The interplay of reader goals, working memory, and text structure during reading

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ABSTRACT

In the current study we examined the complex interactions of instructional context, text properties, and reader characteristics during comprehension. College students were tasked with the goal of reading for study versus entertainment (instructional context) while thinking-aloud about four different expository text structures (text properties). Working memory also was assessed (reader characteristics). Reading goals and working memory interacted to influence paraphrasing and non-coherence processes when thinking aloud. Reading goals, working memory, and text structure all interacted to influence text-based inferences. Text structure also influenced knowledge-based inferences. Post-reading recall was highest for those with the instructional goal of reading for study (compared to entertainment), as well as for problem-response and compare-contrast texts (compared to descriptive and chronological texts). Implications of the findings are discussed.

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1. Introduction

Reading and comprehending texts is one of the principal modes by which individuals learn. In many settings, such as in school, at work, or when reading magazines and newspapers, it is critical to develop a coherent understanding of what texts convey (Kirsch et al., 2002). In these contexts, texts can be structured in many different formats, such as historical timelines, instructions for constructing various objects, editorial pieces that offer potential solutions to a problem, comparisons of different concepts, or descriptions of scenes (Geiger & Millis, 2004; Meyer, 1984). In addition, readers approach texts with different goals and skills (Linderholm, Cong, & Zhao, 2008). All of these factors co-determine successful understanding of the information being put forward by the text (van den Broek & Kremer, 1999).

Reading comprehension, in turn, depends on the successful execution and integration of many processes (Goldman & Bisanz, 2002; Jenkins, 1979; van den Broek, 1994; van den Broek, Virtue, Gaddy, Tzeng, & Sung, 2002). Readers encode information from the text to build a mental representation of what the text is about (Gernsbacher, 1990, 1997; Kintsch & van Dijk, 1978), make inferences to connect different parts of the text (Graesser, Singer, & Trabasso, 1994; Zwaan & Radvansky, 1998), and activate background knowledge to explain textual information (Best, Floyd, & McNamara, 2008; van den Broek & Kendeou, 2008). It is critical to understand the factors that can influence these processes in order to understand everyday reading activities, improve comprehension, provide appropriate text structures and settings, and assist individuals with reading difficulties.

Although a variety of variables can individually influence comprehension (i.e., a reader might engage in different strategies when reading a novel compared to a science textbook), real-world settings are often complex, and contain many variables that dynamically influence one another (Alexander, 2012). For example, a reader with test anxiety may struggle in high-pressure situations regardless of the type of text. This same reader may thrive in more relaxed environments, but only when reading novels. In contrast, another reader may be motivated to perform well in high pressure testing situations, but only when reading historical fiction. Thus, understanding interactions between multiple variables could help to establish settings that optimize comprehension. In an attempt to synthesize the large number of factors that can influence comprehension, van den Broek and Kremer (1999) proposed three overarching factors that can individually and interactively affect comprehension processing: characteristics of the reader, text properties, and the instructional context in which reading occurs. Likewise, several other frameworks advocate the importance of studying interactions between the reader, task, and text (Kirsch et al., 2002; Rapp & van den Broek, 2005; Snow, 2002).

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Understanding such interactions and their influences on reading comprehension is also important for current theories and models of comprehension. Among these models, the construction-integration (CI) model (Kintsch, 1998; Kintsch & van Dijk, 1978) makes explicit assumptions about how the information in a text and a reader's background knowledge interact and combine to form a coherent representation of the text in a reader's memory. In the context of the CI model, background knowledge is portrayed as an associative network of concepts and propositions, whereas frames of reference and reading goals represent global knowledge structures reflective of the context. According to the CI model, comprehension involves two steps: construction and integration. In the first step, readers construct a mental representation of the text from textual information and the activation of related background knowledge. In the second step, textual information and activated background knowledge are integrated in the mental representation (what is termed as the situation model) while irrelevant or contextually inappropriate information is deactivated and falls out of the mental representation (Kintsch, 1988).

In the CI model, the text drives the activation of information during the construction process via associative priming. However, a reader's prior knowledge also influences activation and integration processes. Finally, task demands and reading goals can also influence activation and integration by shifting a reader's attention during reading to task relevant information. Thus, the CI model accounts for multiple interactions during reading: information contained within the text, a reader's background knowledge, and the context (which includes task demands and special reading goals; Kintsch, 1988).

