19 Misinformation effect

Jacqueline E. Pickrell, Daniel M. Bernstein, and Elizabeth F. Loftus

> Memory is a complicated thing, a relative to truth, but not its twin.
> Barbara Kingsolver, *Animal Dreams*

Ah, memories . . . they comfort us, inform us, disturb us, and yes, even define us. Memory is often taken for granted and really only reflected upon when it fails us. In general, our memory is an amazing entity with the ability to provide us with the continuous sense of *self* described by William James. Memory operates in an extremely efficient manner, allowing us to recall more pleasant than unpleasant memories and enough detail to reconstruct past experiences with reasonable accuracy. It is, however, subject to distortion, the study of which has historically been rooted in interference theory. Interference theory, a theory of forgetting, states that the reason we forget is that other memories in long-term memory impair our ability to retrieve the target memory. Memory involves a reconstructive process: It is vulnerable to interference from other experiences, especially from experiences that occur after a to-be-remembered event.

In this chapter, we describe contemporary studies of memory distortion, focusing primarily on the "misinformation effect". This effect refers to the tendency for post-event misleading information to reduce one's memory accuracy for the original event. We begin our discussion with a brief overview of forgetting as a function of event encoding and event retrieval errors. We discuss various laboratory techniques that demonstrate the misinformation effect. The existence of the misinformation effect is rarely disputed, as it is a robust phenomenon. However, the parameters and mechanism underlying the effect are less clear. For example, who is particularly susceptible to the influence of misinformation? What kind of post-event information is necessary to distort a memory, and just how much can we distort that memory? What does the misinformation effect say about the permanence of memory? Beginning with the naturally occurring distortions of memory, through use of the suggestion of misleading details, we will discuss evidence in support of the misinformation effect, including the most complex misinformation effect of all: the creation of memories for entirely false events.

We briefly describe some new data from an experiment that examined consequences of creating a false memory of being attacked by a small dog as a young child, and provide a simple methodology for demonstrating the misinformation effect in a classroom. Finally, we explore the difficulty in distinguishing true from false memories.

MEMORY PRIMER: ENCODING, STORAGE, AND RETRIEVAL

Memory consists primarily of information encoded and stored in such a way as to facilitate retrieval of that information The quality of what is encoded along with the way it is encoded directly influences the subsequent retrieval of that information. Numerous factors affect the encoding process, beginning with attention. In order for the encoding process to be successful, the information must be attended to. Additionally, the depth of processing that one does on the encoded details influences the encoding process. Elaborating on information that is observed, particularly by linking the event or detail to previously learned information rather than experiencing the information with no conscious effort to remember it, will lead to better encoding of the information. In addition, unusual or unexpected information will tend to stand out in our mind and may result in being encoded more effectively than ordinary or familiar details. In general it is safe to say that the accessibility of information that is poorly encoded or not encoded in memory at all will not improve with the passage of time.

Information retrieval is a reconstructive process. The memory for an event is not stored in its entirety, as an exact replica of the event. Rather, the event is broken and organized into personally meaningful pieces. These mental representations capture the gist or essential meaning of the event. The retrieval process involves a mental re-enactment of the original experience, reproducing as many details as possible. This reconstructive process will invariably involve distortions, in the form of omissions, elaborations, or misperceptions. Some theorists have argued that the success of retrieving previously encoded details depends, to a large degree, on the extent to which the retrieval context matches the original encoding context (Tulving & Thompson, 1973).

Related to the organization of memory is research done on schematic memory. The definition of schema is an organized pattern of thought about some aspect of the world, such as events, situations, objects, or a class of people (Bartlett, 1932). Our schematic knowledge may dictate what we pay attention to and what we use to guide our understanding. Schematic knowledge can also be very useful in the reconstructive process of memory. Unfortunately, schema can distort memory because as we store schematic knowledge we do not have to attend to everything in our environment. When we rely on our schematic knowledge to report a memory, we usually

remember things as being quite typical. Because we use our knowledge to identify an event or situation and to form a representation of that event, the errors committed when we "fill in the gaps" may negatively influence our memory.

