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The history of an idea: The misinformation effect

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Abstract

When people are exposed to misleading information after an event has occurred, they frequently fall sway to its influence and report the misinformation as their own memory. This phenomenon, known as The Misinformation Effect, has been intensively studied for half a century. Here, we report on where the idea came from and what aspects of the phenomenon have been explored by scientists over this period of time. These explorations have addressed many questions, such as (1) What are the conditions under which people are more or less susceptible to misinformation? (2) Are there certain types of people who are especially susceptible to misinformation? (3) Can warnings about misinformation reduce its influence? and (4) Just how far can you go in terms of planting false ideas into people's minds? We also review work that examines the interplay between modern technology and misinformation. The Misinformation Effect teaches us about the malleability of memory, but it also has important practical applications.

KEYWORDS

eyewitness, memory, misinformation, testimony

The Misinformation Effect has its own entry in Wikipedia. There it is defined as the notion that a person's recall of memories can become less accurate when they are exposed to post-event information. Presumably, this occurs when the post-event information is erroneous in some way since accurate post-event information can boost the accuracy of someone's memory report. Since the initial studies of the power of misinformation, back in the early 1970's, researchers have repeatedly found that people's memories can be altered by exposing them to other people's memories, encouraging them to answer biased questions or exposing them to media (Loftus, 1979). These are just a few of the ways in which post-event contamination can happen not only in laboratory settings, but also in the real world.

WHERE THE IDEA CAME FROM

In an autobiographical essay, Loftus (2007) described where the idea came from. Loftus had been doing research on semantic memory, that is memory for words, concepts and general knowledge about the world. Just a few years post-PhD, she decided she wanted to do research that had more obvious practical applicability. As a scientist who knew something about human memory and also had a keen interest in legal matters, it made sense that an examination of the memory of witnesses to crimes, accidents or other legally relevant experiences might be the way to go. She began to design studies where research participants were shown videos or slides depicting complex events, and their memory accuracy was measured.

Decades later, several leading experts in the broader field of eyewitness research would write words that tugged at the heartstrings of the first author of this 'history'. They wrote: 'More than any other individual's work, it was Elizabeth Loftus's elegant experiments on post-event information that gave rise to the modern era of eyewitness research' (Wells et al., 2006, p. 47). They summarized some of the major papers that had been published prior to this time before the early 1970s. They cited work by Stern, Whipple and Munsterberg in the early 1900s, and some important work in the 1940s on question effects and on how information is transmitted from one person to another. They speculated that the sparse attention to eyewitness psychology during this period may have been due to a disconnect between what the psychological researchers were doing and what the needs of the legal system demanded. Then they introduced some of the earliest research on the misinformation effect, as well as work that focused on memory for people. In this chapter we focus almost exclusively on the studies that relate most directly to the Misinformation Effect.

FIRST EXPERIMENTS

In one of the early studies, conducted with an undergraduate student named John Palmer, research witnesses were exposed to films of accidents (Loftus & Palmer, 1974). Later they were questioned about the speed of the vehicles involved in the accident. A key finding was that the leading question 'How fast were the cars going when they smashed into each other?' led to a higher estimate of speed than a far less leading question 'How fast were the cars going when they hit each other?' This finding showed that the way a question is worded can affect the answer someone gives and that just changing a single word in the question can dramatically affect that answer. But a second study in the paper revealed that the leading question could have a long-lasting effect. Compared to witnesses who were asked the 'hit' question, witnesses who were asked the 'smashed' question were more likely, a week later, to say that they had seen broken glass in the accident. There was no broken glass. The leading question had consequences for how questions were answered a week after the accident had been viewed. Loftus and Palmer (1974) discussed their findings in terms of a shift in memory. They proposed that the original information and post-event information in the leading question might become integrated together to construct a memory. Put another way, the original memory representation shifts to an altered representation induced by the suggestive post-event activity.

While Loftus was originally interested in the power of leading questions, she would soon realize that these are but one way that a post-event activity can distort memory. When a witness is fed some version of an event allegedly reported by another person or when a witness is exposed to media coverage about an event that is erroneous in some way, the original memory can become contaminated. Many hundreds of studies would follow the standard procedure of showing an event, exposing people to misinformation and asking for recall of the original event. People remembered seeing a yield sign instead of a stop sign, or a perpetrator with a brown jacket instead of a green one. These impairments in a person's memory after exposure to misleading information became known as the Misinformation Effect by the late 1980s (Loftus & Hoffman, 1989). We are not aware of the exact phrasing used earlier, but certainly the main idea behind it was widely studied, examined and recognized throughout much of the 1980s.

