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Are children's memory illusions created differently from those of adults? Evidence from levels-of-processing and divided attention paradigms

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ABSTRACT

In two experiments, we investigated the robustness and automaticity of adults' and children's generation of false memories by using a levels-of-processing paradigm (Experiment 1) and a divided attention paradigm (Experiment 2). The first experiment revealed that when information was encoded at a shallow level, true recognition rates decreased for all ages. For false recognition, when information was encoded on a shallow level, we found a different pattern for young children compared with that for older children and adults. False recognition rates were related to the overall amount of correctly remembered information for 7-year-olds, whereas no such association was found for the other age groups. In the second experiment, divided attention decreased true recognition for all ages. In contrast, children's (7- and 11-year-olds) false recognition rates were again dependent on the overall amount of correctly remembered information, whereas adults' false recognition was left unaffected. Overall, children's false recognition rates changed when levels of processing or divided attention was manipulated in comparison with adults. Together, these results suggest that there may be both quantitative and qualitative changes in false memory rates with age.

Introduction

A vast amount of research over the past 15 years has used the Deese/Roediger–McDermott (DRM) paradigm (Deese, 1959; Roediger & McDermott, 1995) to investigate memory errors in adults. Here

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participants study word lists containing items (e.g., *bed*, *rest*, *snore*, *awake*, *dream*) that all are associated with a nonpresented item, the "critical lure" (e.g., *sleep*). When asked to remember the presented items, some participants also falsely remember the critical lure among the correct list items. This robust false memory effect has also been observed in children. Interestingly, as children's overall memory capacity increases over the primary school period, so too does their false memory rate (e.g., Brainerd, Forrest, Karibian, & Reyna, 2006; Carneiro, Albuquerque, Fernandez, & Esteves, 2007; Dewhurst & Robinson, 2004; Howe, 2006, 2008). This finding from the DRM paradigm is striking because it suggests that here children's net memory accuracy decreases over childhood (Brainerd, Reyna, & Ceci, 2008).

To explain this counterintuitive increase in false memories with age, two theories have emerged. Fuzzy trace theory (FTT) (Brainerd & Reyna, 2005) suggests that presented information is encoded by two different memory traces: a verbatim trace that encodes surface features of items (e.g., the color or specific font of a word) and a gist trace that encodes the overall meaning of an item or a list of items (i.e., the overall theme). It is this gist trace that is thought to be responsible for false memories in the DRM paradigm, particularly when verbatim traces—those that fade more rapidly than gist traces—are no longer available. Developmentally, children's ability to extract the gist of to-be-remembered information improves with age. As this ability increases with age, so too does children's susceptibility to the DRM illusion (Brainerd & Reyna, 2005).

Alternatively, associative activation theory (AAT) (Howe, Wimmer, Gagnon, & Plumpton, 2009) suggests that both true and false memories are a product of automatic associative activation processes. In particular, this theory derives from the idea of spreading activation, also discussed in activation monitoring theory (Roediger, Watson, McDermott, & Gallo, 2001) for adults' false memory. The basic idea is that in an associative network, the processing of one word activates a corresponding node in our mental lexicon and this activation spreads to surrounding concept nodes (Collins & Loftus, 1975; Kimball, Smith, & Kahana, 2007; Landauer & Dumais, 1997). False memories occur because the critical lure is activated many times due to its association with the presented list items in the associative network. Children's false memories increase with age because of changes in children's knowledge base that result in increases in the automaticity with which children access and activate associations in their knowledge base, including associations that mediate false remembering (e.g., Howe, Wimmer, & Blease, 2009).

In sum, both FTT (a dual process theory) and AAT (a single-process theory) provide an explanation of why the quantity of false memories increases with age. However, irrespective of the theoretical basis of the source of the occurrence of false memories, one question remains to be answered: When false memories occur, are these false memories qualitatively different for children and adults?

This question is of fundamental importance for the legal arena, where children are used as eyewitnesses. For some time, it was thought that children were unreliable as eyewitnesses. Due to extensive research, it has been shown that although overall children remember fewer facts than adults, children are capable of providing accurate accounts of past experiences. However, what is still unclear is under which conditions false memories occur in children. For example, do false memories arise only out of consciously experienced events or also out of incidentally experienced events? The aim of the current research was to investigate these possibilities.

For adults, the general consensus is that false memories occur automatically outside of conscious awareness (e.g., Dodd & MacLeod, 2004; Kimball & Bjork, 2002; Seamon, Luo, Shulman, Toner, & Caglar, 2002) but can reach conscious awareness in some circumstances (e.g., McDermott, 1997). For example, false memories occur even when information has been encoded incidentally (Dodd & MacLeod, 2004) or even after adults are forewarned about the false memory phenomenon (Gallo, Roberts, & Seamon, 1997; Gallo, Roediger, & McDermott, 2001; McDermott & Roediger, 1998). Similarly, when adults are instructed to "forget" a just studied word list, true recall, but not false recall, is reduced (Kimball & Bjork, 2002; Seamon et al., 2002; but see Marche, Brainerd, Lane, & Leohr, 2005, for a different finding using a different method). Thus, at least for adults, false memories appear to occur relatively automatically both at the generation or encoding stage (i.e., evidence from incidental memory studies and forewarning procedures) and at the output or retrieval phase (i.e., evidence from directed forgetting studies).

What evidence do we have concerning the automaticity of children's false memories at the generation (encoding) and output (retrieval) phases? To date, there is only one study that examined the