

## Rich False Memories: The Royal Road to Success

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One does not have to look far to find compelling cases in which individuals have held distorted memories about events from their past. Neisser and Harsch (1992) reported on numerous cases in which people mistakenly remembered first hearing the news about the *Challenger* explosion from television, when actually they had first heard about it from a friend or other source. More tragic are the many cases of wrongful conviction caused by faulty memory, where in some instances individuals spent years in prison. Here, the crimes occurred, but the wrong person was "remembered," and DNA testing ultimately uncovered the error. An entire issue of *Judicature*, the journal of the American Judicature Society, was devoted to this issue of wrongful convictions (see Radelet, 2002). There some of the leading scholars in the world talked about the DNA-discovered errors and their causes. Faulty eyewitness memory is continually thought to be the leading cause.

Look a little further and you will find wholly false memories about the past, or what we call *rich false memories*. By this we mean the subjective feeling that one is experiencing a genuine recollection, replete with sensory details, and even expressed with confidence and emotion, even though the event never happened. Mack (1994) reported on a number of individuals who believed and remembered that they had been abducted by aliens, taken to distant spaceships, sexually experimented on, and finally returned to their beds on earth. Although we do not have the DNA hammer, many scientists would be willing to declare that these are absolutely false memories based on other grounds.

### **From Misinformation to Rich False Memory**

The wrongful conviction cases seem to parallel a process that has been studied under the rubric of the *misinformation effect*. In the wrongful conviction case, an event (the crime) occurs. Next, some activity occurs that distorts memory for the event (e.g., a leading question, a biased lineup). Finally, the victim or witness testifies erroneously in court, misidentifying the person who committed

the crime. Analogously, in the misinformation studies, an event occurs (e.g., a simulated accident). Next, some activity occurs that distorts memory for the event (e.g., a leading question, exposure to misleading information). Finally, the participant's memory is tested. A common result is that the participant falls sway to the misinformation, rendering the memory less accurate. Hundreds, perhaps thousands of misinformation studies have established the power of these manipulations to distort or contaminate memory (for a review, see Ayers & Reder, 1998). People have been led to believe in simple distortions, such as that a stop sign was a yield sign or that a fellow with straight hair had curly hair. More dramatic, they have been led to believe that they saw a wounded animal (that was not there) near the scene of a tragic terrorist bombing that actually had occurred (Nourkova, Bernstein, & Loftus, 2004).

The alien abduction and satanic ritual abuse cases seem to parallel a process that has been studied under the rubric of what might be called *memory planting*. The late Carl Sagan talked about the alien abduction "memories" and drew parallels to those involving satanic ritual abuse (Sagan, 1995, p. 165). In both cases, there are specialists—alien abduction specialists, satanic ritual abuse specialists. In both cases, the specialist (a therapist or therapist-like individual) hears of the individual's complaint. In both, the specialist is "profoundly moved by the unmistakably genuine agony" of the individual. Some specialists then ask leading questions and use other methods that can lead suggestible individuals to produce memory reports. Analogously, in the memory-planting studies, some activity occurs that tries to create a wholly false memory (e.g., conveying false information that allegedly came from a family informant). Finally, subjects are asked whether they remember various events occurring to them in the past. A common result is that the subjects fall sway to the suggestion and claim to have experienced the fabricated events. Many of these memory-planting techniques lead to what we are calling rich false memories.

### Creating Rich False Memories

One of the earliest attempts to plant a rich false memory involved a procedure whereby subjects were given short narrative descriptions of childhood events and encouraged to try to remember those events. Although subjects believed that all of the descriptions were true and had been provided by family members, actually one was a pseudo-event that had not occurred. In this study, approximately 25% of subjects were led to believe, wholly or partially, that at age 5 or 6 they had been lost in a shopping mall for an extended time, were highly upset, and were ultimately rescued by an elderly person and reunited with their family (Loftus & Pickrell, 1995). In later studies using a similar procedure, subjects were led to believe that they had been hospitalized overnight or that they had an accident at a family wedding (Hyman, Husband, & Billings, 1995). Even more traumatic, in yet other studies, subjects were convinced that they had been the victim of a vicious animal attack (Porter, Yuille, & Lehman, 1999) or had nearly drowned and had to be rescued by a lifeguard (Heaps & Nash, 2001).