Soon after these early studies were published, Loftus published a short review of them in *Psychology Today* magazine (Loftus, 1974) along with a discussion of their applicability to an actual criminal case. Numerous lawyers read this article and began asking her, and other psychologists, to analyse the memory issues in their cases and to appear in courtrooms as expert witnesses. A lawyer, James Doyle (2005), comprehensively reviewed this period of time in this highly readable book, *True Witness*. All this helped to cement the psychological studies on eyewitness memory (including the Misinformation Effect) to the needs of the legal system.

Today, one can find the Misinformation Effect (or a variation involving the power of misinformation) in many texts in Psychology that deal with the topic of memory. For example, in *Memory Lane* (Greene & Murphy, 2025) sizeable sections are devoted to the phenomenon. *Why We Remember* (Ranganath, 2024) devotes many pages to a discussion of misinformation as a catalyst for memory distortion and false memory. The concept itself is well established in psychology, and years of research have explored aspects of the phenomenon in laboratory settings and in real life (Loftus & Klemfuss, 2024).

WHAT INFLUENCES THE MISINFORMATION EFFECT

Once it was established that memory could be contaminated by misinformation, scientists were eager to learn more about the phenomenon. Myriad questions can be asked, and in this article, we tackle a few of them. What are the conditions under which people are more or less susceptible to having their recollections contaminated by misinformation? Are there certain types of people who are especially susceptible to the contaminating effects of misinformation? Is it possible to warn people about the prospect of misinformation, and if so, which types of warnings work the best? Just how far can you go with a human mind in terms of planting false information? Can you do more than change small details? Could you plant large details or even entire memories for things that never happened? And, most recently, how do advances in technology intersect with the ability of misinformation to contaminate memory? In this article, we describe a small fraction of the research that addresses these issues. Some of the issues were discussed in a review article published two decades ago (Loftus, 2005), and here we update with newer research. We also tackle some new issues, especially those raised by modern technology.

WHEN ARE PEOPLE MORE SUSCEPTIBLE TO MISINFORMATION?

There are a variety of conditions which, when present, can lead to heightened susceptibility to misinformation. One concerns the passage of time between an event and exposure to misinformation. As time passes, memory for an original event weakens, something we have known for at least a century. People are more likely to make memory errors when retention intervals are longer. When misinformation occurs after a long retention interval, it is more likely to be accepted (Frost, 2000; Loftus et al., 1978). This may be true because the ability to detect the discrepancy between an original event and misinformation is reduced (Tousignant et al., 1986). In an effort to fill gaps in memory, people often commit source monitoring errors. The source of the misinformation and original event may not be salient, leading to the misinformation mistakenly being remembered as the original event (Johnson, 1997). The reconstructive nature of memory allows witnesses to be susceptible to post-event contamination, leading them to update their memories to include misinformation.

Another factor that can enhance susceptibility to misinformation is when the misinformation is repeated. One empirical study showing the extra power of repeated misinformation showed subjects a film of a burglary and ensuing police car chase. Later, misinformation was introduced either once or three times through the questioning process. Finally, memory was tested (Mitchell & Zaragoza, 1996). Multiple exposures to misinformation clearly increased the misinformation effect. Further analyses

revealed that if the repeated misinformation was encountered in different modalities rather than the same modality, it was even more likely to be accepted.

Temporary alterations in individual states can also affect susceptibility to misinformation. Sleep deprivation is one example. One study exposed subjects to materials depicting a crime of breaking into a car or stealing a wallet from a woman's purse (Frenda et al., 2014). Later, some were exposed to misinformation and then tested. The results showed that sleep deprivation increased false memories when the subjects had been deprived during the encoding of the event itself, but a period of deprivation after encoding that ended before exposure to misinformation did not have the same damaging effect on memory.

Stress is another alteration in individual state that can be influential in terms of accuracy or susceptibility to misinformation. It has been known for some time that very high levels of stress during an event can negatively affect accuracy, which was confirmed in a meta-analysis of 27 eyewitness memory studies (Deffenbacher et al., 2004). The negative impact of stress can also be observed in experimental work on the misinformation effect. In one study, military personnel endured a highly stressful 30-minute interrogation during a training exercise (Morgan et al., 2013). Later, some were exposed to misinformation about the details of the event or the identification of the aggressive interrogator. The results clearly showed that, contrary to the lay notion that a highly stressful event leaves an imprint in the mind, stress seemed to negatively impact the accuracy of the memory. In fact, after experiencing such high stress, even people who are highly trained are vulnerable to misinformation that they encounter later.

