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Edited by

David G. Payne
Binghamton University
State University of New York

Frederick G. Conrad
Bureau of Labor Statistics



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8 Constraints on the Suggestibility of Eyewitness Testimony: A Fuzzy-Trace Theory Analysis

Valerie F. Reyna
Allison L. Titcomb
University of Arizona

Numerous studies have established that memory performance is subject to distortion (Schacter, 1995). Well-known demonstrations include the *suggestibility effect*, in which misleading information given subsequent to an event causes errors in an eyewitness' account of that event (e.g., Ceci & Bruck, 1993; Loftus & Hoffman, 1989); the *autosuggestibility effect*, in which memory errors are generated by eyewitnesses themselves (e.g., Ackerman, 1992; Brainerd & Reyna, 1995; Reyna, 1995); and *source confusions*, or misattributions, in which eyewitnesses fail to remember the source of misleading suggestions and, therefore, include those suggestions in their account of an event (e.g., Lindsay, 1990). If we broaden our terms to incorporate "earwitness" accounts, as well as memory reports for written material, the literature on memory distortion is large indeed (e.g., Bransford & Franks, 1971; Brown, Smiley, Day, Townsend, & Lawton, 1977; Reyna & Kiernan, 1994).

Although the literature on memory distortion is extensive, much of it is devoted to empirical demonstrations, rather than theoretical explanations. Of course, empirical demonstrations are important for a variety of reasons. First, they indicate the range of phenomena to be explained—what is sometimes referred to as "existence proofs"—that is, they establish that certain effects exist. Empirical demonstrations also isolate factors that should figure in theoretical explanations. For instance, it has been shown that the factor of "delay" between experienced events and later memory tests affects suggestibility; so does age (e.g., Ceci & Bruck, 1993; Reyna, 1995). Hence,

the effects of delay and of age, among other factors, must be addressed by theories of suggestibility.

In this chapter, we discuss recent theoretical approaches to memory distortion, including fuzzy-trace theory, constructivism, and source monitoring. Our discussion is divided into two sections, based on the kinds of memory distortion phenomena that have been observed. In the first section, we review *interference* effects, in which memory distortion is caused by reporting the wrong memory representation. In the second section, memory distortion that results from *forgetting* is discussed. In closing, we spell out specific implications of recent theoretical approaches for applied issues in eyewitness testimony for both children and adults.

INTERFERENCE EXPLANATIONS OF MEMORY DISTORTION

The textbook explanation of distortion effects is that memory is constructive (Bjorklund, 1989; Schwartz & Reisberg, 1991). Constructivist theories have been applied to various forms of memory distortion, including suggestibility, autosuggestibility, and source confusions, in a variety of tasks, including recognition and recall. For example, in recognition tasks, subjects sometimes erroneously accept inferences as having actually been presented (Bransford, Barclay, & Franks, 1972; Bransford & Franks, 1971; Liben & Posnansky, 1977). The constructivist explanation for these false-recognition effects is that experienced events—the sentences that were actually presented—become integrated with inferences and other elaborations that go beyond direct experience. Recognition, as well as recall, is said to be based on integrated semantic representations in which memory for experience is intertwined with its interpretation (Bjorklund, 1989; Schwartz & Reisberg, 1991).

Similar constructivist explanations have been offered for suggestibility effects. Such explanations emphasize the malleability of memory, indicating that misleading suggestions produce some degree of storage failure for original memories (see Loftus, 1995). In these accounts, however, “constructivism” is often used to refer to both the theoretical explanations and to their empirical demonstrations, such as false-recognition effects or inferential remembering. The confounding of explanations with effects seems to be due to the belief that such effects are *prima facie* proof that memory must be constructive (see Reyna & Brainerd, 1995a, 1995b). This confounding would be appropriate if there were only one possible explanation for suggestibility effects, namely the constructivist one. There are, however, other accounts (Reyna & Kiernan, 1994). Furthermore, there is additional evidence about so-called constructivist findings that directly disconfirms the constructivist explanation (e.g., Reyna, 1995; Reyna & Brainerd, 1995b; Reyna & Kiernan, 1994).

