6 False Memories: The Role of Plausibility and Autobiographical Belief

Daniel M. Bernstein, Ryan D. Godfrey, and Elizabeth F. Loftus

On the other side of the dungeon, he perceived an inscription, the white letters of which were still visible on the green wall: "'Oh God",' he read, "'preserve my memory!" Oh yes,' he cried, 'that was my only prayer at last; I no longer begged for liberty, but memory ...'

Dumas, 1844/1997, *The Count of Monte Cristo*, p. 848

INTRODUCTION

False memories can reveal much about the structure and function of memory (Brainerd & Reyna, 2005; Schacter, 2001), especially how we organize details from past and present sources to form a coherent autobiography (Conway & Pleydell-Pearce, 2000). False memories, or memories for experiences that never occurred, abound in our autobiographies. Although the past several decades have seen a great deal of research on false memories, relatively little is known about the underlying mechanisms that cause them. In this chapter, we first review recent findings on false memories. We then propose several ideas about potential mechanisms associated with false memories and present new experimental data that bear on those mechanisms.

What do we know about false memories? We know that false memories *do* occur and are quite common. Looking into one's own past, it is easy to recall a time when two friends had two distinctly different versions of the same event. Most false memories are harmless (e.g., "I visited the Grand Canyon in my youth," when in truth I did not); however, some may have devastating consequences. For example, an eyewitness misidentifies a suspect, thereby leading to the wrongful conviction and imprisonment of an innocent person (see Cutler & Penrod, 1995; Doyle, 2005; Loftus, 1979). After examining these cases, no one would ask whether false memories occur. Rather, a better question to ask is *how* and *why* do false memories occur? Recent laboratory-based studies have helped answer these important questions.

Various techniques have been used to increase people's belief that they experienced a particular event in their past. For example, Loftus and Pickrell (1995) developed the following procedure for planting false memories in participants: First, they confirmed with parents of participants that the subjects had never experienced a particular event in their childhood such as getting lost in a shopping mall for an extended time. Next, the researchers obtained from the parents three true memories for childhood events that had occurred. Finally, the researchers asked participants to discuss their memories for these four events. Three of the events were true and one (shopping mall) was false for every subject tested. Over three successive interviews using these four events, 25% of the participants came to believe that they had been lost in a shopping mall as a child. Hyman, Husband, and Billings (1995) used a similar procedure to suggest falsely to participants that they had spilled a punch bowl at a wedding. Here also, about 25% of the participants came to believe, wholly or partially, that this event had occurred in their childhood.

In other work, Garry, Manning, Loftus, and Sherman (1996) asked participants about a variety of childhood experiences, such as breaking a window with one's hand. Later, some participants were asked to "Imagine that it is after school, and you are playing in the house. You hear a strange noise outside, so you run to the window to see what made the noise. As you are running, your feet catch on something, and you trip and fall." These participants were then asked to imagine breaking the window with their hand, cutting themselves and bleeding. This simple imagination exercise increased participants' confidence that they had broken a window with their hand as a child. Other work involving "imagination inflation" has shown how imagination can lead to the creation of false memories (see Goff & Roediger, 1998; Seamon, Philbin, & Harrison, 2006). Similar findings have emerged using even subtler techniques. For example, explaining how particular events might have occurred in one's life (Sharman, Manning, & Garry, 2005) or writing a biographical sketch (from a third-person perspective) for a fictional adolescent (Nourkova, Bernstein, & Loftus, 2004) increased one's confidence that these events personally occurred in one's own adolescence.

In other work, Wade, Garry, Read, and Lindsay (2002) obtained family photographs of their experimental participants as young children and inserted these photographs into a picture depicting a hot air balloon ride. This manipulation made it appear as though participants had actually gone on a hot air balloon as a child when in fact they had not (this fact was confirmed by the subjects' parents). After seeing a photo of themselves and a family member riding in a hot air balloon, nearly half the participants increased their belief that they had ridden in a hot air balloon as children. More recent studies involving the effects of photographs and imagination on memory have shown that simply seeing yearbook-type photographs of one's entire class is sufficient to increase people's confidence that they got in trouble for hiding toy slime in their teacher's desk (Lindsay, Hagen, Read, Wade, & Garry, 2004). In addition, photographs that depict violence and destruction can also change people's memory for news events, making people falsely remember more negative details about the events (Garry, Strange, Bernstein, & Kinzett, 2007; Sacchi, Agnoli, & Loftus, 2007). For example, Garry et al. asked participants to read a newspaper story of a hurricane hitting a coastal town. Accompanying this story was a photograph. Participants saw either a picture of a village before or after the hurricane struck. Those who saw the photograph of the village *after* the hurricane struck were far more likely to report having read information describing death and injury in the initial newspaper story, although no such mention of death and injury existed in the story. These studies suggest that various techniques can increase people's confidence in individual details for events as well as entire events that never occurred (see also Bodner & Richardson-Champion, 2007; Hannigan & Reinitz, 2001; Pezdek & Lam, 2007; Wade et al., 2007).

One possible explanation for how these procedures produce a false memory involves source monitoring (Johnson, Hashtroudi, & Lindsay, 1993). False memories may arise from participants' inability to attribute their present processing experience to the correct source in their past, that is, to suggestion, imagination, or false feedback (Garry & Polaschek, 2000; Johnson et al., 1993). Participants who imagine having had an experience (like breaking a window and getting cut) may have a feeling of familiarity when tested about that item later. They may misattribute this feeling to early childhood experience rather than to the more recent act of imagination.

Another theory called *fuzzy-trace theory* distinguishes between two types of memory traces: verbatim and gist. Verbatim-based memories store sensory information and are typically linked to detailed recollection of past experiences, while gist-based memories store semantic information and are linked to familiarity (Brainerd & Reyna, 2002; see also Mandler, 1980). Both memory traces can produce accurate as well as false memories; however, accurate memory is more often associated with verbatim traces, while false memory is more often associated with gist traces.