There are a few examples where stress does not have a negative effect on memory. It is often a function of when the stress is being experienced. A meta-analysis showed that if there is a short delay between a stressor and encoding, stress can improve memory (Shields et al., 2017). Post-encoding stress has also been shown to reduce misinformation effects (Nitschke et al., 2019). Something different occasionally happens depending on the timing of the stress experience.

Alcohol has long been known to influence memory. Alcohol myopia theory posits that under the influence of alcohol, cognitive functions are compromised by hindering perceptual abilities (Dysart et al., 2002; Steele & Josephs, 1990). But more specifically what effect does it have when a person is inebriated while experiencing a crime or other complex event? A long history of research has shown that alcohol can impair the formation of new memories (Birnbaum et al., 1978). One might assume that a person who is intoxicated while witnessing a crime might be somewhat more susceptible to suggestive information that is encountered later when the person is no longer inebriated. One study that clearly shows this exposed people to a video of a staged theft in which a male grabs the bag of a female in a park and flees on a bicycle. Some research witnesses were intoxicated, and others were not (Evans et al., 2019). What happens when these theft witnesses are interviewed a week later, while fully sober, and exposed to suggestive information and tested? The witnesses who had been inebriated while witnessing the crime were more likely to fall for the suggestion. In discussing this finding, the authors argue that the consolidation failures due to intoxication at encoding, plus the weakening of memory traces over the week delay, create a scenario in which witnesses are more vulnerable to filling in the blanks of their memory with false details because they fail to detect discrepancies between the suggested details and the original event details. However, a separate meta-analysis suggests that acute alcohol intoxication during encoding does not lead to a significant increase of inaccurate details recalled (Jores et al., 2019), although this can be moderated by level of intoxication and centrality of details.

Different results are often obtained if, for example, the individual is intoxicated during the event, the misinformation and the test. However, this scenario seems less likely to be relevant in real-world cases. In a comprehensive review of the literature, Davis and Fromme (in press) conclude that most studies show this result: those intoxicated during exposure to an event more readily report misinformation. In contrast, alcohol exposure after the event is over, say during misinformation, can make people resistant to the misinformation, presumably because of the poorer processing of that misinformation.

An analogous result has also been seen with cannabis (Kloft et al., 2020). In this study, subjects saw events that were administered in virtual reality, and some were intoxicated. Misinformation was introduced later, while not intoxicated, through a combination of suggestive questions and a virtual

co-witness. Intoxicated participants showed the highest false memory rates in response to leading questions and suggested details. LSD, too, has been shown to heighten vulnerability to suggestion (Carhart-Harris et al., 2015).

These observations have implications for the trustworthiness of memory in real-world situations. For example, when it comes to involvement in a criminal matter, conversations are quite likely to occur between witnesses (Lane & Houston, 2025). Co-witness suggestibility has been shown to lead to memory conformity (Garry et al., 2008; Ito et al., 2019). These are the types of events that are often emotional and salient in people's lives and thus the types of events that are likely to be discussed with others— a fertile ground for misinformation to grow.

WHAT TYPES OF PEOPLE ARE MORE SUSCEPTIBLE TO MISINFORMATION?

Although everyone can fall victim to misinformation due to the fallibility of human memory, there are some who seem to be more susceptible than others. One factor that has received a fair amount of attention is age. For example, research has shown that decreases or limitations in the availability of cognitive resources lead to difficulty with discriminating between true and false information. Compared to young adults, older adults are more accepting of misinformation (Davis & Loftus, 2005; Wylie et al., 2014). While elderly adults are likely more susceptible due to a decrease in available resources, research has also shown that younger children are more susceptible as well, likely due to less developed cognitive abilities (Ceci & Bruck, 1993). Although older and younger individuals are more susceptible due to differences in cognitive resources, age is not the only factor that impacts how available these resources are.

Certain cognitive abilities have been found to correlate with how susceptible individuals are to misinformation or other forms of suggestion. This can be seen in a study where Chinese students first saw slides that depicted crimes like car burglary or wallet theft. Afterwards, they received misinformation and were tested. Those who scored higher on standard tests of intelligence were less susceptible to misinformation. Those who had poor perceptual ability were more susceptible (Zhu, Chen, Loftus, Lin, He, Chen, Li, et al., 2010; Zhu, Chen, Loftus, Lin, He, Chen, Moyzis, et al., 2010). These results suggest that having more available cognitive resources allows a person to better resist misinformation. The authors point to an implication of these relationships, namely, eyewitness evidence in court cases might profitably be considered in light of the cognitive abilities of witnesses.