One alternative to constructivism is source misattribution, in which memory distortions are analyzed as source errors. Consider the standard suggestibility paradigm, in which witnesses experience an original event (e.g., involving a screwdriver), and are later given misinformation (e.g., that the tool was a wrench). Suggestibility effects could occur because witnesses confuse the contexts in which they received original information with those in which they received misinformation (e.g., Lindsay, 1990). In this case, witnesses might retain accurate memories for both experiences that are not integrated with one another, contrary to constructivism (Reyna, 1995). For example, witnesses might accurately remember both a screwdriver and a wrench, but not remember which was presented as part of the original experience.

Although a source-monitoring explanation differs from standard constructivism, an even sharper contrast exists between the latter and fuzzy-trace theory. According to fuzzy-trace theory, witnesses derive both verbatim and gist representations of experience, roughly in parallel, and these memories remain dissociated (e.g., Reyna, 1992). This assumption implies that, in the standard suggestibility paradigm, both gist and verbatim representations of original and misleading information are stored. Accessing the verbatim representation of the original experience produces a correct response. Accessing the other representations can produce an error. Note that such errors do not necessarily imply storage failure.

Therefore, verbatim memory errors need not imply that witnesses have forgotten what they experienced. Instead, errors can occur because memory for the gist of the original experience is accessed, rather than verbatim memory (Reyna & Kiernan, 1994). For example, witnesses could access their gist memory that a tool of some kind was presented, and therefore erroneously accept "wrench." Presenting the original item, however, acts as a cue for verbatim memory (Reyna, 1995; Reyna & Kiernan, 1994). Thus, the same witness who accepted wrench, based on gist memory, could also accept screwdriver, based on verbatim memory.

Consistent with this account, memory distortion effects vary directly with the relative accessibility of gist versus verbatim representations (Reyna, 1995). For example, Ackerman (1992, 1995) has shown that cueing manipulations that cause children to access the gist of narratives increase memory errors. That is, children are *more* likely to erroneously report that an inference was explicitly stated in the narrative when that inference is cued prior to the memory test. In contrast, when verbatim memory is cued (e.g., by re-presenting the original stimuli), children are *less* likely to erroneously accept semantically consistent distractors (Brainerd, Reyna, & Kneer, 1995). Thus, memory errors can be increased by interference from gist representations, or they can be decreased by providing verbatim reminders of the original experience.

The effectiveness of cues depends on a number of factors, including age and delay. As an example, suggestibility effects increase with longer delays between original experience and later misinformation (e.g., Belli, Windschitl, McCarthy, & Winfrey, 1992; Poole & Lindsay, 1995; Reyna, 1995; Reyna & Kiernan, 1994; Titcomb & Reyna, 1995; Warren & Lane, 1995). Such delays decrease the accessibility of verbatim representations of original experience, which support accurate performance, but have relatively little effect on the accessibility of gist. Thus, memory performance after a delay is more likely to be based on gist, as opposed to verbatim memory, and witnesses are more likely to accept suggestions that are not verbatim representations of original experience.

In addition, memory judgments based on gist representations have been found to be independent of those based on verbatim representations (Reyna & Kiernan, 1994, 1995). For example, using a false-recognition paradigm (e.g., Bransford & Franks, 1971), memory judgments about presented sentences that authorized certain inferences were found to be completely unrelated to judgments about those inferences. For instance, judgments about presented sentences such as "The bird is in the cage" and "The cage is under the table" were completely unrelated to judgments about inferences such as "The bird is under the table." Apparently, separate, *nonintegrated* representations of experienced events (verbatim memory) and of inferences (gist memory) could be accessed independently.

