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A brighter side to memory illusions: False memories prime children's and adults' insight-based problem solving

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ABSTRACT

Can false memories have a positive consequence on human cognition? In two experiments, we investigated whether false memories could prime insight problem-solving tasks. Children and adults were asked to solve compound remote associate task (CRAT) problems, half of which had been primed by the presentation of Deese/Roediger–McDermott (DRM) lists whose critical lures were also the solutions to the problems. In Experiment 1, the results showed that regardless of age, when the critical lure was falsely recalled, CRAT problems were solved more often and significantly faster than problems that were not primed by a DRM list. When the critical lure was *not* falsely recalled, CRAT problem solution rates and times were no different from when there was no DRM priming. In Experiment 2, without an intervening recall test, children and adults still exhibited higher solution rates and faster solution times to CRAT problems that were primed than to those that were not primed. This latter result shows that priming occurred as a result of false memory generation at encoding and not at retrieval during the recall test. Together, these findings demonstrate that when false memories are generated at encoding, they can prime solutions to insight-based problems in both children and adults.

Introduction

It is well known that memory is error prone and that errors frequently lead to false memory illusions (i.e., illusions that take the form of a belief that something had actually been present when in fact it had not (Deese, 1959; Roediger & McDermott, 1995)). Such spontaneous errors of commission can

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be studied using the Deese/Roediger–McDermott (DRM) paradigm, where participants are given a word list (e.g., *nap, doze, dream, pillow*) whose members are all associates of an unpresented item or critical lure (e.g., *sleep*). Despite its never having been presented, participants often falsely remember the critical lure as being presented in the list. When studied developmentally, these spontaneous false memories increase with age (e.g., Howe, Wimmer, Gagnon, & Plumpton, 2009).

By now, we are all too familiar with the darker or negative side of false memory illusions, from experts being more prone to false memories in their domains of expertise (Castel, McCabe, Roediger, & Heitman, 2007), to miscarriages of justice (Loftus, 2003), to the outright memory wars of the 1990s (Crews, 1995). However, we argue that there is also a brighter, more positive side to false memories, one that is similar to that usually attributed to true memories. This positive aspect of false recollection is the role they can play in more complex cognitive processes such as insight-based problem solving.

To see this brighter side, consider the notion that false memories, like false beliefs (e.g., McKay & Dennett, 2009), may be the consequence of some creative process. For example, Castel and colleagues (2007) found that because experts have rich and highly interconnected memory networks in their area of expertise, they are more prone to memory errors related to that expertise. It may be, then, that generation of related information, including information not presented (i.e., false memories), is related to the discovery of creative solutions to problems (Sio & Ormerod, 2009), solutions that may depend on spreading activation through well-integrated associative networks that are said to serve as a foundation for human thought (Anderson, 1983; Reder, Park, & Kieffaber, 2009).

One way to investigate this brighter side of false memories is by asking whether false memories can prime solutions to insight-based problems such as those found in compound remote associate task (CRAT) problems. Originally developed by Mednick (1962), these tasks involve the presentation of three words, such as *apple, family,* and *house,* all of which can be linked by a single word, in this case *tree.* To gain insight and solve this problem, theorists have suggested a process involving spreading activation, one that continues until the correct concept has been activated (Bowden, Jung-Beeman, Fleck, & Kounios, 2005). If we also assume that false memories are caused by a spreading activation mechanism (Howe et al., 2009; Roediger & McDermott, 1995), then priming becomes an ideal area of investigation (Anderson, 1983).

In true memory, priming has been interpreted in terms of an enhanced speed and tendency to complete tasks, such as stem completion tasks, when their completion involves the use of a word previously studied (e.g., Graf, Shimamura, & Squire, 1985). McDermott (1997) found that critical lures could also be used to prime word stem and fragment completion tasks, although priming occurred at a level lower than if the items had actually been studied (see Diliberto-Macaluso, 2005, for similar findings with child participants). Similarly, McKone and Murphy (2000) showed that critical lures could prime solutions to both implicit (stem completion) and explicit (stem-cued recall) memory problems. The question addressed here is whether false memories can also prime more complex cognitive tasks.

We suspect that they can because problems requiring a high level of insight may be aided by the spreading activation of concepts in memory, a process similar to the mechanisms proposed in spreading activation models of false memory effects (e.g., Howe et al., 2009; Roediger & McDermott, 1995) as well as Underwood's (1965) original implicit associative response model. For example, Kershaw and Ohlsson (2004) discovered that insight problem solving involves searching through related concepts in memory for relevant information. Bowden and colleagues (2005) also suggested that insight-related problem solving involves the activation of concepts in memory, including those that are unrelated to the solution, followed later by the weak activation of concepts that are critical to the solution. Indeed, research has already shown that true memories can be used to prime problem solving and reasoning tasks successfully (e.g., Kokinov, 1990), so it might not be too far-fetched to anticipate that false memories may also prime problem solutions. In fact, some evidence has recently emerged showing that, at least for adults, false memories can and do prime solutions to CRAT problems. However, this priming occurred only when the critical lure was falsely remembered on a recall test and not simply due to the presentation of a DRM list whose critical lure was not falsely recalled (Howe, Garner, Dewhurst, & Ball, 2010).

In the current research, we wanted to replicate this finding with adults and, more important, to extend these priming effects to children. This question is important developmentally for any number of