Consistent with the CI model, the Landscape model (van den Broek, Risden, Fletcher, & Thurlow, 1996) also posits that the activation levels of text concepts fluctuate as a function of the current text and the reader's background knowledge. An additional component this model proposes is the reader's standards of coherence. Standards of coherence are criteria for comprehension the reader sets explicitly or implicitly over the course of reading; these standards are influenced directly by the reading context and goals (van den Broek, Bohn-Gettler, Kendeou, Carlson, & White, 2011; van den Broek, Risden, & Husebye-Hartmann, 1995).

Although the aforementioned models of text comprehension advocate for the importance of examining multiple factors, only a few studies have empirically examined interactions between more than two variables (van den Broek, Rapp, & Kendeou, 2005). Examining interactions between the reader, text, and task can yield important, and sometimes surprising, findings. For example, McNamara and colleagues examined the interaction between text difficulty and reader knowledge (but did not account for the instructional context). These studies revealed what has been termed the "reverse cohesion effect": When text cohesion varies (i.e., either high or low cohesion) readers with low prior knowledge of the content demonstrate better comprehension for high cohesion texts. However, readers with high prior knowledge of the content demonstrate better comprehension and improved processing for low cohesion texts, presumably because the readers are forced to generate connections between text concepts that are left to be inferred (McNamara, 2001; McNamara, Kintsch, Songer, & Kintsch, 1996; O'Reilly and McNamara, 2007). These findings not only demonstrate the importance of examining interactive effects but also have the potential to improve reading comprehension. Because a wide body of research focuses on only one or two factors, more work is needed to understand the dynamic relations between the reader, the text, and the task (Alexander, 2012; Fox & Dinsmore, 2009).

The primary aim of the current study is to systematically examine the interactive contributions of these three factors during comprehension in an effort to better understand how readers learn from texts in naturalistic settings. To accomplish this aim, we asked readers to think-aloud while reading expository texts, and we manipulated different components of the text and context. With respect to text properties, we focused on text structure; with respect to instructional context, we focused on reading goals; and with respect to reader characteristics, we focused on one important source of individual differences, working memory. We hypothesized that the instructional context (whether a person is reading with the goal of studying versus being entertained), text structure (when reading compare-contrast, descriptive, problem-response, and chronological texts), and working memory would individually and interactively influence the moment-by-moment processing of expository texts.

In the current study, we chose to manipulate just one aspect of each factor in order to begin the systematic documentation of these complex interactive effects. Furthermore, because of the complexity of these interactions, we opted to utilize manipulations shown to be successful in previous research. In this way, we could replicate and extend prior work to understand better specific interactions between the reader, the text, and the instructional context in which reading takes place. In the following, we first briefly review evidence documenting the influence of the specific factors we considered in the present study. Second, we present the specific hypotheses of the study and our methodological approach.

1.1. Instructional context: reading goals

Goals can encourage readers to focus their attention on specific textual information or to adopt general processing strategies (Anderson & Pichert, 1978; Kaakinen & Hyönä, 2005; McCrudden & Schraw, 2007; Rothkopf & Billington, 1979; van den Broek, Lorch, Linderholm, & Gustafson, 2001). The current study is motivated by previous work in which college-aged students were instructed to read a text with the general goal of studying for an essay exam or browsing through a magazine for entertainment. These goals represent common approaches to reading, and are distinct from one another in that they elicit different types of processing during comprehension (Horiba, 2000; Linderholm & van den Broek, 2002; Linderholm et al., 2008; Lorch, Lorch, & Klusewitz, 1993; Narvaez, van den Broek, & Ruiz, 1999; van den Broek, Risden et al., 2001).

Indeed, empirical evidence from a variety of different methodologies documents how the processes that occur during reading vary as a function of these goals. When thinking aloud during reading of expository science texts, college-aged readers tasked with the goal of studying have better memory for the text and engage in processes that enhance comprehension, such as paraphrasing, connecting textual information, and incorporating background knowledge to explain the text. In contrast, when tasked with the goal of being entertained, college-age readers have decreased memory for the text and engage in processes that do not necessarily enhance comprehension, such as making associations with background knowledge that were not related to understanding the text, or providing opinions that did not further their understanding of the text (Geiger & Millis, 2004; Linderholm & van den Broek, 2002; van den Broek, Lorch, et al., 2001). Therefore, asking college students to read with different goals can directly influence comprehension processes and products.

1.2. Reader characteristics: working memory

A variety of reader variables can affect comprehension processing, such as age (Bohn-Gettler, Rapp, van den Broek, Kendeou, & White, 2011; Cain, Oakhill, & Lemmon, 2004; Daneman, Hannon, & Burton, 2006; Nation & Snowling, 1999), prior knowledge (Braten & Samuelstuen, 2004; Fincher-Kiefer, 1992; Kendeou &