Journal of Experimental Psychology:
Learning, Memory, and Cognition
1989, Vol. 15, No. 2, 246-255

0278-7393/89/$00.75

Misled Subjects May Know More Than Their Performance Implies

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Many studies have demonstrated that subjects exposed to misleading postevent information are likely to report the misinformation with confidence on subsequent tests of memory for the event. The purpose of the present studies was to determine whether subjects exposed to misleading postevent information come to believe they remember seeing the misinformation at the original event. A second question addressed by the present studies is whether exposure to misinformation reduces subjects' ability to remember the source of items they witnessed at the original event. In two experiments, subjects viewed a slide sequence depicting an event, were subsequently exposed to misleading information or neutral information about selected aspects of the event, and were later tested on their memory for the source of original and misleading details. The results showed that exposure to misinformation did not lead subjects to believe they remembered seeing the misinformation, nor did it reduce subjects' ability to accurately identify the source of originally seen details. The same pattern of results was obtained whether subjects were tested immediately (Experiment 1) or after a 1-day delay (Experiment 2). Collectively, the results suggest that subjects may report misinformation even if they know they do not remember seeing it.

Inaccuracies in eyewitness reporting are of great interest to cognitive psychologists because they can potentially provide insight into the workings of human memory. Perhaps the most widely studied eyewitness testimony failures are the inaccuracies brought about by exposure to misleading postevent suggestions. Many studies have demonstrated that subjects exposed to misinformation about selected aspects of a previously witnessed event are likely to incorrectly report the misinformation with confidence on subsequent tests of memory for the event (Bekerian & Bowers, 1983; Christiaansen & Ochalek, 1983; Loftus, 1975, 1977, 1979; McCloskey & Zaragoza, 1985a). For example, in a well-known study by Loftus, Miller, and Burns (1978), subjects viewed a slide sequence of an auto–pedestrian accident involving a stop sign. In the second phase of the experiment, some of the subjects were exposed to misleading information implying that the stop sign was a yield sign. When later asked whether they had seen a stop sign or a yield sign, subjects exposed to the misinformation were more likely to select the yield sign alternative than were subjects who had not been misled.

The finding that subjects report misinformation with confidence on tests of memory for the event has often been interpreted to mean that subjects believe they remember actually *seeing* the misinformation at the originally witnessed event. For example, the assumption that subjects will come to believe they saw the misinformation is implicit in many discussions of the more general claim that the original event and misinformation are integrated in memory (e.g., Loftus & Palmer, 1974; see also Gentner & Loftus, 1979, and Pezdek, 1977, for similar proposals about the integration of visual and verbal information). Although the integration claim is open to a number of specific interpretations (cf. Johnson & Raye, 1981; McCloskey & Zaragoza, 1985a), one widely shared assumption is that subjects misremember the postevent information as part of the originally witnessed event.

The finding that subjects report misinformation (or select a test alternative that embodies the misinformation) is certainly consistent with the assumption that subjects believe they remember seeing the misinformation. Nevertheless, these sorts of data do not provide conclusive evidence that subjects have misattributed the source of the misinformation to the original event. In particular, it is possible that subjects report the misinformation because they believe it to be an accurate description of what happened at the event, and not because they believe they specifically remember seeing it. The plausibility of this alternative interpretation is heightened by the fact that (a) there are good reasons to expect that some misled subjects will accept the misinformation as a true description of the original event and (b) subjects in the typical misinformation experiment are not encouraged to distinguish between what they believe happened in the original event and what they specifically remember seeing at the original event.

To illustrate these points, consider first the case of misled subjects who do not remember the original detail "stop sign" (e.g., because they failed to encode it) and then are exposed to the misleading information "yield sign." These subjects are likely to believe there was a yield sign in the original event for two reasons. First, the misinformation yield sign is provided by a source presumed by the subjects to have accurate knowledge—the experimenter who constructed the original slide sequence (cf. McCloskey & Zaragoza, 1985a). Second, the misinformation yield sign fills a gap in the subjects' memory. Because these subjects do not remember the original stop sign they have no reason to mistrust the new information. It is also possible that subjects who can remember the original

The research reported in this article was supported in part by NIMH Grant MH43581 and a Research and Creative Activity Award from Kent State University to Maria S. Zaragoza.

We gratefully acknowledge the assistance of Renee Axiotis, David Pildner, and Jacqueline Ress in the data collection, and of Michael McCloskey and Stephen Fountain for their insightful comments on earlier drafts of this article.