Reviewing the body of work using what they call the *familial informant false narrative procedure*, Lindsay, Hagen, Read, Wade, and Garry (2004) noted that across eight studies, an average of 31% of subjects produced false memories. Sometimes the various investigators distinguished between a partial false memory and a complete false memory. Although the distinction is fuzzy, at least one definition of "complete" is that the subjects demonstrate that they genuinely believe they are remembering the event. In studies that made this distinction, still 20% of the subjects were classified as having a complete false memory, rather than merely accepting that the pseudo-event occurred or speculating about it. The notion of a complete false memory is akin to what we are calling a rich false memory, namely, an experience about which a person can feel confident, provide details, even express emotion about an event that never happened.

### Even With Bizarre Pseudo-Events?

Many of the scenarios in the various false narrative studies involve purported events that are either common or plausible. It has been argued that it would be enormously difficult, if not impossible, to create false memories about events that are rare, bizarre, or implausible. For instance, Pezdek, Finger, and Hodge (1997) were unable to plant a false memory of having received a rectal enema as a child. Yet, one response to this claim is to point to studies in which people have indeed been led to believe in rather implausible experiences. Mazzoni, Loftus, and Kirsch (2001) increased belief in subjects that, as young children, they had witnessed a person being demonically possessed. They accomplished this feat by first having subjects rate the plausibility of various events, including the event of witnessing demonic possession. They also rated the likelihood of having personally experienced these events in childhood. Subsequently, subjects read short articles describing possession, including a testimony from a prestigious person who reported experiencing such witnessing. Finally, subjects repeated the plausibility and life event ratings. A major finding was that those who received the articles—testimonial about demonic possession not only found the idea more plausible but also increased their confidence that it had personally happened.

The possession manipulation varied across the studies. When it included a review of the articles—testimonial plus some false feedback to the participant, it was particularly effective. The false feedback involved giving subjects a *fear profile* in which their level of fear toward various objects (e.g., spiders, animals) was analyzed. Whatever their responses on the profile, they were told that the profile indicated that they had probably witnessed demonic possession as a child, and this was the cause of their fears. Even without the fear profile, when subjects merely reviewed the articles, they rated demonic possession as more plausible and increased their confidence that it had happened to them. The addition of the false feedback enhanced the false memory effect. What is particularly striking about these results is that the manipulation was effective even with people who entered the study with a belief that demonic possession was rather implausible.

Mazzoni et al. (2001) discussed these findings in conjunction with a model of false memory formation. According to the model, one first needs to be led to the belief that the pseudo-event is plausible. Later, one is led to the belief that the pseudo-event personally occurred. Finally, one is led to experience the pseudo-event as if it were a genuine memory. The distinction between belief and memory (Stages 2 and 3 in the model) is well illustrated by the example of "had my umbilical cord cut after birth." People can believe that this occurred to them, even quite confidently, but they presumably have no actual "memory" for the experience. Likewise with pseudo-events, people can believe that they occurred, even if they have no subjective feeling of memory. In the demonic possession studies, the manipulation does appear to have inflated plausibility (Stage 1 of the model). Subsequently, the subjects also demonstrated increased confidence that the event had happened to them (Stage 2 of the model). The subjects in this study were not pressed to determine whether the beliefs were also accompanied by rich sensory detail, so that we could characterize them as being rich false memories. But such work has been done with other false memories studies and could be done with this unusual item.

### **Accessing True Memories Versus Planting False Ones?**

In this line of research, a question repeatedly arises. Is the suggestive manipulation leading people to uncover a true memory or is it leading to the creation of a false one? So the "lost in the mall" suggestion could conceivably be leading people to dredge up a genuine experience of being lost, even if they had temporarily forgotten about it. Although in the "familial informant false narrative procedure" the family members insist that the pseudo-event never occurred, it is conceivable that the family member informants are wrong. To gather evidence bearing on whether suggestive manipulations are truly planting false memories, researchers have adopted several techniques. One such technique involves attempting to plant not merely implausible memories but events that would be impossible.