MISINFORMATION

By the middle of the 20th century, many scientists were engaged in a vain search for the engram, a hypothetical memory trace that left an identifiable and indelible physical trace in the brain. The engram was believed to be both permanent and localizable, two views that dominated early cognitive neuroscience. The permanence theory gained support in the 1950s when neurosurgeon Wilder Penfield began operating on patients with epilepsy. During surgery, he kept patients awake but anaesthetized them so they could respond when he stimulated certain areas of the brain. He claimed that by using this technique he accessed memories. The media jumped on this concept and the hype was communicated to the public as well as to the scientific community. The permanence theory was given a big boost. In reality, Penfield operated on 1100 patients, and only 40 responded by producing anything like a memorial response when the temporal lobe was stimulated. Only 5 of those 40 reported a complete episodic memory, and some of these could be ruled out as real memories by other evidence.

When Elizabeth Loftus and her colleagues (Loftus, 1975; Loftus, Miller, & Burns, 1978; Loftus & Palmer, 1974) claimed that people's memories are malleable after exposure to misleading post-event information, the social and theoretical implications of this finding caused a flurry of interest in the misinformation effect.

In their original studies, Loftus and colleagues demonstrated how question wording and the introduction of misleading post-event information influence what is remembered (see Chapter 18). In one study, Loftus (1975) showed participants a film of an automobile accident, and then asked half of them, "How fast was the white sports car going when it passed the barn while travelling along the country road?" No barn was shown in the film; however, many of the participants who had been asked about the barn claimed to have seen it in the film. In another study, participants answered one of the following questions about a car accident depicted in a film that they had seen: (1) How fast were the cars going when they *hit* each other? or (2) How fast were the cars going when they *smashed into* each other? (Loftus & Palmer, 1974). The researchers found that the latter question produced higher speed estimates than did the former question. Simply changing the word "hit" to "smashed into" affected the subject-witness's memory for the original event. In another study, participants watched a slide sequence involving a car/pedestrian accident. In the slide sequence, a car arrives at an intersection, turns right and hits a pedestrian. A yield sign was

shown to half the participants, while a stop sign was shown to the remaining participants. Later, some participants were asked a question containing a misleading suggestion about either a stop sign or a yield sign (whichever sign they had not seen in the slide sequence). When tested for their memory of the original slides they had seen, many of the misled participants mistakenly claimed that they had seen the sign that had been suggested, rather than the sign that they had actually seen (Loftus *et al.*, 1978). These studies demonstrate that misleading post-event information affects what people erroneously report about the past.

Theoretical accounts of the misinformation effect

About the same time as the first misinformation studies were being published, we saw a rising concern regarding the reliability of eyewitness testimony. This was an important practical implication. Soon thereafter, an important theoretical issue arose. The very nature of memory was now in question. When participants had seen a stop sign, but received a suggestion about a yield sign, and then claimed that they saw a yield sign, what had happened to the stop sign in their memory? Was it still there, but perhaps harder to retrieve? Was it erased or altered in the process of absorbing the suggestive information? McCloskey and Zaragoza (1985) attacked the memory impairment hypotheses claiming, "misleading post-event information has no effect on memory for the original event" (p. 2). The misinformation results were not in question, but the interpretation and procedure were. McCloskey and Zaragoza's key arguments involved the procedure used in these studies. They argued that the acceptance of misinformation occurred because:

- participants never encoded the original information and remembered the post-event information;
- participants encoded both the original and the post-event information and deliberated about what to report, eventually falling sway to the social desirability bias;
- the original information was just forgotten.

