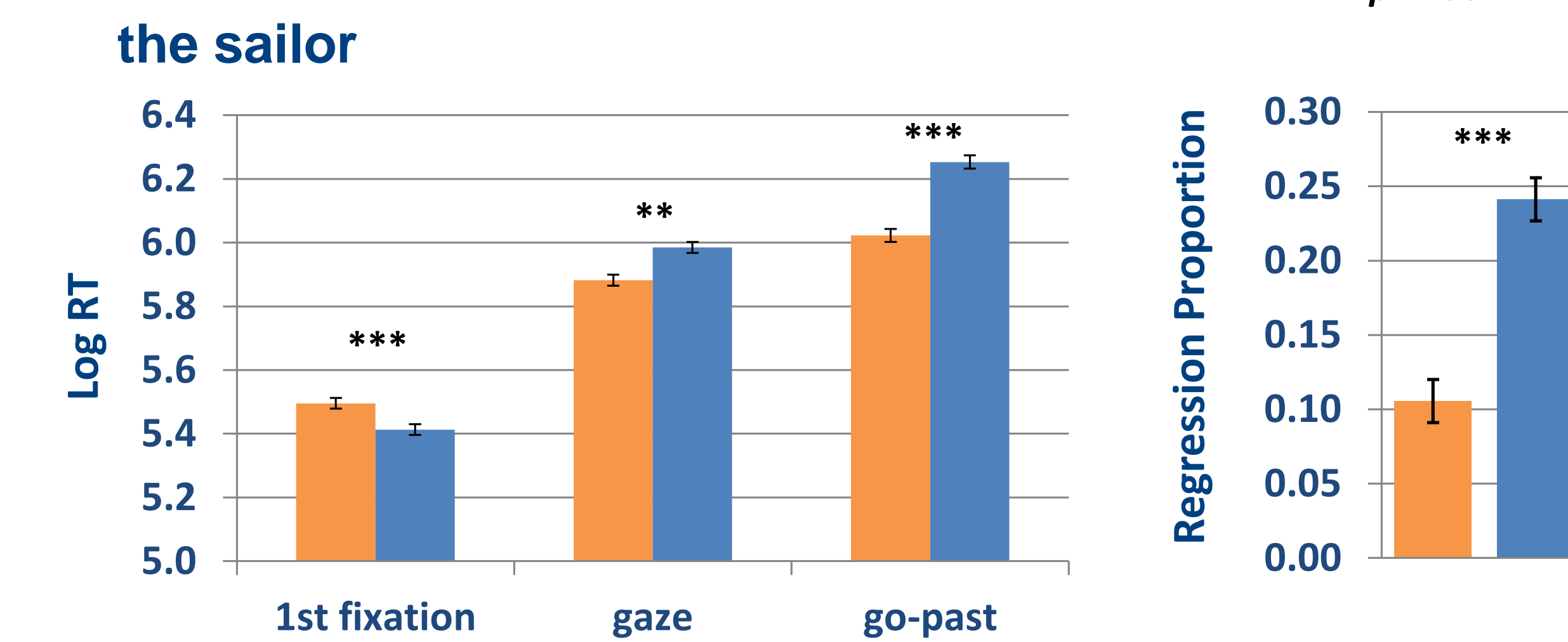
pushed

smashed….

	RC NP	RC Adverb	RC Adverb	MC Verb
	the sailor	*roughly*	*pushed*	*smashed…*
1st fixation				
ORC	224	257	272	299
SRC	244	219	258	267
RC effect	-20***	38***	14*	32***
gaze				
ORC	397	315	335	351
SRC	359	298	320	317
RC effect	38**	17^	15	34**
go-past				
ORC	519	413	398	414
SRC	413	333	401	369
RC effect	106***	80***	-3	45*

EX1: Discussion

In line with a hybrid model, the results indicate separable processing costs for disconfirmed syntactic expectancies and for long-distance integration.

• ORC subject and immediately following adverb → robust ORC penalty under multiple measures

• ORC verb → relatively weak 1st fixation duration effect, with robust indications of the ORC penalty picking up again at the immediately following MC verb

EX2: L-maze Task

Materials: same as in EX1
**Participants:** 48 UA students, English NSs
Task: L-maze [7]

L-maze Item	
The	xxx
pig	mip
giffly	quietly
strell	walked
into	ip
the	sen
lote.	pen.

• If processing costs at the ORC subject and ORC verb are triggered by independent sources, these effects should be isolable under certain task conditions.

• Eye tracking and self-paced reading use comprehension questions to ensure that participants process the input.

  • emphasizes the need not only to understand who did what to whom, but also to *remember* this information.

  • under these conditions, ORC penalty effects related to memory might be heightened.

• L-maze engages syntactic processing without requiring an additional memory task.