Such findings disconfirm the central tenet of constructivism, that "memory errors occur because experienced events are integrated with inferences and other elaborations that go beyond direct experience" (Loftus, 1995). If such errors occurred because experienced events were *integrated* with inferences, then judgments about experienced events and about inferences would be *related* (as predicted by Paris & Carter, 1973). Thus, although constructivist findings have been replicated for both adults (Lim, 1993) and children (Reyna & Kiernan, 1994, 1995), the constructivist explanation for those findings has not been supported because memory for actual experience is dissociated from the understanding of that experience.

This series of studies has also shown that, although subjects engaged in "constructive, elaborative processes" (e.g., they systematically misrecognized true inferences), memory for actual experience was not necessarily influenced by these constructive processes (see Reyna & Brainerd, 1995b). Thus, evidence of systematic memory errors, such as false-recognition effects or suggestibility effects, does not imply that memory for actual experience has been modified. Indeed, memory errors (e.g., misrecognizing inferences as having been presented) and correct judgments about presented items were independent (see also Poole, 1995). Contrary to the constructivist assumption that "storage failures are often caused by constructive processes," the storage of verbatim memories was unaffected by constructive

processes (see also Titcomb & Reyna, 1993; Warren, Hulse-Trotter, & Tubbs, 1991).

In summary, memory distortion can occur if the wrong representation (i.e., the representation of gist rather than of verbatim events) is cued; the effectiveness of cues depends on a variety of factors, such as age and delay; gist and verbatim representations are accessed independently; and accessing gist representations on a verbatim memory test does not necessarily imply storage failure for original memories. These results are explained by fuzzy-trace theory's assumptions regarding dissociated gist and verbatim representations of experience (Reyna & Brainerd, 1995a), but they contradict constructivism.

There is theoretical agreement, however, that meaning is constructed from experience (e.g., Reyna, in press), and that people sometimes falsely assert that this constructed meaning was experienced directly (e.g., Ackerman, 1992, 1995). Furthermore, there is little question that reasoning about experiences can produce false constructions of those experiences, which can seriously undermine the accuracy of testimony about remembered events (Reyna, 1992). However, although memory *performance* is sometimes affected by these constructions, this does not mean that underlying representations of experience have been modified because, as noted, the data indicate otherwise.

Therefore, fuzzy-trace theory cannot be reconciled with constructivism by arguing that "sometimes memory might be shaped by such constructive, elaborative processes and sometimes not" (Loftus, 1995). Although there is agreement that this description applies at the level of data, there is disagreement about its implications. The empirical contradictions—sometimes memory performance appears to be constructive and sometimes it does not—have been noted for some time (see Alba & Hasher, 1983). The contradictions are not merely empirical, however. Constructivism supplies no coherent basis for understanding why, for instance, people sometimes remember schema-consistent events better than schema-inconsistent events, and, at other times, the reverse is true, or why subjects who have already introduced thematic intrusions and other memory distortions into their recollections can later accurately recover the original material (Hasher, Artig, & Alba, 1981; Hasher & Griffin, 1978; Schwartz & Reisberg, 1991). Ultimately, it is not sufficient to "explain" these data by saying that memory is sometimes constructive and sometimes is not. If constructivism encompasses both supportive and nonsupportive data, it is not falsifiable (Reyna & Brainerd, 1995b).

Instead, Reyna (1995) argued recently that these discordant memory phenomena can be better understood in terms of a taxonomy of memory representations and of tasks, or types of questions (see Table 8.1). This taxonomy provides an explanatory structure in which memory phenomena such as source confusions, suggestibility, and autosuggestibility can all be

related, and through which the appearance and disappearance of memory distortion effects can be predicted.

As we have seen, according to fuzzy-trace theory, some distortion effects have to do with *interference* from inappropriate memory representations. In the taxonomy, there are two kinds of questions that subjects might be asked and two classes of representations that subjects might use to answer those questions. Questioners can request exact memories (verbatim questions) or global judgments (gist questions). And, verbatim or gist representations can be used to answer these questions. This implies that there are four possible types of interference errors: giving an inappropriate gist or verbatim response to a verbatim question, or giving an inappropriate gist or verbatim response to a gist question. Examples are given in Table 8.1.

