The Ontogeny and Durability of True and False Memories: A Fuzzy Trace Account

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Fuzzy-trace theory has been developed by Brainerd and Reyna (1998, this issue) to explain a variety of findings. Here we explore the way that fuzzy-trace theory handles three phenomena concerning the creation and maintenance of false memories. We show that fuzzy-trace theory can account for seemingly paradoxical findings, thus providing theoretical clarity that has heretofore been lacking in the developmental literature.

In the past few years there has been a spate of developmental findings that seem, at first glance, contradictory. Among the questions that emerge from this work are first, why false recognitions sometimes increase with age, sometimes decrease with age, and occasionally appear to be developmentally invariant; second, why larger misinformation effects are sometimes found for older children while sometimes the reverse has been reported; and third, why suggestibility has been shown to be a function of trace strength in some studies (e.g., Pezdek & Roe, 1995) but not in others (Howe, 1991; Zaragoza, 1991).

Although explanations have been offered for each of these sets of contradictory findings, the challenge has been to account for all of them within a single framework in a manner that is anticipatory rather than post hoc and that is generative of testable hypotheses. Brainerd and Reyna (1998, this issue) provide just such a theoretical framework for these diverse and seemingly disparate phenomena.

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findings. In particular, they provide a principled basis to account for inconsistencies in the developmental literature by examining, separately, the processes and contributions of first, false alarms (false recognitions) and, second, erroneous rejection of actual targets. As we argue below, fuzzy-trace theory is the engine driving this accomplishment.

Much is already known about the formation of false memories that results from the introduction of misleading postevent questioning (Ceci & Bruck, 1993). However, considerably less is known about the formation of false memories that arise spontaneously, that is, that are self-generated. Brainerd and Reyna’s fuzzy-trace theory provides the first unified theoretical account of the twin phenomena of the formation of spontaneous self-generated false memories as well as the formation of false memories that are induced through misleading, postevent misinformation. This theoretical achievement alone would be reason to take notice of their approach, but it has another, more subtle, advantage: Because fuzzy-trace theory is embedded in a broad empirical framework it is possible to generate testable predictions about the durability and persistence of true and false memories. Below we describe three previously unexplained findings that fuzzy-trace theory predicts: (1) reverse developmental effects, (2) differential time-courses for true and false recognitions, and (3) the memorial bases of developmental suppression of hit rates along with the simultaneous elevation of certain types of false alarms.

Before addressing these issues, it should be noted that fuzzy-trace theory predicts all three findings by virtue of its elegant demonstration that verbatim and gist memory can be functionally independent of each other. Several empirical examples of this principle have been reported (see also Brainerd, 1996; Brainerd et al., 1997; Reyna, 1996). In one type of experiment (e.g., Brainerd & Gordon, 1994; Reyna & Kiernan, 1994), target information is presented (for example, that Farmer Brown owns 10 cows, 7 sheep, and 2 horses) and, later, memory tests are administered for both its verbatim content (Does Farmer Brown own 10 cows? How many sheep does Farmer Brown own?) and, various forms of gist (Does Farmer Brown own more sheep or more horses? What type of animal does Farmer Brown have the most of?) It has typically been found that the accuracy of children’s (and adult’s) performance on gist-memory tests is statistically independent of their performance on tests for the verbatim content that instantiated that gist in the first place. In these same experiments, further evidence for the independence of verbatim and gist traces has been provided by manipulations that dissociate performance on the two types of tests (i.e., manipulations that improve verbatim accuracy without affecting gist accuracy, and vice versa). In the lead paper, Brainerd and Reyna (1998, this issue) have presented mathematical models that allow the types of memory judgments that are supported by verbatim traces (identity and nonidentity) and by gist traces (similarity) to be factored and separately quantified. This step is crucial to bring order to the seemingly contradictory claims enumerated earlier.
Reverse developmental effects. Although it is widely accepted that suggestibility decreases with age, fuzzy-trace theory predicts that reverse developmental effects will appear under specific conditions. In particular, it predicts age increases in suggestibility whenever suggestibility effects depend primarily on verbatim memory for the misinformation (which will improve with age) rather than on forgetting of the original information (which will decrease). An extrapolation of this position leads to the prediction that suggestibility will increase with age whenever the suggestibility is dependent on memory for complex gists. This prediction rests on the premise that older, but not younger, children will have the ability to understand these complex meanings or make these inferences.

