MISGUIDED MEMORIES: SINCERE DISTORTIONS OF REALITY

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ABSTRACT. Considerable research has demonstrated that people can produce sincere but inaccurate recollections by unwittingly assimilating the misleading suggestions of others. Although the boundary conditions that mediate the influence of misinformation have been intensively investigated, considerable debate continues regarding how misleading suggestions influence memory. Additional research has investigated ways to distinguish real from suggested memories. Typically people have great difficulty determining whether or not a memory is real. However, researchers have identified a number of attributes of memory descriptions that can sometimes be diagnostic, e.g., real memory descriptions tend to include more sensory characteristics. A recent exploratory study examined a new potential technique for discriminating real from suggested memories: negative feedback. We explored the hypothesis that subjects would be less reluctant to believe they were incorrect when recalling a suggested memory compared to a real memory. Surprisingly, we found no support for this hypothesis. Subjects often adamantly defended their suggested memories, illustrating the magnitude to which these "unreal" recollections are sincerely adopted.

1. Introduction

Distortions in truth are not always the consequence of an intentional attempt to deceive. Often people's inaccurate recollections are the result of a sincere but misguided memory. There are a number of mechanisms by which one's own memory can inadvertently distort the truth including: expectations, interference resulting from similar events, and the natural decay of memory over time. In this article we focus on one particularly dangerous source of memory inaccuracy: the influence of misleading information.

A recent alleged memory failure reported by Ronald Reagan highlights the seriousness of falsehoods that may result from a misguided memory. On January 26, 1987, the President said that in August of 1985 he had approved the shipment of arms by Israel to Iran. He couldn't remember the precise date, but he did remember giving approval. By February 11, his memory had changed. Now, he said, after talking things over with his close advisor, Donald Regan, he did not recall authorizing the August shipment. President Reagan had gone over the matter several times with Mr. Regan, and specifically recalled that he was "surprised" to learn that the Israelis had shipped arms to Iran, and that this surprised feeling must have meant that he did not give advanced approval for the transfer.

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Later, in February, Reagan tried to explain his changing memory: "In trying to recall the events that happened eighteen months ago I'm afraid that I let myself be influenced by others' recollections, not my own.... I have no personal notes or records to help my recollection on this matter. The only honest answer is to state that try as I might, I cannot recall anything.... the simple truth is, I don't remember - period" (Tower Commission Report, 1987).

Some may question whether this particular falsehood was actually due to a misguided memory. Nevertheless, Reagan might take comfort in knowing of a body of research that shows that our memories can be seriously influenced by the recollections of others. The inaccurate recounts of others can effectively invade us, like Trojan horses, without our awareness of their influence. Once accepted, these inaccurate details become woven into the fabric of our memory, and are often held with the same conviction as our factual memories. In this manner, individuals may unintentionally distort the truth with complete sincerity.

Modern day research showing how memory can become skewed (when people unwittingly assimilate new information) utilizes a simple paradigm. Subjects witness a complex event, like a film of a crime or an accident. Subsequently, some receive new, often misleading, information about the event. Control subjects do not. Finally, all subjects attempt to recall the original event. In a typical example of a study using this paradigm, subjects saw a series of slides depicting a traffic accident. They then received written information about the accident, but some subjects were misled about what they saw. For example, a stop sign in the slides was referred to as a yield sign. When later asked whether they originally saw a stop or a yield sign, the misled subjects performed much more poorly than control subjects.

This basic paradigm has been duplicated in scores of studies, involving a wide variety of materials, and has stimulated a significant degree of interest from memory researchers not only in the United States, but also in Canada, Great Britain, Germany, Australia, and the Netherlands (e.g., Bekerian & Mingay, 1986; Belli, 1987; Ceci, Ross, & Toglia, 1987a and b; Chandler, 1987; Geiselman, Fisher, Cohen, Holland & Surtes, 1986; Hammersley & Read, 1986, 1987; Koehnken & Brockman, 1987; Kroll & Timourian, 1986; Lehnert, Robertson, & Black, 1984; Morton, Hammersley & Bekerian, 1985; Pirolli & Mitterer, 1984; Sheehan, Grigg, & McCann, 1984; Sheehan & Tilden, 1984, 1986; Smith & Ellsworth, 1987; Tversky & Tuchin, 1987; Wagenaar & Boer, 1987; Zaragoza, McCloskey & Jamis, 1987). When exposed to misleading post-event information, subjects have not only misrecalled stop signs as yield signs, but they have misrecalled the color of a car that was green as being blue, hammers as wrenches, straight hair as being curly, broken glass or tape recorders that never existed, and even recalled something as large and conspicuous as a barn when no barn was ever seen. In short, misleading postevent information can alter a person's recollection of an event. We refer to this phenomenon as the misinformation effect.

Now that researchers have established the ubiquitousness of the misinformation effect, they are trying to understand its full nature. What does the misinformation effect tell us about the way memory works? Can we accurately predict its occurrence? Once misinformation has invaded memory, can the original memories ever be recovered? Are there any techniques that can be used to distinguish between a memory that is the result of true perception and a memory that is a result of suggestion?

2. The Malleability of Memory

A variety of experiments have demonstrated the elasticity of memory, and a number of separate lines of research have tried to delimit the boundary conditions for the recollection change phenomenon. There are two ways of discussing the misinformation effect. First, it can be discussed in terms of situational factors surrounding the presentation of postevent information. Second, certain personality dimensions may be associated with an individual's likelihood of being misled.

