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The Distinctions of False and Fuzzy Memories

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Fuzzy-trace theory has recently been used to account for various types of "false memories" (Brainerd & Reyna, 1998, this issue). Although components of fuzzy-trace theory—in particular the distinction between gist and verbatim traces—overlap with distinctions made in other theories of memory, those in fuzzy-trace theory provide an illuminating account of the conditions under which semantic associates of previously seen items are erroneously recognized. However, the theory is less useful in explaining misinformation effects. Fuzzy-trace theory's differential success in accounting for these two types of errors follows from one of its central implications: whereas misinformation effects involve false memories, the erroneous recognition of related lures is due to a reliance on authentic, but underspecified, gist memories. As its name suggests, fuzzy-trace theory is best at explaining memory errors resulting from fuzzy traces. Consistent with this view, fuzzy-trace theory helps to explain another source of memory errors (verbal overshadowing of nonverbal memories) that may also be best characterized as resulting from a reliance on fuzzy, rather than false, memories.
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Although memory errors have been an important topic of research for decades, the recent reframing of such errors as "false memories" has greatly enhanced both the public and the scientific communities' interest in the topic. This new-found fascination with memory errors that have been dubbed "false memories" has likely been fueled by the heated debate over the validity of memories of childhood sexual abuse. Lately there has been a growing concern that therapists may be inducing false memories of childhood abuse in their patients (cf. Lindsay & Read, 1994; Loftus & Ketcham, 1994; Schooler, 1994). One important source of evidence for this concern is the empirical literature that has demonstrated, in a variety of contexts and paradigms, that people can come to falsely remember information that is suggested by an experimenter (for a recent review see Loftus, 1997).

Though much of the original research on false memories involved exper-

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imenter-provided misinformation (e.g., Loftus, Miller, & Burns, 1977; Schooler, Gerhard, & Loftus, 1986), the recently increased interest in the topic has led researchers to consider alternative sources of false memories. In 1995, Roediger and McDermott reintroduced a paradigm originally developed by Deese (1959) in which subjects are given sets of categorically related words that omit the most prototypical member of each. On subsequent recognition tests, participants are as likely to inaccurately recognize the never seen prototype word as the previously seen targets. With a keen sensitivity to the zeitgeist of the times, Roediger and McDermott characterized the high false alarm rate for related distractors as "false memories." Since this redubbing, there has been a remarkable surge in research on memory errors involving semantic associates of previously seen items (for a recent review see, Robinson & Roediger, 1997).

The characterization of memory errors as false memories—induced either through misinformation or related foils—naturally invites theories that can offer a general account of both types of errors. Brainerd and Reyna (1998, this issue) argue that fuzzy-trace theory provides such an account. The central assumption of fuzzy-trace theory is that memories are not unitary representations, but rather involve two distinct traces: (1) a verbatim trace corresponding to an item's surface form and (2) a gist trace corresponding to the semantic, relational, and elaborative properties of the stimulus. Brainerd and Reyna further posit that these two types of traces are differentially affected by various conditions. For example, verbatim traces are hypothesized to decay faster than gist traces, resulting in a greater reliance on gist traces over time.

As will be argued, fuzzy-trace theory is quite effective in explaining the sources of erroneous recognition of related foils. However, a central implication of this account is that such errors are the result of a reliance on fuzzy (gist based), but not actually false, memories. Indeed, it is arguably because such errors are the product of fuzzy but not false memories, that fuzzy-trace theory does so well in explaining them. Consistent with this view, fuzzy-trace theory is notably less effective in accounting for errors that really do involve false memories, that is, to those due to encountering misinformation. However, when applied to memory errors resulting from verbalization of nonverbal memories—that also may involve a reliance on underspecified, but not actually false memories—fuzzy-trace theory once again offers considerable explanatory power.

In the following discussion, I will illustrate fuzzy-trace theory's differential effectiveness in accounting for errors due to fuzzy vs false memories. However, before doing so, it may be helpful to briefly review fuzzy-trace theory's central theoretical underpinning: namely, the verbatim/gist distinction. As will be shown, this distinction overlaps considerably with a number of other memory distinctions, raising important questions regarding exactly how these various distinctions should be mapped on to one another.