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detail stop sign may come to believe the misinformation is accurate, and on this basis, report it on the test. These subjects may come to believe the misinformation if, for example, they trust the information provided by the experimenter more than their own memory.

For the above reasons, it is possible that subjects may come to believe that the misinformation is an accurate description of the original event, even if they know they do not remember seeing it. However, knowing that they do not remember seeing the misinformation may not deter subjects from reporting misinformation if they believe it to be true. Furthermore, there are other social factors, such as the desire to be cooperative and the desire to perform well on the test, that are likely to encourage subjects to report everything they believe happened in the event, whether or not they specifically remember seeing it.

For these reasons, it is not clear whether subjects who select the misleading alternative on a test of memory for the event do so because they believe they remember seeing it or because they believe it to be true.[1] Nevertheless, determining whether subjects exposed to misinformation come to believe they remember seeing it is an important issue with considerable theoretical and practical implications. From a theoretical perspective, an answer to this question should provide useful information about the memorial consequences of exposure to misinformation and should enhance our understanding of how old and new information in memory interact over time. Furthermore, answering this question should also provide some insight into the cognitive mechanisms that mediate inaccurate reporting of misinformation. From a more practical perspective, determining whether subjects come to believe they remember seeing the misinformation they actually read has important implications for the reliability of eyewitness memory. The finding that experimental subjects remember "seeing" misleading details they did not in fact witness would suggest that misleading information can seriously undermine the accuracy of eyewitness memory. On the other hand, if experimental subjects do not come to believe they saw the misinformation, this would suggest that witnesses to real-world events might be resistant to this kind of error.

In considering whether subjects misattribute the source of the misinformation to the original event, it is important to distinguish this question from questions about subjects' memory for the source of the misinformation. This is because subjects' ability to remember the source of the misinformation, although an interesting question in its own right, is not necessarily indicative of whether subjects have misattributed the source of the misinformation to the original event. It is possible, for example, that subjects who accurately remember the source of the misinformation (e.g., that they read it in a narrative) may nevertheless come to believe that they also saw it in the original slide sequence and thus "remember" both seeing and reading about the misled item. Conversely, subjects who do not remember the source of the misinformation may not necessarily come to believe that they remember seeing it; they may simply know that they cannot remember the source of the misinformation. For these reasons we will not be concerned here with questions regarding subjects' memory for the source of the misinformation, but rather, we will focus on questions concerning the extent to which subjects misattribute the source of the misinformation to the original event.

Several studies provide evidence potentially bearing on this source-misattribution issue. For example, Schooler, Gerhard, and Loftus (1986) reported that when subjects incorporated misinformation in their testimony, there were qualitative differences in their descriptions of originally perceived and misleading items. Furthermore, on the basis of these differences, a second group of subjects who were asked to serve as judges were able to distinguish between original and misleading items in the reports. Schooler et al.'s study does not, of course, address the question of central interest here—whether the misled subjects themselves could distinguish between the original and misleading postevent details. Nevertheless, given that subjects' descriptions of perceived and suggested memories (and presumably the memory representations that support these descriptions) differ in identifiable ways, it is possible that subjects are able to use these differences to avoid misattributing the source of the misinformation to the original event.

Another potentially relevant finding from a somewhat different domain is the finding in semantic integration studies that subjects sometimes confuse inferences they have drawn from a set of learned facts with the specific facts themselves. For example, Bransford and Franks (1971) presented subjects with a series of facts with the expectation that subjects would semantically integrate them, that is, draw inferences and abstract the overall meaning of the facts. Bransford and Franks (1971) found that when subjects were later asked to rate test sentences as either *old* or *new*, they consistently rated new sentences that were consistent with the overall meaning of the original sentences as *old*, thus showing that subjects confused inferences with specific sentences they had seen. However, in a similar study by Hayes-Roth and Thorndyke (1979), a very different result was obtained when subjects were asked to identify test sentences as either *true*, *old*, or *new*, thus forcing them to distinguish between inferences that preserved the meaning of the sentences (*true*) and the specific sentences they had read originally (*old*). Hayes-Roth and Thorndyke found that although subjects clearly drew inferences from related facts, they showed considerable memory for the separately acquired facts. That is to say, subjects were likely to respond "old" to the original sentences and "true" to the inferences.