In a series of studies designed to plant impossible memories, subjects evaluated advertising copy for a Disney resort. Some saw a generic ad that mentioned no cartoon characters. Others saw a fake ad for Disney that featured Bugs Bunny. Later on, subjects were asked about any personal trips to Disney that they had taken as a child. In one study, exposure to the fake ad led 16% of subjects to claim that they had met Bugs Bunny at Disney (Braun, Ellis, & Loftus, 2002). This scenario is, of course, impossible because Bugs Bunny is a Warner Bros. cartoon character and would not be featured at a Disney resort. Or, as the *Los Angeles Times* put it: "the wascally Warner Bros. wabbit would be awwested on sight" at Disney ("You Must Remember This," 2003). Multiple exposure to the fake Bugs ad led to even higher false memory rates, boosting the rate to 25% in one study and 36% in a second study (Grinley, 2002). In one of these studies, subjects were asked explicitly what they remembered about meeting Bugs. A quarter of subjects fell sway to the suggestion. Of those who recalled the encounter with Bugs, 62% recalled that they shook his hand, 46% recalled hugging him. Moreover, over 25% remembered touching his ear,

touching his tail, and hearing him say "What's up doc?" One participant even remembered that Bugs was holding a carrot. Thus, subjects imbued their false memory with sensory detail, a finding that is important because people sometimes use the presence of sensory detail as a cue to distinguish their true from false memories.

Another attempt to plant an impossible memory suggested to subjects that they remember "Having a nurse remove a skin sample from my little finger" when they were under age 6. A check of government records revealed no evidence that this medical procedure had ever taken place in the United Kingdom where the subjects were tested. And yet after imagination, subjects became more confident that the false event happened to them. Many of them expressed a rich false memory, for example, "There was a nurse and the place smelled horrible" (Mazzoni & Memon, 2003, p. 187).

Other clever attempts to plant at least highly improbable memories have achieved decent success. In one case, subjects were given photographs of themselves as young children and encouraged to recall the events depicted in the photographs. Although most of the photos were genuine, one photo was fake. It was created by digitally introducing a real childhood image into the basket of a hot-air balloon (Wade, Garry, Read, & Lindsay, 2002). Family informants insisted the event never happened to the participant, and yet after reviewing the fake photos, 50% of subjects reported having memories of the experience. For example, one participant remembered the following: "I'm pretty certain it occurred when I was in form one [6th grade] at um the local school there . . . basically for \$10 or something you could go up in a hot air balloon and go up about 20 odd meters . . . I'm pretty certain that mum is down on the ground taking a photo" (p. 600).

A variant of this procedure tried to plant a false memory of putting Slime in the teacher's desk in Grade 1 or 2. (Slime is a bright-colored goey substance sold as a child's toy.) The specific suggestion ostensibly came from a family informant and included the information that the prank was done with a friend, that the teacher was unhappy, and that the students were forced to sit in the corner facing the wall for a half hour as punishment. Subjects frequently claimed to remember this event, and the false memory rate was boosted when subjects viewed their school class group photo from the same time period. In the photo condition, 65% of subjects were judged to have memories of the pseudo-event. These false memories appear to be quite rich:

These findings are particularly dramatic in that subjects judged as having false memories gave quite high ratings of the extent to which they felt they were remembering the event, of the extent to which remembering the event was like reliving it, and of their confidence that the event had actually occurred. (Lindsay et al., 2004, p. 153)

Lindsay et al. (2004) advanced a number of possible explanations for why the class photo (which did not depict the Slime prank) worked so well. It may have added to the memory's authenticity, it enabled subjects to speculate about the event, and it provided some perceptual details that were subsequently blended with products of imagination to produce images of the pseudo-event.

