Effects of prepositional phrase type on the processing of relative clauses
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Although a large literature demonstrates that object-relative clauses (ORCs) are harder to process than subject-relative clauses (SRCs) (see Table 1, Example 1), there is less agreement regarding where during processing this difficulty emerges, as well as how best to explain these effects (see Gordon & Lowder, 2012 for a review). Explanatory frameworks that focus on the role of memory retrieval conceptualize the ORC-SRC asymmetry as resulting from a greater memory burden placed on the comprehender while processing ORCs as compared to SRCs. This burden stems from the need to encode two noun phrases (NPs) into memory and store them until the embedded verb and matrix verb cue their retrieval. Importantly, retrieval of the NPs in the correct order can be difficult, especially when they are semantically similar to one another, resulting in interference. Thus, memory-retrieval accounts predict greater processing difficulty for ORCs compared to SRCs at the embedded verb and the matrix verb.

A recent eyetracking study by Staub, Dillon, and Clifton (2017) was designed to more carefully examine the source of RC effects on the matrix verb. The researchers systematically manipulated RC type and the presence or absence of a prepositional phrase (PP) (see Table 1, Example 2). Although they found an ORC-SRC effect at the matrix verb in the no-PP condition, they found no such effect in the PP condition. The authors used this pattern to argue against a memory-retrieval explanation for the ORC-SRC asymmetry, reasoning that the presence of a PP should not eliminate the retrieval interference that this account predicts, and in fact increasing the distance between the verbs should increase difficulty (see also Grodner & Gibson, 2005).

A careful examination of Staub et al.'s items reveals that the types of PPs used in the experiment were a mixture of locative PPs (as in Example 2), as well as temporal PPs (e.g., The children that ignored the babysitter before breakfast bothered…). This is important because a locative PP in an SRC can modify either the RC noun (e.g., waiter) or the verb phrase (e.g., distracted the waiter). In contrast, a temporal PP in an SRC can modify only the verb phrase. Previous research has shown that sentences in which a modifier is globally ambiguous tend to be processed faster than sentences that are unambiguous (e.g., van Gompel, Pickering, & Traxler, 2001). Thus, it is impossible based on Staub et al.'s findings to disentangle RC effects from the processes involved in PP attachment.

In the current eyetracking experiment, we systematically manipulated RC type (ORC vs. SRC) and PP type (locative vs. temporal) (see Table 1, Example 3). The items were adapted from Staub et al. Results at the matrix verb (see Table 2) revealed no main effects of RC type or PP type; however, there were significant interactions in gaze duration ($p < .05$) and total reading time ($p < .02$), and a marginally significant interaction in regression-path duration ($p = .058$). The source of the interaction was that in the locative condition, there were significantly longer reading times for ORCs than SRCs, but in the temporal condition, there was either no RC effect or an effect that went in the opposite direction (i.e., longer reading times for SRCs than ORCs).

In contrast to Staub et al.'s findings, the results of the current experiment demonstrate that ORC processing difficulty is detectable on the matrix verb even when material intervenes between the RC verb and the matrix verb. Crucially, the nature of this intervening material matters: ORC-SRC effects emerge on the matrix verb when the material is a locative PP, but the effect reverses when the material is a temporal PP. Because Staub et al.'s materials included a mixture of PP types, it is impossible based on their results to draw any firm conclusions about how intervening material affected RC processing. The current results thus highlight the importance of considering how this intervening material affects both the structure and the meaning of the sentence.

Table 1. Example sentences.

Example 1
The reporter that attacked the senator admitted the error. (SRC) The reporter that the senator attacked admitted the error. (ORC)
Example 2
The chef that distracted the waiter poured the flour onto the counter. (SRC, no PP) The chef that the waiter distracted poured the flour onto the counter. (ORC, no PP) The chef that distracted the waiter in the kitchen poured the flour onto the counter. (SRC, PP) The chef that the waiter distracted in the kitchen poured the flour onto the counter. (ORC, PP)
Example 3
The chef that distracted the waiter in the kitchen poured the flour onto the counter. (SRC, locative) The chef that the waiter distracted in the kitchen poured the flour onto the counter. (ORC, locative) The chef that distracted the waiter for two seconds poured the flour onto the counter. (SRC, temporal) The chef that the waiter distracted for two seconds poured the flour onto the counter. (ORC, temporal)

Table 2. Mean reading times on the matrix verb in milliseconds.

Locative PP	Gaze duration	Regression-path duration	Total time
SRC	265	353	401
ORC	281	379	420
Temporal PP			
SRC	279	365	420
ORC	274	344	400

References

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