Although ample cognitive resources may help protect a person from falling victim to misinformation, even those with rather impressive levels of memory functioning can still be susceptible. Individuals with highly superior autobiographical memory (HSAM) are people who have very accurate and detailed memories of past events in their lives. Therefore, if cognitive abilities are correlated with resistance to misinformation, these individuals might be expected to be less susceptible to misinformation. However, when HSAM subjects were studied, they were just as likely as controls to accept misinformation and give a false report. This may indicate that HSAMs use the same reconstructive processes as ordinary people to recall events (Patihis et al., 2013). These findings suggest that the memory of virtually all of us, regardless of cognitive abilities, may be susceptible to misinformation.

Certain personality traits have been associated with greater acceptance of misinformation. Many of these tendencies can be measured by the Tellegen Absorption Scale (TAS), which measures individual differences in readiness for deep involvement in events. Those who score high on the TAS are more responsive to stimuli, think in images, summon suggestive images, become absorbed in their own thoughts and experience altered states of consciousness. These individuals are more prone to accepting misinformation. Moreover, they are more likely to easily embellish events using the misinformation given to them about an event previously witnessed (Drivdahl & Zaragoza, 2001). Also, in the personality domain, people who report more anomalous experiences and who are higher in absorption are more likely to accept misinformation in the form of imagination inflation (Nichols & Loftus, 2019).

There are many more examples that suggest there is a connection between personality traits and misinformation acceptors. Cann and Katz (2005) found that individuals higher in dissociation were more habitually susceptible to misinformation. In this study, individuals were given multiple opportunities to report misinformation, and those with higher levels of dissociation were more likely to do so multiple times. However, this study did not find other strong personality traits correlated with misinformation, which is in contrast to many other findings. For example, Tomes and Katz (1997) found that individuals higher in empathy were also more likely to be habitually susceptible to false memories. Other personality traits, which are correlated with false memories, include low harm avoidance, higher cooperativeness and higher rewards dependence. However, these traits interacted with lower cognitive abilities, suggesting that those with lower cognitive resources and certain personality traits may be more susceptible to misinformation about an event (Zhu, Chen, Loftus, Lin, He, Chen, Li, et al., 2010; Zhu, Chen, Loftus, Lin, He, Chen, Moyzis, et al., 2010). A recent review article found that generally, misinformation susceptibility has a positive relationship between extraversion, narcissism and a negative association between conscientiousness and agreeableness (Calvillo et al., 2024). Although personality traits may have some relationship with how susceptible people are to accepting misinformation, it is important to know that regardless of personality or cognitive ability, the memories of most of us can be distorted by any form of misinformation. More information about which kinds of people are more susceptible to misinformation and false memories can be found in Greene and Murphy's book wonderfully entitled *Memory Lane* (2025). They devote an entire chapter to the topic, covering factors we have mentioned, and some that we have not. For example, they note that people are more likely to form false memories that align with their existing beliefs and are consistent with their pre-existing thoughts about the world. They end the chapter with a charming quotation from Mark Twain that is worth keeping in mind: 'It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so' (Greene & Murphy, 2025, p.140).

IS THERE A FALSE MEMORY TRAIT?

If a person is highly susceptible to misinformation, are they also highly likely to develop false memories in other paradigms? In other words, is there some sort of 'trait' that makes people susceptible to suggestion across a variety of tasks? This question has been tackled in numerous studies. In one such study, witnesses saw a video in which a man wandered through a house engaging with a number of items, like a can of Coke. Some got misinformation (that it was a Pepsi), and all were tested. Not surprisingly, misinformation contaminated memory. But how did these witnesses perform in other popular false memory tasks? They were not particularly more likely to make errors in tasks involving the DRM paradigm (false memory for word lists) or imagination inflation paradigms (false memories for items that were only imagined) (Nichols & Loftus, 2019). Similarly, other investigators have also shown minimal relationships between misinformation false memories and DRM false memories (Patihis et al., 2018; Zhu et al., 2013). One hypothesis as to why there is little correlation between false memories in multiple tasks is the dual-encoding hypothesis, which states that misinformation has two stages: the original event and the misinformation. Individuals with traits related to strong encoding will encode both the original event and the misinformation. Conversely, individuals with traits related to weaker encoding abilities will have a weaker original memory and be more susceptible to the misinformation. This provides an explanation for why everyone is susceptible to misinformation, regardless of individual traits (Patihis, 2018). These findings led scientists who reviewed this literature to conclude that 'there is no false memory trait, and we are all susceptible to memory distortion, though we may be more or less susceptible at different times in our lives or under different circumstances' (Greene & Murphy, 2025, p.133).

