

Misinformation and Memory: The Creation of New Memories

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Misleading information presented after an event can lead people to erroneous reports of that misinformation. Different process histories can be responsible for the same erroneous report in different people. We argue that the relative proportion of times that the different process histories are responsible for erroneous reporting will depend on the conditions of acquisition, retention, and retrieval of information. Given the conditions typical of most misinformation experiments, it appears that misinformation acceptance plays a major role, memory impairment plays some role, and pure guessing plays little or no role. Moreover, we argue that misinformation acceptance has not received the appreciation that it deserves as a phenomenon worthy of our sustained investigation. It may not tell us anything about impairment of memories, but it does tell us something about the creation of new memories.

Once upon a time, a man (whom we'll call Mike) stumbled upon an armed robbery in a hardware store. The robber rummaged around the cluttered store brandishing a silver weapon; finally, he stole all the money. Then, almost as an afterthought, he grabbed a hand calculator and a hammer, placing these in his satchel as he left the store. The police were summoned immediately, but before they arrived, Mike talked to another customer about the robbery. We'll call her Maria. Maria told Mike that she saw the robber grab a calculator and a screwdriver, stuffing them in his satchel as he left the store. The police arrived, and when they questioned Mike, he recounted the robbery at some length: He described in detail the silver weapon, the money, and the calculator. When the police asked him about a tool that they heard had been taken, "Did you see if it was a hammer or a screwdriver?", he said, "Screwdriver."

How did it happen that an ordinary upstanding guy like Mike came to remember seeing a screwdriver? (a) He might never have seen the hammer in the first place, and he mentioned the screwdriver because he remembered hearing about it. (b) He could have remembered both the hammer and the screwdriver, but he mentioned the screwdriver when asked because he trusted Maria's memory more than he trusted his own. (c) He could have failed to see the hammer and failed to hear Maria mention the screwdriver, and he simply guessed about the tool when asked by the police. Last, (d) he could have initially had a memory for a hammer, but when Maria mentioned the screwdriver, his memory was altered, suppressed, or impaired in some way. In fact, if there had been four customers in Mike's shoes that day, they might have all reported seeing a screwdriver, each for a different reason. Put

another way, entirely different process histories can lead to the same final response.

Mike's erroneous report is analogous to the thousands of erroneous reports after the receipt of misinformation that have been obtained in laboratory studies of the "misinformation effect" conducted in the United States, Canada, Great Britain, Germany, Australia, and the Netherlands (Ceci, Ross, & Toglia, 1987a, 1987b; Ceci, Toglia, & Ross, 1988; Chandler, 1989; Geiselman, 1988; Gibling & Davies, 1988; Gudjonsson, 1986; Hammersley & Read, 1986, in press; Kohnken & Brockmann, 1987; Kroll & Ogawa, 1988; Kroll & Timourian, 1986; Lehnert, Robertson, & Black, 1984; Morton, Hammersley, & Bekerian, 1985; Pirolli & Mitterer, 1984; Register & Kihlstrom, 1988; Sheehan, 1988; Sheehan & Tilden, 1986; Smith & Ellsworth, 1987; Wagenaar & Boer, 1987; Zaragoza & Koshmider, 1989; Zaragoza, McCloskey, & Jamis, 1987). This enthusiasm for investigating the misinformation effect has been fueled by an abiding interest on the part of researchers in uncovering the mechanism that produces it.

When the first collection of misinformation experiments appeared in the mid-1970s, the lesson that was being learned from these experiments was that misleading postevent information can impair memory of an original event (Loftus, 1975, 1977, 1979). According to the "impairment" view, Mike's recollection of a screwdriver came about because of the fourth mechanism just cited: that his memory for the hammer had been altered by the misleading postevent information. The notion of memory alteration bothered people. It challenged the prevailing textbook view that memories, once stored, are permanently stored; that traces once formed always survive; and that forgetting is due to a labile retrieval system (Atkinson & Shiffrin, 1968; Chechile, 1987). In fact, at least one theory explicitly claimed that postevent information does not impair underlying memory traces; rather, it impairs only accessibility to those original memories (Morton et al., 1985).

Among the more articulate of those who were bothered by all notions of impairment were McCloskey and Zaragoza (1985). They claimed that memory for an original event is not impaired by misleading postevent information. According

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to the “no-impairment view,” Mike’s recollection of a screwdriver came about because of one of the first three mechanisms cited earlier: that he never saw the hammer but remembered hearing about the screwdriver, that he remembered both the hammer and the screwdriver but trusted the screwdriver information more, or that he remembered neither tool but guessed that it was a screwdriver. McCloskey and Zaragoza devised a test that excluded the misinformation as a possible response alternative, and they found no misinformation effect. Their procedure was analogous to the policeman’s asking Mike whether the tool he had seen the robber steal was “a hammer or a wrench.” On the basis of the observation of reasonably good reporting of the hammer, given this “modified” test, McCloskey and Zaragoza argued that it was not necessary to assume any memory impairment at all—neither impairment of traces nor impairment of access.

