

Eager interpretation of discourse-level ambiguities: New evidence for costly reanalysis
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Some aspects of linguistic input receive a preferred interpretation as soon as they are encountered, as supported by slowdowns during reading attributed to costly reanalysis, for syntactic ambiguity [1,2] and homonymy [3]. But evidence of costly reanalysis in reading has been hard to pin down for discourse-level ambiguities, like ambiguous inter-sentential pronouns [4,5], temporal ordering [6,7], or uncertain causal inferences between discourse segments [8]. While we know comprehenders have robust off-line preferences [9,10], and asymmetries in on-line expectations [11,12], an absence of costly reanalysis is ultimately compatible with a hypothesis of **Discourse Underspecification**, the claim that incremental representations maintain uncertainty for discourse-level meaning [8,13] in a way they do not for e.g. homonymy.

In two pre-registered English self-paced reading experiments, we show this claim has exceptions. When we look at narratives where discourse ambiguities are subject to especially strong preferences, we can, in fact, see evidence for costly reanalysis. We conclude that discourse meaning can, in some cases, receive rapid interpretation.

Experiment 1 We normed 64 narratives (1) with coordinated clauses S2a & b, where S2b contains an object pronoun *her*. The coordinations admit two readings distinct in discourse coherence and the antecedent of *her* [9]: a list of parallel events where *her* refers to the **Object** of S2a, or a cause-effect sequence where *her* refers to the **Subject**. We elicited forced-choice resolutions of *her* ($n = 30$) and replicated [9]’s strong preference for the Object reading (80%). Still, S3 could later disambiguate to the Subject reading (94%) via the adverbial *in return*.

The 32 narratives with the largest bias reversals were retained for an SPR experiment ($n=96$), alongside 60 fillers, incl. 28 where Object readings were reinforced. We compared (Table 1a) a critical ambiguous condition with Subject-reading disambiguation in S3, to three conditions with an unambig. subject pronoun or no pronoun. Marginal comparisons diagnose slower reading for the ambiguous condition in S3 at the disambiguating region and its spillover (Table 2a), not easily explained in terms of expectations alone (viz. no contrast in GPT-2 surprisals [2]). This is consistent with costly reanalysis of an initial Object reading. Comparisons at the S2 pronoun region show unambig. subj. pronouns also slowed reading (unlike unambig. obj. pronouns in fillers); anticipated coherence may have influenced expectations for S2b content, as in e.g. [12].

Experiment 2 We normed 48 narratives (2) containing a sequence (S2, S3) with two readings distinct in discourse coherence and temporal order: S3 either moves **Forward** in time, describing a result of S2, or **Backward**, describing a cause. S2s featured object implicit causality verbs (e.g. *sued*), known to drive a Backward bias [9]. We elicited forced-choice temporal order judgments ($n = 30$), confirming that bias here (75%). Still, S3 could retroactively disambiguate to the Forward reading (88%) by the content of a subsequent *because* clause.

The 24 items with the largest bias reversals were used in another SPR experiment ($n = 90$), alongside 56 fillers, incl. 24 where Backward readings were reinforced. We compared (Table 1b) a critical ambiguous condition with late disambiguation, to two conditions where the order was unambiguous. Marginal comparisons diagnose slower reading for the ambiguous condition at the disambiguating region and its spillover (Table 2b), again without a GPT-2 surprisal contrast, consistent with costly reanalysis of an initial Backward reading. Comparisons within S3 show weaker effects, suggesting that temporal order may have been settled only after S3 offset.

Discussion These results speak against universal Discourse Underspecification in incremental reading; aspects of inter-sentential meaning seem to be specified rapidly in at least some cases. We think the contrast between these studies and other cases of reanalysis [14-16] vs. cases where no reanalysis costs emerge [4-8] is best explained if the timing of firm discourse interpretation is flexible, conditioned on the strength of the biases at play in a given text [17,8].

- (1) s_1 [The kids were misbehaving at a fancy dinner.] s_2 [Mia hit Winona with a pea and Ian kicked her under the table.]
 (s_3 [Mia didn't kick him in return, she simply went to get more peas.])
 > *Is it more likely that Ian kicked Mia or Winona?* (Mia, Winona)
- (2) s_1 [Tensions were high in the shops on Main Street.] s_2 [Phil sued Liz.]
 s_3 [She defaced his shop on Tuesday, with red paint] (, because his lawsuit was cruel.)
 > *Given the way the story was told above, which event most likely happened first?* (P sued L, L defaced P's shop)

Table 1a (L), 1b (R): Example stimulus sets from Expts. 1 and 2. Presentation was chunked (/ = boundary) and non-cumulative.