McCloskey and Zaragoza proposed a more appropriate procedure in an attempt to account for participants who may fall into any of the above categories. They conducted six experiments using both this new procedure and the original. The *modified* test procedure was identical to the original procedure except that the test was different. The original procedure has participants choose from either the original event/item or the misleading event/item. In the modified procedure, participants are asked to choose between the original event/item and a *novel* event/item. The misleading information is not an option. McCloskey and Zaragoza hypothesized that if the misleading information alters memory for the original event, when that

Text box 19.1 Misinformation study

As a classroom demonstration of the misinformation effect we suggest using a modified version of Loftus et al.'s (1978) study. In order to demonstrate the effect in the most straightforward manner, we will use one independent variable, the type of information, with three levels (consistent, inconsistent, neutral).

Method

Materials

A series of eight colour slides are shown in a sequential manner to depict an auto–pedestrian accident. This modified set is a subset of the original series of 30 colour slides used by Loftus et. al. (1978). The modified set includes the following:

- a red car leaving a parking lot
- the red car approaching an intersection with a bus on the left
- the bus moving through the intersection in front of the red car
- *the red car stopped at a stop sign*
- a male pedestrian crossing the street in front of the red car
- the pedestrian lying on the road in front of the red car
- the arrival of a police car and a female pedestrian
- the police car pulled over to the side of the road

Eight questions, including one critical question are administered immediately after participants have viewed the slides. These questions serve as a memory test for the information presented in the slide sequence, and are as follows (note that the critical question is in italics):

- Did you see the red car leaving the parking lot?
- Did you see a bicycle?
- Did the bus pass in front of the red car from the right or left?
- *Did another car pass the red car while it was stopped at the intersection with the yield sign?*
- Did you see the taxi cab?
- Was the pedestrian who was hit a man or a woman?
- Was the second pedestrian a man or a woman?
- Did the police officer get out of the car?

After participants have answered each of these questions, they are shown eight pairs of slides. Each pair of test slides contains the original slide and a distractor slide similar to its counterpart except for one key detail. For example, if the original slide depicted the pedestrian lying in front of the red car, the distractor might depict the driver of the red car getting out of the car. For each pair of test slides, participants report which slide they saw before.

Materials

All participants view the slide sequence showing a stop sign at the intersection. Participants are then randomly assigned to receive consistent, inconsistent, or neutral information with respect to the original traffic sign viewed in the slide sequence. Participants receiving information asking about the stop sign are receiving information consistent with the slide series (Consistent). Another third of the participants receive information where it is suggested that they saw a yield sign (Inconsistent). The final control condition participants receive no information (Neutral).

A yes–no recognition test is administered after a brief (we suggest 15–20 minute) filler task. Eight pair of test slides are shown to participants, who report which slide of each pair they saw before. The critical slide pair, the scene showing either the original stop sign or the misleading yield sign, is randomly placed within the eight pairs of slides.

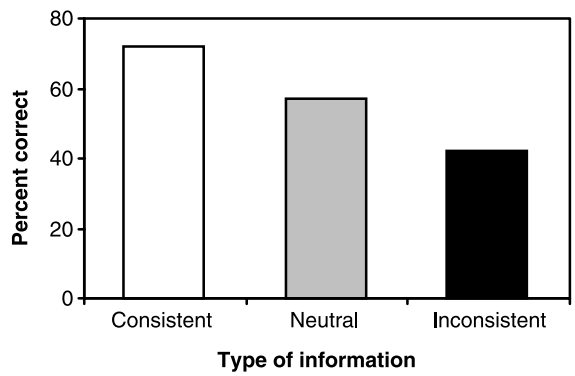

Figure 19.1 The effect of the type of information on the proportion of correct answers given on the recognition test 2 days after viewing the slide show and completing the questionnaire.

Results

What proportion of participants correctly chooses the stop sign from the original slide-show sequence? With the recognition test administered immediately after the exposure to the misinformation, Loftus et al. (1978) found that participants who received the information that was inconsistent with what they had actually seen were much less accurate in their responses compared to the participants in the other two conditions. In addition, when the retention interval is increased to 2 days (see Figure 19.1), and we compare the response of those in the neutral condition with the other two groups, receiving the consistent information improved performance on the recognition task. Along with the fact that the type of information has an effect on memory for the original information, Loftus et al. demonstrated that delay of the questionnaire containing the misleading information also hindered memory performance. Apparently, time allows the original memory trace to weaken, thus making it easier for an erroneous memory report to be given.

information was not an option at test, memory for the original information would be selected less often than selected by those in the control condition.