PARALLELS BETWEEN THE VERBATIM/GIST DISTINCTION AND OTHER MEMORY DISTINCTIONS

Theoretical memory distinctions are a bit like toothbrushes. Everyone seems to have one, but no one wants to use anyone else's (cf. Watkins, 1984). Consequently, the literature is littered with memory distinctions that closely resemble one another, but for which the precise degree of overlap is never fully assessed. The gist/verbatim distinction is no exception. Although Brainerd and Reyna's dual representation approach provides an illuminating account of various patterns of memory errors, it shares some fundamental, yet underspecified, similarities with numerous other approaches.

Schematic and nonschematic memories. Brainerd and Reyna note that fuzzy-trace theory was specifically developed to counter the constructivists' claim that verbatim information is lost from memory, leaving only the gist. While this is an important point, it was also persuasively made by Alba and Hasher (1983). Alba and Hasher similarly concluded that memory is not purely constructive, but rather maintains a surprising wealth of information beyond the gist or schema of the event. As Alba and Hasher note, "memory for complex events is far richer and more detailed than schematic processes would allow. At least some schematically unimportant information is stored"[1] (p. 225).

Dual process theories. Mandler's (1980, 1989) dual process theory is another approach which has strong parallels to fuzzy-trace theory (see also Atkinson & Westcourt, 1975; Jacoby & Dallas, 1981). Dual process theory assumes that retrieval involves two processes, familiarity and recollection, that depend on two distinct types of information. Familiarity is assumed to depend on a perceptual code which "involves sensory and perceptual integration of the elements of the target event . . . independent of its relation to other events and representations" (Mandler, 1980, p. 255). In contrast, recollection is hypothesized to depend on a conceptual code which involves "the establishment of relationships with other mental contents" (Mandler, 1989, p. 211). In addition to being distinguished by their conceptual quality and relatedness to other items, these two types of information also parallel the gist/verbatim distinction in the manner in which they are associated with various encoding and retrieval conditions. For example, like verbatim memories, the perceptual code is strengthened by repetition. Similarly, like gist memory, the conceptual code is strengthened through its association to conceptually related information. With respect to retrieval, both the perceptual code and verbatim traces are hypothesized to decay relatively quickly, whereas both the conceptual code and gist traces are hypothesized to decay more slowly.

Despite these striking parallels, there are also some important incongruities

[1] Despite this central conclusion, Brainerd and Reyna nevertheless cite Alba and Hasher as an exemplar of the constructivist view. However, they are in good company. Hasher (personal communication, April 3, 1998) notes many citations to this work omit its central conclusion that memory is *not* entirely schematic.

between the perceptual/conceptual distinction and the verbatim/gist distinction. Most notably, Brainerd and Reyna argued that verbatim memories elicit the phenomenology of recollection whereas gist memories are subjectively experienced as familiarity. In contrast, Mandler made the opposite mapping, with the perceptual code associated with familiarity and the conceptual code with recollection. It is not exactly clear how to reconcile these disparities, but they highlight the need for greater explicit comparison between what are otherwise very similar distinctions.

Distinctiveness and similarity. Hunt and McDaniel (1993) proposed yet another theory that posits distinct memory information sources which, like fuzzy-trace theory, differentially emphasize relational and item specific information. Hunt and McDaniel similarly observe the difficulties with positing singular memory representations and instead emphasize the value of separately considering the contribution of distinctive and relational information in memory. Like verbatim memories, distinctive processes are characterized as relying on the unique attributes of each stimulus. Like gist memories, relational processes are characterized as relying on the relations between stimuli. Also, as with fuzzy-trace theory, Hunt and McDaniel hypothesized that both types of information contribute to recognition decisions, but that the relative contribution of each depends on the specific encoding and retrieval conditions.

