

The Formation of False Memories

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For most of this century, experimental psychologists have been interested in how and why memory fails. As Greene¹ has aptly noted, memories do not exist in a vacuum. Rather, they continually disrupt each other through a mechanism that we call "interference." Virtually thousands of studies have documented how our memories can be disrupted by things that we experienced earlier (proactive interference) or things that we experienced later (retroactive interference).

Relatively modern research on interference theory has focused primarily on retroactive interference effects. After receipt of new information that is misleading in some ways, people make errors when they report what they saw.^{2,3} The new post-event information often becomes incorporated into the recollection, supplementing or altering it, sometimes in dramatic ways. New information invades us, like a Trojan horse, precisely because we do not detect its influence. Understanding how we become tricked by revised data about a witnessed event is a central goal of this research.

The paradigm for this research is simple. Participants first witness a complex event, such as a simulated violent crime or an automobile accident. Subsequently, half of the participants receive new misleading information about the event. The other half do not get any misinformation. Finally, all participants attempt to

recall the original event. In a typical example of a study using this paradigm, participants saw a video depicting a killing in a crowded town square. They then received written information about the killing, but some people were misled about what they saw. A critical blue vehicle, for instance, was referred to as being white. When later asked about their memory for the color of the vehicle, those given the phony information tended to adopt it as their memory; they said the vehicle was white.⁴ In these and many other experiments, people who had not received the phony information had much more accurate memories. In some experiments, the deficits in memory performance following receipt of misinformation have been dramatic, with performance differences as large as 30% or 40%.⁵

This degree of distorted reporting has been found in scores of studies involving a wide variety of materials. People have recalled nonexistent broken glass and tape recorders, a clean-shaven man as having a mustache, straight hair as curly, stop signs as yield signs, hammers as screwdrivers, and even something as large and conspicuous as a barn in a bucolic scene that contained no buildings at all. In short, misleading post-event information can alter a person's recollection in powerful ways, even leading to the creation of false memories of objects that never in fact existed.

LOST IN A SHOPPING MALL

Most of the experimental research on memory distortion has involved deliberate attempts to change memory for an event that actually was experienced. An important issue is whether it is possible to implant an entire false memory for something that never happened. Could it be done in an ethically permissible way? Several years ago, a method was conceived for exploring this issue—Why not see whether people could be led to believe that they had been lost in a shopping mall as a child even if they had not been. (See Loftus and Ketcham⁶ for a descrip-

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tion of the evolution of the idea for the study.)

In one of the first cases of successful false memory implantation,⁷ a 14-year-old boy named Chris was supplied with descriptions of three true events that supposedly happened in Chris' childhood involving Chris' mother and older brother Jim. Jim also helped construct one false event. Chris was instructed to write about all four events every day for 5 days, offering any facts or descriptions he could remember about each event. If he could not recall any additional details, he was instructed to write "I don't remember."

The false memory was introduced in a short paragraph. It reminded Chris that he was 5 at the time, that he was lost at the University City shopping mall in Spokane, Washington, where the family often went shopping, and that he was crying heavily when he was rescued by an elderly man and reunited with his family.

Over the first 5 days, Chris remembered more and more about getting lost. He remembered that the man who rescued him was "really cool." He remembered being scared that he would never see his family again. He remembered his mother scolding him.

A few weeks later, Chris was reinterviewed. He rated his memories on a scale from 1 (not clear at all) to 11 (very, very clear). For the three true memories, Chris gave ratings of 1, 10, and 5. For the false shopping mall memory, he assigned his second-highest rating: 8. When asked to describe his memory of getting lost, Chris provided rich details about the toy store where he got lost and his thoughts at the time ("Uh-oh, I'm in trouble now."). He remembered the man who rescued him as wearing a blue flannel shirt, kind of old, kind of bald on top ... "and, he had glasses."

Chris was soon told that one of the memories was false. Could he guess? He selected one of the real memories. When told that the memory of being lost was the false one, he had trouble believing it.