Collapsing over numerous experiments, McCloskey and Zaragoza successfully replicated the misinformation effect using the original procedure. Participants in the control condition correctly reported the original information 72% of the time whereas the misled participants correctly reported the original information only 37% of the time. However, the results looked quite different in the modified procedure. Here, Controls correctly reported the original information 75% of the time, while Misled participants correctly reported the original information 72% of the time. The researchers' conclusions were direct:

> We conclude from these results that misleading post-event information does not impair participants' ability to remember what they originally saw. In other words, misleading information neither erases the original information nor renders it inaccessible.
>
> (McCloskey & Zaragoza, 1985, p. 7)

McCloskey and Zaragoza want to explain these results with factors other than memory impairment, specifically, either task demands, or strategic effects. Zaragoza, McCloskey, and Jamis (1987) proceeded to test the modified and original procedures with recall rather than recognition and supported their belief that differences between the misled and control conditions in the original procedure are due to factors other than the impairment of memory. McCloskey and Zaragoza assert that the test should be such that process-of-elimination strategies can be controlled.

More recent experiments designed to reduce or eliminate strategic effects have demonstrated effects of impaired memory (see Ayers & Reder, 1998, for review). In addition, the modified test may be insensitive to memory impairment. When overall memory performance is low, the effect may need the additional strength of the exposure to the misleading information once again at test.

It seems that each of the explanations offered accounts for some of the findings, but as yet we have not developed a theory to explain all of the results. Metcalfe (1990, in Ayers & Reder, 1998, p. 19) proposed her CHARM theory, a memory model that accounts for the misinformation data by means of memory trace alteration. This is a single-trace model that explains the integrated and blended memory data but falls short of explaining the small effects sometimes seen using the modified procedure.

Ayers and Reder (1998) proposed an activation-based model that might explain the various misinformation effect findings in terms of a source of activation confusion (SAC) model of memory. This multi-trace model predicts that in our classic misinformation example, a participant might be aware of the high activation of the concept "yield sign", but be unaware of the reason that it was activated. Yield sign would be more highly activated at

test than the original stop sign because it had been activated more recently. This model is consistent with the ideas expressed by Kelley and Jacoby (1996) that, under some conditions, the source of activation is unclear. If the source is either unavailable or unknown, it may be misattributed, resulting in memory errors. This model is, however, at direct odds with an integration/blending theory. If the memory trace is altered or overwritten, there can be no source misattribution because there is only one source. In summary, our colleagues at Western Washington University may have said it best: "Although the misinformation effect is easily replicated, the explanation of such memory errors is hotly contested" (Hyman & Pentland, 1996, p. 101).

Today, there seems to be a consensus among cognitive psychologists that no single process is responsible for all of the misinformation effects. The debate involves several different explanations for the results. While some favour the impairment hypothesis, others favour the co-existence hypothesis. Whichever view is correct, the misinformation effect data support the reconstructive nature of memory and illustrate how this reconstruction leaves memory susceptible to errors.

Manipulations of the misinformation effect

Many factors influence the effectiveness of misinformation. First, the passage of time renders the original memory less accessible, thereby allowing misinformation to "creep in" undetected. Second, the subtler the discrepancies are between the original information and the post-event information, the stronger the misinformation effect. Third, the more ignorant one is of the potentially misleading effects of post-event information, the more susceptible one will be to the misinformation effect.