## Consequences of False Memories

In virtually all of the memory-planting studies, the ultimate question asked of subjects is whether they believe that the pseudo-event happened in their past. Sometimes they are then probed to determine whether the event is "remembered." Occasionally, there are attempts to determine whether the event is held with confidence, whether it is accompanied by sensory detail, or whether it is associated with emotion. But even after determining that a rich false memory has been created, little is known about whether holding such a false memory is associated with any consequences later on. Does the false memory affect the thoughts or behaviors of the individual in some further way? For example, if a false memory is planted that the participant met Bugs Bunny at Disney, would the participant later think about Bugs whenever Disney is mentioned? Or, if a false memory is planted that a participant experienced a vicious attack by a dog as a child, would the participant show fear of dogs later on?

Grinley (2002) explored the consequences of the Bugs Bunny manipulation. Recall that in one of her thesis experiments, she convinced approximately 36% of subjects that they had met Bugs Bunny at a Disney resort. In this study she also explored the impact of the manipulation on semantic associations. Subjects viewed pairs of cartoon characters and indicated the extent to which the characters were related to one another. For example, how related are Mickey Mouse and Minnie Mouse, Donald Duck and Sleeping Beauty, Mickey Mouse and Bugs Bunny? Naturally, people find Mickey and Minnie to be closely related, and they find Donald and Sleeping Beauty to be relatively unrelated. But after the Bugs manipulation, people find Mickey and Bugs to be more closely related than control subjects do. Thus, the false memory manipulation influenced the thought processes of the exposed subjects, and in that sense created a consequence. Whether subjects would act differently as a result of their altered thought processes is a matter for future research.

A more compelling example of a false memory having consequences for an individual comes from preliminary work conducted by Heather Collins as part of her honors thesis conducted in our lab (Collins, 2001, reviewed in Pickrell, Bernstein, & Loftus, in press). Collins asked whether people who were led to believe that they had been attacked by a small dog as children would later show inclinations to avoid that type of animal. In her study, subjects were first asked whether various events had happened to them as children. The key item, buried in a long list, was whether they "were unexpectedly attacked by a small dog." Sometime later, some of these subjects were given bogus feedback, based on previously completed questionnaires, that they had likely been attacked by a small dog. When subsequently asked about the key experience, these subjects were more confident that they had been attacked in this way as children. In terms of consequences, those individuals also later indicated that they were less interested in owning a dog as a pet, compared with controls who had not received the false feedback manipulation. So the memory-altering manipulation appears to be able to influence one's later interests, preferences, attitudes, or whatever this report is measuring. Whatever they are, what we have here is a demonstration that our suggestive false memory manipulations can have

consequences beyond a simple report of belief or memory. Although Collins showed an influence on reported preferences in her study, it still is an empirical question whether her manipulation would also affect actual behavior (e.g., would people be less likely to actually purchase or obtain a dog as pet?). Of course, we do know that a primary determinant of a person's behavior is the intention the person has to perform that behavior (Cappella, Yzer, & Fishbein, 2003). And intention itself is a function of the attitude that the person has toward performing the behavior, so it seems reasonable to speculate that the manipulations might affect actual behavior.

We have recently conducted pilot work addressing this question. Subjects completed a questionnaire about childhood experiences pertaining to food, for example, "Slipped on a banana peel and fell down" or "Ate freshly picked vegetables." Embedded within this list of events was a critical item. For one group of subjects (egg group), this item was "Got sick after eating too many hard boiled eggs." For another group of subjects (pickle group), this item was "Felt ill after eating a dill pickle." Subjects returned to the lab a week later and were given false feedback allegedly coming from a sophisticated computer program. They were told that their answers to previous questionnaires indicated that they had either gotten sick from eating hard boiled eggs (egg group) or that they had gotten sick after eating a dill pickle (pickle group). Next, subjects completed the same food questionnaire that they had completed 1 week prior. Our first question was whether the bogus feedback increased people's beliefs about the critical item. As predicted, the egg group was now more likely to believe that they had, in fact, become ill after eating hard-boiled eggs as children. And those given the false feedback about getting sick on a dill pickle showed increased confidence that that had occurred in their childhood.