The kids/were misbehaving/at a fancy dinner.		Tensions were high/in the shops/on Main Street./Phil sued Liz...	
Ambiguous pronoun	Mia hit Winona/with a pea/ and/Ian kicked her/under the table.	Ambiguous order	She defaced his shop/on Tuesday,/with red paint,/ because his lawsuit/was cruel.
Unambiguous subject pronoun	Mia hit Harrison/with a pea/ and/Ian kicked her/under the table.	Progression adverb	She defaced his shop/in response,/with red paint,/ because his lawsuit/was cruel.
so + Unambig. subj. pronoun	Mia hit Harrison/with a pea/ so/Ian kicked her/under the table.	so + Progr. adv.	so she defaced his shop/in response,/with red paint,/ because his lawsuit/was cruel.
Unambiguous Name	Winona hit Harrison/with a pea/ and/Ian kicked Mia/under the table.		
Mia didn't kick him/in return,/ she simply/went to get more peas.		She was/ready to destroy his reputation/in the town.	

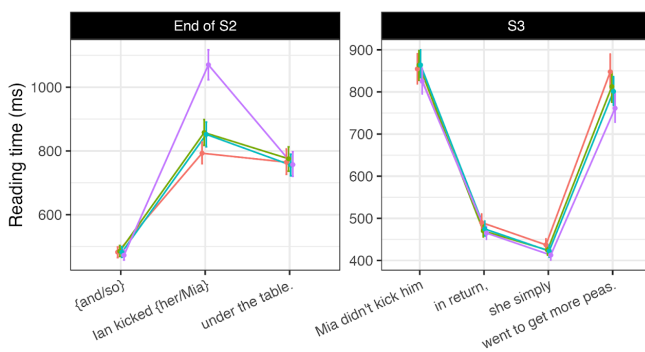


Figure 1: SPR latencies by region in Experiment 1.

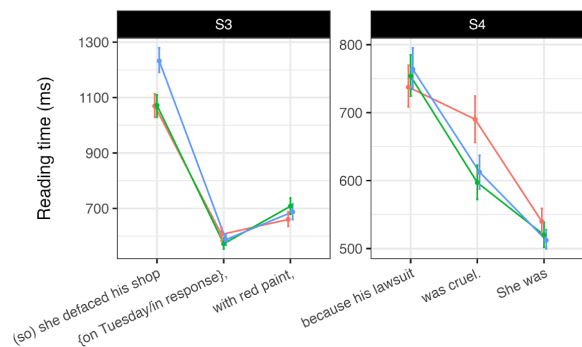


Figure 2: SPR latencies by region in Experiment 2.

Table 3a (L), 3b (R): Posterior estimates of marginal comparisons (in ms) from log-normal mixed-effects regressions fit in brms, with 95% highest-density posterior intervals (HDPIs). We take cases where the HDPI excludes 0 to be noteworthy. Models were fit using regularizing priors, and included slopes for trial number; comparisons were extracted for median trial. See materials for more details.

Comparison	lan kicked x	in return,	she simply	Comparison	with red paint,	was cruel.	She was
Ambig vs. All others	-52 (-74, -30)	11 (0, 22)	12 (4, 20)	Ambig vs. Advs.	-21 (-41, -1)	58 (34, 82)	22 (9, 36)
Ambig vs. Unambig prs.	-27 (-53, -1)	13 (0, 25)	14 (3, 24)	Adv. vs. so + Adv.	16 (-6, 39)	-8 (-26, 10)	4 (-10, 18)
Un. pr. vs. so + Un. pr.	2 (-25, 29)	-6 (-18, 7)	-1 (-12, 10)				

Pre-registrations and supplementary materials: Available here on OSF.

References [1] Frazier & Rayner (1982) *Cogn Psychol* [2] Huang et al. (2024) *J Mem Lang* [3] Duffy et al. (1988) *J Mem Lang* [4] Stewart et al. (2000) *J Mem Lang* [5] Stewart et al. (2007) *Q J Expt Psychol* [6] Dickey (2000) UMass Diss. [7] Sasaki (2021) UCSC Diss. [8] Duff (2023) UCSC Diss. [9] Kehler et al. (2008) *J Semant* [10] Marx & Wittenberg (2024) *Glossa Psycholing* [11] Arnold et al. (2000) *Cogn* [12] Kuperberg et al. (2011) *J Cogn Neuro* [13] Asher & Lascarides (2003) Cambridge [14] Gordon & Pearce (1995) *Mem Cogn* [15] Mak & Sanders (2010) in *Linguistics enterprise*, Benjamins. [16] Jones & Bergen (2024) *Lang Cogn* [17] Fishbein & Harris (2014) *J Mem Lang*