McCloskey and Zaragoza (1985) were right about one thing: When the policeman asked Mike whether he saw a hammer or screwdriver, his answer, “Screwdriver,” did not necessarily imply that he once had a memory for a hammer and that memory was now impaired. So the question now is, Does misinformation ever produce memory impairment? Belli (1989) says “Maybe,” whereas Tversky and Tuchin (1989) say “Yes,” on the basis of new findings involving “Yes”/“No” retrieval tests, rather than the usual forced-choice recognition tests. Although the studies are similar in that both involved “Yes”/“No” tests, they differed in terms of the number of tests concerning a critical category of item (e.g., the number of tests about various tools) that any individual subject receives. More specifically, Belli’s procedure is analogous to the policeman’s asking Mike either “Did you see a hammer—yes or no?” or “Did you see a wrench—yes or no?” (i.e., no subject received both questions). Tversky and Tuchin’s procedure is analogous to the policeman’s asking Mike both questions and, in addition, a similar question about a screwdriver.

In both studies, the researchers found that misleading postevent information reduced the “Yes” responses to the question about the original item (e.g., the hammer). In both studies, they found that subjects were quite good at rejecting the novel item (e.g., the wrench). Belli (1989) found that misled subjects were better than control subjects at rejecting the novel item, whereas Tversky and Tuchin (1989) found that they were as good as control subjects. Belli never asked people what they thought about the misinformation item (e.g., the screwdriver), but Tversky and Tuchin did. Misled subjects were more likely to incorrectly say that they had seen the misinformation item than to say that they had seen the one they actually saw. When they adopted the misinformation item as their own memory, they did so with a high degree of confidence, which is not something that one would expect from people who are merely guessing.

The collection of experiments seem to be teaching us an important lesson: When people do not have an original memory, they can and do accept misinformation and adopt it as their own memory. However, it also appears that misinformation can sometimes impair an otherwise accessible original memory. But this conclusion leaves us with many unanswered questions. How much impairment occurs? What does it mean

to say that memory has been impaired? Is it the memory traces themselves that are impaired, or is it our ability to reach those memories?

How Much Impairment Occurs?

Belli (1989, Experiment 2) estimated that 32.6% of correct responses about the event item resulted from an actual memory for the item in the control condition. He estimated that 26% of the correct responses resulted from an actual memory for the item in the misled condition, which was thus a drop of 6.6%. Although the 6.6% difference between control and misled subjects’ performances appeared on the surface to be rather small, Belli stressed that the impact of misinformation on actual memory was actually more substantial. When considering only the responses traceable to a true memory for the original item, the misled subjects suffered more than a 20% (6.6% of 32.6%) reduction in accuracy in comparison with control subjects. When looked at in this way, this reduction suggests that memory impairment can be a significant source of erroneous reporting. However, this may not always be the case. In the experiment in which Belli obtained a 20% impairment, the exposure time was 5 s, the interval until misinformation was 5 min, and the final test occurred 10 min after that. The relative proportion of times that the different process histories cited earlier are responsible for erroneous reporting will depend completely on the conditions of acquisition, retention, and retrieval of information. Consider an extreme case: Mike sees a hammer; minutes later Maria mentions a screwdriver, and months pass before the policeman asks Mike, “Did you see a hammer or a screwdriver?” The response of “Screwdriver” would very likely be due to pure guessing. On the other hand, if Mike saw the hammer, and months passed before Maria talked to him about a screwdriver and the policeman questioned him, his response of “Screwdriver” would very likely be due to what Belli calls misinformation acceptance.

What Does It Mean to Say That Memory Has Been Impaired?

Memory impairment could refer to a weakening of memory traces, or a clouding of memory, or an intrinsic impoverishment of memory. It could refer to what an earlier generation of psychologists called “unlearning” (Barnes & Underwood, 1959; Melton & Irwin, 1940) or to what a later generation called “disintegration” of features (Brainerd & Reyna, 1988b). Whatever the mechanism, its fading involves things that we currently cannot see or touch but can only infer from behavior.

Another potential form of interference has been called *source misattribution* (Lindsay & Johnson, 1987). The idea here is that there is access to the postevent item but confusion regarding its origin. Although appealing at first glimpse, the notion of source misattribution has been tossed around; not much thought has been given to what it really is in the context of exposure to misinformation.

Belli (1989) argues that memory impairment and source misattribution hypotheses have one thing in common: the

notion that misleading information interferes with the ability to remember an original item. He combines these hypotheses, referring to them collectively as *misinformation interference* hypotheses, and then distinguishes them from misinformation acceptance hypotheses (in which no interference is assumed). He eventually concludes that some misinformation interference occurs and then declines to commit to deciding whether impairment or source misattribution or both are the responsible parties.