Why is this important? From a practical point of view, sometimes people involved in legal matters have been measured on a scale, like the Gudjonsson Suggestibility Scale (Gudjonsson, 1984), to determine whether they are a highly suggestible person. Experts in court cases have done so to assert that a party was or was not likely to be suggestible in the situation that brought him to court. The GSS is a

widely used method today (Gignac & Powell, 2009), but the GSS happens to use a methodology that is very similar to a misinformation paradigm. It involves asking people to read a fictional story and then exposing them to misleading questions. Later they are told they made errors and are given the test again to see if they change their answers. Given the literature suggesting that performance in one task is unrelated to performance in a different task, perhaps high suggestibility in the GSS paradigm might *not* translate into high suggestibility in other sorts of tasks or situations like the one that brought the witness to court.

CAN WARNINGS HELP PEOPLE RESIST MISINFORMATION?

Intuitively, one would expect that warning someone about the potential for misinformation would have a protective effect by making them more vigilant towards event details and heightening their ability to detect discrepancies when they processed the misinformation. Studies published more than 20 years ago already revealed that a warning before receiving misinformation could help a person resist the damaging effects of misinformation, whereas warnings given after exposure to misinformation were much less effective (Eakin et al., 2003; Greene et al., 1982). In the intervening years, we have seen much additional work on warnings that indicates that the dynamics between misinformation and warnings are more nuanced. There are a variety of terms used to describe warnings within the current misinformation literature. Forewarnings, pre-warnings, and prospective warnings are used to describe a warning presented before misinformation has been exposed while post-warnings and retrospective warnings are after misinformation has been exposed. Karanian et al. (2020) presented event details with visual cues and post-event misinformation with audio clips to investigate how pre- and post-warnings differ in brain activation, and they found both warnings enhanced memory accuracy similarly. Overall, warnings increased neural activity associated with visual regions and decreased activity in auditory regions. Warnings have the potential to improve memory accuracy when misinformation has been presented.

Literature investigating the benefits of pre- vs. post-warnings seems to be mixed. In their meta-analysis, Blank and Launay (2014) discovered that post-warnings reduced the effects of misinformation by nearly half in comparison to those not given post-warnings. It is worth noting that there was variability in the studies composing their meta-analysis; more specifically, some studies found post-warnings to be completely ineffective and in others, the misinformation effect was eliminated. Pre-warnings have been shown to be effective in the short term but consequently lose their durability after long delays (Buzcel et al., Buzcel et al., 2024). Sometimes, people still rely on initial event details that were later revealed to be false. This phenomenon is often referred to as the continued influence effect of misinformation.

To complicate the picture further, research has explored how misinformation accessibility and warning specificity can impact post-event contamination. There are two levels of misinformation accessibility: low (misinformation presented once) and high (misinformation presented more than once). Immediate post-warnings have been shown to be effective with low accessible misinformation, but not with highly accessible misinformation (Eakin et al., Eakin et al., 2003). General and item-specific post-warnings have been shown to reduce misinformation effects, with item-specific warnings being much more effective (Higham et al., 2017). When considering the intersection of warning specificity and misinformation accessibility, general and specific item-level warnings can be effective in reducing low and highly accessible misinformation (Bulevich et al., 2022). Efforts have been made to further investigate how warnings can help mitigate the effects of misinformation. Some new methods, such as eliciting unconscious awareness of potential discrepancies and educating witnesses about memory, are being investigated to help protect against misinformation (Kękuś et al., 2024; Sheaffer et al., 2022).

CAN MISINFORMATION PLANT ENTIRE MEMORIES INTO SOMEONE'S MIND?

In most of the misinformation studies reviewed earlier, the misinformation attempted to change a person's memory for details of an event that was actually experienced or to add a detail that was not there. In Loftus et al. (1978), the misinformation persuaded witnesses that a car went through a stop sign instead of a yield sign. In the work of Mitchell and Zaragoza (1996), the misinformation persuaded witnesses that they had seen a gun in the hands of a thief when he had no gun. In Morgan et al. (2013), the misinformation persuaded people that a different person conducted an interrogation or that there was a weapon or telephone in the interrogation room when there was not. But just how far can you go with witnesses? Can you get them to 'remember' an entire event that never happened? Can you plant 'rich false memories'?

