



Anticipatory looks reveal expectations about discourse relations



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ABSTRACT

Previous research provides evidence for expectation-driven processing within sentences at phonological, lexical, and syntactic levels of linguistic structure. Less well-established is whether comprehenders also anticipate pragmatic relationships between sentences. To address this, we evaluate a unit of discourse structure that comprehenders must infer to hold between sentences in order for a discourse to make sense—the intersentential coherence relation. In a novel eyetracking paradigm, we trained participants to associate particular spatial locations with particular coherence relations. Experiment 1 shows that the subset of listeners who successfully acquired the location~relation mappings during training subsequently looked to these locations during testing in response to a coherence-signaling intersentential connective. Experiment 2 finds that listeners' looks during sentences containing coherence-biasing verbs reveal expectations about upcoming sentence types. This work extends existing research on prediction beyond sentence-internal structure and provides a new methodology for examining the cues that comprehenders use to establish relationships at the discourse level.

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1. Introduction

The nature of a coherent discourse is that the utterances within it do not appear together arbitrarily but, rather, relate to each other in meaningful ways. In dialog, speakers' questions and answers help signal how nearby utterances relate: An utterance may prompt a question (e.g., "Why?" or "What happened next?") and the response is likely to provide the relevant information (about, say, the cause or consequence). Dialogs thus contain frequent overt signals to the relationships that hold between utterances, and speakers track these relationships to understand the structure and content of the conversation. In monologues or single-author texts, intersentential relations are likewise crucial for understanding the content, but comprehenders must often draw their own inferences

about what implicit question a particular sentence answers.

The inference of implicit questions or coherence relations (Asher, 1993; Asher & Lascarides, 2003; Grimes, 1975; Hobbs, 1979; Kehler, 2002; Mann & Thompson, 1988; Roberts, 1996) is part of what makes a discourse more than just an arbitrary sequence of sentences. An open question in the experimental pragmatics literature is whether pragmatic inferences are drawn after, during, or even before the relevant sentences are processed in their entirety: Do listeners wait to hear complete propositions in order to initiate discourse-level processing (Garnham, Traxler, Oakhill, & Gernsbacher, 1996; Stewart, Pickering, & Sanford, 2000) or is the identification of pragmatic dependencies incremental, allowing for the integration of cues as they become available (Gibbs, 2002; Koornneef & van Berkum, 2006; Tiemann et al., 2011; Van Berkum, Brown, & Hagoort, 1999), or even anticipatory, reflecting expectations about upcoming dependencies (Kaiser & Trueswell, 2004;

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Pyykkönen & Järvikivi, 2010)? Existing research has posed this question for a variety of pragmatic phenomena from presupposition and implicature to coreference. Anticipatory pragmatic effects are also relevant to sentence processing more generally, given that pragmatic processes that start mid-sentence can influence within-sentence processing, such as the resolution of local syntactic ambiguity (Altmann & Steedman, 1988; Crain & Steedman, 1985; Desmet, De Baecke, & Brysbaert, 2002; Rohde, Levy, & Kehler, 2011; Sedivy, 2002; Van Berkum et al. 1999).

In this paper, we ask whether anticipation plays a role in the establishment of coherence relations, and we introduce a novel methodology for measuring such anticipation. Previous work generally has not addressed the time course of coherence establishment, since it is not immediately apparent how a coherence relation could be inferred between a pair of sentences before the content of both sentences is known. Here, we test two cues that have been shown in offline studies to guide preferences about the coherence relation that holds between two sentences, in order to establish whether those cues yield online anticipatory effects regarding the relation between the current sentence and an upcoming sentence. The cues we manipulate involve between-sentence connectives (Simner & Pickering, 2005) and sentence-internal lexical semantics (Kehler, Kertz, Rohde, & Elman, 2008), thereby allowing us to examine how intersentential and intrasentential cues influence online coherence establishment.

2. Intersentential coherence relations

To understand the role of coherence relations in discourse, processing, consider the following:

- (1) Beryl applauded John. She admired him.
- (2) Beryl applauded John. She pleased him.

The first sentences in (1–2) are the same, and the second sentences are structurally and referentially similar—each describes a state of affairs involving two individuals, in both cases re-mentioning the two referents from the first sentence in the same syntactic positions and with the same tense marking on the verb. They differ, however, at semantic and pragmatic levels: Admiration and pleasure differ in their lexical semantics, and that difference yields a contrast in the relationship between the two sentences in (1) and (2). A natural interpretation of (1) is that the second sentence explains the event in the first sentence, whereas in (2), the second sentence is likely to be understood as describing a consequence of that event. These two relations represent two examples from a larger inventory of relations proposed in the literature (Asher, 1993; Asher & Lascarides, 2003; Hobbs, 1979; Kehler, 2002; Mann & Thompson, 1988).¹

¹ Across discourse coherence models, all posited inventories distinguish causes and consequences (e.g., Explanation/Result relations in Kehler (2002) or “because”/“as a result” implicit connectives in Prasad et al. (2008)). In the present experiments we adapt terminology from the papers whose results we build on: *cause/consequence* for Experiment 1 (Simner & Pickering, 2005) and *cause/occasion* for Experiment 2 (Kehler et al., 2008).

Note that in (1–2), identifying the intersentential coherence relation requires inferences about other information—either that applause is an action typically performed for someone admirable or that applause is the kind of action likely to please someone. Neither piece of information is stated overtly, yet these passages fail to make sense if that information is not understood or accommodated. Such inferences are ubiquitous in discourse processing, yet are only apparent if we struggle to identify information that would make a passage cohere, as in (3):

- (3) Beryl applauded John. She hated him.

As in (1–2), the sentences in (3) are well-formed and easy to understand, but making sense of this passage requires an inference that is hard to reconcile with knowledge of the real world—namely that hatred could plausibly arise from or result in applause. The very fact that readers may start considering contexts in which (3) makes sense (maybe Beryl believes that John is a nervous and private person who cannot bear to be applauded?) is a testament both to readers’ expectations that some coherence relation must hold between adjacent sentences and to the ease with which additional inferences arise beyond what is explicitly stated.

Previous work shows that the establishment of intersentential coherence relations is sensitive to a variety of cues, including but not limited to overt connectives (Fraser, 1999; Prasad et al., 2008), coreference (Kehler & Rohde, 2013), visual priming (Kaiser, 2012), prosody (Tyler, 2012), verb class (Kehler et al., 2008), and also the preceding coherence relation (Simner & Pickering, 2005). In the present work we focus on two of these cues, the preceding coherence relation (Experiment 1) and verb class (Experiment 2), for our investigation of expectation-driven coherence establishment.

Experiment 1 builds on an offline passage-continuation study by Simner and Pickering (2005, Experiment 3), in which the coherence relation in a prompt guided the relation that participants established between the prompt and their own continuation. Examples (4–5) show two of Simner and Pickering’s prompts. Unlike examples (1–2), in which the coherence relation between the two propositions was left implicit, the prompts in (4) and (5) contain two propositions joined by an overt connective (“so” and “because”, respectively). The second proposition in (4–5) is held constant but the relation between the two propositions varies: In (4), the first proposition gives the reason for the applause (because she admired him, she applauded him); in (5), it describes the consequence (as a result of her applause, she pleased him).

- (4) Beryl admired John so she applauded him.
- (5) Beryl pleased John because she applauded him.

In these prompts, the connective marks the relation between the first and second propositions; in turn, that relation determines what type of information has been provided and what information is still missing. In (4), the missing

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