It is now commonly accepted that false memories can and do occur (Brainerd & Reyna, 2005). However, it is still unclear exactly how and why false memories emerge. Mazzoni, Loftus, and Kirsch (2001) proposed a three-step model for the development of false memories. According to the model, (a) an event comes to be seen as plausible in the culture of the remember (plausibility); (b) one obtains a personal belief that the event likely occurred to him or her (autobiographical *belief*);

and (c) one interprets thoughts and images about the event as actual memories (autobiographical memory). Mazzoni and colleagues have since added a step to their model in which an event comes to be seen as personally plausible before one comes to believe that the event likely occurred to them (Scoboria, Mazzoni, Kirsch, & Relyea, 2004). The present work focuses on the mechanisms underlying plausibility and autobiographical belief.

We hypothesize that the probability that an individual comes to believe that an event is generally plausible and that it likely occurred in their remote past depends, in part, on the ease with which the event is processed. Researchers have typically defined ease of processing as speed and speed of processing as fluency because processing speed is easily measured with reaction time. However, fluency can also be the integration, coherence, or well-formedness of perceptual detail or the perception of ease independent of the speed of processing (Whittlesea & Leboe, 2003). Fluency can be enhanced by different stimulus variables, such as repetition, clarity, and presentation duration. When people are unaware of the source of their fluency, they may mistake that fluency for familiarity. Put another way, when people experience fluent processing of some material, they sometimes mistakenly believe that the material is familiar to them.

For example, Jacoby and Whitehouse (1989) found that when viewing words in a recognition test, subjects unaware of subliminal repetition prime words misattributed the enhanced fluency of test words to a prior exposure of the test words. Thus, they developed a false memory for having experienced the words in the past, although these illusions of familiarity arose from brief and subliminal exposure to the repetition primes. Subjects have also been shown to misattribute fluency to various cognitive, perceptual, and affective judgments, including memory, belief, clarity, liking, fame, and even beauty (see Bernstein, 2005; Briñol, Petty, & Tormala, 2006; Clore, 1992; Kelley & Lindsay, 1993; Sanna & Schwarz, 2006; Sanna, Schwarz, & Kennedy, Chapter 13, this volume; Unkelbach, 2006; Winkielman, Schwarz, Reber, & Fazendeiro, 2003). These experiments show that sometimes an increase in fluency leads people to think they like something more, to think a made-up name is actually that of a famous person, and that something is beautiful. We operationalize fluency as the speed, ease, and accuracy with which a person processes a stimulus.

Researchers have argued that increasing one's belief that an event is generally plausible helps to make people believe that the event was personally experienced (Hyman & Loftus, 1998; Pezdek, Finger, & Hodge, 1997; Smeets, Merckelbach, Horselenberg, & Jelicic, 2005). Also, the more plausible the event seems generally, the more likely it is that a person will come to believe that it occurred in the past. Once belief in the general event is instilled (plausibility), it can then be transformed into an autobiographical belief and memory through a variety of suggestive techniques, including imagination, suggestive stories, and dream interpretation (Garry et al., 1996; Lynn, Barnes, & Matthews, Chapter 7, this volume; Mazzoni, Loftus, Seitz, & Lynn, 1999; see also Mazzoni & Kirsch, 2003). All of these techniques serve to increase the fluency with which the event is later processed. For processing fluency to increase plausibility and autobiographical belief, we hypothesize that the individual must be unaware of the actual source of the fluency. After all, if the person is aware of the actual source, he or she will not misattribute it to an actual memory from the past. We argue that a single, general process underlies both plausibility and autobiographical belief. The current work aims to clarify the path of false memory formation. Although our focus here is on plausibility and autobiographical belief, we hypothesize that both of these processes (and the creation of complete false memories) occur, in part, through the misattribution of processing fluency.

Consider the following experimental paradigm: Participants see a sentence with one word scrambled, and their task is to unscramble that word (e.g., "broke a *nwidwo* playing ball"). Most participants will quickly recognize that the scrambled word is "window." Participants are then asked to indicate how likely it is that in their childhood they had the experience "broke a window playing ball." Several studies using this procedure have revealed that unscrambling a word enhances the perception that the experience did in fact occur (Bernstein, Whittlesea, & Loftus, 2002; Kronlund & Bernstein, 2006). But why? The idea here is that participants use the intact portions of the event to help them unscramble the anagram. At first, participants' processing of the word *nwidwo* is

dysfluent. However, when they successfully unscramble the word to form window, they experience a rush of meaning and fluent processing, akin to an "aha" experience. They may then misattribute this enhancement of fluency as familiarity for experiencing the event in their childhood.

This manipulation bears directly on an intriguing observation in cognitive psychology called the *revelation effect* (Watkins & Peynircioglu, 1990). The revelation effect refers to the tendency for participants to claim that an item is "old" in a recognition task if the target word itself is somehow degraded or obscured and then revealed (*rednelb* for blender) or if the target word is preceded by an anagram (*rednelb*—raindrop). This effect has traditionally been regarded as idiosyncratic to episodic memory (Frigo, Reas, & LeCompte, 1999; Hockley & Niewiadomski, 2001; Luo, 1993; Mulligan & Lozito, 2006; Watkins & Peynircioglu, 1990; Westerman & Greene, 1996). Bernstein et al. (2002) replicated this finding with judgments of childhood history (e.g., "Hit your finger with a *mharme* [hammer]"). They also obtained similar effects for general knowledge statements ("heaviest internal organ"—*velir* [liver]). Unscrambling an anagram served to increase participants' confidence that the life events had indeed occurred in their childhood and that the general knowledge statements were true.

The present work explores the processes responsible for making life events feel generally plausible and part of one's own autobiographical past—the first two stages in Mazzoni et al.'s (2001) model of false memory formation. In Experiment 1, we explore the formation of plausibility. In Experiments 2 and 3, we investigate the formation of autobiographical belief. The thread running throughout the experiments reported here is that belief in the general plausibility of life events and in the likelihood that the events occurred in one's own past depends, in part, on the misattribution of familiarity.

EXPERIMENT 1: PLAUSIBILITY

Experiment 1 had two goals. First, we wished to replicate and extend the revelation effect that Bernstein et al. (2002) obtained for general knowledge and childhood experiences. In our previous work, we showed that unscrambling key words in the context of answering trivia questions or remembering life events increased confidence that the answer was true or that the events occurred in one's own childhood. We wondered whether a revelation effect would also occur if, instead of attempting to remember their own childhood, participants estimated the likelihood that the events occurred in *another person's* childhood; in this case, the other person was the "average" North American. It is not obvious that the revelation effect would occur in these circumstances given that nearly all demonstrations of the effect involve episodic memory judgments. Estimating the likelihood that life events occurred in another person's childhood is clearly not an episodic memory judgment according to Tulving's (1972, 1983) episodic-semantic classification of memory. If we observe a revelation effect for judgments of another person's childhood, this would extend the boundary conditions of the effect to yet another nonepisodic judgment.