The first of these studies is sometimes referred to as the 'lost in the mall' study and utilized a form of misinformation exposure that has been widely adapted in subsequent studies. Sometimes you will see it called 'the familial informed interview technique'. In this paradigm, researchers recruited subjects, let's call one Sigmund. Researchers then gathered truly experienced childhood events from Sigmund's mother or other relatives. Following this, they constructed, with the relative's help, a fake scenario in which Sigmund had been lost in a shopping mall at about age 6, crying, rescued by an elderly person and reunited with his family. They succeeded, over the course of a few interviews, in getting about a quarter of subjects to remember all or part of this fake event (Loftus & Pickrell, 1995). Other studies also utilized this familial informed interview to plant a wide range of false memories of traumatic events. For example, Heaps and Nash (2001) planted false memories in participants that they had drowned as children and were rescued by a lifeguard. Hyman et al. (1995) used this interview technique to get participants to falsely remember spilling a punch bowl at a wedding. The 'lost in the mall' method of planting false memories demonstrates how powerful suggestions can be in creating pseudo memories for a wide range of events that never actually occurred. By the early 2000s, the literature was sprinkled with quite a few published studies showing the power of this fairly strong form of suggestion in getting people to believe events that were completely manufactured, which would have been rather traumatic had they actually happened.

While implanting a variety of traumatic events is impressive, false memories can be so pervasive that they cause individuals to admit to doing things they never have. For example, the familial interview paradigm has been utilized to show that people will falsely admit to a crime they never committed. In this study, Shaw and Porter (2015) utilized the familial interview paradigm to explore whether a false memory of committing a crime can be implanted. 70% of participants in this study created a false memory and gave a detailed account of committing a crime in adolescence. It should be mentioned that a re-analysis of the data utilizing different coding criteria produced a lower but still impressive false memory rate. The re-analysis classified 43% as false beliefs and 26% as false memories, and that false memory rate was still comparable to other false memory studies (Scoboria et al., 2017; Wade et al., 2018). Compared to false memories of non-criminal acts, these accounts were just as detailed and just as prevalent, with participants going so far as to recount multisensory details of their crime and of the supposed police encounter that followed. This study not only demonstrates how people can admit to a crime they never committed, but also how with enough suggestion, individuals can create whole new memories of committing the crimes they are accused of.

While these studies are commonly used demonstrations of just how much false information you can plant in a person's mind, a critique has been that the memories implanted supposedly occurred before the onset of childhood amnesia. However, Strange et al. (2008) demonstrated that, while more difficult to achieve, false memories can be implanted of events that supposedly occurred when participants were ten years old, after the onset of childhood amnesia would have occurred. This study also utilized the familial interview paradigm to implant a false memory which either occurred at two or at ten years of age. While it was easier to implant a false memory at two, participants still sometimes created false memories at ten, demonstrating that false memories can be implanted both before and after the onset of childhood

amnesia. Another critique of many false memory studies is that the events are very plausible, and relatives may be incorrect in confirming the events never happened to participants. However, research has shown that impossible memories can be implanted. For example, Braun et al. (2002) implanted the impossible false memory of shaking hands with Bugs Bunny at Disneyland into 16% of participants. In this study, they utilized a doctored Disney flyer of Bugs Bunny at Disneyland rather than the familial interview paradigm and were still able to implant impossible false memories. Other studies have been able to convince children they experienced highly implausible events. Utilizing a fake newspaper article and true stories, 39% of children created specific details about being abducted, and they elaborated with specific detail, such as claiming that nine or ten people were abducted along with them (Otgaar et al., 2009). These studies demonstrate that false memories of rather implausible events can be created and sometimes have characteristics (like detail) that listeners often associate with true memory.

Before leaving the discussion of rich false memories, it should be mentioned that there have been critiques of this line of research. For example, Andrews and Brewin (2024) have raised the issue of whether people who make reports of 'rich false memories' might be reporting real episodic details. They recoded the memory reports from the Irish replication of 'lost in the mall' and concluded that many of them could be potentially made up of real memories. From this they concluded that the false memories were not really false. In response to this criticism, Wade et al. (2025) pointed out that prior discussions of false memories have already noted that they can contain remnants of real details. They argue that people's reports of past events, whether they are real or false, often contain details that are real. To suggest that false memories must consist of only false details flies in the face of the entire reconstructive nature of memory. Murphy and Greene (2025) also responded to this critique. They forcefully argue that mountains of evidence on the reconstructive nature of memory would lead us to expect that people might construct a memory by merging bits and pieces of their past knowledge and experience into the new construct.