Our main question, though, was whether this increase in autobiographical belief would translate into subsequent observable behavior. Would subjects who thought that they had gotten sick after eating hard-boiled eggs or eating pickles as children now be more likely to avoid such foods? To test this, we asked subjects to imagine themselves at a barbeque with 100 guests. We then asked them to rate how likely they would be to eat certain foods. Embedded within this list of foods were the critical items: hard-boiled eggs and dill pickle spears. As we had predicted, subjects in the egg group rated themselves as less likely to want to eat hard-boiled eggs, and those in the pickle group said that they were less likely to want to eat dill pickles.

We realize that it is one thing to say that "I wouldn't want to eat dill pickles at a barbeque" and another thing altogether to actually avoid dill pickles at a barbeque. However, as we mentioned above, intentions are excellent predictors of actions. In future work, we hope to test this idea by giving subjects the real choice of eating foods that they falsely believe that they got sick eating as children and other foods with which they have no bad experience—either imagined or real. For example, we might suggest to subjects that they got sick after eating chocolate as children and then present them with the real option of eating chocolates or other nonchocolate candies. Based on our egg/pickle results, we hope to show that subjects will more often choose the other candies, because they now believe (falsely) that they had had a bad experience with chocolate as children. If we obtain this effect, we might even have a new dieting

technique! These experiments indicate that people can be led to believe past events that never happened, and that such beliefs can change not only the way in which people think about the present but also the way in which they now behave.

## **Distinguishing True and False Memories**

Many of the false memory studies have explored whether true and false memories differ. Most studies find that when comparing groups of false memories with groups of true ones, there are statistical differences. For example, Loftus and Pickrell (1995) compared the false memories of being lost with reports of true memories, and they found that subjects used fewer words in describing their false memories and rated the clarity of their false memories as lower than the true ones. They were also less confident in the false memories. Hyman and Pentland (1996) investigated the role of mental imagery in the formation of false memory and reported that false memories differ from some true memories. However, true memories that were not recalled at first and then recalled up to 3 weeks later were similar to false memories in terms of emotional strength, image clarity, and the confidence with which subjects held such memories. Hyman and Pentland pointed out that true memories, like false ones, are constructed (Bartlett, 1932), underscoring the difficulty in discerning true from false memories (for further evidence supporting this conclusion, see Heaps & Nash, 2001; Porter et al., 1999).

Recent work using neuroimaging has attempted to locate differences in the brain that might reveal something about true and false memories. The goal of much of this work is to demonstrate that true and false memories have different neural signatures (Curran, Schacter, Johnson, & Spinks, 2001; Fabiani, Stadler, & Wessels, 2000; Miller, Baratta, Wynveen, & Rosenfeld, 2001). The allure of such work has not been ignored, and there is likely to be considerable effort expended in the future on the neurophysiology of false memory. However, as we have argued elsewhere, this work tells the memory researcher little about the veracity of particular memories (Bernstein & Loftus, 2002). The reason for this is that findings are based on group averages. Unfortunately, group averages do not allow us to focus on an individual memory and to reliably discern whether it is true or false. Another potential problem with neuroimaging work on false memory is that such studies typically involve memory for words recently learned, and the few studies that have been done using this procedure have yielded inconsistent results. The methodological constraints of neuroimaging tools such as functional magnetic resonance imaging (fMRI) and event-related potentials (ERPs) make it difficult to study the types of rich false memories that we have been discussing. False memories of recently learned words are bound to be far more pallid than the rich false memories we are discussing.

Individuals who have rich (probably false) memories of alien abduction have been recently studied by Richard McNally and his collaborators (McNally, 2003). One study explored whether people who believe they have been abducted exhibit heightened physiologic reactivity (heart rate, skin conductance) that

is common to patients with posttraumatic stress disorder (PTSD) when they think about their true traumas. The abductees studied had experienced apparent sleep paralysis and hypnopompic hallucinations (such as seeing figures hovering near their beds). Most had recovered memories with techniques such as guided imagery and hypnosis. Some recovered memories involved sexual intercourse with aliens, or having sperm extracted for breeding purposes. They listened to prerecorded audiotaped scripts about their experiences. Their physiological reactions were similar to those shown by people with PTSD who listen to audiotaped scripts of their true traumas. McNally (2003) noted that these findings underscore "the power of belief to drive a physiology consistent with actual traumatic experience" (p. 273).

