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What factors underlie children's susceptibility to semantic and phonological false memories? Investigating the roles of language skills and auditory short-term memory

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ABSTRACT

Two experiments investigated the cognitive skills that underlie children's susceptibility to semantic and phonological false memories in the Deese/Roediger–McDermott procedure (Deese, 1959; Roediger & McDermott, 1995). In Experiment 1, performance on the Verbal Similarities subtest of the British Ability Scales (BAS) II (Elliott, Smith, & McCulloch, 1997) predicted correct and false recall of semantic lures. In Experiment 2, performance on the Yopp–Singer Test of Phonemic Segmentation (Yopp, 1988) did not predict correct recall, but inversely predicted the false recall of phonological lures. Auditory short-term memory was a negative predictor of false recall in Experiment 1, but not in Experiment 2. The findings are discussed in terms of the formation of gist and verbatim traces as proposed by fuzzy trace theory (Reyna & Brainerd, 1998) and the increasing automaticity of associations as proposed by associative activation theory (Howe, Wimmer, Gagnon, & Plumpton, 2009).

1. Introduction

False memories in children and adults have been widely investigated using lists of words that converge on a common theme. For example, in the Deese/Roediger–McDermott (DRM) procedure, named after studies by Deese (1959) and Roediger and McDermott (1995), participants study lists of words that are semantic associates of a nonstudied critical lure (e.g., participants study words such as *bed*, *dream*, *awake*, and *tired*, which are associates of the critical lure *sleep*). When memory for the lists is tested, participants typically show high levels of false recall and false recognition of the critical lures (for a review see Gallo, 2006). Similar phenomena have been observed using lists of words that are associated phonologically rather than semantically. For example, Sommers and Lewis (1999) presented participants with lists of the most confusable phonological neighbours of a critical lure (e.g., participants studied words such as *fat*, *cab*, *cot*, and *kit*, which differ by one phoneme from the critical lure *cat*). Sommers and Lewis also found high levels of false recall, paralleling the results reported by Roediger and McDermott using semantic lists.

Although these methods reliably produce high levels of false recall and recognition in adult participants, they are less effective when it comes to eliciting false memories in children. Many studies have reported a *developmental reversal*, whereby levels of false memory are lower in young children than in older children and adults. For example, using the semantic DRM procedure, Brainerd, Reyna, and Forrest (2002) found near-floor levels of false recall in five- and seven-year-olds, and lower levels of false recognition in five-year-olds relative to eleven-year-olds and young adults. This pattern has been replicated in many subsequent

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studies (e.g., Howe, 2006; Howe et al., 2009; Metzger et al., 2008; Odegard, Holliday, Brainerd, & Reyna, 2008, see Brainerd, Reyna, & Ceci, 2008, for a review). Investigations of the developmental trajectory of phonological false memories have produced less consistent results. Holliday and Weekes (2006) found that false recognition of critical lures from semantically related lists increased with age, whereas false recognition of critical lures from phonological lists decreased with age (see Brainerd & Reyna, 2007, for a similar age-related decline in phonological false recognition). In contrast, a recent study by Swannell and Dewhurst (2012) found a developmental reversal in phonological false recall when study lists converged on a single critical lure. However, Swannell and Dewhurst did not measure false recognition so their findings cannot be compared directly with those of Holliday and Weekes.

The two dominant accounts of children's false memory are fuzzy trace theory (Reyna & Brainerd, 1998) and associative activation theory (Howe et al., 2009). According to fuzzy trace theory, participants encode two traces of study items; verbatim traces that include specific details of each item and its encoding context, and gist traces that reflect the underlying theme of a set of items. Gist traces are assumed to be responsible for false memories, and susceptibility to false memories is attributed to the ability to extract the gist of DRM lists (see Brainerd et al., 2008, for a review). Gist extraction improves with age, leading to the aforementioned developmental reversal. According to associative activation theory, susceptibility to false memories is determined by the automaticity with which associates are activated in response to study items. Adults are more susceptible than children to the DRM illusion because the automaticity of associations increases with age (see also Wimmer & Howe, 2009, 2010).

The aim of the current study was to investigate the cognitive processes that give rise to false memories in children. As discussed above, previous developmental studies have typically measured age-related changes in levels of false memory and interpreted their trajectory in terms of cognitive development. In the current study, we took a different approach by investigating whether susceptibility to false memories among children within the same age range was predicted by individual differences in their language skills. Experiment 1 investigated whether susceptibility to semantic false memories was related to performance on the Verbal Similarities subtest of the British Ability Scales (BAS) II (Elliott et al., 1997), which measures awareness of semantic associations between words. Experiment 2 investigated whether susceptibility to phonological false memories was related to performance on the Yopp–Singer Test of Phonemic Segmentation (Yopp, 1988) which measures phonemic awareness. In both experiments, our prediction was that test scores would be positively associated with susceptibility to false memories, such that children who achieved the higher scores on the tests would show higher levels of false recall.

Two previous studies have taken a similar individual differences approach to the investigation of children's false memories. In a study looking at the role of learning ability, Brainerd, Forrest, Karibian, and Reyna (2006: Experiment 2) found that levels of correct and false recall were lower in learning-disabled children relative to nondisabled children. Comparison of 7- and 11-year-olds also showed that the learning disabled children did not show the developmental reversal observed in nondisabled children. These findings are consistent with those of studies showing that the ability to connect meaning across words within other types of list (e.g., lists of category associates) is reduced in learning-disabled children (Swanson, 1991).

More recently, Weekes, Hamilton, Oakhill, and Holliday (2008) investigated semantic and phonological false memories in 9- and 11-year-olds who were either normal readers or poor comprehenders (defined as having impaired reading comprehension but intact word recognition and phonological decoding skills). Relative to normal readers, poor comprehenders showed lower levels of false recall and recognition after studying semantic lists but not after studying phonological lists. Weekes et al. interpreted this pattern of findings in terms of the claims by Nation, Adams, Bowyer-Crane, and Snowling (1999) and Nation and Snowling (1999) that poor comprehenders have weak semantic skills. In Experiment 1 of the current study, we tested this view directly by investigating whether susceptibility to semantic false memories is predicted by a test that measures the understanding of high level semantic knowledge. As noted above, Weekes et al. found that poor comprehenders did not show reduced levels of phonological false memories. In Experiment 2 of the current study we investigated whether susceptibility to phonological false memories can be predicted by performance on a test of phonological rather than semantic knowledge.

To summarise, the two experiments reported below investigated false memories in children using lists of words that were associated semantically (Experiment 1) or phonologically (Experiment 2). In each experiment, we investigated whether susceptibility to false memories was positively associated with performance on a relevant test of language ability. Our sample consisted of children within the age range of 8–11 years, as previous research has shown that children within this age range are susceptible to both semantic and phonological false memories (e.g., Dewhurst & Robinson, 2004; Holliday & Weekes, 2006). It is also similar to the age range tested by Weekes et al. (2008). We also investigated the influence of auditory short-term memory using the BAS II recall of digits forward subtest (Elliott et al., 1997). Research with adults has shown that high working memory capacity is negatively related to levels of false memory (Watson, Bunting, Poole, & Conway, 2005). Based on this finding, our prediction was that children with high short-term memory capacity would show reduced susceptibility to false memories.

2. Experiment 1

2.1. Method

2.1.1. Participants

Seventy children from three local primary schools took part in Experiment 1. The children (35 male, 35 female) were aged between 8 and 11 years ($M = 10.22$, $SD = 1.03$). All spoke English as their first language. Ethical approval