Who is susceptible to the misinformation effect? Perhaps the largest misinformation study ever conducted provides insight into just *who* is most likely to accept misinformation (Loftus, Levidow, & Duensing, 1992). At a science museum in San Francisco, approximately 2000 visitors participated in a typical misinformation study. Participants viewed a short film and then some of the participants were given misinformation while others were not. All of the participants then answered questions about the film. While the majority of misinformation studies have been conducted in university laboratories with college students, this particular study included people ranging in age from 5 to 75 years, providing a unique opportunity to gather information on the effect of age and misinformation. Consistent with other studies involving children (Ceci, Ross, & Toglia, 1987), the youngest participants showed large misinformation effects. Additionally, the elderly showed a large misinformation effect, too (Loftus et al., 1992).

The preceding discussion has focused primarily on the fact that memory details are sensitive to misinformation. For example, subtle word choice embedded within post-event information can influence memory (for more examples see Chapter 18 in this volume). Such memory distortion can be

seen even in highly salient memories, or memories that some theorists have dubbed "flashbulb memories" for their highly emotional, meaningful, and subjectively permanent nature. One could imagine how the following, subtly worded question could lead people to remember seeing details about the September 11 terrorist attacks that they never saw: "Did you see the explosion after seeing the plane crash into the Pentagon during the September 11 terrorist attacks?" There was no footage of the plane crashing into the Pentagon. However, the question suggests that such footage not only exists, but that the individual might have seen it. This suggestion, coupled with the knowledge that a plane did, in fact, crash into the Pentagon, might lead people to think mistakenly that they saw the plane crash.

In addition to changing memory for details, misinformation can also change entire memories. In one study, 25% of participants either partially or wholly accepted the false suggestion that they had been lost in a shopping mall at the age of 5 (Loftus & Pickrell, 1995). Likewise, Hyman, Husband, and Billings (1995) convinced many of their participants that, as children, they had knocked over a punch bowl at a wedding and spilled punch on the bride's parents. Both studies utilized a procedure in which the researchers acquired three true memories from the participants' parents. The researchers then provided participants with the true memories and the false memory. Participants were asked to try to remember the events and to describe them in detail. Not only did nearly one quarter of the participants come to believe that the false event had occurred, but they also elaborated on the false event (e.g., "I do remember her [an elderly lady] asking me if I was lost, . . . and asking my name and then saying something about taking me to security", Loftus & Pickrell, 1995, p. 724).

There are, of course, other ways to increase one's confidence in various childhood events. Mock personality profiles and dream interpretations are procedures that utilize the power of suggestion to increase one's subjective confidence in events that never actually occurred (see Chapter 22). Participants might be told that their personality profiles reveal that, as young children, they had been attacked by a dog. Or a dream "expert" might interpret a dream as meaning that, as a young child, one had to be rescued by a lifeguard. Such misinformation can increase participants' confidence in the critical events (Mazzoni, Loftus, Seitz, & Lynn, 1999).

Another form of suggestion used to inflate confidence in childhood events involves imagining in detail an event that never occurred. For example, Garry, Manning, Loftus, and Sherman (1996) asked participants about a variety of childhood events, including whether they had broken a window with their hand. Next, some participants were asked to imagine in detail running through the house as a child, and tripping, falling, and breaking a window with their hand, cutting themselves and bleeding. This type of imagination exercise significantly increased participants' confidence that the event in question occurred in their childhood. Additional research on "imagination inflation" has established the utility of this procedure.

More recent techniques have also been developed. Drivdahl and Zaragoza (2001) asked participants to view a film depicting a bank robbery. Participants then read a narrative of the event that contained misleading suggestions, in addition to questions designed to produce perceptual elaboration of details for events that were not in the film. For instance, a participant answers specific questions about the physical appearance or location of a suggested but false event ("Was the ring that the thief stole in a box?"). By focusing on perceptual details, the participant creates an image of the scene, imbuing it with life. This perceptual elaboration, in turn, increased participants' confidence in the false event.

Another recent technique used to create false memories involves altered photographs. Wade, Garry, Read, and Lindsay (2002) asked participants about a variety of childhood events, including riding in a hot air balloon. The researchers then obtained childhood photographs of their participants and inserted these pictures into a photograph depicting a hot air balloon ride. After participants saw themselves riding in a hot air balloon, they began to "remember" the ride, even though the experience had been completely fabricated.