In the lead article, Brainerd and Reyna review data which show increases in suggestibility with age; these data were obtained under conditions which, according to fuzzy-trace theory, should favor age-linked increases in suggestibility. Not only are these results theoretically intriguing, but they may also have important consequences for how we assess the credibility of child witness’ testimony in certain court cases. For instance, if interviewers suggested many things to an 8-year-old, the prosecution might argue that one need not be concerned with this high degree of suggestion because preschoolers, not 8-year-olds, exhibit heightened suggestibility under such conditions. However, if the 8-year-old is testifying to specific alleged facts, the child would be more likely to recollect the verbatim details of the interviewer’s suggestion than even preschoolers would be. This helps explain the occurrences, albeit rare, in which older children exhibit more suggestibility than younger children (Duncan, Whitney, & Kunen, 1982; some aspects of Pezdek & Roe’s, 1995 findings).

Time-course for true and false recognitions. Fuzzy-trace theory makes the counterintuitive prediction that false memories, under the relevant experimental conditions, persist longer than true memories. The memorial basis of correct recognition (i.e., hits) is verbatim processing, which deteriorates faster than gist-based processing and which, under appropriate experimental conditions, underpins false recognitions. Under such conditions, it follows that the memorial basis of hits can be expected to shift over time from verbatim to gist based while the memorial basis of false recognitions remains stable (i.e., gist based). Hence, under the relevant experimental conditions, false recognitions should have greater durability than hits.

Developmental suppression of hit rates. Misinformation can have either of two results; first, it can lead to the suppression of correct identification, and second, it can lead to the elevation of false recognition rates if the foils entail the misinformation’s gist. By assuming that (1) judgments made on the basis of verbatim processing customarily lead to hits, (2) that the suppression effect is due to retrieval of some of this verbatim information, and (3) that judgments of nonidentity lead to rejection of related distracters, then the elevation of incorrect decisions can be the result of either the retrieval of verbatim traces or gist-based aspects of the misinformation that was presented. This is a tidy way of account-
ing for the diverse findings that have appeared in the literature in recent years (e.g., the different patterns reported in Ceci, Ross, & Toglia, 1987; Howe, 1995; and Pezdek & Roe, 1995).

**Suggestibility and trace strength.** Perhaps nowhere has the confusion been greater than over the claim that suggestibility is independent of the strength of the original memory (Howe, 1991). Intuitively, one would expect instead that the stronger one’s memory of something, the harder it would be to overwrite it with false suggestions. Although there is ample empirical support for the intuitive claim that it is hard to alter strong beliefs and memories (Pezdek & Roe, 1995; Warren & Lane, 1995), there are several sets of findings that complicate this intuition (Howe, 1991; Zaragoza, 1991). Brainerd and Reyna’s framework allows us to go beyond intuition by providing an account of why and when trace strength manipulations should be associated with suggestibility. In Experiments 1 and 2 Brainerd and Reyna found between-group variation as a function of trace strength. However, in Experiment 3, they found that the effect is essentially reversed for related distracters when targets are still fresh. This finding is consistent with a trace strength hypothesis.

Finally, we come to the potential forensic implications of Brainerd and Reyna’s distinction between spontaneous and induced false memories. In forensic cases, an important consideration is false memory reports that arise from specific suggestions by police, social workers, parents, and therapists. One aspect of developmental research that has become widely known to law enforcement and social services interviewers is the admonition to avoid interviewing young children suggestively. However, there is still little awareness that some false memories arise spontaneously (i.e., they are not induced by the interviewer’s suggestions). Indeed, spontaneous false memories are a routine part of everyday memory, probably more common than the implanted variety. Brainerd and Reyna’s article may well become known for the empirical separation and explanation of these two sources of inaccuracy. Among the many contributions of their work, this may be the most lasting.

**REFERENCES**


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