This line of argument raises the important question of just what source misattribution is. We think that neither Belli (1989) nor Tversky and Tuchin (1989) adequately dealt with this issue. *Source misattribution* means, in its most general sense, confusion over the source of origin of some item. It might involve interference with an original item in memory, but on the other hand it might not. Suppose that Mike never saw the hammer in the first place. He subsequently hears Maria talk about a screwdriver and decides that he has seen the screwdriver during the original robbery. Mike has committed a source attribution error, but no interference with an original memory has occurred because there was no original memory to begin with. Change the facts slightly and, lo and behold, we have on our hands a source attribution error that is indeed associated with interference with an original item in memory. If Mike encoded the hammer and subsequently encoded "screwdriver" from Maria, he could become confused about the source of "screwdriver," could reconstruct his memory to include a screwdriver, and simultaneously could "impair" his original memory for a hammer. In this case, Mike would have committed a source attribution error that was associated with memory impairment. This analysis makes it clear that there is more than one type of source misattribution. The type that does not involve memory impairment is definitely at least partly responsible for the observed results (at least in some subjects); this is in fact what misinformation acceptance is all about.

However, Belli (1989), at least, showed more than this. He showed that memory impairment has occurred. It could result from a "clouding" or degrading of memory (picture a Xerox of a Xerox of a Xerox), or it could be a type of source misattribution that is associated with accessibility of the original memory, or it could be some of both. Whatever he wants to call it, it appears to involve a type of impairment, and thus Belli's conclusions favoring the memory impairment hypothesis could be expressed more strongly than in fact they were. On this fine point, Belli could take a lesson from Tversky and Tuchin (1989) on how not to be a shrinking violet. They unhesitatingly characterize their data as arguing "against the claim that nothing happens to the memory for the original event as a consequence of misleading information" (p. 89).

In reaching this conclusion, we acknowledge that a different type of research is probably necessary before specific claims about what "impairment" means can really be addressed. Some biologically oriented psychologists have suggested that additional neurobiological facts are required before researchers can settle the issue of whether impaired performance reflects an actual loss of information from storage and a corresponding regression of some of the synaptic changes that originally represented that stored information (Squire, 1987).

Tversky and Tuchin (1989), in a related vein, asserted that specific claims about the retroactive alteration of memory traces cannot be addressed, given current knowledge and tools. We believe that the future "knowledge and tools" may involve the discovery of new neurobiological facts, but strong advances in theorizing in this area will occur with new developments in cognitive research.

How Much Guessing Occurs?

Among the reasons why Mike might have reported seeing a screwdriver, one (cited earlier) is that he failed to encode the hammer and he did not hear Maria mention the screwdriver, but when asked whether it was a hammer or a screwdriver that he saw, he simply guessed that it was a screwdriver. In other words, he made a pure guess, as opposed to a biased guess. We argued earlier that pure guessing could under certain conditions of acquisition, retention, and retrieval, be responsible for a significant proportion of erroneous "screwdriver" reports. However, in the current studies, we believe that pure guessing plays little or no role. Tversky and Tuchin (1989) found that when misled, subjects were certain of their errors, which is not the type of response that one would expect from people who were merely guessing.

Using the now-familiar burglary sequence (McCloskey & Zaragoza, 1985), Donders, Schooler, and Loftus (1987) also gathered data that argue against the notion that the "pure guessing" process history makes much of a contribution to the misinformation effect. In this study, subjects watched the burglary sequence (including, for example, a hammer), then received misinformation (e.g., about a screwdriver) or neutral information about four critical items, and then were tested in what Tversky and Tuchin (1989) call the "Loftus test" (e.g., "Did you see a hammer or a screwdriver?"). The innovation in Donders et al.'s (1987) research is that speed of responding was measured, in addition to confidence. If a high proportion of the misled subjects who selected the misinformation (the screwdriver) were simply guessing, one would expect their response times to be long and not associated with a high degree of confidence. The obtained confidence data revealed that when misled subjects selected the misinformation item, they did so with a high degree of confidence (just as Tversky & Tuchin, 1989, found when they used the "Yes"/"No" test). The fastest response times of all occurred when misled subjects selected the misinformation item (see Figure 1).

In sum, because subjects embrace the misinformation item with a high degree of confidence, and they do so very quickly, we believe that pure guessing does not play a significant role in producing the misinformation effect in studies in which fairly typical exposure time and retention interval parameters are used. We do not mean to imply that pure guessing never occurs, but only that it is a rare process history in the misled condition.