Consequences

We know that there are consequences of true experiences that we no longer remember. One of us (JP) knows firsthand of an individual (her daughter) who retained her fear of dogs long after she had forgotten having been attacked by a large dog when she was 2 years old. What if the daughter had had a false belief about being attacked? Would this also lead to a similar kind of lingering fear? More generally are there long-range consequences associated with the planting of false beliefs or memories? If a person comes to believe they were attacked by a dog while a young child, might they be more inclined as an adult to own a cat instead of a dog? To address this issue a study was designed in our lab, and carried out by Collins (2001) as part of her senior honours thesis. The question addressed in the study is whether there are verifiable consequences to having a false memory. In this case, the false memory was one of being attacked by a small dog.

Introductory psychology students at the University of Washington completed a pre-test where they were asked how confident they were that each of 58 life events had occurred to them in their childhood. Additionally, participants completed a preference questionnaire on which they indicated their preference towards certain things, such as what kind of pet they might like to own and what breed of dog they preferred.

Participants who indicated with a low rating that it was highly unlikely they "Were unexpectedly attacked by a small dog" were contacted and asked to participate in a future experiment for additional credit. For Session 2, those in the experimental group returned to the laboratory, and were told that their responses on various personality scales during the pre-testing

indicated that, as young children, they likely had been attacked by a small dog. Those assigned to the control condition participated in other unrelated experiments during Session 2. During Session 3, all participants returned to the laboratory to complete the post-test questionnaires, identical in content to the pre-test questionnaire, but this time administered on computers.

Participants who originally claimed not to have been attacked by a small dog as children were led to believe that they had, in fact, been attacked. Simply telling participants that their initial responses were indicative of someone who had been attacked by a dog as a child significantly increased their confidence that they had been attacked. What is perhaps more surprising and chilling, though, is that these participants were less likely to claim to want to own a dog as a pet after receiving the false feedback. The results of this experiment demonstrate that not only is it possible to increase people's beliefs in an entire false event, but that this false belief can be accompanied by important, negative consequences. Given these findings, it also should be theoretically possible to alter one's memory and to *positively* influence one's attitudes.

Braun (1999) examined the effects of misinformation, in the form of an advertisement, on one's subsequent memory for the taste of orange juice. Braun asked participants to taste orange juice and to describe its flavour. Some participants then evaluated the effectiveness of a false advertisement that described the orange juice that they had tasted 15 minutes earlier as being "sweet, pulpy and pure" (p. 323). The misinformation in this advertisement significantly altered participants' memories a few minutes later for the original orange juice that they had tasted. Specifically, the false advertisement made participants think that the orange juice that they had tasted earlier was better than it in fact had been (see Chapter 18). The results of Braun's work and of the dog-bite study that we discuss above suggest that it is possible to alter a true memory and to plant a false memory, with either positive or negative consequences.

Possible mechanisms

What is not clear from the work described up to this point are the precise boundary conditions of the misinformation effect and the underlying mechanism responsible for memory distortion. Some have investigated the limits to what types of memories can be created through suggestion or imagination. Pezdek, Finger, and Hodge (1997) could not convince their participants that they had received an enema as a child. Mazzoni, Loftus, and Kirsch (2001) have argued that an event must be seen as plausible in the rememberer's culture and that it must be seen as personally plausible before the person comes to incorporate the experience into his/her own autobiographical memory.

One possible mechanism that might explain memory distortion after different forms of misinformation is that of familiarity (Garry et al., 1996).

Larry Jacoby and colleagues (e.g., Jacoby, Kelly, & Dywan, 1989) have argued that many false memories arise through the misattribution of familiarity. According to this notion, when participants fluently process an event or experience, they experience a feeling of familiarity. They then search for reasons that might explain this processing fluency. If they are unable to detect an obvious source, they may attribute the fluency to past experience.