For instance, an error consisting of misidentifying gist as verbatim information might involve reporting an inference as having been witnessed directly. A number of familiar phenomena can be classified in this way, as gist interference with a verbatim task. These include standard false-recognition effects (Paris & Carter, 1973), inferential remembering in free recall (Brown, Smiley, Day, Townsend, & Lawton, 1977), say-mean confusions in which inferences are misattributed to text rather than to self (Beal, 1990a, 1990b), and source confusions in which imagined actions are misremembered as having actually been performed (Foley, Johnson, & Raye, 1983). Although these phenomena have been explained by different theories, fuzzy-trace theory suggests that they can be grouped together under the same explanatory umbrella.

Regarding source confusions, Reyna (1995) distinguished suggestibility effects that have to do with memory for events themselves from effects

TABLE 8.1
Examples of Interference Errors to Verbatim and Gist Questions

<i>Presented Stimuli</i>	
The bird is in the cage.	
The cage is under the table.	
The bird has yellow feathers.	
<i>Verbatim Question</i>	
Verbatim Error	Reject "The bird has yellow feathers" because retrieve "The bird is in the cage."
Gist Error	Accept "The bird is under the table" because retrieve inference.
<i>Gist Question</i>	
Verbatim Error	Reject "The bird is under the table" because retrieve "The bird is in the cage."
Gist Error	Accept "The bird is a canary" because retrieve inference.

Note: For verbatim questions, respondents should accept sentences that were actually presented. For gist questions, respondents should accept sentences that convey the meaning of presented sentences.

that have to do with memory for source. According to Reyna, event memories can be based on either gist or verbatim representations. However, source information, *as it is typically manipulated in experimentation* (e.g., Lindsay, 1990; Lindsay & Johnson, 1991), is likely to be represented only in verbatim memory. Therefore, memory for source is likely to become inaccessible at a more rapid rate than memory for content, leading to source confusions for remembered content.

Thus, suggestibility effects can occur either because subjects fail to remember *what* was presented or because they remember what was presented, but not *where* it was presented, and erroneously attribute later information to the original experience. Rather than treating all suggestibility effects as source confusions, this analysis implies that there are different kinds of suggestibility effects arising from different kinds of representations.

These effects of gist interference in verbatim tasks are also subject to developmental change. As children get older, they are more resistant to interference of all types, including gist interference with verbatim judgments (Dempster, 1992). For example, although younger children are not subject to greater misrecognition of inferences under neutral cueing conditions (e.g., Liben & Posnansky, 1977; Reyna & Kiernan, 1994), they are less able than older children to inhibit interference once inferences are cued (Ackerman, 1992, 1995; Beal, 1990a, 1990b). In other words, cueing children about inferences prior to verbatim questioning produces more errors among the younger children; asking whether it is *true* that the bird is under the table is apt to encourage children to claim that they heard the experimenter say "The bird is under the table."

In addition to being examples of gist interference in verbatim memory tasks, these kinds of say-mean confusions (as well as inferential remembering and confusion of imagined with real actions) are all examples of "autosuggestion" (Reyna, 1995). In autosuggestion, people confuse internally generated events with events that were actually experienced (Binet, 1900; Brainerd & Reyna, 1995; Ceci & Bruck, 1993; Reyna, 1995). For example, memories of imagined, dreamed, or inferred events may be reported as memories of real events. Thus, for both autosuggestion and suggestion, people misreport actual experience, but in suggestion the impetus is external.