Our second aim in Experiment 1 was to show that such increases in the general plausibility of various life events may occur, in part, through the misattribution of familiarity. We attempted to create familiarity for certain items in Experiment 1 by first training participants on "unconstrained items" that contained an anagram. Unconstrained items are those that lack contextual detail that might aid in solving the anagram in the context of a life event: "saw a rpaead [parade]." In previous work, we failed to obtain any revelation effects without this type of training procedure (Bernstein et al., 2002; Bernstein, Godfrey, Davison, & Loftus, 2004). Next, we presented unconstrained items at test along with some highly "constrained" critical items: "witnessed a solar lecsiep [eclipse]." These constrained items are much easier to solve than the unconstrained items because they provide context. However, the result of pairing unconstrained and constrained test items is that the training items and the unconstrained test items lead participants to expect that unscrambling anagrams is difficult. Thus, when they encounter a constrained anagram, they should experience it as surprisingly easy to unscramble. In turn, if participants fail to realize that this ease of processing is due to

the contextual detail contained in the phrase, they may interpret processing fluency as familiarity and misattribute this familiarity to the general plausibility of the event.

We calculated two means for each participant. First, we obtained the mean plausibility rating for intact items; that mean was 4.42 on an 8-point scale. Next, we obtained the mean plausibility rating for all correctly unscrambled anagrams. Participants correctly unscrambled 99% of the items, and the mean rating for plausibility for those items was significantly higher, at 4.60. Between these two means, 0.18 ± 0.16 was the mean difference.[1] Thus, solving an anagram embedded within a life event description increased participants' belief that the event was likely to occur in the average North American childhood.

It is unclear exactly how this increase in plausibility arises. One possibility is that participants use their own childhood experience as a gauge to determine what likely occurs in the average child's life (see Rogers, Kuiper, & Kirker, 1977). While this might be true, it is unclear why participants would choose only the events for which they had to unscramble words to be likely candidates of the average childhood. Another, perhaps better, alternative stresses the importance of processing fluency and familiarity in the formation of plausibility. The fact that anagrams increase the plausibility of life events indicates that the way in which the item is processed is what is crucial to the plausibility effect. While some theorists might argue that subjective ease (i.e., fluency) arising from successfully unscrambling anagrams is sufficient to produce the enhanced plausibility that we observed in Experiment 1 (Sanna, Schwarz, & Kennedy, Chapter 13, this volume), we suggest that plausibility arises partly through the misattribution of familiarity. To graphically represent these two alternatives, fluency can affect plausibility directly (fluency → plausibility) or indirectly via familiarity (fluency → familiarity → plausibility). We favor the latter path for reasons that we now outline.

What people experience on completing an anagram within the context of a life event ("broke a nwidwo [window] playing ball") is an unexpected rush of meaning and fluency (Bernstein et al., 2002). This unexpected fluency in turn leads to the perception of discrepancy between one's initial expectation of how difficult it will be to unscramble the word and the subsequent rush of meaning that they experience on successfully unscrambling the word. This perception of discrepancy is interpreted by participants as a feeling of familiarity, a process that Whittlesea and Williams (2000) call "discrepancy attribution." Participants seek to attribute this feeling of familiarity to a source. In the present experiment, we argue that participants mistakenly attribute familiarity to the general plausibility of the life event in question rather than to the fact that they just unscrambled the word (see Bernstein et al., 2002, 2004).

In sum, Experiment 1 extends the boundary conditions of the revelation effect to include plausibility judgments about childhood life experiences. The fact that unscrambling can also increase plausibility ratings for general knowledge statements leads us to posit that illusory plausibility arises, in part, through the misattribution of familiarity. Although familiarity misattribution provides a mechanism to explain how events come to be regarded as plausible, it is also possible that fluency exerts a direct effect on plausibility. We cannot at present distinguish between these two alternatives. We now turn to the role of familiarity misattribution in the formation of false autobiographical belief. The next two experiments address this stage of the process.

EXPERIMENTS 2 AND 3: AUTOBIOGRAPHICAL BELIEF

There is substantial evidence suggesting that exposure to misinformation after an event hinders one's ability to accurately remember the details of the event (Ayers & Reder, 1998; Loftus, Miller, & Burns, 1978). Moreover, people sometimes combine details from postevent misinformation with their memory of the original event, resulting in a "blended" memory (Loftus, 1977). So, a blue car that was seen is later described as green, and some subjects will remember it as bluish-green. We wondered whether prior experience with words or phrases that later appear in the context of life events might influence participants' confidence that the events had occurred in their childhood. There is ample reason to think that prior exposure would affect belief about one's past. For instance,

many judgments are influenced by prior experience with words, phrases, and names, including judgments of recognition and truth (Bernstein, 2005; Hasher, Goldstein, & Toppino, 1977; Kelley & Lindsay, 1993); perceptual duration (Witherspoon & Allan, 1985); perceptual clarity (Whittlesea, Jacoby, & Girard, 1990); and fame (Jacoby, Woloshyn & Kelley, 1989). Fluency and familiarity appear to be involved in each of these illusory judgments. If the mechanism responsible for illusory plausibility is familiarity, as we have argued, then we might expect that prior exposure to key words would increase the fluency with which those words are later processed in the context of life events. Consequently, this increased fluency could lead to a feeling of familiarity and increase one's belief that the events occurred in one's own childhood. To be more concrete, suppose that a person is exposed to the word *window* on a list of words or a photograph of a window. Shortly thereafter, the person is asked whether they ever broke a window playing ball. Would prior exposure to window increase fluency, and would that make people more likely to think they had, as a child, broken a window playing ball? Experiments 2 and 3 explore this idea.

