

## Discourse expectations are sensitive to the Right Frontier Constraint

Runyi Yao, Daniel Altshuler and E. Matthew Husband (University of Oxford)

When processing discourse, comprehenders continually generate discourse-level expectations, such as expectations for the causal relationships between the current and the upcoming discourse segments, i.e., coherence relations [1][2]. A well-established finding in expectation-driven discourse processing is that comprehenders use implicit causality (IC) verbs, a class of verbs that guide causal inferences, to predict upcoming EXPLANATION (cause-effect) relations [3]. Recent evidence suggests that when IC-driven discourse expectations are not immediately fulfilled, they can be maintained across at least one intervening discourse unit [4]. Meanwhile, an open question remains whether the maintenance of such discourse expectation is constrained by discourse properties, such as the Right Frontier Constraint (RFC).

The RFC is a constraint on discourse attachment and anaphora resolution [5][6]. It posits that in the Segmented Discourse Representation Theory (SDRT) framework [7], new utterances can only be attached to the right frontier of the existing discourse structure and that a Coordinating relation (e.g. '(and) then' NARRATION) extends the right frontier of a discourse, whereas a Subordinating relation (e.g. '(who is)' BACKGROUND) does not (see Table 1 for examples; see [8] for SDRT's subordinating / coordinating relations). While the RFC is well integrated into a theory of discourse coherence, few studies have investigated its role in online discourse processing [9]. To address this gap, this study examines whether readers are sensitive to the RFC during online discourse processing by investigating whether it blocks IC-driven EXPLANATION expectations in English.

**Prediction.** Since an IC-driven Expectation is a Subordinating unit that must attach to the IC clause [8], its maintenance depends on the accessibility of that clause for attachment. We predicted that IC-driven expectations are sensitive to the RFC: They will be maintained across a Subordinating intervening unit but blocked by a Coordinating intervening unit, which pushes the RFC forward and renders the IC clause inaccessible for further attachment.

**Methods.** In a sentence-by-sentence self-paced reading study (N=65), 36 experimental items were manipulated based on Verb Type (IC vs. non-IC) and Intervening Sentence Type (Coordinating vs. Subordinating) (Table 1). Items were counterbalanced and intermixed with 36 fillers. A norming study (N=30) using a likelihood judgment task (Table 2) confirmed that intervening sentences were not perceived as plausible explanations, whereas target sentences were deemed highly plausible explanations for IC verbs. These results validate the experimental design by ensuring that intervening sentences do not fulfill IC-driven expectations.

**Results.** We analyzed the data using linear mixed-effects models with maximal random effects. Figure 1 displays model-estimated RTs for each sentence across conditions. On the target sentence, we found a significant main effect of verb type ( $\beta = -68.48$ ,  $t = -2.89$ ,  $p = .005$ ), indicating faster reading times for IC conditions compared to non-IC conditions. As predicted, a significant interaction was observed between verb type and intervening unit type ( $\beta = -113.61$ ,  $t = -2.20$ ,  $p = .03$ ). Post-hoc comparisons using *emmeans* showed a significant difference between IC and non-IC conditions in the Subordinating condition ( $\beta = -125.3$ ,  $t = -3.54$ ,  $p = .0015$ ), but not in the Coordinating condition ( $\beta = -11.7$ ,  $t = -0.34$ ,  $p = .74$ ). This indicates that the IC-driven expectations only facilitated processing when the intervening unit was Subordinating, supporting our hypothesis that the RFC blocks IC-driven expectations. In addition, no significant effects were observed on either the intervening sentence or the spillover sentence.

**Discussion & Conclusion.** This study demonstrates that IC-driven expectations are sensitive to the RFC, indicating the RFC can rapidly influence how readers anticipate and structure discourse in real time. However, we did not observe a slowdown in IC-coordinating conditions, which might have indicated difficulty establishing EXPLANATION relations due to an RFC violation. This suggests participants either did not attempt to establish such relations or the RFC violation imposed no significant processing cost. Future studies may further investigate this question.