More recently, we have completed a study that uses a procedure similar to that used with Chris. We asked 24 individuals to recall events that were supplied by a close relative. Three of the events were true, and one was a research-crafted false event about getting lost in a shopping mall or other public place. We now describe this study in detail.

LOST AGAIN

Overview

The subjects in this study thought they were participating in a study of "the kinds of things you may be able to remember from your childhood." The subjects were given a brief description of four events that supposedly occurred while the subject and a close family member were together. Three were true events and one was the false "lost" event. Subjects tried to write about these events in detail. Later they were interviewed about the events on two separate occasions.

Method

Subjects. Three males and 21 females, ranging in age from 18 to 53, completed all phases of the study. They were recruited by University of Washington students; each student provided a pair of individuals, which included both a subject and the subject's relative. The pairs consisted primarily of parent-child pairs or sibling pairs, and the youngest member of the pair was at least 18 years of age. The "relative" member of the pair had to be knowledgeable about the childhood experiences of the "subject," the younger member of the pair.

Materials. Subjects were mailed a five-page booklet containing a cover letter with instructions for completing the booklet and the scheduled interviews. The booklet contained four short stories about events from the subject's childhood provided by the older relative. In actuality, three of the stories were true, and one was the false event about getting lost. The order of events in the booklet and in the subsequent interviews was always the same, with the false event about getting lost always presented in the third position. Each event was described in a single paragraph at the top of the page, with the rest of the page left blank for the subject to record the details of his or her memory.

To exemplify a false memory paragraph, here is one created for a 20-year-old Vietnamese-American woman who grew up in the state of Washington: "You, your mom, Tien, and Tuan all went to the Bremerton K-Mart. You must have been 5 years old at the time. Your mom gave each of you some money to get a blueberry Icee. You ran ahead to get into the line first, and somehow lost your way in the store. Tien found you crying to an elderly Chinese woman. You three then went together to get an Icee."

Procedure. Interviews with the relative for each subject were conducted to obtain three events that happened to the subject between the ages of 4 and 6. The stories were not to be family "folklore" or traumatic events that the subject will either remember easily or find painful to remember. In addition, the relative provided information about a plausible shopping trip to a mall or large department store in order to construct a false event where the subject could conceivably have gotten lost. The relative was asked to provide the following kinds of information: (1) where the family would have shopped when the subject was about 5 years old; (2) which members of the family usually went along on shopping trips; (3) what kinds of stores might have attracted the subject's interest; and (4) verification that the subject had not been lost in a mall around the age of 5. The false event was then crafted from this information. The false events always included the following elements about the subject: (1) lost for an extended period, (2) crying, (3) lost in a mall or large department store at about the age of 5, (4) found and aided by an elderly woman, and (5) reunited with the family.

Subjects were told that they were participating in a study on childhood memories, and that we were interested in how and why people remembered some things and not others. They were asked to complete the booklets by reading what their relative had told us about each event, and then writing what they remembered about each event. If they did not remember the event, they were told to write "I do not remember this." After completing the booklet, they mailed it back to us in a stamped envelope that we had provided to them.

Upon receipt of the completed booklet, subjects were called and scheduled for two interviews. If it was convenient, the interviews took place at the University; otherwise, they were conducted over the telephone. Initially we had planned to manipulate, as an independent variable, the time intervals between the receipt of the booklet and the two subsequent interviews. However, scheduling difficulties created by subject unavailability prevented us from doing this. Thus, in the end, all subjects were first interviewed approximately 1 to 2 weeks after receipt of the booklet, and received a second interview approximately 1 to 2 weeks after that. Two interviewers, both female, conducted and recorded the interview sessions.