EXPERIMENT 2: FORCED CONFABULATION

Drivdahl and Zaragoza (2001) developed a useful technique involving forced confabulation to increase confidence for events that were never experienced. They asked participants to view a film depicting a bank robbery. Participants then read a narrative of the event that contained several misleading suggestions in addition to several questions designed to elicit perceptual elaboration of details for events that were never seen in the film. For example, a participant might be asked to answer specific questions about the location or physical appearance of a suggested but false event ("Was the ring that the thief stole in a box?"). This "forced confabulation" significantly increased false memory for such fictitious details.

We wondered whether a procedure similar to forced confabulation would increase participants' confidence for a variety of childhood events, presumably through the misattribution of familiarity. In the present experiment, participants imagined a series of life events in detail and then answered a question about each event. For example, participants might imagine "broke a window playing ball" and then answer whether the window was broken in many pieces, one long crack, or with a hole through it. These same events later appeared on a life events inventory along with new events. We hypothesized that imagining the events and answering questions about them would increase one's confidence that the imagined events were from their own childhood.

This did not occur. Participants were no more likely to believe that old items were part of their childhood in comparison to new items ($M = 4.26$ vs. 4.24, respectively; Mean difference = 0.02 ± 0.34). Thus, previously imagining life events and answering a question about each event did not increase participants' belief that these events had occurred in their childhood. Judging from the magnitude of the confidence interval, one possible reason for our failure to detect a difference in our conditions might be a lack of statistical power. We think this is unlikely for reasons that will become apparent later. Another, perhaps better, explanation for our failure to increase confidence for previously seen events is that those events were in fact processed more fluently than new events, but participants realized the source of the fluency. When and if participants realize why some items feel familiar and others do not, they will likely attribute the familiarity to its true source, in this case the imagination exercise they performed during training. This raises the question of why techniques like imagination inflation and forced confabulation have been found to work at all (e.g., Drivdahl & Zaragoza, 2001; Mazzoni & Memon, 2003).

Two important factors that are present in many imagination inflation studies are the use of a time delay (up to 1 week) between imagination and testing and the use of very few (up to six) critical, imagined items in relation to many noncritical items. These factors may obscure the imagination exercise, thereby making imagination a less-obvious source of the familiarity that it produces. As Garry and Polaschek (2000) have argued, imagination inflation works largely because participants fail to realize that imagination creates familiarity for the critical items. In the present experiment,

participants imagined 24 of the 48 events on the Life Events Inventory. This may have been too many. By having participants vividly imagine half of the test items as well as answering questions about them, the source of the fluency may have been transparent. Thus, in Experiment 3, we attempted to obscure the source of familiarity for some items and make it more obvious for others.

EXPERIMENT 3: VOWEL COUNTING AND VIVIDNESS

In contrast to Experiment 2, in which participants encountered the same life events in the exposure and test phases, in Experiment 3 participants rated key words (e.g., "eclipse") in terms of either their number of vowels or their vividness. The main question was whether either type of experience would affect participants' subsequent processing of those words if they appeared in the context of life events (e.g., "witnessed a solar eclipse") either a short time after the initial exposure or 1 week later.

There is good reason to think that previous experience with words would facilitate and prime later processing of those words (cf. Jacoby & Dallas, 1981; Kolers, 1976), and that longer delays between encoding and retrieval impairs memory (Ebbinghaus, 1885/1964). Moreover, the type of initial processing that one performs affects how well one later remembers, with deeper processing leading to better memory (Craik & Lockhart, 1972).

We hypothesized that processing words by counting their vowels (a shallow task) or rating their vividness (an elaborate task) would enhance the fluency with which participants subsequently processed those words in comparison to new words by mistaking that fluency as evidence that they experienced particular life events in their childhood. In addition, we were interested in whether the attribution to one's childhood would be affected by participants' memory for the particular words that they rated in terms of vividness or for which they counted vowels.

During an exposure phase, participants counted vowels or visualized words or short phrases (e.g., hammer, laughed hard). For visualization, participants spent 3 to 5 s creating a vivid picture of the item in their minds. Participants then completed a distractor task, after which they completed a Life Events Inventory. Participants returned a week later to complete another Life Events Inventory. Each of these Life Events Inventories contained items that participants had seen before in the exposure phase in addition to new items. Finally, participants completed a recognition test.

Six means were calculated for each participant. There were no differences between old items that had been seen during the exposure phase and new items (Old $M = 4.11$; New $M = 4.07$; Difference $= 0.04 \pm 0.16$). Moreover, the 1-week delay had no effect on confidence ratings (Time 1 $M = 4.07$; Time 2 $M = 4.12$; Difference $= 0.05 \pm 0.20$). Finally, there was no interaction between prior exposure and delay (Interaction $= -0.11 \pm 0.54$).

To analyze recognition performance, the probability that participants recognized words from the exposure phase alone was calculated, as well as from the exposure phase and the two test phases combined. As expected, participants had better recognition for words they had visualized during the exposure phase and from the exposure phase and test phases combined ($M = 0.42$ and 0.16, respectively) than after counting vowels in words ($M = 0.31$ and 0.11, respectively).

These results suggest that prior exposure to words or phrases that later appear in the context of life events has little effect on beliefs that such events derived from childhood. Although we did not measure fluency directly, we can only infer that prior exposure to words increased the fluency with which the words were later processed in the context of life events (see Kolers, 1976, for evidence that prior exposure to words can facilitate reading those words even 1 year later). It is possible that participants recognized the source of the fluency if they had previously visualized those words. However, it is unlikely that participants realized the source of fluency when they had only counted vowels in those words. Indeed, counting vowels could have been such a shallow processing task that it failed to act as a prime at all. The recognition data clearly show that participants were better at remembering words they had previously visualized than words for which they had simply counted vowels. So, our processing manipulation worked as we had intended. These results indicate that

fluency per se is likely insufficient to cause people to believe that an event occurred in their child-hood (autobiographical belief).[2]

GENERAL DISCUSSION

To summarize, we showed that unscrambling an anagram in the context of a life event (e.g., broke a nwidwo [window] playing ball) increased participants' belief that the event occurred in the average North American childhood (Experiment 1). In other work, we have shown that unscrambling anagrams also increases confidence in one's own childhood autobiographical belief (Bernstein et al., 2002, 2004). However, visualizing a phrase (e.g., broke a window playing ball) and then answering a question about it (e.g., Was the window broken in many pieces, one long crack, or with a hole through it?) had no effect on participants' confidence that the event occurred in their own childhood (Experiment 2). Also, visualizing or counting the number of vowels in a series of key words or phrases (e.g., window) had no effect on participants' autobiographical confidence when they later encountered those key words or phrases in the context of childhood life events (e.g., broke a window playing ball, Experiment 3). Thus, unscrambling words increases one's confidence in childhood biography and autobiography, but prior elaboration of and exposure to entire life events, key words, or phrases had no direct effect on one's childhood autobiographical belief.

