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Simulating a story character's thoughts: Evidence from the directed forgetting task ☆

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ABSTRACT

Readers' memory representations have been shown to include the sensory details of characters' movement, dialogue, and navigation through space and time (e.g., Glenberg & Kaschak, 2002; Gunraj, Drumm-Hewitt, & Klin, 2014; Levine & Klin, 2001; Zwaan, 1996). We ask whether readers also encode the mental experiences of story characters, such as their thoughts and goals. To examine this question, we used a variation of the list-method directed forgetting paradigm (Bjork, 1970), with two word-lists embedded within a narrative. In contrast with the traditional directed forgetting paradigm, it was the story character, rather than the participant, who needed to remember List 1 or forget List 1. If readers take the character's perspective, the character's intention to remember or forget List 1 should influence the reader's intention to remember or forget List 1. This, in turn, should produce the typical pattern of effects for directed forgetting: decreased recall for List 1 (costs) and increased recall for List 2 (benefits) in the Forget condition relative to the Remember condition. The List 2 benefits were found across experiments, even without explicit instructions to forget or remember List 1. However, the List 1 costs were not reliable. Results are discussed within Sahakyan and Delaney's (2003, 2005) two-factor account of directed-forgetting, in which the List 1 and List 2 effects are dissociable. More generally, we conclude that when readers are actively engaged in a story, they may infer and simulate the mental activity of the characters, remembering and forgetting what the story characters remember and forget.

A reader's mental representation of a story is not a copy of the words and sentences that make up the story. The information in a reader's representation may be in a very different format than the one in which the information was initially encountered. The printed words on the page may be transformed into visual images, auditory images, tastes, and emotions. Further, readers do not encode all of the information explicitly presented in a text nor all of the inferences that they draw. Given all the differences between the written text and the reader's memory representation, a critical goal for any theory of discourse processing is to specify the nature of the reader's mental representation.

In the current paper, we ask how the reader's representation is influenced by the story character's experience. Across many genres, story characters are salient and powerful in shaping the reader's understanding (e.g., Morrow, 1985). According to O'Brien and Albrecht (1992), text "information is continually checked against the protagonist's location, actions, and thoughts, and the mental model is updated to reflect any changes" (p. 777). Similarly, according to Zwaan (1999), readers behave as though they are part of the narrated situation, keeping track of dimensions such as space, time, and character goals. In the embodied, or grounded, cognition framework (e.g., Barsalou, 1999; Barsalou, 2008; Fischer & Zwaan, 2008; Gibbs, Gould, & Andric, 2006), the reader's understanding of the narrative world involves forming sensorimotor simulations of the actions and events described in the text, often from the perspective of the characters (Klin & Drumm, 2010). Support for claims about the centrality of a story character's perspective in the reader's text representation has been provided by neuroimaging studies (e.g., Yao, Belin, & Scheepers, 2011) as well as by behavioral measures.

A number of dimensions of the story character's experience, including their movement through time and space, their motor movements, and their dialogue have been found to influence the reader's mental representation. With regard to time, Zwaan (1996) found that readers were slower to read phrases that introduced temporal discontinuities (e.g., a few days later) than phrases that did not introduce discontinuities (e.g., a moment later). Zwaan

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concluded that readers track the temporal experience of the character. Findings are similar with regard to location. Levine and Klin (2001) found that a story character's current location was more active in the reader's memory than their past location. Further, even when a character's current location (e.g., a state forest) had not been explicitly mentioned in the past several sentences, readers had no difficulty processing a definite reference to an object typically found in that location (e.g., the trees). Like temporal movement, readers appear to track story characters' movement in space, incorporating it into their text representation.

Story characters' motor movements also guide the reader's representation (e.g., Bergen & Wheeler, 2010; Kaup, Lüdtke, & Maienborn, 2010; Zwaan, Taylor, & de Boer, 2010). Glenberg and Kaschak (2002) found that after reading a sentence that described someone making an arm movement in a particular direction (e.g., "He closed the drawer"), participants were faster to press a key on a response box when it involved making a movement in the same direction as the character (e.g., moving their hand away from their body) than when it involved making a movement in the opposite direction (e.g., moving their hand toward their body). Readers simulated the character's motor actions, which then influenced the speed with which they performed a related action. Consistent with this, reading action words, such as *eat* and *kick*, produces patterns of cortical activity corresponding, at least roughly, to the motor areas that control the movements made with those body parts (e.g., Pulvermüller, Shtyrov, & Ilmoniemi, 2005).