Researchers have been able to successfully implant false memories in multiple ways beyond the use of the familial interview paradigm or giving people false feedback. Another paradigm that has been developed is termed the Blind Implantation method. This method, created by Otgaar et al. (2022), is much less time consuming and utilizes no family members. In this study, participants were asked if they had experienced a list of autobiographical events. When participants then checked that they had not experienced the critical event of losing their swimming trunks, they moved to the next stage of the study. In stage two, participants were given a second list with the critical event included in the events they said they had experienced. Participants were then asked to give belief and recollection ratings and to provide details about each of these events. By utilizing participants as their own source of true and false experiences, researchers took out the need and potential unreliability of family recollection. This method resulted in between 9% and 30% of participants falsely remembering that they had lost their swimming trunks, a rate similar to other false memory implantation methods. While this is just an example of an additional method, a critique of these various memory studies is that the use of multiple methods and multiple coding schemes may be painting an inaccurate picture of the rate at which false memories can be implanted. A recent mega-analysis combined eight peer-reviewed false memory studies and found that, across the various types of coding schemes and implantation methods, there is around a 30% success rate in implanting these rich false memories (Scoboria et al., 2017). These various methods and similar success rates demonstrate that memory is fallible to all types of misinformation.

HOW DOES TECHNOLOGY PLAY A ROLE IN MISINFORMATION MEMORIES?

For quite some time we have known that showing people doctored photos can influence what they remember about their past. A well-known example involved subjects from New Zealand who were shown doctored images of themselves taking a hot air balloon ride as a child, with a parent also on board (Wade et al., 2002). After viewing themselves in the photoshopped scene, about half of

the subjects reported remembering the made-up event. Inspired by this work, a group in Norway showed a similar result after they had viewed themselves in a photoshopped image on a Viking ship ride (Johnson et al., 2023).

Doctored videos can also influence people's beliefs and memories, though the effects depend on the type of manipulation. In an early study, Nash and Wade (2009) asked participants to perform a simple card game and then exposed them to fabricated video footage suggesting that they had cheated. While the study did not include a direct memory measure, participants who saw the doctored video often came to believe they had cheated, sometimes signing false statements and even supplying invented details. Follow-up work extended these findings by including explicit memory measures (Nash, Wade, & Brewer, 2009; Nash, Wade, & Lindsay, 2009). These studies demonstrated that doctored videos can distort both belief and memory, especially when the footage appears personally credible (e.g., showing the participant themselves alongside an experimenter). In particular, memory distortions were strongest when doctored materials combined familiar elements, such as the participant's own likeness, with plausible but fabricated actions.

If doctored photos and videos can create false memories, think about the potential for contamination of memory with Deepfakes. Deepfakes are digital creations that can make a compelling video of a person saying something or doing something that they have never said or done. Scientists feared that these might make the potential for false memories even greater than, say, a convincing narrative or photo of a false event. It turns out the potential might not be 'greater' in magnitude, but the ability to create false memories with this kind of misinformation is still present. In her doctoral dissertation research, Noor (2025), created a deepfake video of Kim Kardashian marketing edible underwear and showed it to hundreds of research subjects. Later, participants claimed to remember that Kim Kardashian was involved in the sale of this made-up product. Murphy, Ching, et al. (2023); Murphy, Dawson, et al. (2023) asked subjects to view deep-fake recreations of popular movies. In one of the deepfakes, Brad Pitt replaced Jack Nicholson in *The Shining*. Their subjects later 'remembered' that they had seen, or at least learned in the past about, these nonexistent fake recreations.

Jump ahead to more recent times, and we have seen research be influenced by artificial intelligence in dramatic ways. A research group at the Media Lab at MIT has recently shown the power of AI (Pataranutaporn et al., 2025). Here, subjects saw a collection of images and were later presented with AI-edited images or AI-generated videos of the original images. For example, the subjects might have seen a man and woman next to each other while the woman was not smiling, while the edited image showed her smiling. When later trying to recall what they had seen, many subjects fell sway to the post-event images. In this example, they remember the original scene involved a smiling woman. Thus, manipulated images can create false recollections that differ from reality. In another study, witnesses to an event were later interviewed by AI chatbots or in a more conventional way (Chan et al., 2024). The AI chatbots produced more false memories than did the more conventional method of interviewing. False memories were not only seen in the short term, but they persisted over time, thus showing that AI-enhanced interrogations have the potential of becoming a new vehicle for suggestive influence.