At the beginning of the first interview, subjects were reminded about each of the four events, one at a time, and asked to recall as much as they could about them. They were instructed to tell us everything they remembered about the event, whether or not they had already written the information in their booklets. We told the subjects we were interested in examining how much detail they could remember, and how their memories compared with those of their relative. The event paragraphs were not read to them verbatim, but rather bits of them were provided as retrieval cues. When the subjects had recalled as much as possible, they were asked to rate the clarity of their memory for the event on a scale of 1 to 10, with 1 being not clear at all and 10 being extremely clear. Next, subjects rated their confidence on a scale of 1 to 5 that if given more time to think about the event, they would be able to remember more details (1=not confident and 5=extremely confident that they would be able to remember more).

The interviewers maintained a pleasant and friendly manner, while pressing for details. After the first interview, the subjects were thanked for their time, and were encouraged to think about the events and try to remember more details for the next interview. They were told not to discuss the events at all with their relative or anyone else.

The second interview session, conducted 1 to 2 weeks after the first, was essentially the same: subjects tried to remember the four events, they rated their clarity and confidence, but at the end of this session, they were debriefed. The debriefing phase explained our

attempt to create a memory for something that had not happened, and asked subjects to guess which event may have been the false one. We apologized for the deception and explained why it was necessary for the research.

Results

The 24 subjects were asked to remember a total of 72 true events, and succeeded in remembering something about 49 (68%) of these 72 true events. In other words, 68% of the true events were remembered. Figure 1 shows that this percentage held constant from the initial booklet stage through the two subsequent interviews. The Figure also shows the rate of remembering the false event. In the booklet, 7 (29%) of the 24 subjects "remembered" the false event, either fully or partially. The partial memories included remembering parts of the event and speculations about how and when it might have happened. During the first interview, one subject decided she did not remember, leaving 6 (25%) of the 24 claiming to remember, fully or partially. This same percentage held for the second interview.

Subjects used more words when describing their true memories, whether these memories were fully or only partially recalled. For purposes of analysis, we calculated the mean number of words using only the 29% who produced a full or partial false memory in their initial booklets. The mean word length of descriptions of true memories was 138.0, whereas for descriptions of false memories, it was 49.9. Six of the seven subjects used more words to describe their true than false memories, and the seventh used very few words to describe any memories (a mean of 20 for the true memories and 21 for the false one).

During the first interview session, 17 subjects continued to maintain that they had no memory whatsoever of the false event happening to them. One additional subject, who had earlier accepted the event partially, now claimed that she did not remember being lost. Thus, 75% resisted the suggestion about being lost, and they continued to resist during the second interview.

We analyzed the clarity ratings for the subjects who embraced the false event during the first interview, and compared these clarity ratings to the ones given by these particular subjects for their true events. In general, the clarity ratings for the false events tended to be lower than for the true events. For purposes of analysis, we took five individuals who falsely remembered being lost and analyzed their mean and median clarity ratings. (Unfortunately, one subject could not be included in this analysis because clarity ratings were inadvertently not collected during the first interview.) The mean clarity rating for the true memories of these five individuals was 6.3 during the first interview and also 6.3 during the second interview. The mean clarity rating for the false memory was 2.8 during the first interview and 3.6 during the second interview (Figure 2). All five subjects had mean clarity ratings for their true events that

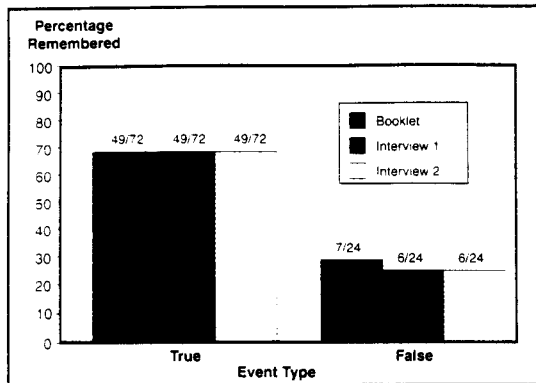


Figure 1. Twenty-four subjects were asked to remember true and false events over three stages—booklet and two interviews. The percentage remembering is shown.

