

## Explanation coherence inside sentences, but only offline

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A main task for comprehenders is determining what relationships hold between linguistic units in the course of understanding what messages speakers are trying to convey. Some of these relationships are what many formal theories of discourse call *coherence*, i.e., meaningful and sometimes non-obligatory relationships, not governed by syntactic or semantic constraints, but instead determined pragmatically by factors including a comprehender's world knowledge. For instance, Result (forwards causal) and Explanation (backwards causal) are two such coherence relations. Prior research has found that comprehenders generate expectations about coherence relations between sentences [1][2][3] and relative clauses [4], reflected in, e.g., faster processing when text matches coherence expectations. However, coherence within sentences has also been observed but not explored experimentally (e.g., *A jogger/teacher was hit by a car* → 'hit while jogging/\*teaching'; [5]; see also [4]). We investigated whether English comprehenders establish Explanation coherence between resultative adjectives within noun phrases and instruments of events that can cause such results, and, if so, whether this relation facilitates real time processing via an expectation-based mechanism. We manipulated the availability of an Explanation relation by changing the topichood of the result adjective-modified NP via Definiteness and Structure: Definite NPs are presuppositional and can serve as topics when they are subjects [7][8]. As topics, they can be interpreted outside the scope of an event quantifier [6], permitting backward causal inference between the NP's result state and the main clause event that is otherwise blocked.

**Study 1: Comprehension.** Structure (Active, Passive) and Definiteness (Definite, Indefinite) were manipulated to create 40 items, with the prediction that Definite Passives would permit coherence while other conditions would not (Table 1). Items were counterbalanced and intermixed with 40 fillers. 48 Prolific-recruited participants responded to comprehension questions probing Explanation coherence, i.e., the potential causal relationships between resultative adjectives (e.g., *broken*) and instruments of events (e.g., *a stone*), using a 7-point Likert scale (1 represents 100% Yes/7 represents 100% No). A cumulative link mixed model revealed a significant interaction ( $z = -3.23$ ,  $p = .001$ ), with Explanation most likely in the Definite Passive condition. Post hoc comparisons via *emmeans* confirmed that the effect of the Definiteness in the Passive (Est = -1.25) was larger than in the Active (Est = -0.44) (Table 2). This suggests that comprehenders used Definiteness and Structure as cues when establishing Explanation relations between resultative adjectives and associated instruments within sentences in offline processing.

**Study 2: Self-paced reading.** 101 Prolific-recruited participants performed a word-by-word SPR task on the same 40 experimental items in Study 1 and 40 fillers. Fig. 3 shows model estimated reading times on the critical instrument word (CW) and the three words preceding and following the CW. By region linear mixed effects models only revealed main effects of Structure on CW-2 (Est = -15.10ms,  $t = -2.58$ ,  $p < .05$ ), CW-1 (Est = -12.79ms,  $t = -2.30$ ,  $p < .05$ ), CW (Est = -17.69ms,  $t = -2.40$ ,  $p < .05$ ), CW+1 (Est = -13.21ms,  $t = -2.25$ ,  $p < .05$ ) and CW+2 (Est = -10.80ms,  $t = -2.06$ ,  $p < .05$ ). No interaction was found (all  $ps > .172$ ), suggesting that establishing coherence did not speed real time processing. The effects of Structure we found were perhaps due to a higher expectation for preposition phrases in the passive conditions.

**Conclusion.** While comprehenders used Definiteness and Structure to guide potential explanation coherence inferences between a resultative adjective and an instrument within a sentence, incremental reading times failed to show a related processing effect. Comprehenders, therefore, may only establish intra-sentential coherence offline, and perhaps only when cued by a comprehension question as they were in Study 1. However, this asymmetry of results may also be due to the coarse-grained nature of SPR reading times. Prior research on inter-sentential coherence finds online effects in later eye movement measures (e.g. rereading times, total reading times; [4][9]). Follow up research using eye movements is ongoing to investigate whether later eye movement measures reveal online processing effects of intra-sentential coherence.