Hemispheric difference. Memorial differences hypothesized to distinguish the two hemispheres also have a close mapping to the verbatim/gist distinction. Metcalfe, Funnell, and Gazzaniga (1995) proposed that "the right hemisphere may be better than the left at veridical information, whereas the left hemisphere generalizes over and (incorrectly) remembers related information" (p. 157). Using a commisurotomy patient, Metcalfe et al. observed that the patient's right hemisphere was superior to his left in rejecting new stimuli that were similar to previously seen ones. In fuzzy-trace terms, this suggests that the right hemisphere may be superior to the left at relying on verbatim traces. Other studies have found the left hemisphere to be more effective on tasks that require a sensitivity to gist information. For example, using a visual classification task with normal subjects in a split visual field paradigm, Marsolek (1995) found that new but prototypically related items were more effectively categorized when presented to the left hemisphere (right visual field) than when presented to the right hemisphere (left visual field).

Summary. The above is only a sampling of the extant memory distinctions that may share at least the gist of fuzzy-trace theory. Other potentially relevant distinctions include: dual code theory (e.g., Paivio, 1986), the data driven/conceptual driven processing distinction (e.g., Roediger, Weldon, & Challis, 1989), and the exemplar vs rule based categorization distinction (e.g., Whittlesea, Brooks, & Westcott, 1994). However, because these parallels have not been fully mapped out, it is difficult to assess the extent to which these distinctions are identities or merely share a certain family resemblance. In addition to helping to

sort out the new from the old, a systematic comparison of the various distinctions that are (at least superficially) similar to the gist/verbatim distinction might provide some important conceptual advances. For example, if the perceptual code of dual trace theory is distinct from the verbatim memory of fuzzy-trace theory, then their otherwise striking similarities raise the possibility that in some situations their respective contributions could be confounded. The clear delineation of the relationship between verbatim/gist and other related distinctions could also help to reveal important sources of mutual compatibility. For example, given the laterality data reviewed above, it seems quite plausible that gist and verbatim memories may be hemispherically distinguished. Identifying different neural substrates for gist and verbatim memory processes would certainly represent an important advance in conceptualizing fuzzy-trace theory.

THE UTILITY OF FUZZY-TRACE THEORY IN ACCOUNTING FOR VARIOUS TYPES OF MEMORY ERRORS

Although certain key components of fuzzy-trace theory may overlap with other theories, the theory unquestionably provides a number of important and novel insights into the sources of memory errors (as well as incidentally helping to elucidate children's reasoning processes, e.g., Reyna, 1995). In the following section, I will briefly review fuzzy-trace theory's success in accounting for memory errors due to: (1) related lures, (2) misinformation, and (3) verbalization of nonverbal memories.

Fuzzy-trace theory and errors due to related lures. Fuzzy-trace theory offers a straightforward account of why people often incorrectly recognize lures that are semantically related to previously seen items. Specifically, it suggests that such errors occur when experimental conditions encourage a reliance on gist based memories. Accordingly, because a related lure and a target share the same gist, from the perspective of gist memory, a related lure has been seen before. In contrast, when conditions favor the retrieval of the verbatim memory, related lures should be rejected because they are, from the vantage of a verbatim memory, quite different from what was encoded. The seemingly straightforward insight that related lures are old from the perspective of gist memory has a rather profound implication for discussions of false memories. Specifically, it suggests that many of the memory errors that have recently been characterized as false memories are not really false memories at all, they are simply fuzzy memories. When participants incorrectly recognize a related lure, they are not relying on new memory for something that never occurred. Rather, they are relying on an accurate gist memory in the absence of access to the verbatim component. Although deceptively simple, this basic account helps to explain a number of otherwise puzzling findings. For example, the observation that related foils are sometimes more likely than actual targets to be recognized can be explained by the assumption that the foils share the gist of more previously learned items than do the targets. Consequently, these prototypical foils are favored on recognition tests that especially draw on gist representations.