Interference of the opposite sort—verbatim interference in gist tasks—has also been observed. Younger children are more susceptible to this kind of interference as well; they are more likely to give inappropriate verbatim responses in gist tasks. For example, younger children are more likely to erroneously reject true inferences in a comprehension task (to erroneously reject the true statement that "The bird is under the table") because the inferences cannot be located in (verbatim) memory (Brainerd & Reyna, 1993). Note that the same true inference—The bird is under the table—

should be accepted in the gist task but rejected in the verbatim task. Therefore, cues that were beneficial in the verbatim task, because they made verbatim memories more accessible, are detrimental in the gist task, and vice versa (Brainerd & Reyna, 1993; Reyna, 1995). In both the gist and verbatim tasks, older children are better able to inhibit inappropriate responses. Thus, there is *greater* dissociation between gist and verbatim representations with age.

This pattern of increasing dissociation with age between gist and verbatim representations disconfirms predictions by Piagetian constructivists that understanding gist improves memory performance (e.g., Chapman & Lindenberg, 1992; Prawatt & Cancelli, 1976). Rather than relying on their understanding of gist in verbatim memory tasks, older children more effectively inhibit these inappropriate representations. As verbatim memory becomes increasingly dissociated from gist, verbatim memory performance improves (Reyna, 1995; Reyna & Kiernan, 1994). Thus, developmental improvements in verbatim memory performance do not seem to be attributable to the development of constructive processes, such as inference and elaboration (see also Perner & Mansbridge, 1983).

These recent theoretical developments in the study of memory distortion have a number of practical implications. First, there appear to be multiple scenarios involving interference that can lead to the misreporting of actual experience. Total verbatim accuracy is an unrealistic expectation, even for truthful and highly motivated witnesses. Once experience is erroneously reported, however, memory cannot be assumed to be, "Humpty Dumpty like," broken beyond repair. Cues that reinstate original experience, such as returning to the scene of an event, can prompt the retrieval of accurate memories. Thus, it is crucial to distinguish different meanings of "remembering," depending on whether memories refer to gist or verbatim representations.

Some examples of gist versus verbatim remembering were apparently provided in the case of O. J. Simpson, accused of the murder of his ex-wife (e.g., "Limo Driver," 1995). For instance, in a preliminary interview, a witness in the O. J. Simpson case testified that he saw O. J. Simpson return to his home the night of the murder. Later, the same witness testified that he could not tell whether the person he saw was a man or a woman, but that he inferred that it was a man from the individual's size. Similarly, another witness testified that she remembered O. J. Simpson talking to a person outside her window; afterwards, she testified that what she actually remembered was that she heard another voice, and inferred that another person must be present. If we treat remembering as unitary, then these witnesses have contradicted themselves. Such witnesses might be challenged as unable or unwilling to tell the truth. On the other hand, if we distinguish gist from verbatim memories, the witnesses have not contradicted themselves. In both

instances, the gist is indeed consistent with the verbatim memory. With respect to discovering the truth, however, verbatim memory has clear advantages over gist (Reyna, 1992). Efforts to clarify these distinctions for witnesses, and to create conditions for interviewing witnesses that maximize opportunities to tap verbatim memory, would seem to be in order.

Interestingly, the "cognitive interview" (e.g., Fisher, McCauley, & Geiselman, 1994), designed to maximize the amount of correct information derived from witnesses, appears to incorporate something like the gist-verbatim distinction. As Fisher et al. noted, an "eyewitness may have several mental representations of the target event"; some representations are "highly detailed and reflect the minute, sensory properties" of the event, whereas other representations "reflect a more abstract, meaningful representation of the event" (p. 251). The techniques employed in the cognitive interview are aimed at increasing access to both kinds of representations. For example, witnesses are encouraged to relate events as though they were telling "a story" (i.e., to recall the gist of the event), but are also told to report specific (verbatim) detail "regardless of its perceived importance" (p. 247) in the overall narrative. Presumably, by tapping multiple memories for the same event, such techniques have produced impressive increases in the completeness of eyewitness accounts. Although the cognitive interview appears to encourage both gist and verbatim remembering, by decreasing leading questions and other potential sources of error, increases in correct information are generally produced without significant increases in incorrect information (see also Geiselman & Fisher, chap. 15, this volume).