Misinformation Acceptance: A Worthy Phenomenon

Among the many reasons why Mike might have reported seeing a screwdriver after hearing Maria mention it, one (cited

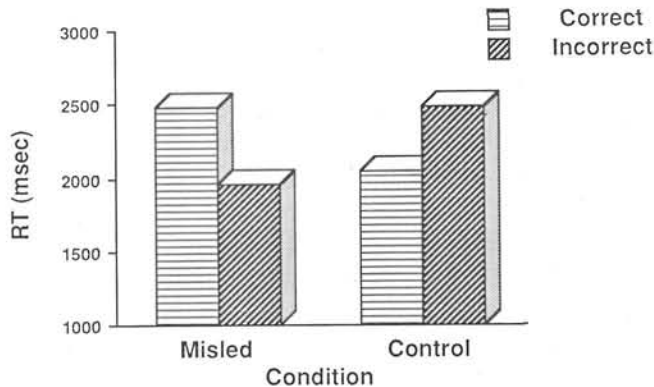


Figure 1. Reaction times (RT) associated with correct and incorrect responses (Donders, Schooler, & Loftus, 1987). (Msec = milliseconds.)

earlier) is that he never saw the hammer in the first place, and he claimed that he saw the screwdriver because he remembered hearing about it. If Mike reported the screwdriver with conviction, we would say, in Belli's (1989) language, that he had accepted the misinformation. In fact, this is one of the clearest cases of misinformation acceptance; it cannot by definition involve any original memory impairment because there was no original memory to be impaired. Much of the theoretical discussion about the misinformation effect would leave us with the impression that this process is uninteresting. It may not, of course, tell us anything about impairment of memories, but it does tell us something about the creation of new memories. If a memory for a screwdriver came about through the process of suggestion but was subjectively as real and as vivid as a memory that arose from the actual perception of a screwdriver, we would find this fact important from both a theoretical and an applied perspective. In fact, there is evidence that suggested memories might differ statistically from genuine memories (Schooler, Gerhard, & Loftus, 1986), but they still have great similarities in common. For one thing, suggested memories are expressed with a great deal of confidence, just as are some genuine memories (Donders et al., 1987; Tversky & Tuchin, 1989). Moreover, suggested memories are quickly accessible, just as are some genuine memories (Donders et al., 1987).

Thus researchers in this area should be more interested in "misinformation acceptance," especially when it is associated with a high degree of conviction about the new memories. In exploring the factors that enhance susceptibility to misinformation, we have discovered that allowing time to pass after the event, so that the original memory can fade, makes a person particularly vulnerable to suggestion (Loftus, Miller, & Burns, 1978). Some items that could never be modified when they are fresh in the mind will eventually fade to the point that modification is possible. The process could essentially involve one of creating a new memory, but it would still be an interesting one, worthy of our research attention.

These ideas also bear on Belli's (1989) observation that having a better overall memory for original items would make it easier for misinformation interference to be detected (others

have similarly argued for the crucial role played by the strength of the original memory: Brainerd & Reyna, 1988a; Ceci et al., 1987a; Chandler, 1989). Belli did indeed find more misinformation interference when there was more memory to begin with. However, there is a limit. In the extreme case, when memory for an original item is virtually perfect, people are unaffected by misinformation (e.g., see Loftus, 1979). They readily notice a discrepancy between what they have in memory and what is being offered to them as misinformation (Tousignant, Hall, & Loftus, 1986). In order to affect those persons whose memory for some critical item is strong to begin with, one must wait until the memory fades to a level below which they are not likely to immediately notice discrepancies.

Conclusion

We are grateful to McCloskey and Zaragoza (1985) for making it evident that there are different ways of arriving at the same memory report. Initially, we thought that memory impairment was implicated in the process of distortions in reporting that are due to misleading postevent information. We are gratified to find some support for this notion in the current studies. However, even in the absence of memory impairment, the finding that people can come to accept misinformation and adopt it faithfully as their own is an important phenomenon in its own right. Put another way, regardless of whether there is a buried original memory, waiting to be kissed awake like Sleeping Beauty, researchers still must take seriously the erroneous memory reports that are so freely obtained. Researchers have created them in laboratory environments, which Tversky and Tuchin (1989) claim are "unusual." However, we believe that we have tapped a phenomenon that occurs quite often in real life whenever people who experience the same event talk to one another, overhear each other talk, or gain access to new information from the media, interrogators, or other sources. We believe that the misinformation effect is sufficiently pervasive and eventually may be so highly controllable that we are tempted to propose a Watsonian future for the misinformation effect (see Watson, 1939, p. 104): Give us a dozen healthy memories, well-formed, and our own specified world to handle them in. And we'll guarantee to take any one at random and train it to become any type of memory that we might select—hammer, screwdriver, wrench, stop sign, yield sign, Indian chief—regardless of its origin or the brain that holds it.

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