Fuzzy-trace theory also holds potential for accounting for the rather inconsistent developmental findings regarding these types of errors. As Brainerd and Reyna observed, developmental patterns in children's inclination to false alarm to related lures are inconsistent with some studies finding increases with age, other studies finding decreases, and still others finding no effects of age at all. Such confusing age trends can potentially be resolved based on three quite reasonable assumptions: (1) Accessing gist and verbatim memories have opposite effects on the probability of calling a related lure old; (2) both gist and verbatim memories improve with age; (3) experiments vary in the degree to which they encourage the use of verbatim and gist memories. Accordingly, in situations in which gist memories are particularly apt to be accessed, the false recognition of related lures should increase with age because older children are more likely to retrieve the corresponding gist memory and therefore to believe that the related lure is old. Under situations in which verbatim memories are most apt to be accessed, the pattern should be reversed, with older children being less likely to false alarm to related distractors. In such situations, since older children are more likely to retrieve verbatim traces, they should be better able to recognize that a related lure is inconsistent with the verbatim trace. Finally, in conditions in which both types of traces are likely to be accessed, there should be no developmental differences in the propensity to false alarm to related foils, because the increases in accessibility of gist and verbatim traces should cancel each other out.

Consistent with the above account, Reyna and Kiernan (1994) encouraged verbatim retrieval by giving memory tests in close temporal proximity to encoding and observed that false recognition effects to lures decreased with age. In contrast, Brainerd and Mojardin (1997) encouraged gist retrieval by introducing delays between encoding and test and observed developmental increases in false recognition. One problem with such analyses is that the relative reliance on gist vs verbatim memory must be inferred based on the nature of the experimental conditions. A more compelling demonstration of the role of gist and verbatim memory in mediating developmental trends in false recognition of related foils would entail actually assessing the contribution of these two sources within paradigms that showed developmental differences. Although Brainerd and Reyna have yet to provide such a systematic comparison of studies producing distinct age trends, they recently introduced a conjoint recognition paradigm that has the potential to tease out the relative contributions of gist and verbatim traces in developmental studies. In addition to the standard task of accepting targets and rejecting related and unrelated distractors, this paradigm also includes trials in which participants must accept related distractors and reject both targets and unrelated distractors and trials in which they must accept both targets and related distractors and reject unrelated distractors. Through somewhat elaborate multinomial modeling, this procedure enables the independent assessment of participants' reliance on verbatim and gist knowledge for both acceptance (identity) and

rejection (nonidentity) judgments. In a developmental study that found no overall changes in false recognition, Brainerd and Reyna nevertheless observed with this procedure that both gist memory and verbatim memory improved with age. This pattern is consistent with the claim that a lack of developmental changes in false alarms to related lures can occur when developmental changes in gist and verbatim memory cancel each other out.

In short, fuzzy-trace theory provides a compelling account of the mechanisms underlying the false recognition of related lures, and although more data need to be collected before firm conclusions can be reached, it also offers a rather promising explanation for inconsistencies in developmental changes in such errors.

Misinformation effects. Although fuzzy-trace theory's account of false alarms to related lures is quite compelling, its characterization of misinformation effects is less useful. According to fuzzy-trace theory, and indeed according to most current conceptualizations of misinformation effects, when individuals encounter misinformation about an event, they may generate a *new* inaccurate memory for the suggested item. Since, unlike memory errors associated with related lures, misinformation induced memory errors correspond to a new inaccurate memory, such memories really can be characterized as false memories. However, because these errors result from a conflict between authentic and false memories, rather than between gist and verbatim memories, fuzzy-trace theory is relatively ineffectual in accounting for misinformation based memories. In other words, fuzzy-trace theory's advantage in accounting for relatedness (as compared to misinformation based errors) results because the distinction between gist and verbatim memories, which is at the heart of both fuzzy-trace theory and relatedness errors, is ultimately only ancillary to misinformation based errors.