Familiarity attribution may help explain why people accept misinformation and why they increase their confidence for childhood events after imagining these events or after being told that the events likely occurred. In such cases, people will process the imagined or suggested event more fluently than they would otherwise have processed it. They will, in turn, evaluate their present processing experience. Instead of correctly focusing on the misinformation, the imagination exercise, or the suggestion as the source of familiarity, they mistakenly attribute the familiarity to their childhood.

DISTINGUISHING TRUE FROM FALSE MEMORIES

Unfortunately, it is very difficult to tell whether an individual memory is real or imagined. In fact, research over the past 20 years suggests that it is virtually impossible to determine whether or not a particular memory is real. In one study, Loftus and Pickrell (1995) compared subjects' reports for true and false memories. The participants used more words when describing their true memories, and rated the clarity of their true memories higher than they rated the clarity of their false memories. Confidence ratings revealed that people were less confident in their false memories than they were in their true memories.

Hyman and Pentland (1996) used a paradigm similar to that of Loftus and Pickrell to investigate the role that mental imagery plays in the creation of false memories. After successfully planting false memories, additional questions were asked in an attempt to compare recovered true memories with false memories. True memories that were never recovered or those remembered all along were different from those recovered. The emotional strength of the false memories was comparable to the recovered true memories; the clarity ratings for these two groups were also in the same range. Additionally, the confidence ratings were similar between these two groups. Hyman and Pentland (1996, p.111) claim, "The overall pattern of ratings leads us to two conclusions. First, it will be difficult to discern any differences between recovered true memories and created false memories. Second, one reason for this difficulty may be that the recovered true memories are actually creations as well."

Roediger and McDermott (1995) created false memories for words not presented in lists (see Chapter 17). Not only were false memories as common as true memories in the study, but participants expressed as much confidence in their false memories as they did in their true memories. Perhaps

even more upsetting to those who hope to be able to accurately distinguish true and false memories, participants claimed to "remember" (or mentally to relive) the experience of having heard words before that they had not heard. Thus, false memories were easily created, and they were virtually indistinguishable from the true memories.

Porter, Yuille, and Lehman (1999) investigated whether phenomenological and content features could discriminate between real and false memories, in an effort to systematically assess the credibility of childhood memories. Porter et al. employed the Memory Assessment Procedure (MAP) criteria. This consists of seven items designed to record phenomenological (subjective) features, and five items designed to record the specific features of memories. Content analysis revealed that participants rated true memories as more vivid/clear and more detailed. Participants also expressed more confidence in true memories when compared to the implanted memories. No difference was measured in stress levels. Additionally, 40% of participants recalled the real memory from a participant perspective. That is to say, they "re-experienced the event from their own eyes" (p. 28). The remaining 60% of participants viewed the real memory from the observer perspective, meaning they could view themselves as if watching a movie. The percentages were exactly reversed when participants recalled the implanted memory: 60% saw it from the participant perspective and 40% from the observer perspective. Although this was not a reliable difference, it does suggest that real and false memories may possibly differ in terms of their phenomenological and content features.

Heaps and Nash (2001) conducted another recent examination of differences between true and false memories. A variation of the Loftus and Pickrell paradigm was employed in order to plant false memories in participants. In other words, they used information from relatives to suggest to people that they had had certain experiences. The researchers replicated the basic finding of greater detail remembered for the true memories when compared to the false memories. On first pass, the true memories appeared different from the false memories, because they were rated as being more important, more emotionally intense, and more typical, and as having clearer imagery. These distinctions were eliminated when rehearsal frequency was used as a covariate in the statistical analyses. This suggests that increased rehearsal shifts the false memory closer to the recollective experience of true memories. A final observation concerned the consequences of the target event. False memories contained less information about any consequences of the event.

The move into the legal arena will clearly lag behind the scientific advances. It will be long after we are able to distinguish false memories from true ones in the lab that we may apply such standards to tests in the courtroom. Heaps and Nash (2001) illustrate the problem, ". . . the possibility [exists] that repeated remembering of false memories over greater periods of time [longer than 3 weeks] may make recollective experience more complete and more like that found in true autobiographical memories" (p. 17). Few

things are more rehearsed than legal testimony, traumatic memories, and events made important by police and legal proceedings. Currently, external corroboration remains the only reliable way to determine the veracity of a memory.