One line of research exploring situational factors related to the misinformation effect concerns the delay interval between the initial experience and when misleading information is encountered. Loftus, Miller, and Burns (1978, experiment 3) varied the time interval between the original event and a questionnaire containing misleading, consistent, or neutral postevent information at intervals ranging from 20 minutes up to one week. Immediately following the questionnaire, subjects were given a forced choice test of their memory for the original event. Misleading information significantly impaired performance relative to the other groups. In addition, the proportion of subjects who chose correctly on the recognition test decreased significantly as the time between the original and postevent information increased.

Another interval of interest is the time between the receipt of misinformation and one's attempt to retrieve the original information. Other conditions of the Loftus et al. (1978) experiment examined this interval by presenting the postevent information immediately after the event, but then delaying the test by a minimum of twenty minutes, up to a maximum of one week (1978, experiment 3). They found that misled subjects performed worse when tested immediately after receiving misinformation and better after a delay between misinformation and test. It appears as if when the event and misinformation occur near each other, followed by a long delay, both items faded in memory and performance is barely above chance.

Warnings about misinformation may diminish its impact on memory. When people know they may be misled, they are likely to carefully scrutinize the information they receive. Two aspects of warnings seem to be important - first, their relative strength, and second, their placement in relation to other information. Greene, Flynn, and Loftus (1982) found that warnings prior to misinformation aided performance of misled subjects, but that warnings after misinformation did not improve it.

An experiment performed by Christiaansen and Ochalek (1983) produced somewhat different results. They found that warnings could not only improve subjects' performance when given before misinformation, but improved performance when given after misinformation as well. Subjects who were warned, whether before or after the introduction of misleading information, performed better than those who were not warned, and equally well as control subjects who were never misled.

The difference in results between these two studies may be due to differences in the warnings used by the two sets of researchers. Greene et al. (1982) used a tentatively worded warning, "Because the police cadet was inexperienced at detailing observed crimes, some of the information in the paragraph may be (have been) inaccurate. Therefore, it is exceedingly important that you read the paragraph carefully" (p. 210). Christiaansen and Ochalek used more explicit wording, stating that there were indeed inaccuracies in the narrative; "A few of the details in the description are inaccurate - some of the details are correct and a few are incorrect. Take a minute to think about the description" (p. 469). Given the

differential outcomes of misinformation warnings in these two studies it seems likely that definitively warned subjects are more likely to choose the correct items from their memories than tentatively warned subjects.

The presentation of blatantly false misinformation has an interesting impact on subjects' misinformation acceptance. Loftus (1979b) found that subjects were highly resistant to misinformation when it blatantly contradicted previous information. When misled about the color of a wallet that had been highly visible and central to a slide presentation depicting a theft, only two percent of the subjects responded in favor of the misinformation item upon later memory testing. This finding was true regardless of when the blatant misinformation was introduced in relation to other information.

Not only is blatant misinformation easily edited from subjects' reports, it has been found to enhance resistance to subtle (less obvious) misinformation. Subjects who received blatant and subtle misinformation in the same passage of a narrative were resistant to subtle misinformation. Their recall performance was better than that of subjects who never received blatant misinformation and subjects who received blatant misinformation one hour after subtle misinformation.

Another factor effecting one's likelihood of accepting postevent misinformation as correct information is the strength of one's original memory. A strong memory trace should be more difficult to impair than a weak memory trace. An example of research in this area is that of Shaughnessy and Mand (1982). The experimenters varied the strength of original memory traces by showing an event only once to some subjects and twice to others. When misinformed, subjects who had seen the event twice and thus presumably had a stronger original memory trace were less apt to accept misinformation as subjects who witnessed it once.

Retrieval conditions at the time of testing have also been shown to influence the affect of misinformation. Surprisingly, the order of the questions on a memory test may affect the likelihood of a correct response. Bekerian and Bowers (1983) replicated the original testing procedure, adding one factor. Half of the subjects, when tested, received their questions in the order in which the event had evolved. The questions for the remaining subjects were presented in random order, out of sequence with the original event, as had been previously practiced. It was found that when questions were presented in the same sequence as the original event, subjects were substantially more accurate than when the questions were randomly presented. In fact, the misinformation effect did not emerge when subjects were tested sequentially.

As can be seen, there are several situational factors relevant to the misinformation effect. If each of these factors were found to be independent of each other, then one could take a measure of the situation surrounding an event to determine the possible accuracy of a witness with respect to that event. Better predictability of accuracy could be obtained, however, if we had a test or measure which could link an individual's personality to his or her "misleadability." Ideally, if we could correlate several personality dimensions with the tendency to accept misinformation, one could use personality assessments as general guidelines for evaluating the accuracy of eyewitnesses.

Currently, this is impossible. Although there have been a number of studies pairing personality with the general ability of witnesses, an insufficient number of studies have examined individual traits that might correlate highly with misinformation acceptance. Perhaps traits which have already been shown to correlate with general eyewitness accuracy may prove to be good predictors of misleadability as well.

A study by Ward and Loftus (1985) described personality dimensions which correlate with suggestibility. Their research found that people typed as introverted and/or intuitive were more likely to be affected by postevent information, both consistent and inconsistent, than people typed as extroverted or sensate. The procedure of this study was very similar to that of Loftus et al. (1978), with the exception of an added measure. Subjects filled out a personality inventory, the Myers-Briggs Type Indicator, and were classified as either introverted or extroverted, and intuitive or sensate.

When comparing the responses of subjects with differing personality types, those subjects who were introverted or intuitive were more likely to accept postevent information. When postevent information was consistent with what was actually witnessed, introverts or intuitives performed better than extroverts and sensates; when inconsistent, introverts and intuitives performed worse. Subjects who were both introverted and intuitive were most likely to accept postevent information of any sort. These subjects were prone to either extreme accuracies or failures in performance, depending on the type of postevent information they received.