One further concern in the true versus false memory distinction department is this: In many of the real-world cases, there are numerous attempts to get people to remember, to discuss their memories, to imagine the details, and more. These very techniques can serve to make the false memories be experienced as more detailed and vivid, and can make them even more indistinguishable from true memories.

## Implications

### *Theoretical*

False memories can be created using a variety of means. The process by which this occurs, though, is still unclear. As we described above, Mazzoni et al. (2001) have proposed a three-stage model by which false memories arise. Briefly, one must be led to believe that the event is plausible. Next, one must come to believe that the event personally occurred. Finally, one must experience the event as if it were a real memory. We recently demonstrated that surprising fluency accounts for the first two steps of this model (Bernstein, Godfrey, Davison, & Loftus, in press). *Surprising fluency* is defined as an unexpected rush of meaning that accompanies one's information-processing experience. Bernstein et al. presented subjects with life events that either were intact (e.g., "broke a window playing ball") or contained a key word that was scrambled (e.g., "broke a nwidwo playing ball"). In one experiment, subjects were asked to rate the events in terms of the likelihood that they occurred before the age of 10 in the average North American child's life. In other experiments, subjects were asked to rate the life events in terms of the likelihood that they occurred personally before the age of 10. In both cases, unscrambling a word was sufficient to increase one's belief that the event occurred in the average North American child's life as well as one's own childhood.

The process by which solving an anagram can lead one to believe that the event is generally plausible and that it likely occurred in one's own childhood is as follows: When subjects first encounter the anagram, they expect their processing to be slow and laborious. However, they quickly solve the anagram and experience a rush of meaning, akin to an "aha." This sudden rush of meaning is experienced as surprising fluency that the participant, in turn, experiences as familiarity (see Whittlesea & Williams, 2001). The participant

then seeks to attribute this familiarity to a source, and in so doing, mistakenly attributes it to childhood experience rather than to the fact that he or she just unscrambled an anagram (see also Bernstein, Whittlesea, & Loftus, 2002). In a series of experiments, we demonstrated that fluency per se is insufficient to explain the increase in confidence. Instead, surprising fluency seems to account better for the way in which an event can be seen as plausible and likely to have occurred in one's own life. We argued that the same process may help explain how pseudo-events can be experienced as real, rich memories that subtly become part of one's autobiography.

Much of the work that we have described in this chapter can be explained using this familiarity misattribution model. To create rich false memories, investigators have used a variety of techniques. They may ask subjects to imagine themselves experiencing certain events such as breaking a window. The act of imagination makes this event feel more familiar when it is subsequently encountered on a list of possible childhood events, because the event is processed surprisingly well. This familiarity is then misattributed to childhood experience rather than being correctly attributed to the act of imagination. Similarly, asking subjects to try to remember a fictitious event causes them to imbue the experience with sensory detail and even emotion. When subjects later are asked whether the event in question is a real memory, their previous attempt at recollection causes the event to feel highly familiar now. Subjects may find it difficult to discern the memory's origin and mistakenly accept it as real (see Johnson, Hashtroudi, & Lindsay, 1993). Thus, familiarity misattribution may explain how events come to be seen as both generally plausible and personally experienced as real memories.

### *Applied*

It should be clear by now that there are many ways to lead people to falsely believe that something happened in their past that did not, and in some cases to lead them to develop rich false memories. As we have noted before, this is not simply a nuisance for the individual, but it also represents a serious social problem contributing to miscarriages of justice in the legal system, to mistreatments of patients in clinical settings, and to consumer gullibility to manipulative advertising (van de Wetering, Bernstein, & Loftus, 2002). When innocent people are jailed, when therapy patients are made sicker, we have a societal problem worth worrying about.