Fuzzy-trace theory's relative lack of explanatory strength in accounting for misinformation errors is illustrated by a brief review of the predictions that it makes. Its first prediction is that misinformation will simultaneously elevate false alarm rates for misinformation embodying distractors and lower hit rates for targets (Brainerd & Reyna, 1998). This follows because the verbatim trace for the target item is suppressed while the verbatim trace for the suggested item is created. However, this prediction falls out from any memory coexistence account (e.g., Chandler, 1989; Morton, Hammersley & Bekerian, 1985) that assumes that following misinformation, the suggested item becomes more available and the target less so. Fuzzy-trace theory's second prediction regarding misinformation effects is equally indistinct. Specifically, it predicts that false alarm rate elevation should be larger than the hit rate suppression. This follows because access to either verbatim or gist traces of the misinformation produces false alarms to distractors, but only access to the verbatim trace of the misinformation produces misses. However, this prediction also follows from any theory that assumes that some people who do not encode the original information are apt to encode the postevent suggestion (cf. McCloskey & Zaragoza, 1985; Lindsay, 1990). Ac-

cording to such accounts, all subjects who encode the postevent information can drive increases in false alarms to distractors. However, reductions in hits for targets that are induced by misinformation will be limited primarily to that subgroup of participants who encode the target and then lose access to it following the encoding of misinformation.

Fuzzy-trace theory also does little to further our understanding of the inconsistent developmental trends in susceptibility to misinformation. Under the assumption that increases in age are associated with increases in both gist and verbatim memories, it follows that age should increase retrieval of both types of traces for both the original and the postevent items. Because the gists are identical for the two types of memories, changes in gist memory should have no impact on performance with respect to misinformation effects. Thus, age increases are predicted to enhance the availability of the verbatim representations of both the original and postevent suggestion, leading to no clear predictions regarding developmental changes in misinformation effects. Brainerd and Reyna (1998) claimed that variations in the relationship between misinformation effects and age should be "lawfully related to manipulations that affect reliance on verbatim and gist memory." However, they provide no real evidence for this assertion, they never precisely flesh out what those lawful principles should be, nor do such principles logically follow from their theory. Again the inadequacy of fuzzy-trace theory in this context occurs because, as noted, the verbatim gist distinction is basically ancillary to misinformation effects.[2]

Brainerd and Reyna are correct in proposing that "reversals in developmental trends for . . . the misinformation effect can be explained as nothing more than normal variations in opponent memory processes" (p. 45). Fuzzy-trace theory simply does not appear to offer the opposing processes that could account for such developmental variations. An alternative account of opposing processes that may be more effective in explaining such developmental discrepancies is provided by Schooler and Loftus (1993). They argue that with age, children may become decreasingly inclined to acquiesce to misinformation when it is encountered (because either their memory for the original event is weaker and/or they are generally more aquiescent). However, if misinformation is accepted, then older children's superior memory skills may make them more apt to subsequently recall the misinformation. Schooler and Loftus note that such developmental differences in *immediate misinformation acceptance* and *delayed misinformation*

[2] Although fuzzy-trace theory does not appear to offer much in the way of new theoretical insight into the sources of or individual differences in misinformation effects, Brainerd and Reyna's conjoint-misinformation procedure (in press) may still prove to be quite useful. Specifically, this procedure can (in principle) distinguish between two distinct effects of misinformation: decreases in preference for the misinformation item and increases in preferences for the suggested item. Note, however, that from the perspective of fuzzy-trace theory, both of these effects would be characterized solely with respect to differences in the verbatim memory of the original and misinformed item. Thus, the verbatim/gist distinction itself would not add to our understanding of such differences.

retrieval could potentially account for the mixed findings in the literature. As they observe:

> Generally speaking, studies with longer [retention] intervals, have observed less differences between adults and children, perhaps because with longer delays, children are more likely to forget the misinformation, thereby counteracting any greater tendency they may have to accept misinformation in the first place. (p. 199)

Thus, in contrast to fuzzy-trace theory, this approach identifies two distinct memory components (immediate misinformation acceptance and delayed misinformation recall) that are likely to (1) differentially mediate the effects of misinformation, (2) develop in opposite directions, and (3) differentially contribute to performance depending on experimental conditions. (Incidentally, differences in these two components were also shown to potentially contribute to a number of other individual differences in misinformation as well.) In the context of the previous distinctions-as-toothbrushes analogy, at least in this case, our toothbrush may do a better job than theirs.