FORGETTING EXPLANATIONS OF MEMORY DISTORTION

In the first section, we discussed the nature of gist versus verbatim memory representations, and their independence, in order to explain various examples of apparent memory distortion, such as suggestibility, autosuggestibility, and source confusion. As Titcomb and Reyna (1995) have noted, there are other tenets of fuzzy-trace theory that are relevant to the interpretation of such effects. These tenets concern the nature of forgetting (as the disintegration of traces), and differential forgetting rates for gist and verbatim memories.

A number of researchers have used these notions to explain suggestibility effects in children and adults (e.g., Brainerd, *in press*; Brainerd & Ornstein, 1991; Brainerd & Reyna, 1988; Cassel & Bjorklund, 1995; Ceci & Bruck, 1993; Poole & Lindsay, 1995; Poole & White, 1993, 1995; Reyna, 1992, 1995; Reyna & Kiernan, 1994; Warren & Lane, 1995). Based on this research, it is possible to identify conditions that should produce different types of suggestibility.

Specifically, in experimental studies, misleading suggestions have usually concerned verbatim details, rather than gist (e.g., the color of a car involved in an accident; the kind of tool used in a break-in). If subjects had access to verbatim memories for original events, they would resist such suggestions. The specificity of verbatim representations, then, is key to blocking acceptance of contradictory details.

If subjects were to rely on gist, on the other hand, misleading details would not necessarily contradict subjects' memories. The tendency to rely on gist seems to be greater in tasks that involve reasoning and decision making, rather than strictly retrieval of memories (e.g., Reyna & Brainerd, 1991, 1993). These data suggest, for example, that a juror deciding the guilt or innocence of a defendant (especially over a protracted trial) would tend to rely on representations of the gist of the evidence (e.g., Pennington & Hastie, 1993). Therefore, misleading details might be accepted because they are compatible with how events are understood, rather than how they are remembered. As our earlier discussion implies, it is possible to accept misleading details, by relying on gist, despite the ability to access accurate verbatim memories of original events (Reyna & Kiernan, 1994).

Which representation subjects access, verbatim or gist, is influenced by forgetting (e.g., Poole & White, 1993; Warren & Lane, 1995). According to fuzzy-trace theory, forgetting consists of a gradual process of trace disintegration in which retrieval failure and storage failure are discrete states (Brainerd, Reyna, Howe, & Kingma, 1990). Forgetting occurs more rapidly for verbatim, as opposed to gist, representations and, as we have discussed, this explains why subjects are more likely to rely on verbatim representations immediately after original information is witnessed, but shift to gist after a delay (Reyna & Kiernan, 1994). Because forgetting is not an all-or-none loss of a trace, but instead involves gradual disintegration, the features of a trace (e.g., source information) can become dissociated from one another (Reyna, 1992). Under certain circumstances, these features can also be reintegrated, or re-stored (e.g., Brainerd et al., 1990).

Certain predictions about suggestibility follow from these general assumptions about the nature of forgetting (Titcomb & Reyna, 1995). First, direct blocking between original and misleading details should be observed under immediate conditions. That is, when original and misleading information are presented close together in time, and memory is tested immediately thereafter, verbatim memories for both presentations remain relatively accessible. Their specificity forces an either-or choice between them. For example, if specific memories of both "screwdriver" and "wrench" are retrieved, the acceptance of one tool entails the rejection of the other. This general account is supported by Chandler's (1991) data, in which targets (originally presented items) and related distractors were tested immediately and after a delay; blocking was detected on the immediate test, but disappeared after the delay.