It might sound rather trite, but perhaps one of the best remedies for these problems is widespread education. If people were made more aware of the problem of false memories, they might become less susceptible. Encouraging people to think hard about the potential source of the memories or the source of particular details in a memory has been shown to reduce the false memory problem, although it does not eliminate it (Chambers & Zaragoza, 2001). People might profitably be trained to examine these sources autonomously and routinely.

In addition to raising awareness on the part of the rememberer, it would be useful to educate those who are in a position to influence the memories of

others. Police and other investigators need to be aware of their power to influence, and to avoid inadvertent contamination of memory. A question as seemingly innocent as "Mrs. Jones said it happened this way, what did you see?" is just the kind of manipulation that our studies have shown can lead people to misremember the past.

Clinicians too need to be wary. When they take a client who has no memories of sexual abuse and use leading questions, guided imagery, dream interpretation, and other techniques to plumb the past, they may be inadvertently creating a past. More than a few clients have been led to develop some of the richest false memories that we have ever seen (Loftus & Ketcham, 1994).

### Concluding Remarks

We have tried to show how people can be led to believe in details and events in their past that never occurred. Our focus has been on what we call rich false memories, or wholly false memories about the past. Evidence is growing that memory is highly malleable and that it can both aid us and lead us astray. Most of the time, memory serves us very well. At times, though, memory misleads us. Sometimes the error is inconsequential; other times, it can be disastrous. We have reviewed some of our own work and that of others showing how false memories arise and how they can influence the way we think about the world and the way we behave. We have also discussed some of the difficulties inherent in trying to differentiate true and false memories. Finally, we offered a theoretical account of false memory formation and discussed some real-world applications of false memory research. Future work on false memory will undoubtedly answer some of the many questions that remain. For the present, the major hurdle for individuals, juries, and clinicians is to remain cognizant of the fact that rich false memories can appear and feel just as real and true as true memories. Just because the memory report is detailed, just because the person expresses confidence, just because the individual is highly emotional when reporting, does not mean it really happened.

### References

- Ayers, M. S., & Reder, L. M. (1998). A theoretical review of the misinformation effect: Predictions from an activation-based memory model. *Psychonomic Bulletin & Review*, 5, 1-21.
- Bartlett, F. C. (1932). *Remembering: A study in experimental and social psychology*. Cambridge, England: Cambridge University Press.
- Bernstein, D. M., Godfrey, R., Davison, A., & Loftus, E. F. (in press). *Memory's free radicals: When familiarity alters autobiography*. *Memory & Cognition*.
- Bernstein, D. M., & Loftus, E. F. (2002). Lingering difficulties distinguishing true and false memories: A comment on Shevrin's psychoanalytic view of memory. *Neuro-Psychoanalysis*, 4, 129-141.
- Bernstein, D. M., Whittlesea, B. W. A., & Loftus, E. F. (2002). Increasing confidence in remote autobiographical memory and general knowledge: Extensions of the revelation effect. *Memory & Cognition*, 30, 432-438.
- Braun, K. A., Ellis, R., & Loftus, E. F. (2002). Make my memory: How advertising can change our memories of the past. *Psychology and Marketing*, 19, 1-23.