The power of AI to change memory raises an important societal concern. Contemporary digital platforms are places where lots of people can readily deposit their AI altered material and can thus potentially shape what lots of other people believe to be true. These 'influencers' can potentially affect a person's personal knowledge of their past, but they can also create another kind of misinformation, namely misinformation of world knowledge about elections, pandemics, social movements and more (Lewandowsky et al., 2012, 2020). They create misinformation, post it, and other people share it. We have seen this in action. Wang et al. (2022) found that during the COVID-19 pandemic, a group of 'superspreader' accounts on Twitter generated the majority of misinformation-related retweets.

Our current digital environment is flooded with an expansion of misinformation domains. Moreover, this is often accompanied by a shielding of users from contradictory content. These 'filter bubbles' (Pariser, 2011) attempt to manipulate people by increasing exposure to some viewpoints and restricting exposure to competing viewpoints. The result can have a profound impact on both personal recall and public consensus about important topics. This historical evolution from the olden days of lab studies

with misleading questions to the modern era of AI-generated contamination is what we have seen over the last half-century.

A FEW FINAL COMMENTS

The literature on the power of misinformation is vast, and this short history cannot begin to do it justice. Misinformation can plant small details into people's minds and very large ones. It can plant entire memories in the minds of otherwise healthy humans. Modern studies have been conducted that replicate some of the earlier findings, with larger sample sizes and more sophisticated designs. For example, Wiechert et al. (2025) replicated the stop sign/yield sign study with new materials and a variety of testing formats. Specifically, their participants watched a video of a car crash and were then exposed to misinformation about the traffic sign. Misled subjects showed poorer performance. They also explored whether demand characteristics could explain the misinformation effect, as opposed to a true memory distortion. They concluded that demand may play some role, but that memory-based mechanisms also played a substantial role. An unrelated replication of the rich false memory lost in the mall study was also recently published and cited earlier (Murphy, Ching, et al., 2023; Murphy, Dawson, et al., 2023). They found an even larger percentage of participants falling for the suggestion than the original study had found. Part of their project involved an extension of the study where mock jurors were asked to judge whether the memories were real or not. The researchers found that overall, the jurors were highly likely to believe that the participants were truly remembering something real. These replication studies elevate our confidence in the existence of false memories and the reliability of various individual false memory findings. Moreover, the general field today is showing a promising trend in open science practices (like replication, data sharing or pre-registration) which is likely to be good for this field, as well as others (Wiechert et al., 2024).

We have attempted to show the variety of questions researchers have asked about the misinformation effect. Given more space, we would have also covered research on what misinformation memories are like for people. Suffice it to say, they can be experienced with a great deal of confidence, described in detail and expressed with emotion. We also would have explored the issue of whether people who give a misinformation response have a belief that the details happened or whether they actually feel they are remembering it. Sometimes post-event activities cause participants to end up with a mere belief while at other times they end up with a strong sense of recollection (Mazzoni & Memon, 2003). Another question is about 'non-believed memories', or memories for events that people no longer believe happened to them (Mazzoni et al., 2010). A further question one might have is the deep question about human memory inspired by the misinformation literature. Namely, once misinformation takes hold, what happens to the original memory that might have been available had there been no misinformation? An important debate on this issue arose in the mid-1980s (e.g., McCloskey & Zaragoza, 1985) but has not been very much at the forefront of researchers' minds today.

The Misinformation Effect teaches us a great deal about the processing of information about the past and the malleability of memory. But it also has important practical implications. In everyday life, it might not matter very much if someone falls for misinformation. If Sigmund tells us he had chicken for dinner last night instead of veal, it might not matter. But when it comes to some real-world memories, like those expressed in legal cases, very small errors in memory can make a very big difference. It is there that life and liberty are at stake. That is partly why one of us has long been a fan of the saying that 'Memory, like liberty, is a fragile thing'.

AUTHOR CONTRIBUTIONS

Elizabeth F. Loftus: Conceptualization; writing – original draft; writing – review and editing. **Emily S. Sutton:** Writing – original draft; writing – review and editing. **Aundia Dianat:** Writing – original draft; writing – review and editing. **Jessica P. Hoffmann:** Writing – original draft; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to report.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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