Although the semantic integration of related ideas may differ in some important ways from the phenomena observed in misinformation studies, the results of the Hayes-Roth and Thorndyke (1979) study suggest that subjects may have more information about the source of their memories than their performance on any one test suggests. In particular, although

[1] It is also possible that some subjects are influenced by the demandcharacteristics of the situation and report the misinformation even though they do not believe it to be true. Such subjects might feel pressured to go along with the misinformation in order to be viewed favorably by the experimenter (cf. Weinberg, Wadsworth, & Baron, 1983). It is not yet known to what extent demand characteristics play a role in these effects.

subjects will often claim to recognize inferences they have drawn as previously presented, they do not make these errors when asked to distinguish between what they believe to be true and what they specifically remember seeing. It is possible, then, that if explicitly asked to do so, misled subjects will be able to distinguish between misinformation they believe to be true of an event and other aspects of the event they specifically remember seeing.

The purpose of the present studies was to determine whether subjects who have been exposed to misinformation come to believe they remember seeing the misinformation at the original event. The procedure used in the present experiment was identical to the procedure typically used in misinformation experiments, with the exception of the memory test employed. Subjects viewed a slide sequence depicting an event and were subsequently exposed to misleading information (misled condition) or neutral information (control condition) about selected aspects of the event. At the time of test, subjects were presented with a series of individual slides and asked to make judgments about their memory for the source of the critical items depicted in each slide.

One of the difficulties with assessing source misattributions in the typical misinformation experiment is that subjects may report misinformation whether or not they believe they remember seeing it. In the present study we assessed source misattributions more directly by posing the test questions in such a way that subjects were forced to distinguish between items originally perceived, items suggested in a postevent narrative, and items that were consistent with their memory for the event but for which they did not remember the source. Evidence of misattribution was obtained to the extent that misled subjects claimed they saw the misinformation. However, the number of subjects in the misled condition who claimed to have seen the misinformation cannot be taken as a direct measure of the extent to which exposure to misinformation caused subjects to believe they remembered seeing it. This is because there may have been some proportion of subjects who claimed to remember seeing the misinformation even if they had not been misled. To control for this possibility, in the present study we compared the responses of subjects following misinformation (misled condition) with their responses following neutral postevent information (control condition). Note that in the control condition, subjects had not seen or read about the misleading test items in the context of the experiment. If subjects came to believe they saw the misinformation as a consequence of being misled, the proportion of subjects who claimed to have seen the misinformation should be greater in the misled condition than in the control condition.

A second question addressed by the present study is whether exposure to misinformation renders subjects less able to remember the source of items they saw at the original event. For example, given that a subject has seen a stop sign in the original event, reading postevent misinformation about a yield sign may lead the subject to confuse the stop sign for something they had read or lead the subject to forget the source of the stop sign. An answer to this question can be obtained by comparing the proportion of subjects in the misled and control conditions who correctly identify the originally seen details as those they saw. To the extent that misinformation interferes with subjects' ability to accurately remember the source of originally seen details, we should observe fewer correct *saw* responses in the misled condition than in the control condition.

Experiment 1

Before determining whether misled subjects believe they remember seeing the misinformation, we first had to establish that we could replicate the misinformation effect reported in previous studies. To this end we conducted a study with 72 subjects in which we employed the test procedure typically used in misinformation studies (e.g., Loftus et al., 1978), which we refer to as the original test procedure. This test gives the subject a forced choice between the original and misleading information. Although substantial misinformation effects have already been demonstrated with the materials we used in the present study (McCloskey & Zaragoza, 1985a), the previous studies employed a written test of memory for the original event. Because subjects in the present experiments were asked to make judgments about their source memory for items depicted in slides, we sought to demonstrate that misinformation effects would be observed when subjects were asked to select between two slides.

Subjects in the original test condition were given an eight-item two-alternative, forced-choice recognition test consisting of four critical items and four filler items. Each test item consisted of two nearly identical slides projected side by side. For each test pair, subjects were instructed to select the slide they had seen in the original slide presentation. All the critical pairs consisted of an original slide paired with a slide depicting the item presented to misled subjects as misleading information. Across subjects, each of the critical items appeared equally often in the left and right positions.

As we expected, misled subjects selected the misleading slide more often than subjects who had not been misled. Mean performance was 53% correct for misled items and 77% correct for control items, a difference of 24%, $t(71) = 4.1$, $p < .001$. Having established that a significant misinformation effect could be obtained with these materials, we proceeded to test the hypothesis of interest.