Readers also seem to encode features of story character's voices, including emotion (Scherer, Banse, Wallbott, & Goldbeck, 1991) and speaking rate (Alexander & Nygaard, 2008; Gunraj, Drumm-Hewitt, & Klin, 2014). For example, Gunraj et al. examined the representation formed when readers encounter a character's dialogue. Not only did readers activate the meanings of the words that the character uttered, they also activated an auditory representation of the words. When a character was described as speaking quickly, the dialogue lines were read more quickly than when the character was described as speaking slowly. Interestingly, this occurred only when the participants were asked to read aloud, matching the character's behavior. After reading passages that contained character dialogue, Kurby, Magliano, and Rapp (2009) found that readers were faster to respond to auditory recognition probes when they matched the voice of the character who had been described as speaking that line of dialogue. Similar conclusions were drawn by Yao et al. (2011) who used fMRI to compare the processing of direct descriptions of a character's speech (e.g., *Mary said, "I'm hungry"*) to indirect descriptions (e.g., *Mary said she was hungry*). These led to differential brain activation in voice-selective areas of the auditory cortex. These findings indicate that readers form auditory images of a story character's dialogue and, more generally, that the reader's representation of a narrative is influenced by the story character's reality.

We continue this line of inquiry, asking how a story character's experience influences the reader's understanding and memory representation. Rather than focusing on the character's external world--time, space, motor movements, dialogue--we ask about the character's internal, mental world. If readers take the perspective of the story character, we expect that they should also experience the character's thoughts and goals. Although not extensively investigated, there are some hints that this is true. For example, in an fMRI study, Speer, Reynolds, Swallow, and Zacks (2009) found that changes in a character's goals corresponded with changes in brain activity in areas normally associated with observing or acting out goal-directed actions. There is also evidence that readers activate preferences about the fate of characters. Rapp and Gerrig (2006) found that when a story described an outcome that was inconsistent with the reader's preferences for that character, reading times were longer, indicating that these preferences are encoded into the reader's representation (see also, Allbritton & Gerrig, 1991; Gerrig, 1993).

In the current set of experiments, we examined the influence of a story character's mental experience on readers' long-term memory representation of the text. To do this, we used a modification of the list-wise directed forgetting paradigm (Bjork, 1970). In this extensively used task, participants study two (or more) lists of words for a later memory test (for a review of directed-forgetting, see Bjork, Bjork, & Anderson, 1998; MacLeod, 1998; Sahakyan, Delaney, Foster, & Abushanab, 2013). After the first list is presented, participants in a Forget condition are instructed to forget the words, as they will not be included on the memory test. Participants in a Remember condition are reminded to remember the words. Next, a second list is presented to all participants. This is followed by a memory test, often free recall, on both lists. The standard pattern of findings across a variety of types of instructions, timing, and stimuli, is that the forget instructions lead to costs--impaired memory for List 1 relative to the Remember condition--as well as benefits--enhanced memory for List 2 relative to the Remember condition.

There are a number of theoretical explanations for the list-method directed forgetting findings, as the cognitive mechanisms underlying these intentional forgetting effects are a matter of extensive debate (e.g., Rummel, Marevic, & Kuhlmann, 2016). A dominant explanation is the *retrieval-inhibition account* (Basden, Basden, & Gargano, 1993; Bjork, 1989), in which the forget instructions inhibit the retrieval of the words on List 1. This reduces access to List 1 at test, which leads to the directed forgetting cost (i.e., reduced List 1 recall in the Forget condition). It also reduces proactive interference to List 2, which leads to the directed forgetting benefit (i.e., increased recall for List 2 in the Forget condition). In contrast, according to a *mental context change account* (Sahakyan & Kelley, 2002), the forget cue serves to induce a mental context change, with participants in the Forget condition treating List 1 and List 2 as part of different mental contexts. Participants in the remember group treat List 1 and List 2 as part of the same event, and thus, the context overlaps for the two lists. Critically, for List 1, the test context is a poorer match in the Forget condition than the Remember condition, leading to reduced recall for List 1 in the Forget condition. Again, the reduced access to List 1 serves to decrease proactive interference, leading to the List 2 benefits. According to a *context-inhibition account* (Pastötter & Bäuml, 2010), the forget cue serves to induce the inhibition of the List 1 context, rather than List 1 items themselves. Like the mental context change account, the change in context reduces access to List 1, leading to the directed forgetting costs, and this in turn reduces interference to List 2, leading to the directed forgetting benefits. According to Rummel et al. (2016), a reduction in proactive interference leads to recall benefits either because it facilitates retrieval or increases storage for the List 2 items.

The current set of experiments was not designed to differentiate between the different explanations. We assume only that the instruction to forget leads to intentional, or deliberate, forgetting. We use the task to examine the influence of a story character's forgetting on readers' forgetting. In contrast with the standard directed forgetting task, in which the participant is asked to forget or remember List 1, in the current experiments, it is the story character who needs to remember or forget List 1. Narratives were written so that the List 1 items were either to be remembered or forgotten by the protagonist. (See Appendices A–C for the experimental stimuli.) Should readers take the perspective of the character and infer aspects of the character's mental experience, we should find that the character's need to remember or forget will influence the reader's need to remember or forget. This should, in turn, produce the same pattern of recall effects that are found in the standard directed forgetting paradigm.