This data pattern is puzzling. There is ample evidence in the literature that various manipulations can lead to false autobiographical belief and memory. These manipulations include imagination inflation, anagram unscrambling, forced confabulation, suggestion, and misinformation, to name but a few. The real puzzle here is why these manipulations produce false autobiographical belief and memory, while prior exposure to key words or phrases does not. We have now conducted over 10 experiments to test the effect of prior exposure on false autobiographical belief and memory. In no case have we obtained a significant effect. We must therefore conclude that prior exposure in and of itself does not produce false autobiographical belief and memory, at least with this experimental paradigm.

Adding to this puzzle, we obtained evidence in two previous experiments that elaborate prior exposure can interact with anagram unscrambling to produce false autobiographical belief (Bernstein et al., 2004; Experiment 2 and 3). In these previous experiments, during an exposure phase, participants visualized key words or generated sentences using key words (e.g., window: He saw the bird through the window). Later, in the test phase, participants encountered these words either intact or as anagrams in the context of life events (e.g., broke a nwidwo playing ball). When participants had to unscramble the key words, they were more likely to claim that these events had occurred in their childhood. This prior exposure by anagram unscrambling interaction disappeared, however, when participants counted vowels in the key words during the exposure phase (Bernstein et al., 2004, Experiment 1) or when they generated childhood events using the key words during the exposure phase (Bernstein et al., 2004, Experiment 4).

There are at least two reasons why the vowel counting and the childhood event generation manipulations did not interact with anagram unscrambling in our previous work: (a) Vowel counting is too shallow a processing task to render a lasting memory trace (see note 2); (b) generating a childhood event with a key word or phrase, although an elaborate processing task, provides participants with a likely (and correct) source to explain the familiarity that they experience when they encounter those key words and phrases in the context of childhood life events. Once again, in none of these four experiments from our previous work did prior exposure directly produce false autobiographical belief. Thus, we conclude that elaborate prior exposure can interact with other manipulations, such as anagram unscrambling, to produce false autobiographical belief; however, this elaborate prior exposure must be obscured as a source that would otherwise explain the familiarity that participants likely experience for target life events (see Clore, 1992). Finally, prior exposure does not *directly* produce false autobiographical belief.

So, what are we to make of our puzzle? Memory is inherently a reconstructive process (Bartlett, 1932). As such, memory encodes experiences in preparation for future action (see Schacter & Addis, 2007). Sometimes this encoding is faulty, leading people to misremember both the details of past events and entire past events. The precise mechanism responsible for false memory is unknown; however, memory errors come in different shades. It is therefore likely that there is no single mechanism subserving all false memories. We next turn to a brief discussion of two mechanisms that may underlie false memory: binding and familiarity misattribution.

BINDING

To the extent that the details of an encoded experience are bound together, the person will correctly remember the original experience. This idea helps explain false memory for details of an event. However, it does not explain rich false memories or memories for entire events that are false (Loftus & Bernstein, 2005). The binding problem pertains to how the brain combines sensory information at encoding to permit us to represent an experience (Roskies, 1999). For example, seeing a red fire engine zoom by with sirens blaring in the rain is a complex sensory experience. Each of the sensory details of this experience (e.g., red large moving object making loud noise while water pelts one's skin) must be combined to faithfully capture the event. Our brain appears to execute this process seamlessly. This apparent ease is misleading, however, for we often misremember the details of experience.

But, what about mistakenly remembering an *entire* experience that never happened? Such rich false memories cannot be the result of binding errors, especially when the details of these memories never occurred. Researchers have identified the integral role that suggestion and imagination play in the formation of false memories (Garry & Polaschek, 2000; Johnson & Raye, 1981; Lynn et al., Chapter 7, this volume). Merely imagining an experience, and imbuing it with sensory details, is often sufficient to render the entire experience and its details indistinguishable from a real memory.

Where the concept of binding may pertain to rich false memories is in one's failure to adequately tag an experience as imagined or otherwise false. Imagining the details of an experience, such as witnessing a solar eclipse or listening to a friend's detailed recollection of her own experience of witnessing a solar eclipse, may be bound faithfully in one's memory. However, if the imaginer or the listener fails to correctly tag this experience as imagined or as belonging to one's friend, then the experience is apt to become part of one's own autobiography (Marsh & Bower, 1993; Nourkova et al., 2004). Such gist-based encoding, although highly adaptive for later remembering and performance, leaves memory vulnerable to error (see Brainerd & Reyna, 2002; Mandler, 1980; Schacter & Addis, 2007).

FAMILIARITY MISATTRIBUTION

Prior experience facilitates and primes subsequent processing of the same experience. This priming leads to fluent processing, which in turn may be interpreted as familiarity. What does one do with this familiarity? To the extent that the correct source of the familiarity is obscured, misattribution ensues.

What leads an individual to believe that a particular life event occurred in their childhood? It cannot be pure fluency because if it were, then we would expect to see an increase in confidence for old items versus new items (an old/new effect) in the studies that involved all intact test items (Experiments 2 and 3). What we observed instead in the present study and in our previous work was that prior exposure to key words had no direct effect on subsequent confidence ratings. Thus, prior exposure by itself is insufficient to cause a later increase in autobiographical belief despite the increased fluency that typically accompanies words that have been seen before.

The paradox posed by our current and previous results is that unscrambling words increases childhood confidence, while prior exposure to words has no direct effect on childhood confi-

dence. One might expect the opposite pattern of results for several reasons. First, the mere act of unscrambling a word embedded within a life event should have no effect on one's confidence that the event occurred in one's childhood. Yet, it does. Second, prior exposure has been shown to influence a variety of judgments, including recognition and truth (Begg, Anas, & Farinacci, 1992), fame (Jacoby et al., 1989), and perceptual duration (Witherspoon & Allan, 1985). The key is to make the context of the test judgment sufficiently different from that of the prior exposure so participants do not discount the fluency. If participants realize that the increased fluency is due to recent prior exposure, they will likely discount it by attributing the fluency to the recent exposure (Jacoby & Whitehouse, 1989). If, however, participants fail to make this connection or if prior exposure appears irrelevant to the present judgment (see Bernstein, 2005), then they will misattribute the fluency. Thus, we contend that participants simply fail to see the connection between unscrambling words and autobiographical belief (leading to misattribution of familiarity), whereas participants do see the connection between prior exposure to words and phrases and autobiographical belief (leading to discounting of familiarity).

