Schematic expectations or relational differences?

Causal coherence relations in discourse processing

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Coherence relations like causal, contrastive, and additive relations play a central role in discourse processing and representation (Zufferey & Degand, 2024). Over the years, several studies have shown how various types of relations result in different representations and are processed differently; evidence is strong for CAUSAL versus non-CAUSAL relations. Causal relations are crucial in text comprehension and discourse processing: causal networks predict recall of discourse information (Trabasso & Van den Broek, 1985; Wolfe et al. 2005) and causally related information is represented better than non-causally related information (Sanders & Noordman, 2000; Kaiser, 2019). Moreover, causally related information is processed faster than non-causally related information (Haberlandt & Bingham, 1978; Sanders & Noordman, 2000; Kuperberg et al., 2011), and reading times decrease when causality increases (Myers et al., 1987).

The current study builds on Sanders and Noordman (2000), who conducted a self-paced reading study in which they embedded a similar text segment in two different contexts. In one case it was a Solution to a Problem, in the second case the same segment was part of an addition. When the segment was part of a PROBLEM-SOLUTION relation, they were processed faster, and verification and recall was better. Such findings illustrate how causally related information is encoded faster and retrieved better than additively related information, suggesting a strong processing and representational advantage of causal relations (Sanders, 2005).

However, a crucial question remains: how to explain for such processing differences? One explanation is that readers make use of schematic, text-structural expectations that steer the discourse processing in a top-down way. The PROBLEM-SOLUTION relations would result in clear discourse expectations (compare Scholman et al., 2020): on the basis of the Problem description, experienced readers expect a Solution. As a result, the discourse segment that contains the SOLUTION is processed faster than the identical discourse segment that functions as part of a LIST structure, about which readers do not have such clear expectations. An alternative explanation can be based on the principles of relation interpretation: during processing, readers have to infer the coherence relations between the discourse segments, and this process proceeds faster for causals than for additives, because of readers' causal preferences (Noordman & Vonk, 1998; Sanders, 2005).

To further investigate these two explanations, we conducted an eye-tracking-while-reading experiment with expository texts. Following Mulder (2008), we added a new experimental condition to the experimental set-up of Sanders & Noordman (2000): a causal relation that does not raise such clear expectations as PROBLEM-SOLUTION structures do, i.e. CAUSE-CONSEQUENCE. Hence, we compared a text with a LIST structure to two types of causally related texts: PROBLEM-SOLUTION and CAUSE-CONSEQUENCE. This allowed us to investigate whether it is the top-down schematic expectations that explain for processing differences, or whether these differences are due to the differences in bottom-up relation processing. Under the first explanation, PROBLEM-SOLUTION would be processed faster than the other two relations, because readers have clear expectations about this structure, that they do not have for the other two. Under the second explanation, both causal relations would benefit from the causal preferences readers are supposed to have: both causal relations would be processed faster than the LIST relations.

We constructed texts in three experimental conditions, with identical target-sentence across the versions.

PROBLEM-SOLUTION

[…] The heavy traffic in the Main Street has led to numerous dangerous situations, which even resulted in deaths among pedestrians.

CAUSE-CONSEQUENCE

[…] Due to sewer renewal the Main Street will be broken up.

LIST

[…] Several construction works are expected in the area. A new Parking Garage will be opened soon.

Target-sentence: As of December first, the Main Street will be closed for motor vehicles.

Final sentence: The residents have reacted positively to this news.

The experimental items were tested in an earlier continuation experiment (Mulder, 2008). Texts were presented without the target sentences and participants were to read and then continue them with two sentences. The results indicate that the Problem-contexts indeed raise stronger expectations than the other two contexts: participants more often continued with Solutions.

Our eye-tracking data show how PROBLEM-SOLUTION relations are initially processed faster than the other two relations on the first region in first pass reading times. However, when readers integrate the whole target-sentence, PROBLEM-SOLUTION and CAUSE-CONSEQUENCE are both processed faster than the LIST-relations, as first pass data at the end of the target sentence show. This effect remains in the final sentence of the text.

We conclude that the results show clear evidence in favor of a bottom-up approach to relational processing: the two types of causals are processed faster than the LIST-relations. Possible expectation-driven effects seem limited to the first pass readings of the first region of the PROBLEM-SOLUTION relations. We discuss the implications for theories of coherence relations and discourse processing.

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