Blocking effects suggest that Loftus, Levidow, and Duensing's (1992) *principle of discrepancy detection* would apply under immediate testing conditions (i.e., when verbatim memories can directly compete). The principle (which states that the poorer one's memory for original events, the more susceptible one is to suggestion) would apply to discrepancies between verbatim memories. The principle might also apply if the gist of both original and misleading information were to conflict—that is, if the acceptance of one version of events entailed the rejection of the other version, but this has not been explicitly investigated (Titcomb & Reyna, 1992). The principle does not apply to verbatim and gist memories, however, because they differ in degree of specificity. In other words, verbatim details, such as whether a tool was a screwdriver or a wrench, are typically immaterial to the gist of an event, such as that a tool was used in a break-in.

After a delay, however, original verbatim memories are gradually forgotten, and, so, they cannot compete with verbatim memory for misleading information (usually presented closer in time to the memory test). Thus, delays between original information and the memory test, and more recent presentation of misleading information, should favor observing suggestibility effects, and this, too, has been reported (e.g., Belli et al., 1992; Cassel & Bjorklund, 1995; Ceci & Bruck, 1993; Ceci, Ross, & Tolia, 1987; Titcomb & Reyna, 1993; Warren & Lane, 1995). Consistent with this interpretation, factors that enhance verbatim memory for original events decrease suggestibility after a delay (Brainerd, in press; Warren & Lane, 1995).

One factor that has been shown to enhance memory performance after a delay is early memory tests (Brainerd & Ornstein, 1991; Reyna, 1992). The effect of early tests on forgetting was initially demonstrated in the absence of misleading suggestions. These studies showed that children who received a memory test shortly after stimulus presentation performed significantly better after a long-term retention interval, compared to previously untested subjects after the same interval (see also Poole & White, 1995). Such improvements are likely to be due to changes in verbatim memory because they can only be obtained if tests are given within a short period after stimulus presentation (when verbatim memory is still accessible). Mathematical modeling of the forgetting process also indicates that early testing produces reintegration, or re-storage, of original memory traces (Howe, Courage, & Bryant-Brown, 1993). Thus, according to fuzzy-trace theory, early testing postpones the rapid disintegration of verbatim traces. Consequently, Warren and Lane (1995) predicted that, because early neutral testing re-stores verbatim traces, such testing ought to decrease susceptibility to misleading suggestions. Results confirmed this prediction.

In addition, according to fuzzy-trace theory, traces should become disintegrated after a delay so that it is possible to forget such aspects of an experience as its source, while remembering others. For example, witnesses might

remember seeing a face, but not where it was seen; or, witnesses might remember seeing an object in a certain location, but not when it was last seen there; or witnesses might know that certain events took place, but be unable to tell whether they remember the events or whether they were told about them.

Brown, Deffenbacher, and Sturgill's (1977) results dramatically illustrate this kind of phenomenon, namely, retention of information but confusion about its source. In the Brown et al. study, witnesses were exposed to a staged crime, and then viewed a large number of mug shots. Several days later, the witnesses were shown a lineup, and were asked to pick out the people who had been involved in the crime. Although witnesses did not choose unfamiliar people, they were as likely to choose a person who had been seen only in a mug shot as they were to choose a person who had actually been involved in the staged crime. Thus, the witnesses did not forget the faces they had seen; they simply forgot where they had seen them.

Such scenarios, in which witnesses can report the substance of events but not where or when they learned about them, would be especially probable because, as we have noted, source is typically a verbatim detail. Therefore, source should be forgotten more quickly than the substance of information, creating opportunities for suggestion (Reyna, 1995). Evidence favoring this kind of "source confusion" explanation for suggestibility effects has been reported (e.g., Belli, Lindsay, Gales, & McCarthy, 1994; Lindsay, 1990; Lindsay & Johnson, 1991). Interestingly, this research has also shown that instructions emphasizing accurate source monitoring decrease suggestibility effects.