Explanations of these findings discussed the internal states of introverts and the perceptive mechanisms of intuitives. Introverts are, in general, more internally aroused than extroverts, a factor which has been found to negatively affect eyewitness accuracy. Also, they may have less self esteem and confidence, resulting in their being more apt to accept external information than their own memories. Intuitives do not always rely directly on their own senses to determine the state of the world - "...those using intuition may not be able to see, touch, taste, hear, or smell something, but they believe it to be true nonetheless" (Ward & Loftus, p.193). Since intuitives are more prone than others to accept things they have not seen, they are likely to believe the postevent information, consistent or misleading, in the narrative.

3. The Fate of Memory

Although research on the misinformation effect is clear in showing that postevent information can influence a person's reported recollection, many questions remain as to why this occurs. Why is the postevent information remembered instead of what was originally experienced? A further question concerns the fate of the underlying memory traces. When a person sees an accident involving a car racing through an intersection with a red traffic light, and later "learns" that the light was green and now remembers seeing green, what happened to the original memory for a red light? Has the memory truly been updated or altered by the postevent information so that the original traces could not be recovered in the future? This has been referred to as the "alteration" hypotheses, and it suggests that the original memory representations are altered when postevent information is encoded that differs from what was originally experienced. Another position is the "coexistence" hypothesis, which assumes that the original and the postevent information coexist in memory. The introduction of postevent information, under this position, is thought to make the original memories simply less accessible, but still potentially recoverable at some future time.

The coexistence-alteration issue is important from both a theoretical and a practical standpoint. Speaking practically, the dichotomy bears on attempts that one might make to correct a memory after it has been biased by postevent

suggestion. Under the coexistence view, but perhaps not the alteration view, it makes sense to vigorously pursue retrieval techniques (e.g., hypnosis, reinstatement of context) that might access the original information. Under the alteration view, one's efforts would be placed elsewhere because it is likely that the only way to return to the original information is by a "re-alteration" of memory.

Theoretically speaking, the dichotomy bears on one of the most fundamental questions about memory: the permanence of memory traces. The coexistence view is consistent with the idea that all information, once stored in memory remains there more or less permanently. The alteration view implies a true loss of information from memory due to the updating, substitution, or blending in of new inputs.

There are several studies using the original testing procedure (and variations of it) which have led to results which may be explained in terms of an alteration hypothesis (Loftus et al., 1978; Loftus & Loftus, 1980; Loftus, 1979a, Loftus, 1979b). Alteration theories derive their support (although are certainly not proven) by numerous empirical failed attempts to recover original memory, for example, incentives for correct performance, second guess techniques, and the presentation of blatant misinformation. Even the mysterious techniques of hypnosis has failed to lead to the original memories once they have been altered (Sheehan & Tilden, 1984; Sheehan et al., 1984). Of course such failures do not prove that the original memories do not exist, as Loftus and Loftus admit (1980), because it can always be argued that the original memory does exist but that the appropriate retrieval method was not used, or that the method used was not sufficiently powerful.

Loftus (1979a) tested the idea that one may not exhibit memory for the original event simply because there is insufficient motivation to do so. Given high motivation, one might be persuaded to reveal the trace for the original memory if it were still to exist. By offering subjects various amounts of money for a correct response on critical items, motivation was introduced. Supposedly, if one were to gain up to 25 dollars for an accurate answer, one would be careful to give such a response. Upon testing, however, subjects who were offered monetary gains contingent upon performance were no more often correct than subjects offered no such reward.

A second source of incentive was also examined since some people do not find money a source of motivation. Verbal incentives were also used in an attempt to elicit responses based on original memory. It was hypothesized that telling people that "most intelligent people can pick out the slide they saw before, despite any distracting information they have been exposed to" (p. 119) might raise the rate of accuracy. This method, as the one before, failed to raise performance above that of subjects not exposed to incentive.

Second guess techniques have also been used as an attempt to recover original memory (Loftus, 1979a). After receiving misinformation, subjects respond to questionnaires with three choices per question, the correct response from original memory, the misinformation item, and a novel item. If a subject is incorrect on his or her first guess, he or she tries again. Motivating this method was the idea that if there were any trace remaining of the original memory, subjects should be able to respond at a rate better than chance on their second guess. Most of the misled subjects in this study were incorrect on their first attempt, a demonstration of the misinformation effect. Given a second opportunity, they were not more likely to respond correctly than incorrectly, suggesting that there was no original memory to be retrieved.

The Loftus (1979b) study on blatant misinformation also obtained results consistent with an alteration hypothesis. Blatant misinformation has been assumed to increase subjects' scrutiny of information. According to alteration hypotheses, blatant misinformation had no positive effect on performance when presented after subtle misinformation because there were no longer two conflicting pieces of information to be compared. Misinformation had already been incorporated into subjects' memory for the original event, so the heightened scrutiny that blatant information elicits was of no use since there was only one piece of information, the misinformation, remaining in memory.

It is possible that misinformation can have an impact on memory for original events without necessarily destroying or altering it. Coexistence theories derive their support from studies that show successful recovery of original memories. Despite these successful recoveries of allegedly altered memories, this still does not mean that all memories are similarly recoverable.

Original memories have been successfully recovered, for example, by reinstating the context of the original event more fully. Bekerian and Bowers (1983) found that original memory could be recovered when questions about the event were presented in order. When tested in order, misled subjects performed equally well as control subjects, showing no memory impairment. The same test questions, when presented randomly, produced a misinformation effect. Original information has also been recovered by warning people that they may have been exposed to misleading information. Christiaansen and Ochalek (1983) gave subjects warnings that some of the details they read were inconsistent with what they had witnessed. This led them to scrutinize the information more carefully, and as a result the misinformation effect was diminished.