One way to conceptualize the effects of unscrambling and prior exposure on autobiographical belief is that the fluency derived from the active unscrambling of anagrams produces a different phenomenological experience than does the more passive experience of being exposed to key words. Although passive exposure may enhance processing fluency, the fluency associated with the active production of a response via unscrambling anagrams may lead people to infer incorrectly that the reason it was so easy to unscramble the anagram was because it came from one's own memory (an illusion of familiarity).

If this account is correct, then the absence of the old/new effect that we observed in several other studies is likely the result of fluency discounting. In contrast, the revelation effect for plausibility and autobiographical belief occurs because participants fail to realize that unscrambling anagrams is a legitimate source of fluency. This failure to make the connection between unscrambling the anagram and the aha that participants experience on successfully unscrambling it results in a mistaken belief that the event in question occurred in one's own (autobiographical belief) or another person's childhood (plausibility). Schooler and Dougal (2007) have proposed a theory that accounts for some of our findings. According to their theory, discovering the solution to an anagram produces an aha that is mistaken for remembering. By this account, we would not expect to find increased confidence in our studies involving a simple old/new paradigm (Experiments 2 and 3) because there is no self-discovery or aha. In revelation studies, on the other hand, in which participants must unscramble words, there is the opportunity for self-discovery: Successful unscrambling produces an aha that can be mistaken for remembering. The notion of self-discovery thus accounts nicely for the absence of the old/new effect that was observed in Experiments 2 and 3.

CONCLUSION

We designed the present experiments to explore possible mechanisms underlying the formation of plausibility and autobiographical belief, the first two stages in Mazzoni et al.'s (2001) model of false memory formation. We have tried to show that familiarity and its subsequent attribution to a source is one likely mechanism. Other work has investigated the roles of familiarity and recollection in false memory (e.g., Roediger & McDermott, 1995), often using Tulving's (1985) remember versus know distinction. However, much of this work has been done using recognition and recall of words presented earlier in the study. The present work focused instead on memory for childhood autobiographical events. In this way, our work departs from many studies on false memory and offers a mechanism (familiarity misattribution) that might also explain how entire autobiographical events come to be viewed as both plausible and likely to have occurred in one's own childhood (see also Conway & Pleydell-Pearce, 2000). Future work, possibly using methods similar to those presented here, should aim to assess the role of familiarity in the formation of false autobiographical memory (see Mazzoni & Kirsch, 2003; Scoboria et al., 2004, for discussion). We suspect that autobiographi-
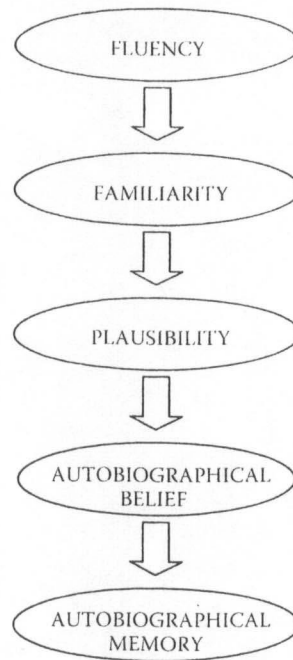
FIGURE 6.1 Hypothesized steps in false memory formation.

cal memory, just like plausibility and autobiographical belief, relies in part on evaluations and attributions of fluency and familiarity (see Figure 6.1).

NOTES

1. When we report $x + y$, x refers to a mean difference between conditions, and y refers to the 95% confidence interval. We report no hypothesis tests; rather, we consider effects "real" if the mean difference plus or minus the confidence interval excludes zero. Such effects are also significant using traditional null hypothesis significance testing (see Loftus & Masson, 1996).
2. We ran an additional experiment ($N = 51$) involving vowel counting of words or phrases, as was done in this experiment, and vowel counting of words embedded within the same life event that appeared approximately 30 min later at test. For example, participants may have counted vowels in the underlined word, "wedding" or "Participated in a wedding" and later rated how likely they were to have "Participated in a wedding" as a child. Once again, on a 1–8 scale, old events containing words that appeared alone prior ($M = 4.20$, SEM [standard error of the mean] = 0.10) and old events that appeared as full sentences prior ($M = 4.25$, $SEM = 0.10$) were no more likely to be judged as autobiographical experiences than were new events ($M = 4.28$, $SEM = 0.10$).

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.

Begg, I. M., Anas, A., & Farinacci, S. (1992). Dissociation of processes in belief: Source recollection, statement familiarity, and the illusion of truth. *Journal of Experimental Psychology: General, 121*, 446–458.

Bernstein, D. M. (2005). Making sense of memory. *Canadian Journal of Experimental Psychology, 59*, 199–208.

Bernstein, D. M., Godfrey, R., Davison, A., & Loftus, E. F. (2004). Conditions affecting the revelation effect for autobiographical memory. *Memory & Cognition, 32*, 455–462.

Bernstein, D. M., Whittlesea, B. W. A., & Loftus, E. F. (2002). Increasing confidence in remote autobio-
    graphical memory and general knowledge: Extensions of the revelation effect. *Memory & Cognition,
    30*, 432–438.

Bodner, G., & Richardson-Champion, D. D. (2007). Remembering is in the details: Effects of test-list context
    on memory for an event. *Memory, 15*, 718–729.

Brainerd, C. J., & Reyna, V. F. (2002). Fuzzy-trace theory and false memory. *Current Directions in Psycho-
    logical Science, 11*, 164–168.

Brainerd, C. J., & Reyna, V. F. (2005). *The science of false memory.* New York: Oxford University Press.

Briñol, P., Petty, R. E., & Tormala, Z. L. (2006). The meaning of subjective ease and its malleability. *Psycho-
    logical Science, 17*, 200–206.