  • should only show ORC penalty effects related to disconfirmed syntactic expectancies.
    → processing difficulty at the ORC subject

• If processing difficulty at the ORC subject relates to the violation of syntactic expectancies, this effect should be obtained at the first element that indicates the impossibility of the preferred SRC parse (as in Forster et al. (2009)).
    → processing difficulty at the article in the ORC subject (*The soldier who **the** sailor…*)

EX2: Results and Discussion

The soldier who…

the sailor roughly pushed smashed…
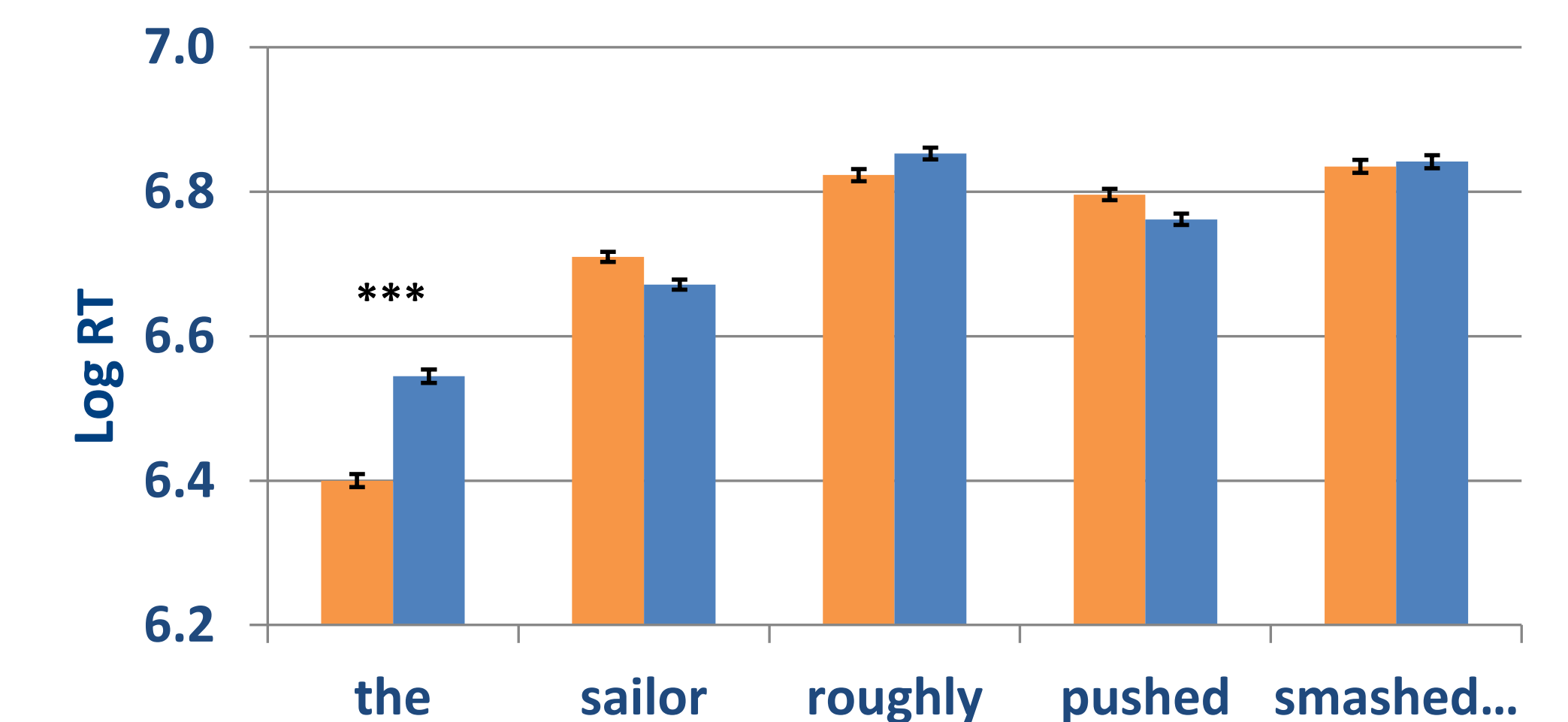
• **ORC penalty only at the article in the ORC subject.**

  • Processing costs at the ORC subject and ORC verb are isolable under specific task conditions; relate to independent sources.

  • Processing difficulty at the first element that can disconfirm an SRC parse (and trigger reanalysis) further suggests that this effect relates specifically to disconfirmed syntactic expectancies.

General Discussion

• Taken together, EX1 and EX2 provide clear support for a hybrid model of the ORC penalty.

• This model offers a framework for investigating factors that have been found to modulate RC processing difficulty, such as
  • working memory capacity [5]
  • animacy, semantic similarity, and frequency of the modified noun and the noun(s) in the RC [1] [5] [9]
  • plausibility [10]

  By manipulating these factors under different task conditions and examining the loci of processing difficulty, a more complete model of RC processing can be developed.

References

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