There are two types of coexistence theories. The first, exemplified by Morton et al. (1985), explains the misinformation effect in terms of incorrect access cues at the time of retrieval. Their depiction of memory is that it is permanent, and is stored in discrete and independent units they call Records. Each of these Records has a very specific access code, a Header, which acts like a key to open the memory in each Record. The contents of a Header, unfortunately, are by definition not accessible. The Header must be matched by a Description, which is formed at the time of the retrieval attempt by Task Specification. Task Specification refers to a mind set during the time one searches for a desired memory, a sort of goal for the memory to be accessed. If a Description fits more than one Header, the most recent one will be accessed.

Searching one's memory for lost car keys provides a good example of this model. The searcher feels it necessary to find the keys. This is Task Specification. He thinks to himself, "Where did I put them - on the kitchen table, in the living room, or in the bedroom?" The places he thinks about are the Description which he will use when scanning his memory. If he makes the correct Description, it will match the Header to the Record which contains the information about his keys. With successful access to a Record, he will remember where he put them.
Failure to produce the correct Description means that a Record remains inaccessible; this is normally called forgetting. According to the tenets of this model the Description formed at the time of testing is capable of accessing both the old and new Headers, but the Record containing misinformation is accessed because it is more recent. What is needed to access the correct Header is a Description adequately detailed to discriminate between the two records; this may be highly difficult.

A second type of coexistence hypotheses deals with source misattribution. People are often capable of recalling information, but are unable to recall its source. An example of this would be if one were to recall some facts that were read in an article yet not remember which journal the article came from. Johnson and Lindsay (1986) have done extensive research on source misattribution, relating it to the misinformation effect. They suggest that traces for original and misinformation are both stored in memory. The information and context surrounding the correct and incorrect information are highly similar. So similar, in fact, that one is unable to distinguish the two pieces of information by examining their sources. For some reason, perhaps recency or saliency, the misinformation is incorrectly assessed as a part of original memory.

A number of researchers favor the notion of coexistence of traces. Studies supporting this position have been done by Shaughnessy and Mand (1982), Pirolli and Mitterer (1984), Belli (1988), and Tversky and Tuchin (1987). Once there is successful retrieval of original information in the presence of misleading postevent information, one cannot maintain a strict alteration hypothesis. What may still be of concern is if alteration ever occurs, and if so under what conditions.

Until recently, memory impairment was generally accepted, and the battle lines were drawn between coexistence and alteration explanations of such impairment. However, recently a new camp appeared upon this intellectual battleground, claiming that neither the coexistence nor the alteration view hold up. McCloskey and Zaragoza (1985) maintain that misleading postevent information neither alters the original memory nor makes it less accessible.

McCloskey and Zaragoza (1985) argued that the misinformation effect did not arise from an alteration of memory at all; rather, it emerged as a bias inherent in the original testing procedure. Using the original testing procedure, they claimed that misinformation has no impact on subjects' original memory for events. McCloskey and Zaragoza had two specific complaints about the original testing procedure, and formatted their own procedure, the "modified procedure."

The first criticism was directed at a response bias created by the original procedure. Due to differential guessing rates, subjects in the misinformed condition would always be expected to perform more poorly than control subjects. The reason for this is that there will always be a proportion of subjects who do not recall the original version of the event. Those subjects in the control condition who do not recall the original event will have to guess and respond at a chance rate when tested for their original memory. Subjects in the misled condition who forgot the original information will guess at a different rate; they will be expected to perform at a rate lower than chance for they are likely to remember the misinformation and respond in favor of it when tested. Thus, although there may be no memory impairment, a misinformation effect is produced.

The second criticism of the original procedure is one of possible demand characteristics. Subjects who encode and remember both events, they claim, will be biased to respond in favor of the misinformation. Subjects who remember both pieces of information may respond in favor of the misinformation they read in the narrative because they think that the person who wrote the narrative must be more qualified at observations than they are.

These criticisms motivated the development of a new test, the modified procedure. It was the same in format but for one crucial thing - the misinformation item was not a choice on the recognition test. Instead, the original, correct item was paired with a novel item which had been experienced in neither the slides nor the narrative. The logic behind this test format was that if memory were impaired by

misinformation, then subjects in the misled condition would perform less well than control subjects on the modified test because their memory for the original item would be weakened. Using this method of examination, McCloskey and Zaragoza (1985), in a series of six experiments, found no difference in performance between control and misled conditions. They concluded that misinformation had no effect on subjects' memory for events.

A number of criticisms have been levelled at McCloskey's and Zaragoza's conclusions, suggesting that the modified test is insensitive to assessing memory impairments. The first criticism stems from the reality monitoring principle that subjects are very good at distinguishing between familiar and novel items (Lindsay & Johnson, 1987). The modified test can be considered a familiar/novel detection task. Perhaps misinformation directly impairs the strength of original memory only slightly. This slight memory impairment would not be detected by the modified test, for as long as one has any familiarity with the original item, he will be able to perform accurately on the modified test. It is worth noting that, insensitive as it may be, the modified procedure on at least one occasion has shown evidence for memory impairment. Ceci, Ross, and Toglia (1987a, experiment 3) assessed the effects of misinformation on young children's memory using the modified and the original procedures. Compared to control performance, children who got misleading information performed less well on both types of tests.

Another criticism by Johnson and Lindsay (1986) is that misinformation may impair original information indirectly without being detected on the modified procedure test. Perhaps both pieces of information coexist in memory, but misinformation, due to recency or saliency is more readily accessible than original information. Since subjects are not allowed to show their preference for choosing misinformation as it is not a test option, the modified procedure test again fails to detect another possibility of impairment.