Structure	Definiteness	Coherence (expected)	Sentence
Passive	Definite	Yes	The broken window was struck by a <u>stone</u> from the sidewalk next to the building.
Passive	Indefinite	No	A broken window was struck by a <u>stone</u> from the sidewalk next to the building.
Active	Definite	No	Bethany struck the broken window with a <u>stone</u> from the sidewalk next to the building.
Active	Indefinite	No	Bethany struck a broken window with a <u>stone</u> from the sidewalk next to the building.
<b>Question</b>			Was the window broken because of the stone?

Table 1 Sample Experimental Item

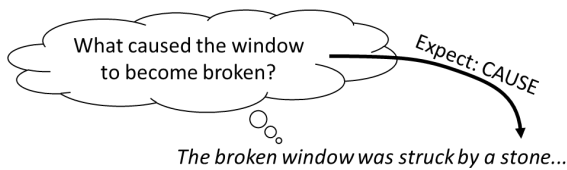


Figure 1 An illustration of the expectation generation in coherence between resultative adjectives and instruments.

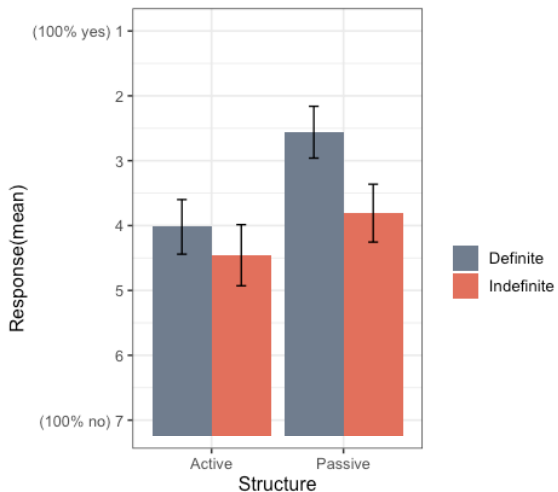


Figure 2 Mean ratings of an Explanation relation in Exp 1.

	Est	SE	z	Pr (>  t )
Structure	-1.03	0.19	-5.43	<.001***
Definiteness	-0.80	0.14	-6.14	<.001***
Interaction	-0.83	0.26	-3.23	.0013**
<b>Contrast: Definite - Indefinite</b>				
	Est	SE	z	Pr (>  t )
Active	-0.44	0.15	-2.85	.0044**
Passive	-1.25	0.21	-5.86	<.001***

Table 2 Output of CLMM model and post-hoc pairwise comparisons of Exp 1.

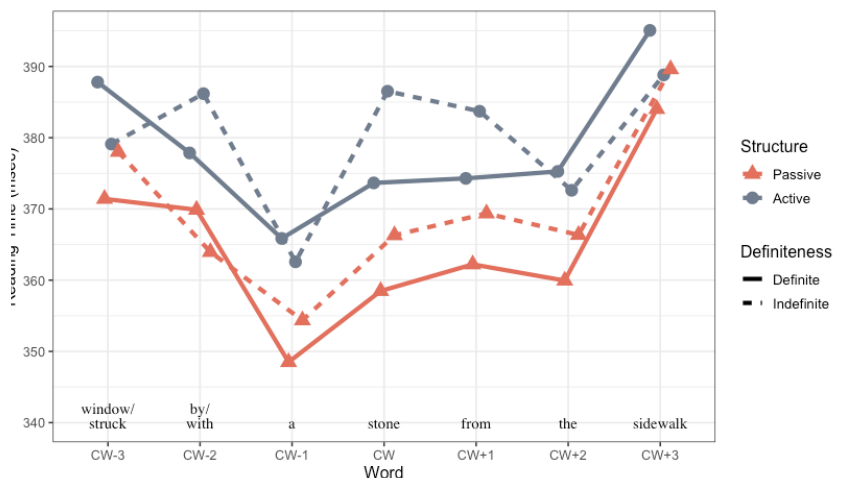


Figure 3 Estimated reading times in four conditions in Exp 2.

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