Clore, G. L. (1992). Cognitive phenomenology: Feelings and the construction of judgment. In L. L. Martin &
    A. Tesser (Eds.), *The construction of social judgments* (pp. 133–163). Hillsdale, NJ: Erlbaum.

Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autobiographical memories in the self
    memory system. *Psychological Review, 107*, 261–288.

Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of
    Verbal Learning and Verbal Behavior, 11*, 671–684.

Cutler, B. L., & Penrod, S. D. (1995). *Mistaken identification.* New York: Cambridge University Press.

Doyle, J. M. (2005). *True witness.* New York: Palgrave Macmillan.

Drivdahl, S. B., & Zaragoza, M. S. (2001). The role of perceptual elaboration and individual differences in the
    creation of false memories for suggested events. *Applied Cognitive Psychology, 15*, 265–281.

Dumas, A. (1997). *The count of Monte Cristo.* Ware, Hertfordshire: Wordsworth Editions. (Original work
    published 1844)

Ebbinghaus, H. E. (1964). *Memory: A contribution to experimental psychology.* New York: Dover. (Original
    work published 1885)

Frigo, L. C., Reas, D. L., & LeCompte, D. C. (1999). Revelation without presentation: Counterfeit study list
    yields robust revelation effect. *Memory & Cognition, 27*, 339–343.

Garry, M., Manning, C. G., Loftus, E. F., & Sherman, S.J. (1996). Imagination inflation: Imagining a child-
    hood event inflates confidence that it occurred. *Psychonomic Bulletin and Review, 3*, 208–214.

Garry, M., & Polaschek, D. L. L. (2000). Imagination and memory. *Current Directions in Psychological Sci-
    ence, 9*, 6–10.

Garry, M., Strange, D., Bernstein, D. M., & Kinzett, D. (2007). Photographs can distort memory for the news.
    Applied Cognitive Psychology, 21, 995–1004.

Goff, L. M., & Roediger, H. L., III. (1998). Imagination inflation for action events: Repeated imaginings lead
    to illusory recollections. *Memory & Cognition, 26*, 20–33.

Hannigan, S. L., & Reinitz, M. T. (2001). A demonstration and comparison of two types of inference-based
    memory errors. *Journal of Experimental Psychology: Learning, Memory and Cognition, 27*, 931–940.

Hasher, L., Goldstein, D., & Toppino, T. (1977). Frequency and the conference of referential validity. *Journal
    of Verbal Learning and Verbal Behavior, 16*, 107–112.

Hockley, W. E., & Niewiadomski, M. W. (2001). Interrupting recognition memory: Tests of a criterion-change
    account of the revelation effect. *Memory & Cognition, 29*, 1176–1184.

Hyman, I. E., & Loftus, E. F. (1998). Errors in autobiographical memories. *Clinical Psychology Review, 18*,
    933–947.

Hyman, I. E., Husband, T. H., & Billings, J. F. (1995). False memories of childhood experiences. *Applied
    Cognitive Psychology, 9*, 181–197.

Jacoby, L. L., & Dallas, M. (1981). On the relationship between autobiographical memory and perceptual
    learning. *Journal of Experimental Psychology: General, 110*, 306–340.

Jacoby, L. L., & Whitehouse, K. (1989). An illusion of memory: False recognition influenced by unconscious
    perception. *Journal of Experimental Psychology: General, 118*, 126–135.

Jacoby, L. L., Woloshyn, V., & Kelley, C. (1989). Becoming famous without being recognized: Unconscious
    influences of memory produced by dividing attention. *Journal of Experimental Psychology: General,
    118*, 115–125.

Johnson, M. K., & Raye, C. L. (1981). Reality monitoring. *Psychological Review, 88*, 67–85.

Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin, 114*,
    3–28.

Kelley, C. M., & Lindsay, D. S. (1993). Remembering mistaken for knowing: Ease of retrieval as a basis for
    confidence in answers to general knowledge questions. *Journal of Memory and Language, 32*, 1–24.

Kolers, P. A. (1976). Reading a year later. *Journal of Experimental Psychology: Human Learning and Memory, 2*, 554–565.

Kronlund, A., & Bernstein, D. M. (2006). Unscrambling words increases brand name recognition and preference. *Applied Cognitive Psychology, 20*, 681–687.

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. (1977). Shifting human color memory. *Memory & Cognition, 5*, 696–699.

Loftus, E.F. (1979). *Eyewitness testimony.* Cambridge, MA: Harvard University Press.

Loftus, E. F., & Bernstein, D. M. (2005). Rich false memories: The royal road to success. In A. Healy (Ed.). *Experimental cognitive psychology and its applications: Festschrift in honor of Lyle Bourne, Walter Kintsch, and Thomas Landauer* (pp. 101–113). Washington, DC: American Psychological Association Press.

Loftus, E. F., Miller, D. G., & Burns, H. J. (1978). Semantic integration of verbal information into a visual memory. *Journal of Experimental Psychology: Human Learning and Memory, 4*, 19–31.

Loftus, E. F., & Pickrell, J. E. (1995). The formation of false memories. *Psychiatric Annals, 25*, 720–725.

Loftus, G. R., & Masson, M. E. J. (1996). Using confidence intervals in within-subject designs. *Psychonomic Bulletin & Review, 1*, 476–490.

Luo, C. R. (1993). Enhanced feeling of recognition: Effects of identifying and manipulating test items on recognition memory. *Journal of Experimental Psychology: Learning, Memory & Cognition, 19*, 405–413.

Mandler, G. (1980). Recognizing: The judgment of previous occurrence. *Psychological Review, 87*, 252–271.

Marsh, R. L., & Bower, G. H. (1993). Eliciting cryptomnesia: Unconscious plagiarism in a puzzle task. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19*, 673–688.

Mazzoni, G., & Kirsch, I. (2003). Autobiographical memories and beliefs: A preliminary metacognitive model. In T. Perfect & B. Schwartz (Eds.), *Applied metacognition* (pp. 121–145). Cambridge, UK: Cambridge University Press.

Mazzoni, G., 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., Loftus, E. F., Seitz, A., & Lynn, S. J. (1999). Changing beliefs and memories through dream interpretation. *Applied Cognitive Psychology, 13*, 125–144.

Mazzoni, G., & Memon, A. (2003). Imagination can create false autobiographical memories. *Psychological Science, 14*, 186–188.