Fuzzy-trace theory and verbal overshadowing. Though fuzzy-trace theory provides little additional explanatory power in accounting for misinformation effects, it may be quite useful in accounting for a seemingly related type of memory distortion known as verbal overshadowing—the finding that verbalization of nonverbal stimuli (faces or color) can interfere with subsequent recognition performance (for recent reviews see Schooler, Fiore, & Brandimonte, 1997; Schooler, Ryan & Reder, 1996). In the standard verbal overshadowing paradigm (e.g., Schooler & Engstler-Schooler, 1990), individuals view a difficult to verbalize stimulus such as a face. Later some subjects are asked to describe the stimulus in as much detail as possible while others (controls) engage in an unrelated activity. Finally all subjects are given a recognition test in which they have to distinguish the target stimulus (e.g., a different picture of the same face) from verbally similar distractors (e.g., a set of foils that generally fit the description of the previously seen face). The standard and somewhat counterintuitive finding in this paradigm is that the act of verbally describing a nonverbal stimulus can markedly impair individuals' subsequent ability to recognize that stimulus. This basic finding has now been found to generalize to a variety of different nonverbal domains including memory for color (Schooler & Engstler-Schooler, 1990), audition (Houser, Fiore, & Schooler, 1998), taste (Melcher & Schooler, 1996), maps (Fiore, 1994), and visual forms (Brandimonte, Schooler, & Gabbinno, 1996).

In the original account of verbal overshadowing effects (Schooler & Engstler-Schooler, 1990), verbal overshadowing was assumed to be an a analogue to the misinformation effect. Accordingly, verbalization of nonverbal stimuli was hypothesized to result in the formation of a self-generated nonveridical representation (a false memory) that interfered with subsequent access to the original perceptual representation. However, a variety of studies have now found evidence inconsistent with this claim. For example, such an account predicts a

relationship between the contents of participants' verbalization and their recognition decisions. However, Fallshore and Schooler (1995) found no relationship between the quality of verbal descriptions (as determined by whether independent judges could identify the target face on the basis of the description alone) and recognition accuracy (whether the verbalization subjects were successful). More telling still, Dodson, Johnson, and Schooler (1997) found that verbalization was disruptive even when it was not of the precise target stimulus; that is, verbalizing one face interfered with the recognition of a different face. These findings suggest that, rather than causing a competing false memory representation, verbalization may alter a subject's relative access to critical information necessary for successful performance on nonverbal memory tasks, (though see Brandimonte, Schooler, and Gabbino (1997) for a variant of the paradigm that may involve conflicting representations).

Although perplexing when considered as a source of false memories, these consequences of verbalization may readily lend themselves to an account in terms of fuzzy-trace theory. Accordingly, under the assumption that verbalization emphasizes the gist of a memory, verbalization may cause a shift in individuals' relative access to gist and verbatim information, increasing access to gist information and decreasing access to item specific (verbatim) information. Because the foils in these studies are similar to the targets, a change in the relative reliance on gist vs verbatim memory would simultaneously increase foil false alarms and decrease target identification. And this is exactly what we have found. Thus, verbal overshadowing errors seem to be an especially fruitful domain for future applications of fuzzy-trace theory.

Further support for the potential relevance of fuzzy-trace theory to verbal overshadowing effects stems from recent investigations of individual differences in susceptibility to verbal overshadowing. Ryan and Schooler (in press) examined the impact of verbalization on memory for faces as a function of participants' relative verbal and perceptual memory skills. From the perspective of fuzzy-trace theory, individuals with strong verbal abilities and modest perceptual memories might be expected to rely more on their gist memories in recalling perceptual experiences such as the appearance of a face. Accordingly, if verbalization encourages a reliance on gist memories, this should not be disruptive for such individuals because they are presumably already relying on their verbatim memories. And indeed, consistent with this prediction, verbal overshadowing effects were completely eliminated (in fact numerically reversed) for subjects who had strong verbal abilities but relatively weak perceptual memory abilities. In contrast, from the perspective of fuzzy-trace theory, individuals with strong perceptual abilities and weak verbal skills might be expected to rely particularly on their verbatim (perceptual based) memories. Thus, if verbalization especially disrupts verbatim memories, these individuals could reasonably be expected to be especially impaired by verbalization. Consistent with this prediction, Ryan and Schooler found that verbal overshadowing effects were maximized for individ-