How then should we test for impairment? Neither the original nor the modified test in themselves have been without problems. Methods of testing without the bias of the original procedure and the insensitivity of the modified procedure were called for. Using different types of tests or pairs of tests, a number of studies have attempted to reconcile the seemingly opposite views of alteration and nonimpairment hypotheses, each resulting in coexistence explanations of memory impairment (Belli, 1988; Tversky & Tuchin, 1987).

Tversky and Tuchin (1987) used a yes/no procedure which they called the "modified" procedure to test for memory impairment. Rather than presenting subjects with a forced-choice test between two items, subjects were presented with three questions about each of the critical items which could be answered yes or no. The questions asked if subjects recalled seeing the original item, the misinformation item, and a novel item. With this format, memory for each alternative could be examined separately. The results of this study showed that misled and control subjects were equally adept at correctly rejecting novel items. Misled subjects, however, incorrectly rejected the original information and accepted the misinformation item more often than control subjects. Reconciling the results of nonimpairment and impairment hypotheses, Tversky and Tuchin (1987) concluded that subjects were using different judgment methods when answering questions on original and modified procedure tests. The modified procedure test involved a rejection judgment - subjects could tell that they had not previously encountered a novel object, and rejected it by choosing the other item on the test. The original procedure test involved an acceptance judgment - subjects choose in favor of the object that they thought was most familiar. Based on their results, Tversky and

Tuchin concluded that misinformation impairs memory by reducing access to the original memory.

The intellectual dispute over the fate of memory remains unresolved. While the memory alteration hypothesis has been challenged by many researchers, the notion that memory traces are susceptible to modification is an assumption of a number of current memory models (e.g. Eich, 1982; Tulving, 1983). Thus it seems quite likely that memory alteration hypotheses will continue to be considered. While a number of recent studies have suggested that coexistence interpretations are the most viable, McCloskey and Zaragoza have reported new research providing additional evidence for non-impairment (Zaragoza et al., 1987). Ultimately, it seems likely that all three approaches will be shown to be applicable in different situations. An important task of future research is to determine under what conditions misinformation produces alteration, coexistence, or has no effect.

While the fate of memory is a fascinating theoretical question, knowing whether misinformation produced interference, alteration, or simply supplemented memory, is of little help in determining whether a memory report has been influenced by misinformation. In short, the existence of the misinformation effect not only raises the question of what happens to the original memory, but also is there any way to distinguish a memory that results from a true perceptual experience from a memory that results from postevent suggestions? It is this latter question that we now address.

4. Distinguishing Real and Suggested Memories

The problem of judging the reality of memory arises again and again. When we listen to people describe events from their past, we make judgments about those descriptions. We judge whether or not the speaker is lying, perhaps using cues such as reduced eye contact or speech hesitations to indicate a possible lie (see Bull in this volume). But, what if our speaker is trying to tell the truth - he might or might not be accurate. Can the average listener tell which memories are accurate and which are not? When Oliver North testified at the Iran-Contra hearings that the late CIA director William Casey had given him a ledger in which to record the flow of money to the contras, and at times this account contained as much as $175,000, was this memory accurate? Could we examine North's words carefully, and get clues as the veracity of the underlying memory?

Johnson and Raye (1981) have investigated a theory termed "reality monitoring" that accounts for how people distinguish memory that results from a true perceptual experience from memory that results from acts of imagination, or from other unreal memories. The representation of a true perception is thought to contain more spatial and temporal attributes, more sensory attributes, and more detail. The representation of an unreal memory is thought to contain more information about the cognitive operations that produced these details.

Schooler, Gerhard, and Loftus (1986) tested these predictions by comparing the written descriptions of real and suggested memories. In one study, subjects viewed a series of slides depicting a car accident. Some viewed a slide of a car at an intersection having a yield sign. Others viewed the identical scene with the exception that the yield sign was absent. Subjects next received a questionnaire with one critical question. For those subjects who did not view the yield sign, it was "Did another car pass the red Datsun while it was stopped at the yield sign?" For those who had seen the yield sign the question referred to another slide in the

event. Subjects were then given a second questionnaire about the event, asking if subjects recalled seeing several objects from the event, and their confidence that they were correct. One of these questions asked subjects if they had seen the yield sign. Subjects were then asked to describe in detail those objects that they had just affirmed having seen. Subjects who had actually seen the yield sign were much more likely to claim a memory and provide a description for it than subjects for whom its presence had been suggested.

There were several interesting differences between descriptions based on real memories and those based on suggested memories. Real memory descriptions reflected more perceptual processing, including greater sensory detail. The color, size, and shape of the sign, such as , "I saw the yield sign - it was red and white - looked like any old yield sign" were more often mentioned for real than for suggested memory descriptions. Real memory descriptions were also slightly although not significantly more likely to mention geographic attributes of the sign, like its location relative to the car, the intersection, the curb, etc. An example of a description containing this attribute is, "The yield sign was to the right of the corner of the Datsun. A special green bus was to its left."

Suggested memory descriptions typically reflected more internal processing, including more mention of cognitive processes. They were substantially more likely to contain information about the subjects own thoughts, for example, "After seeing the question, the answer I gave was more of an 'immediate' impression of what I remembered. But I believe it was located on the corner just before the car turned." They were also significantly more inclined to mention the purpose of the sign, for example, "I believe there is a yield sign for the traffic going in the other direction." Another distinguishing factor was that suggested memory descriptions contained more verbal hedges, like "I think", "I'm not sure but", and "I believe." Descriptions of suggested memories were also likely to contain more words than those of real memories.