Introductory sentence		Bill manages many international employees.
IC	Subordinating	This morning he fired Jenny. Jenny is Austrian.
IC	Coordinating	This morning he fired Jenny. Jenny then walked into her office.
Non-IC	Subordinating	This morning he talked to Jenny. Jenny is Austrian.
Non-IC	Coordinating	This morning he talked to Jenny. Jenny then walked into her office.
<b>Target sentence</b>		<b>She had been embezzling money for years.</b>
Wrap-up		It was big news for everyone.

Table 1. Sample experimental item. All intervening sentences in Subordinating conditions are BACKGROUND, which provide additional information about the described event; all intervening sentences in Coordinating conditions are NARRATION, which advance the story.

Bill manages many international employees. This morning he fired Jenny. We know one more thing:	
a. Jenny is Austrian.	[Subordinating intervening sentence]
b. Jenny then walked into her office.	[Coordinating intervening sentence]
c. Jenny had been embezzling money for years.	[Target sentence]
<b>Question:</b> How likely do you think Bill fired Jenny because {she is Austrian\she then walked into her office\she had been embezzling money for years}?	

Table 2: Sample judgment task. Participants were instructed to respond on a four-point Likert scale. The conditions were counterbalanced using a Latin Square design, so that participants saw all narratives but never the same narrative across multiple conditions.

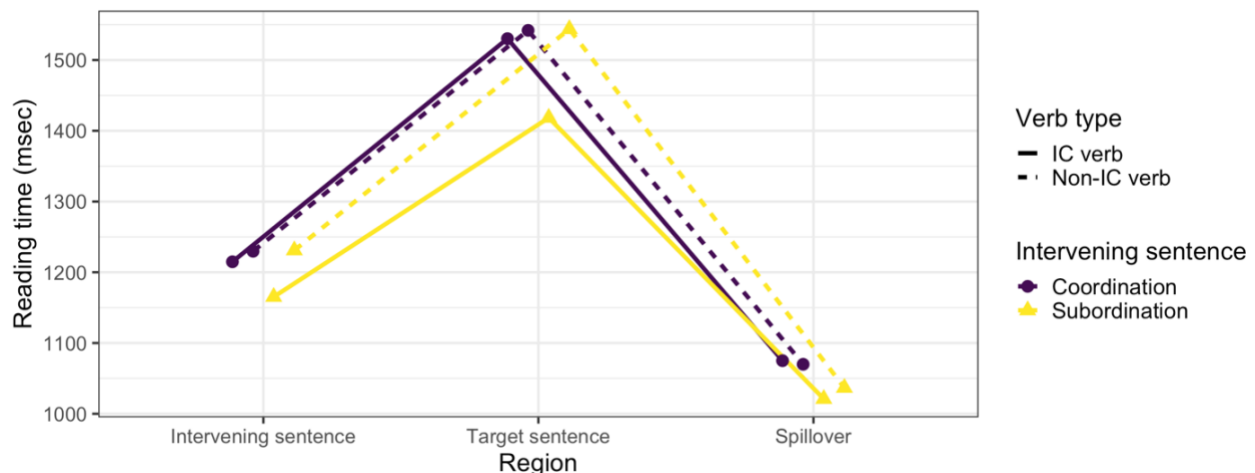


Figure 1. Model estimated reading times on the intervening sentence, the target sentence and the spillover per condition.

**Reference.** [1] Rohde, H., Levy, R., & Kehler, A. (2011). *Cognition*, 118(3), 339–358. [2] Rohde, H., & Horton, W. S. (2014). *Cognition*, 133(3), 667–691. [3] Kehler, A., Kertz, L., Rohde, H., & Elman, J. L. (2008). *Journal of Semantics*, 25(1), 1–44. [4] Hoek, J., Rohde, H., Evers-Vermeul, J., & Sanders, T. (2021). *Cognition*, 210, 104581. [5] Polanyi, L. (1988). *Journal of pragmatics*. [6] Webber, B. (1988). *26th annual meeting of the association for computational linguistics*. [7] Asher, N. & Lascarides, A. (2003). Cambridge University Press. [8] Asher, N & Vieu, L. (2005). *Lingua*. [9] Sasaki, K. M. (2021). PhD dissertation UCSC.