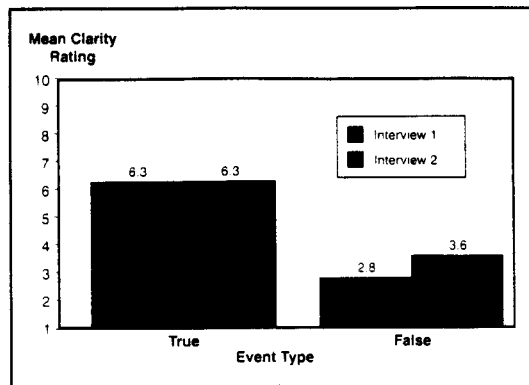


Figure 2. Clarity ratings of subjects who believed the false event during the first interview, compared to the clarity ratings they gave to the true events.

exceeded the clarity rating for the false event. Three of the five subjects increased their clarity ratings for the false event, while two gave the same rating. Medians showed a similar pattern: higher ratings for the true events, and a modest rise in clarity from the first to the second interview for the false event only. The subject with missing data gave a median rating of 7.0 to her true memories and a rating of 4.0 to her false memory.

One subject's performance illustrates this pattern. She was a 20-year-old woman who was convinced that she had been lost at K-Mart when she was about 5 years old. In her booklet, she used 90 words to describe her false memory and a mean of 349 words to describe her true memories. During the two interview sessions, her clarity ratings were mostly higher for the true memories than for the false one, and only the clarity rating for the false memory rose from the first to the second interview. More specifically, her false memory was initially rated 3, then rose to 4. By contrast, her true memories were rated 7 then 2, 9 then 9, and 6 then 6.

Subjects also rated how confident they were that they would be able to recall additional details at a later time, using a scale from 1 to 5. We examined the confidence ratings for the subset of subjects embracing the false event during the first interview and who provided two sets of confidence ratings. In general, the confidence ratings were low, but lower for the false event than for the true ones. The mean confidence rating for the true memories for this set of people was 2.7 during the first interview and 2.2 during the second interview. The mean confidence rating for the false memory was 1.8, then 1.4 (Figure 3). All five subjects had mean confidence ratings for their true events that exceeded the confidence rating for the false one. Most of the subjects gave the same low confidence rating during the two interviews.

At the end of the second session, subjects were debriefed and asked to choose which event may have been the false one. Of the 24 total, 19 subjects correctly chose the getting-lost memo-

ry as the false one, while the remaining five incorrectly thought that one of the true events was the false one.

Although subjects sometimes correctly chose the getting-lost memory as the false one, this does not mean that they were not previously misled into genuinely embracing the false event. Sometimes they chose correctly simply by a process of elimination. Here is an example from one subject who was led to believe that she had been lost at the Hillsdale Shopping Mall. She described her getting-lost experience using 66 words (as opposed to a mean of 128 words for her true memories). During the second interview, she said,

I vaguely, vague, I mean this is very vague, remember the lady helping me and Tim and my mom doing something else, but I don't remember crying. I mean I can remember a hundred times crying ... I just remember bits and pieces of it. I remember being with the lady. I remember going shopping. I don't think I. I don't remember the sunglasses part.

She went on to remember that the elderly lady who helped her was "heavy-set and older. Like my brother said, nice." She gave her false memory a clarity rating of 4.

When the subject was debriefed and asked to tell which was the false memory, she said: "Well, it can't be Slasher, 'cause I know that he ran up in the chimney and I know that that car got smashed and I know that we got robbed so it had to be that mall one." Despite the debriefing, she continued to struggle mildly with her persisting memory: "... I totally remember walking around in those dressing rooms and my mom not being in the section she said she'd be in. You know what I mean?"