Could subjects' descriptions of the yield sign be dependent upon the wording of the postevent information? If the yield sign were mentioned in a postevent question that included a different context the pattern of results might differ. A different question, such as "Was the yield sign red and white?" might elicit descriptions pertaining more to the color and other sensory attributes than in the previous experiment. Schooler et al. (1986, experiment 2) examined this possibility as well, using a stop sign as the critical item. This experiment had three groups, one which saw the stop sign and two which did not. Of the two groups who did not see the sign, one had its presence suggested in a context relative to its location, "Did another car pass the Datsun while it was at the intersection with the stop sign?" The other group's memory was created in a context related to its sensory details, "Was the Datsun the same color as the stop sign?"

The results of this experiment were similar to those of the previous experiment. As before, subjects who had really seen the sign were more likely to report a memory for it than those who had not. Compared to descriptions of real memories, descriptions of suggested memories contained more words, were more likely to mention cognitive processes, and were more frequently qualified by verbal hedges. In addition, descriptions of real memories more often mentioned sensory attributes of the sign. When comparing the two suggested memory groups, the rates were similar, with the exception of the mention of sensory details. Subjects whose postevent question had been about the color of the stop sign were more likely to include this information in their descriptions, although this finding only approached significance.

In addition to the cues present in the written descriptions of memories, perhaps there are other differences between real and unreal memories that can be detected when people provide verbal memory descriptions. Schooler, Clark, and Loftus (1988), performed an experiment similar to the Schooler et al. (1986) study, with two important differences. First, the slide sequence was different, providing more critical items. This was to ascertain if the differences between real and suggested memories extended beyond the domain of traffic signs. Second, subjects were asked for verbal, rather than written, descriptions of the critical items. They were videotaped while they responded. These videotaped responses were later converted to written transcripts.

The "video" study produced these results. Descriptions of "real" memories were more likely to contain sensory details than those of suggested memories. Descriptions based on suggested memories contained more references to cognitive processes and more verbal hedges than real memory descriptions. In addition, the pronoun "I" was more frequent in the suggested descriptions, lending support to the idea that suggested memory descriptions may be more internally rather than perceptually based.

Contrary to the results of the Schooler et al. (1986) study, there was not a significant difference in the number of words used to describe real and unreal memories. Two possible explanations were given. First, it could reflect some underlying difference between spoken and written memory descriptions. Or perhaps the lack of difference is due to the increased complexity of the critical items which were used in the videotape study. The items in the early study were more stereotypical than those in the later study. There is a limited amount of information one can give about a stop or a yield sign, since the signs themselves have few variations. A bathrobe which was a critical item the video tape study, on the other hand, can come in many shapes, sizes, colors, and materials, thus more variation and detail in created memory and description are possible to begin with.

There are empirical differences between real and suggested memories, but a question arises if these differences are or can be made apparent to untrained judges. Can people detect the available cues and differentiate between real and unreal memories? To test this, Schooler, Gerhard and Loftus (1986, experiment 3) presented subject judges with a set of written descriptions from their first experiment, half of which were based on real and half of which were based on suggested memories. They were asked to classify each description as real or unreal and give a reason for their decisions. With no prior training about how to choose between the two, judges could differentiate real from unreal memory descriptions at a rate only slightly higher than chance.

One possible explanation for the difficulty that Schooler et al.'s (1986) subjects had in distinguishing real from suggested memory descriptions is the paucity of cues upon which the judges could rely. Since subjects were not able to watch or hear the memory descriptions they may have been deprived of potentially useful non-verbal or paralinguistic cues (see DePaulo & Kirkendol, and Ekman, this volume). To resolve this issue, Schooler et al (1988) presented judges with the videotaped interviews of subjects describing real and suggested memories. To individually assess the possible contribution of auditory and visual non-verbal cues, the descriptions were presented in three different modes: audio-visually, auditorially, or as written transcripts. Judges' ability to discriminate the real memories from the suggested memories was the same in all three conditions, only slightly better than chance. This finding thus indicates that judges' poor ability to discriminate between real and suggested memories, in earlier studies was not due to a lack of non-verbal

and paralinguistic cues. Indeed the only influence of receiving the additional auditory and visual cues was a general increase in judges' tendency to believe that a memory report was real regardless of whether it was. The tendency to be more skeptical of written memory descriptions may be the result of the awkward quality of transcribed speech. The "umms", incomplete sentences, and grammatical errors that often seem innocuous when spoken, may stand out in the transcripts.

If non-verbal and paralinguistic cues are not useful, can people be helped in any other way to better distinguish real from unreal memories? Fortunately, it appears that there is. Since their classification ability was so low, Schooler et al. (1986) hypothesized that subject judges did not fully appreciate the differences between the descriptions. If briefed about them, performance might improve. Judges who were given "hints" about the kinds of differences likely to be found between the two types of memories were better able to identify suggested memory descriptions than judges not given hints. Thus, telling people what to look for can have a beneficial effect on performance.

What are the theoretical implications of observing differences between the descriptions of real and suggested memories? It could be argued that differences between real and suggested memories bear on the question of the nature of the mediating memories. According to this reasoning, if misled subjects accessed a revised version of their original memory then the verbal characteristics of suggested memories should be similar to that of true memories. Since the descriptions of suggested memories differ (statistically) from true memories, it follows from this perspective that suggested memories must have a different (i.e., a new) representation. Alternatively, it can be argued that the distortion of the original memory also changes the manner in which that memory is described. From this perspective, differences between real and suggested memory descriptions do not necessarily reflect the formation of a new representation. However, the fashion by which the description as well as the memory is changed would need to be specified.

While differences between real and suggested memories may have implications for the fate of memory, they also bear on the theory of reality monitoring (Johnson & Raye, 1981). Specifically, as noted earlier, this theory proposes that people use the qualitative characteristics of their memory (such as sensory quality) to determine the source of their memory. The fact that people overlook the tell tale cues that can be associated with suggested memories indicates that the reality monitoring process is far from perfect, and it hints at possible ways of improving it.