Another factor that has been found to reduce forgetting (and re-store verbatim traces) is later repeated questioning about the same event (Brainerd & Ornstein, 1991; Poole & White, 1991, 1993, 1995). Repeated questioning about the same event is also an important feature of the cognitive interview (e.g., Fisher et al., 1994). Warren and Lane (1995) have replicated the repeated-questioning effect using the suggestibility paradigm. After receiving the original and then the misleading information, some subjects were later given neutral questions about the original events. They showed significantly less suggestibility, compared to subjects who had received no questions after the original event. Similarly, Belli (1993) found that suggestibility effects were not detectable on a final recall test after an interpolated recognition test for original events (Experiment 1). Although the textbook view of forgetting is that performance declines over time, these findings indicate that decline is not inevitable in either children (e.g., Brainerd et al., 1990) or in adults (e.g., Roediger & Payne, 1982). Through repeated questioning and other factors that spur redintegration, previously forgotten memories can be recovered.

In summary, susceptibility to suggestion depends on factors affecting the forgetting of verbatim memories for original events (e.g., Brainerd, in press;

Reyna, 1992): Factors that increase verbatim forgetting increase suggestibility effects. Delaying misleading information increases its impact because competing original information is forgotten (e.g., Chandler, 1994). On the other hand, when subjects receive immediate tests for original events, which reduces forgetting of verbatim information, later suggestions have smaller effects (Warren & Lane, 1995). Repeated questioning after a delay also combats the effects of forgetting: Memory performance improves—and suggestibility effects decrease—after repeated tests (e.g., Brainerd, *in press*; Payne, 1987; Poole & White, 1991, 1993, 1995).

Although gist representations of original events endure for longer periods of time, they lack specificity, and so they do not necessarily contradict misleading details. Therefore, despite robust memories for the gist of events, suggestions rejected at short delays might be accepted after long delays. As original events are forgotten, elements such as source can become dissociated from other aspects of the events. To the degree that source memories are verbatim, they will be forgotten more rapidly than the substance of events, producing confusions on later memory tests.

There are a number of practical implications of these findings (Table 8.2). First, although the testimony of witnesses should ideally be based on verbatim memories, delay increases the chances that testimony will be based on memory for the gist of events (Brainerd, *in press*; Reyna, 1992). Source, being an aspect of verbatim memory, is apt to be forgotten more quickly than gist memory (Reyna, 1995). Therefore, witnesses can have strong memories for what they think is the substance of events, but fail to remember that those “memories” were acquired from interrogators.

A number of factors can mitigate the effects of forgetting. Early neutral questioning can inoculate verbatim traces against forgetting, and can thereby decrease susceptibility to later misleading questions (Warren & Lane, 1995). Given the differential probative value of gist versus verbatim memory, early neutral questioning is clearly desirable. Later repeated questioning can reintegrate forgotten verbatim traces (Poole & White, 1991, 1993, 1995). As a result of questioning, witnesses are apt to recover additional, veridical memories. Rather than being evidence of inaccuracy, intentional or otherwise, delayed recovery of true memories is to be expected after a series of interrogations, according to laboratory research.

In short, suggestibility, and related effects encompass a collection of phenomena, many of which have been investigated in basic memory research (e.g., Brainerd, *in press*; Brainerd et al., 1990; Reyna, 1995; Reyna & Brainerd, 1995a, 1995b). Factors that have been studied extensively in research on memory, such as age, cueing, delay, early testing, repeated testing, and so on, have predictable effects on suggestibility (e.g., Brainerd, *in press*). The theoretical interpretation of these effects explains both consistencies and apparent contradictions in the literatures on suggestibility,

and on memory distortion generally. In particular, four principles of fuzzy-trace theory that were derived from basic memory research can be used to organize ostensibly discrepant findings: that gist and verbatim representations of events function independently; that these representations vary in specificity; that they also vary in forgetting rates; and that forgetting consists of the gradual fragmentation of memories for aspects of the same event (e.g., Reyna & Brainerd, 1992; Titcomb & Reyna, 1995).

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