Discussion

These findings reveal that people can be led to believe that entire events happened to them after suggestions to that effect. We make no claims about the percentage of people who might be able to be misled in this way, only that we are

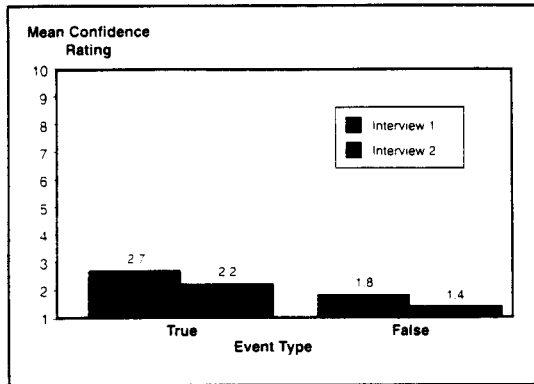


Figure 3. The subjects who believed the false event at first interview were asked to rate their confidence that they would be able to recall additional details of this event at a later time. They also rated their true memories.

providing an "existence proof" for the phenomenon of false memory formation. In addition to the current subjects, and those of Loftus and Coan,⁶ we have successfully implanted the getting-lost memory in a number of other individuals, some of whom have taught us how fervently subjects will cling to their false memories even after debriefing.

In two demonstration cases, supplied by The MacNeil/Lehrer News Hour, individuals were successfully led to create a false memory of being lost. The process of memory implantation was filmed, with the subjects' full permission and cooperation, for purposes of demonstrating this scientific methodology to the public. One of the demonstration cases, Becca, was led to believe that she had been lost in the Tacoma Mall while she had been shopping with her mother and father. By her last interview, she thought she may have been looking at puppies at the pet store about the time she got lost. She remembered "the initial panic when you realize that your mom and dad aren't there any more." She remembered the elderly lady who rescued her, and thought she may have been wearing a long skirt. "I do remember her asking me if I was lost, and ... asking my name and then saying something about taking me to security." She remembered that she didn't cry while she was lost, but did cry when she saw her parents again. When we debriefed her at the end of the study, Becca found it so hard to believe that her getting-lost memory was false that she telephoned both of her parents to check. The parents, now divorced, independently confirmed that the episode in the Tacoma Mall had never happened.

A predictable comment about the false memories of getting lost is that people may have actually been lost in their lives, however briefly, and they may be confusing this actual experience with the false memory description. But our subjects were not asked about any experience of being lost. They were asked to remember being lost around the age of 5—in a particular location with particular people present, being frightened, and ultimately being rescued by an elderly person. This is

not to say that the actual experience of being lost briefly or of hearing about someone else being lost (even Hansel and Gretel) is not important.

The development of the false memory of being lost may evolve first as the mere suggestion of being lost leaves a memory trace in the brain. Even if the information is originally tagged as a suggestion rather than a historic fact, that suggestion can become linked to other knowledge about being lost (stories of others), as time passes and the tag that indicates that being lost in the mall was merely a suggestion slowly deteriorates. The memory of a real event, visiting a mall, becomes confounded with the suggestion that you were once lost in a mall. Finally, when asked whether you were ever lost in a mall, your brain activates images of malls and those of being lost. The resulting memory can even be embellished with snippets from actual events, such as people once seen in a mall. Now you "remember" being lost in a mall as a child. By this mechanism, the memory errors occur because grains of experienced events or imagined events are integrated with inferences and other elaborations that go beyond direct experience.

FALSE MEMORIES OF HOSPITALIZATIONS AND OTHER EVENTS

It could be argued that getting lost, however briefly, is a common experience, and that fact enabled subjects to construct a false memory about a particular occasion of getting lost. Could false memories be constructed about events that were not so common in childhood experiences? Hyman et al⁸ used a similar procedure to explore this issue. In their first experiment, college students were asked to recall actual events that had been reported by their parents and one experimenter-crafted false event—an overnight hospitalization for a high fever with a possible ear infection. They were informed that they would be asked to recall childhood experiences based on information obtained from their parents. They thought the goal of the research was to compare their recall to the information supplied by the parents.