uals who had strong perceptual memory abilities but weak verbal ability. In short, although not explicitly formulated to test the application of fuzzy-trace theory to verbal overshadowing, Ryan and Schooler's findings suggest that fuzzy-trace theory may be helpful in accounting for specific individual differences in susceptibility to verbal overshadowing. These findings also suggest that examination of individual differences in verbal and perceptual skills may be useful in other domains in which participants can vary in their reliance on verbatim and gist memories.

CONCLUSION

Although fuzzy-trace theory has recently been suggested to provide a general account of various sources of "false memories," a central implication of fuzzy-trace theory is that some errors that have been characterized as false memories are not really false at all. Ironically, it is precisely these types of errors that fuzzy-trace theory explains the best. Fuzzy-trace theory is particularly successful in explaining false alarms to related lures. However, its account of such errors does not assume that participants have generated a new memory for something that never occurred. Rather, erroneous identifications of related lures are assumed to involve the accurate remembering of the gist of the memory in the absence of access to the verbatim component. In short, a central implication of fuzzy-trace theory is that the erroneous identification of related lures is a consequence of fuzzy, but not false, memories.

In contrast to memory errors resulting from the relatedness of targets and lures, errors resulting from misinformation really can be appropriately characterized as false memories. However, fuzzy-trace theory is considerably less effective in accounting for misinformation based memory. Fuzzy-trace theory's difficulty in accounting for misinformation effects stems from the fact that, in contrast to errors associated with related lures, misinformation based errors cannot be distinguished from accurate responses on the basis of their relative reliance on verbatim and gist information. Thus, fuzzy-trace theory does not appear to provide the opposing processes necessary to account for individual differences in the recall of accurate and suggested memories.

A potentially more useful distinction in accounting for individual differences in susceptibility to misinformation is between the processes that contribute to immediate misinformation acceptance and delayed misinformation retrieval (cf. Schooler and Loftus, 1993). Accordingly, with age, individuals may become decreasingly likely to acquiesce to misinformation when they first encounter it, but increasingly likely to recall misinformation if they did happen to accept it. Thus, from this view, findings of increases, decreases, or no developmental changes in susceptibility to misinformation may depend on the degree to which the characteristics of an experiment especially emphasize immediate misinformation acceptance (e.g., if the misinformation is blatant) or delayed misinformation recall (e.g., if there is an extended period between misinformation and

test). Accordingly, if the paradigm emphasizes immediate misinformation acceptance (which is hypothesized to decrease with age), then suggestibility should similarly be found to decrease with age. If a paradigm emphasizes delayed misinformation recall (which is expected to increase with age) then suggestibility should be found to increase. And if a paradigm emphasizes both factors, then there may be little relationship between age and suggestibility.

Although fuzzy-trace theory does not appear to be all that useful in extending our understanding of misinformation effects, it does seem to hold great potential in accounting for yet another type of memory disruption: the disruptive effects of verbalization on nonverbal memories. However, once again, fuzzy-trace theory's utility in this context stems from the fact that such memory errors are not, as was once thought, a product of the formation of new nonveridical (false) memories. Rather, verbal overshadowing effects now appear to result from a verbally induced shift to a reliance on less discriminating (more fuzzy) memorial information; precisely the type of account for which fuzzy-trace theory is most effective.

The recent surge in popular interest in false memories makes it tempting to refer to all memory errors as false memories. However, both the successes and limitations of fuzzy-trace theory suggest that we must avoid such overgeneralizations. Whereas some recollections are false, others are just fuzzy.

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