- Cappella, J. N., Yzer, M., & Fishbein, M. (2003). Using beliefs about positive and negative consequences as the basis for designing message interventions for lowering risky behavior. In D. Romer (Ed.), *Reducing adolescent risk* (pp. 210–219). Thousand Oaks, CA: Sage.
- Chambers, K. L., & Zaragoza, M. S. (2001). Intended and unintended effects of explicit warnings on eyewitness suggestibility: Evidence from source identification tests. *Memory & Cognition*, *29*, 1120–1129.
- Collins, H. R. (2001). *Another reason to dislike Chihuahuas and other small dogs: Behavioral consequences of false memories*. Unpublished honors thesis, University of Washington, Seattle.
- Curran, T., Schacter, D. L., Johnson, M. K., & Spinks, R. (2001). Brain potentials reflect behavioral differences in true and false recognition. *Journal of Cognitive Neuroscience*, *13*, 201–216.
- Fabiani, M., Stadler, M. A., & Wessels, P. M. (2000). True but not false memories produce a sensory signature in human lateralized brain potentials. *Journal of Cognitive Neuroscience*, *12*, 941–949.
- Grinley, M. J. (2002). *Effects of advertising on semantic and episodic memory*. Unpublished master's thesis, University of Washington, Seattle.
- Heaps, C. M., & Nash, M. (2001). Comparing recollective experience in true and false autobiographical memories. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *27*, 920–930.
- Hyman, I. E., Jr., Husband, T. H., & Billings, F. J. (1995). False memories of childhood experiences. *Applied Cognitive Psychology*, *9*, 181–197.
- Hyman, I. E., Jr., & Pentland, J. (1996). The role of mental imagery in the creation of false childhood memories. *Journal of Memory and Language*, *35*, 101–117.
- Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin*, *114*, 3–28.
- Lindsay, D. S., Hagen, L., Read, J. D., Wade, K. A., & Garry, M. (2004). True photographs and false memories. *Psychological Science*, *15*, 149–154.
- Loftus, E. F., & Ketcham, K. (1994). *The myth of repressed memory*. New York: St. Martin's Press.
- Loftus, E. F., & Pickrell, J. E. (1995). The formation of false memories. *Psychiatric Annals*, *25*, 720–725.
- Mack, J. E. (1994). *Abduction: Human encounters with aliens* (Rev. ed.). New York: Ballantine Books.
- Mazzoni, G. A. L., Loftus, E. F., & Kirsch, I. (2001). Changing beliefs about implausible autobiographical events: A little plausibility goes a long way. *Journal of Experimental Psychology: Applied*, *7*, 51–59.
- Mazzoni, G. A. L., & Memon, A. (2003). Imagination can create false autobiographical memories. *Psychological Science*, *14*, 186–188.
- McNally, R. J. (2003). *Remembering trauma*. Cambridge, MA: Harvard University Press.
- Miller, A. R., Baratta, C., Wynveen, C., & Rosenfeld, J. P. (2001). P300 latency, but not amplitude or topography, distinguishes between true and false recognition. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *27*, 254–361.
- Neisser, U., & Harsch, N. (1992). Phantom flashbulbs: False recollections of hearing the news about Challenger. In E. Winograd & U. Neisser (Eds.), *Affect and accuracy in recall: Studies of "flashbulb" memories* (pp. 9–31). New York: Cambridge University Press.
- Nourkova, V., Bernstein, D. M., & Loftus, E. F. (2004). Altering traumatic memory. *Cognition & Emotion*, *18*, 575–585.
- Pezdek, K., Finger, K., & Hodge, D. (1997). Planting false childhood memories: The role of event plausibility. *Psychological Science*, *8*, 437–441.
- Pickrell, J. E., Bernstein, D. M., & Loftus, E. F. (in press). The misinformation effect. In R. Pohl (Ed.), *Cognitive illusions: A handbook on fallacies and biases in thinking, judgment and memory*. Hove, England: Psychology Press.
- Porter, S., Yuille, J. C., & Lehman, D. R. (1999). The nature of real, implanted, and fabricated memories for emotional childhood events: Implications for the recovered memory debate. *Law and Human Behavior*, *23*, 517–537.
- Radelet, M. L. (2002). Introduction: Wrongful convictions of the innocent. *Judicature*, *86*, 67–68.
- Sagan, C. (1995). *The demon-haunted world*. New York: Random House.

- van de Wetering, S., Bernstein, D. M., & Loftus, E. F. (2002). Public education against false memories: A modest proposal. *Cognitive Technology, 2*, 4–7.
- Wade, K. A., Garry, M., Read, J. D., & Lindsay, D. S. (2002). A picture is worth a thousand lies: Using false photographs to create false childhood memories. *Psychonomic Bulletin & Review, 9*, 597–603.
- Whittlesea, B. W. A., & Williams, L. D. (2001). The discrepancy-attribution hypothesis: I. The heuristic basis of feelings of familiarity. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 27*, 3–13.
- You must remember this [Editorial]. (2003, February 24). *Los Angeles Times*, p. 10, Part 2.