All events, including the false one, were first cued with an event title (family vacation, overnight hospitalization) and an age. If subjects couldn't recall the event, they received brief additional cues, such as location or other people involved. After the first interview, subjects were encouraged to continue thinking about the events, but not to discuss them, and to return for a second interview 1 to 7 days after the first.

In the first interview, subjects recalled and described 62 of the 74 true events (84%), and in the second interview, they provided memories for 3 of the 12 events that had not been remembered during the first interview. As for the false events, no subject recalled these during the first interview, but 4 of 20 subjects (20%) incorporated false information in an event description during the second interview. One subject "remem-

bered" that the doctor was a male, but the nurse was female and also a friend from church.

In a second study, Hyman et al. tried to implant three new false events that were rather unusual. The first was attending a wedding reception and accidentally spilling a punch bowl on the parents of the bride. The second was having to evacuate a grocery store when the overhead sprinkler systems erroneously activated. The third was being left in the car in a parking lot and releasing the parking brake, causing the car to roll into something. While the methodology was basically the same as in the first study, there were some minor variations. Instead of beginning by simply cueing subjects with an event title and an age, they were now given more cues at the start (age, event, location, actions, and others involved). In subsequent interviews, the researchers provided only the event title and age, and only when subjects failed to recall the event were additional cues provided. Moreover, the experimental demands were intensified somewhat by, for example, pressures for more complete recall. There were three interviews spaced 1 day apart.

In the first interview, subjects recalled and described 182 of the 205 true events (89%). In the second interview, they provided a bit more information, and by the third interview, they had provided some recall for 95% of the events. During the third interview, subjects provided memories for 13 of the 23 true events that had not been remembered during the first interview. As for the false events, again no subject recalled these during the first interview, but 13 (25%) did so by the third interview. For example, one subject had no recall of the wedding "accident," stating "I have no clue. I have never heard that one before." By the second interview, the subject said "... It was an outdoor wedding and I think we were running around and knocked something over like the punch bowl or something and made a big mess and, of course, got yelled at for it."

These results show that people will create false recalls of childhood experiences in response to misleading information and the social demands inherent in repeated interviews.^{9,10} The process of false recall appeared to depend, in part, on accessing some relevant background information. The authors hypothesized that some form of schematic reconstruction may account for the creation of false memories. What people appear to do, at the time they encounter the false details, is to call up schematic knowledge that is closely related to the false event. Next, they think about the new information in conjunction with the schema, possibly storing the new information with that schema. Now, when they later try to remember the false event, they recall the false information and the underlying schema. The underlying schema is helpful for supporting the false event—it adds actual background information and provides the skeletal or generic scenes.

Creation of false memories in this manner

can be viewed as a form of source confusion as described by Schacter and Curran.¹¹ The false event is assumed to be a personal memory rather than an event presented by the researchers as ostensibly coming from the parent. Schacter and Curran's patient, B.G., came to "remember" words that were never studied, probably because these words were represented in his long-term memory prior to the experiment and this pre-experimental familiarity was wrongly used as evidence that the word had recently appeared. Similarly, some elements of the false memories created by us, and by Hyman and colleagues, are represented in long-term memory prior to the experiment. This pre-experimental familiarity can be wrongly used as evidence that the false event actually happened.

FINAL COMMENT

Nearly two decades of research on memory distortion leaves no doubt that memory can be altered via suggestion. People can be led to remember their past in different ways, and they can even be led to remember entire events that never actually happened to them. When these sorts of distortions occur, people are sometimes confident in their distorted or false memories, and often go on to describe the pseudomemories in substantial detail. These findings shed light on cases in which false memories are fervently held—as in when people remember things that are biological or geographically impossible. The findings do not, however, give us the ability to reliably distinguish between real and false memories, for without independent corroboration, such distinctions are generally not possible.

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