Before one becomes overly tempted to use the advice to make assessments of whether a particular memory is real or not, caution is in order. Many unreal memories contain a lot of detail. The astonishingly detailed memory of one man, John Dean, provides the perfect example. Recall that Dean was former counsel to President Richard Nixon during the Watergate break-in. In June, 1973, Dean testified before a committee of the United States Senate, and he began his testimony with a 245 page statement describing dozens of meetings that he had attended with various other persons on Nixon's staff over the previous several years. Because Dean's memory was so detailed, several Senators disbelieved Dean's memory. One asked Dean, "Have you always had a facility for recalling the details of conversations which took place many months ago?" The Senator was especially impressed that Dean had done this without the benefit of notes or a daily diary. Dean said he kept a newspaper clipping file from the data of the first Washington Post article until the time of the senate hearings. He said he triggered his recollection by reading every single newspaper article, outlining what happened, and then placing himself in the described scene.

Did the articles trigger his recollection, as Dean claimed, or did they partially supplement or distort his memory? Dean was unaware that all conversations in Nixon's Oval Office were secretly recorded. Neisser (1981), after an extensive comparison of those tapes with Dean's senate testimony, concluded that Dean was entirely wrong about the course of many conversations, but nevertheless he essentially recounted the facts of those conversations. Although it is difficult to ascertain whether Dean truly remembered those facts or whether he reinstated those facts into his memory from his perusal of newspaper clippings, it is of interest that his excessive detail prompted disbelief in those charged with judging his memory. Whether this reverse interpretation of memory detail was appropriate is matter of further investigation. However, this example highlights the point that we are still a ways from being able to confidently use the characteristics of a memory description, such as its wealth of detail, to determine its veracity.

5. New Research: The Influence of Negative Feedback

The only moderate success of memory description analysis compelled us to explore new techniques for determining whether a memory is real. One promising technique, occasionally used in actual court cases, involves the use of negative feedback. Negative feedback given to eyewitnesses was used in a widely publicized case involving a man accused of being "Ivan the Terrible", the operator of gas chambers that killed perhaps as many as a million people at the Treblinka concentration camp in Poland during World War II. Five eyewitnesses identified John Demanjuk from a set of photographs as unquestionably being Ivan the Terrible. Some of these witnesses were then given negative feedback; they were told by the investigator that American authorities had determined that the man that they had identified was not at Treblinka but was rather at Sobibor, another concentration camp. All of the witnesses who received this negative feedback, rejected it, insisting that they American authorities must be wrong, as this man was unquestionably "Ivan".

We wondered whether a reluctance to accept negative feedback about one's memory was in fact an indictor that the memory is true. Perhaps authoritatively telling a subject that their memory was wrong would separate the wheat from the chaff, leaving only the truly accurate memories intact. In order to examine the influence of negative feedback in dissociating real from misguided memories, we conducted an exploratory study, replicating the general misinformation paradigm with one critical addition: at the end of the interview, we informed subjects that they had been mistaken about certain critical items, (regardless of whether or not they really had been mistaken). We then observed subjects response to this negative feedback in order to determine whether subjects with accurate memories would respond differently from those with misguided memories.

Twenty seven students from the University of Washington were individually shown one of two different sets of slides depicting a house robbery. The slide sequence included four critical items: a robe, dishwashing detergent, a garden tool and an object on a dresser. These four objects differed in the two slide versions, for example in one version subjects saw Ivory soap, whereas in the other version they saw Sunlight soap. After viewing the slide sequence subjects were given a narrative describing the slide sequence. The narrative was composed so that for both slide sequences two of the four objects were described incorrectly and two correctly. Across subjects each of the four critical items, were equally often referred to

correctly and incorrectly. After a five minute interval subjects were given a multiple choice test including the four critical items. Subjects were then brought into another room where they were interviewed while being video-taped. Subjects were asked to describe each of the items that they had mentioned having seen on the earlier questionnaire. Subjects were then given feedback about their responses. For the non-critical questions, subjects were always told that they were correct. For the critical questions subjects were told that they were incorrect. The interviewer was not informed of which of the two slide sequences the subject viewed, thus the interviewer did not know whether the feedback was correct or incorrect. After receiving feedback about a response subjects were encouraged to comment on why they had given the answer they did, and if wrong to conjecture why they were wrong. Finally, subjects were debriefed and were asked once again to indicate what they believed they really saw.

Two measures of the influence of negative feedback were considered: 1) whether subjects were reluctant to accept the negative feedback; and 2) whether subjects changed their original responses at the end of the interview. The critical question of interest was whether subjects reaction to negative feedback, as indicated by these two measures, differed for correct and incorrect memories. Unfortunately, however, not all subjects generated both correct and incorrect responses, thus complicating comparisons. As a consequence, 13 macro-subjects were constructed (12 groups of two subjects and 1 group of three subjects). The only constraints on macro-subject construction was that both subjects in a group viewed the same critical items. The results for both measures revealed no difference between subjects acceptance of negative feedback when correct and incorrect. The mean percentage of responses associated with a reluctance to accept the negative feedback was 19% for correct responses and 22% for incorrect responses, $t(12)=.54$, $p>.05$. The mean percentage of responses that were changed at the end of the interview was 32% of correct responses and 38% of incorrect responses, $t(12)=.46$, $p>.05$.