Finally, there have been recent attempts to distinguish true from false memories at the physiological level using highly sophisticated brain-imaging techniques such as event-related potentials (ERPs), Positron Emission Tomography (PET), and functional Magnetic Resonance Imaging (fMRI). If in fact different "sensory signatures" in the brain can be used to differentiate true and false memories, then these physiological differences might hold great promise to memory researchers (Fabiani, Stadler & Wessels, 2000). To date, the results of this line of exploration are mixed. Perhaps most importantly, current brain-imaging techniques are most reliable when reporting group averages. Group averages, while valuable sources of information, tell the memory researcher very little about the real or illusory quality of a *particular* memory. While assessing the reliability of brainwave activity measured with an electroencephalograph (EEG), Hassett (1978) reported that one group of researchers may have put it best when they said, "we are like blind men trying to understand the workings of a factory by listening outside the walls" (as cited in Kassin, 2001, p. 51).

CONCLUSION

What is clear from the myriad studies conducted in the area of memory distortion, and specifically those exploring the parameters of the misinformation effect, is that misinformation can lead to memory changes ranging from minute details of events to memory for entire false events. While the misinformation effect is an extremely robust phenomenon, it can affect people in a number of ways. It can add to memory, it can just change what people report, and it sometimes appears to lead to impairments in previously stored memories.

The current comparison of true and false memories shows us that in general, the phenomenological experiences of both types of memory are indistinguishable (for details see Chapter 17 in this volume). While some studies point to participants being clearer and more confident in their true memories (Loftus & Pickrell, 1995; Porter et al., 1999), others report less discernible evidence (Heaps & Nash, 2001; Roediger & McDermott, 1995). Along with technological advances in brain-imaging techniques comes the potential to distinguish between true and false memories at a physiological level. The ability to determine the "true" nature of a memory and exactly which areas of the brain are activated during the remembering process holds promise for both the courtroom and the therapist's office.

Heaps and Nash (2001) showed that false memories contained less information about consequences of the false event when compared to the

consequences revealed when the memory was true. Future research on the consequences of memory distortion may also open a window on the issue of distinguishing true from false memories. The dog-bite study discussed here illustrates an overlooked power inherent in the acceptance of misinformation, namely the consequences of such behaviour. The applied perspectives are important as we look at not only the legal implications but also potential consequences under less extreme circumstances. The need to understand false memory reports and the impact on everyday actions becomes more important when we realize we are all susceptible to misinformation in myriad ways.

And given that we can manipulate positive events resulting in positive consequences as well as negative, there may be therapeutic implications whereby changes in memory and associations might be beneficial in changing future behaviours.

SUMMARY

- The misinformation effect occurs when a person receives post-event information (e.g., new information after the original event) that interferes with the person's ability to accurately recall the original event.
- The misinformation effect is a very robust phenomenon.
- The underlying cognitive mechanism remains less clear. As explanation, cognitive theories claim that either the original memory trace is altered or the original memory trace remains intact but inaccessible.
- The effect has been found with a variety of materials and experimental procedures, ranging from changing details of an event to planting false memories of an entire event.
- The consequences of memory distortions have important implications for several applied problems.
- As yet, we have no reliable means of distinguishing true from false memories.

FURTHER READING

An excellent overview about research on the misinformation effect was given by Ayers and Reder (1998). In addition, practical legal applications are explored in depth in Elizabeth F. Loftus and Katherine Ketcham (1991) *Witness for the Defense: The accused, the eyewitness and the expert who puts memory on trial*. For recent empirical articles, the *Journal of Applied Cognitive Psychology* (published by John Wiley & Sons) covers theoretical, empirical, as well as applied aspects of the misinformation effect. For information regarding the misinformation effect in children, see Ceci, Ross and Toglia (1987).

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