Mulligan, N. W., & Lozito, J. P. (2006). An asymmetry between memory encoding and retrieval: Revelation, generation, and transfer-appropriate processing. *Psychological Science, 17*, 7–11.

Nourkova, V. V, Bernstein, D. M., & Loftus, E. F. (2004). Biography becomes autobiography: Distorting the subjective past. *American Journal of Psychology, 117*, 65–80.

Pezdek, K., & Lam, S. (2007). What research paradigms have cognitive psychologists used to study "false memory," and what are the implications of these choices? *Consciousness & Cognition, 16*, 2–17.

Pezdek, K., Finger, K., & Hodge, D. (1997). Planting false childhood memories. *Psychological Science, 8*, 437–441.

Roediger, H. L., III, & McDermott, K. B. (1995). False perceptions about false memories. *Journal of Experimental Psychology: Learning, Memory and Cognition, 22*, 803–814.

Rogers, T. B., Kuiper, N. A., & Kirker, W. S. (1977). Self-reference and the encoding of personal information. *Journal of Personality and Social Psychology, 35*, 677–688.

Roskies, A. L. (1999). The binding problem. *Neuron, 24*, 7–9.

Sacchi, D. L. M., Agnoli, F., & Loftus, E. F. (2007). Changing history: Doctored photographs affect memory for past public events. *Applied Cognitive Psychology, 21*, 1005–1022.

Sanna, L. J., & Schwarz, N. (2006). Metacognitive experiences and human judgment. *Current Directions in Psychological Science, 15*, 172–176.

Schacter, D. L. (2001). *The seven sins of memory: How the mind forgets and remembers.* Boston: Houghton Mifflin.

Schacter, D. L., & Addis, D. R. (2007). The cognitive neuroscience of constructive memory: Remembering the past and imagining the future. *Philosophical Transactions of the Royal Society (B), 362*, 773–786.

Schooler, J. W., & Dougal, S. (2007). Discovery misattribution. *Journal of Experimental Psychology: General, 136*, 577–592.

Scoboria, A., Mazzoni, G., Kirsch, I., & Relyea, M. (2004). Plausibility and belief in autobiographical memory. *Applied Cognitive Psychology, 18*, 791–807.

remote autobio-
ry & Cognition,

test-list context

ions in Psycho-

ersity Press.
ability. Psycho-

L. L. Martin &
baum.
ories in the self

arch. Journal of

ity Press.

fferences in the
–281.
(Original work

over. (Original

erfeit study list

agining a child-
8–214.
chological Sci-

ry for the news.

maginings lead

nference-based
ı, 27, 931–940.
lidity. Journal

iterion-change

gy Review, 18,

ences. Applied

and perceptual

y unconscious

l: Unconscious
logy: General,

Bulletin, 114,

l as a basis for
e, 32, 1–24.

Seamon, J. G., Philbin, M. M., & Harrison, L. G. (2006). Do you remember proposing marriage to the Pepsi machine? False recollections from a campus walk. *Psychonomic Bulletin and Review, 13*, 752–756.

Sharman, S. J., Manning, C. G., & Garry, M. (2005). Explain this: Explaining childhood events inflates confidence for those events. *Applied Cognitive Psychology, 19*, 67–74.

Smeets, T., Merckelbach, H., Horselenberg, R., & Jelicic, M. (2005). Trying to recollect past events: Confidence, beliefs and memories. *Clinical Psychology Review, 25*, 917–934.

Tulving, E. (1972). Episodic and semantic memory. In E. Tulving & W. Donaldson (Eds.), *Organization of memory* (pp. 381–403). New York: Academic Press.

Tulving, E. (1983). *Elements of episodic memory.* New York: Oxford University Press.

Tulving, E. (1985). Memory and consciousness. *Canadian Psychologist, 26*, 1–12.

Unkelbach, C. (2006). The learned interpretation of cognitive fluency. *Psychological Science, 17*, 339–345.

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.

Wade, K. A., Sharman, S. J., Garry, M., Memon, A., Mazzoni, G., Merckelbach, H., et al. (2007). False claims about false memory research. *Consciousness and Cognition, 16*, 18–28.

Watkins, M. J., & Peynircioglu, Z. F. (1990). The revelation effect: When disguising items induces recognition. *Journal of Experimental Psychology: Learning, Memory and Cognition, 16*, 1012–1020.

Westerman, D. L., & Greene, R. L. (1996). On the generality of the revelation effect. *Journal of Experimental Psychology: Learning, Memory and Cognition, 22*, 1147–1153.

Whittlesea, B. W. A., Jacoby, L. L., & Girard, K. (1990). Illusions of immediate memory: Evidence of an attributional basis for feelings of familiarity and perceptual quality. *Journal of Memory and Language, 29*, 716–732.

Whittlesea, B. W. A., & Leboe, J. P. (2003). Two fluency heuristics (and how to tell them apart). *Journal of Memory & Language, 49*, 62–79.

Whittlesea, B. W. A., & Williams, L. D. (2000). The source of feelings of familiarity: The discrepancy-attribution hypothesis. *Journal of Experimental Psychology: Learning, Memory and Cognition, 26*, 547–565.

Winkielman, P., Schwarz, N., Reber, R., & Fazendeiro, T. A. (2003). Cognitive and affective consequences of visual fluency: When seeing is easy on the mind. In L. M. Scott & R. Batra (Eds.), *Persuasive imagery: A consumer response perspective* (pp. 75–89). Mahwah, NJ: Erlbaum.

Witherspoon, D., & Allan, L. G. (1985). The effects of a prior presentation on temporal judgments in a perceptual identification task. *Memory and Cognition, 13*, 101–111.

7

INTRODUC

Hypnosis has l
whether therap
Chapter 6, this
about suggestiv
that traumatic
be repressed an
that were used
ell & Boer, 19
suggestive proc
from his patien
he presented w
Lynn, in press).

By the end
documented by
ate perceptions
the first therapis
and substitute l
developed a mo
tine became ha
help, used hypn
ing a Chinese
the unbidden im
general dancing

In the case
false memories
of a highly trou
the lingering eff
actually have a
"reality" of the

The commu
with the apparen
heim (1891/197
and on her last
bathroom four ti
striking aspect
memory was fal