The results of this exploratory experiment are rather discouraging with respect to identifying a new procedure for discriminating real from misguided memories. Subjects were no less willing to accept the negative feedback when accurate than when inaccurate. In fact it was rather striking to see the conviction with which some subjects maintained their misguided memories. Compare the following two reactions to negative feedback: "I still think I am right" and "I don't think I was wrong. I know I saw a rake". Both of these subjects sound quite certain of their memories even in the face of authoritative negative feedback. In the former case the subject is referring to an accurate memory, however, the latter subject never saw the object he is so certain of. In short, the results of this study provide no evidence that a reluctance to accept that one's memory is in error is a sign of an accurate memory. Nevertheless, we should not rule out the possibility that future research might observe differential effects of negative feedback on real and suggested memories. For example, in the present study, we had only a few items per subject. It is possible that with more observations per subject we might get a more stable measure of individual subject's reaction to negative feedback to accurate and inaccurate responses. Such within subject measures may yet provide evidence for the discriminative value of negative feedback.

6. Summary and Conclusions

A large body of research has demonstrated that people can produce sincere bu inaccurate accounts of the past by unwittingly assimilating inaccurate informatio into their memory. This type of memory distortion, known as the misinformatio effect, has been shown to be influenced by a number of variables including: the tim at which the inaccurate information is received, warnings, the salience of th original memory, the nature of the memory test, as well as by individual difference such as extroversion and intuitiveness. Researchers have debated the mechanisn by which misinformation influences memory. Some researchers have suggeste that the original memory is actually altered. Others have proposed that the ne information coexists with the original memory. Still others have argued tha misinformation does not influence the original memory at all but simply fills i missing gaps. Research distinguishing between these interpretations has bee equivocal, each approach being supported by different findings. It thus seems likel that all three mechanisms may apply under different situations.

Another important aspect of the misinformation effect is exploring ways t distinguish real from suggested memories. Typically judges have a great difficult distinguishing whether or not a memory is real. However, researchers hav identified a number of qualities that are diagnostic: real memory descriptions ten to include more sensory characteristics, while suggested memory descriptions mor often mention verbal hedges, thought processes, and the pronoun "I". Althoug non-verbal and paralinguistic cues do no help judges to discriminate real fron suggested memories, "hints" about the differences identified by research have bee shown to improve judges discrimination. However, even with hints, judges are sti not very accurate.

The present article described a recent exploratory study examining anothe potential technique for discriminating real from suggested memories: negativ feedback. We explored the hypothesis that subjects would be less reluctant t believe that they were incorrect when recalling a suggested memory compared to real memory. Surprisingly, no support for this hypothesis was found. Subjects ofte adamantly defended their misguided memories, illustrating the magnitude to whic these "unreal" recollections are sincerely adopted.

While we have made considerable advances in understanding the influence c misinformation and some of the attributes of "suggested memories", we are still long way from being able to reliably determine when a memory has been distorte We seem to be masters at weaving information from various sources into coherent memory whose patchwork is neither evident to ourselves or other Finding the threads that reliably disentangle the facts is a challenge that has yet t be fully overcome.

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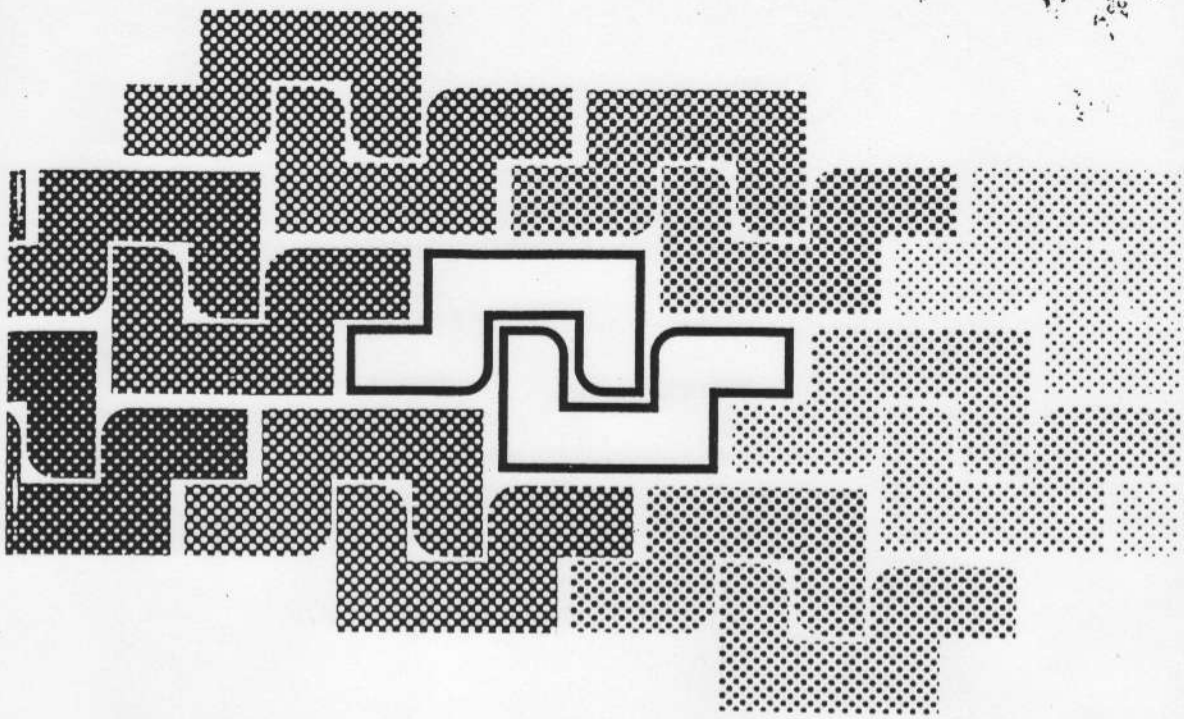

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