Method

Subjects. Subjects were 192 undergraduates from Kent State University who participated in the experiment in partial fulfillment of a course requirement.

Stimuli. The slide sequence and postevent narrative were the same as those used by McCloskey and Zaragoza (1985a). The series of 79 slides depicted an incident in which a maintenance man enters an office, repairs a chair, finds and steals $20 and a calculator, and leaves. The slide sequence included four critical slides, each showing one of four critical items. For each critical slide, three different versions were used. The critical item and the three versions of each were as follows: a coffee jar on a file cabinet (Folgers, Nescafe, Maxwell House), a magazine on a table (*Glamour*, *Vogue*, *Mademoiselle*), a soft drink can on a desk (Coke, 7Up, Sunkist orange soda), and a tool lifted from a tool box (hammer, screwdriver, wrench). For each critical item, each version was presented to one

third of the subjects. For example, one third of the subjects saw a hammer, one third saw a screwdriver, and one third saw a wrench.

The postevent narrative was a detailed description (approximately 750 words in length) of the incident depicted in the slides. For each subject, the narrative presented misleading information about two of the critical items (the misled items) and neutral information about the other two critical items (the neutral items). The assignment of critical items to misled and control conditions was counterbalanced across subjects. Specifically, each version of each critical item served as a control item for half of the subjects to whom it was presented and as a misled item for the other half. For example, half of the subjects who saw a hammer in the slides received a narrative referring to it as a tool (control condition), and the other half received a narrative referring to it as a wrench or screwdriver (misled condition). Further, for each version of each critical item, the two alternative versions were used equally often as misleading information. For example, for subjects who saw a hammer and were then misled about this item, half received *screwdriver* as the misleading information, and half received *wrench* as the misleading information. Except for variations in reference to the critical items, the narrative was the same for all subjects.

Design and procedure. Subjects were tested in groups of 5 to 25. As a rationale for presentation of the slides and narrative, subjects were told that the experiment concerned intuitions about memory. The subjects were informed that they would see a slide sequence depicting an event and that they would then read written descriptions of the event. The task, they were instructed, was to judge whether memory for the event generally would be better for the visual or the verbal mode of presentation. Subjects were told to pay close attention to both the slides and the narrative.

The subjects then (a) viewed the slide sequence at a rate of 5 s per slide, (b) performed a 10-min unrelated filler task, (c) read the postevent narrative once at their own pace, and (d) answered two questions concerning their intuitions about memory and mode of presentation. Following the meta-memory questions, subjects were given a source-identification test. Included in the instructions that preceded the test was a detailed explanation of the distinction between items one specifically remembers seeing and items one does not specifically remember seeing but believes to be true of a witnessed event (the instructions are reproduced verbatim in the Appendix).

The subjects were then given an answer sheet that had four columns labeled *saw*, *read*, *consistent*, and *inconsistent*. Subjects were told that for each test slide, they were to indicate the one alternative that best described their memory for the critical item depicted in the slide. They were instructed to (a) select *saw* only if they were sure they remembered seeing that particular item in the original slide sequence (they were told that they should not claim to have seen a slide if they only remembered reading about it); (b) select *read* if they did not remember seeing the item but did remember reading about it in the narrative; (c) select *consistent* if the item in the slides was consistent with what they remembered about the event, but they did not know where it came from; (d) select *inconsistent* if the item in the slides contradicted what they remembered about the event. Note that the four responses were constructed so that all subjects who believed they remembered seeing an item would have to select the *saw* response, whether or not they remembered reading about it. This was accomplished by instructing subjects to select the *read* response only if the subjects did not remember seeing the item but did remember reading it. The *saw* response was not restricted to items subjects remembered seeing only; subjects could select *saw* if they thought they had read the information as well.

The four response types were illustrated with example slides that were not used as part of the final test. In addition to the instructions and examples, subjects were also given a sheet of paper summarizing what each response meant. Subjects were encouraged to refer to this sheet throughout the test session to aid them in selecting their responses.

The test consisted of eight test slides, the four critical slides and four filler slides. Each test slide was presented individually for 15 s. As each test slide was presented, the experimenter said, "Please check the column that most closely describes what your remember about the ____ shown here," where the blank represents the category name of the test item (e.g., coffee jar, magazine, soda pop, tool, cigarette pack, book). It was necessary to focus subjects' attention on the critical item because pilot testing had shown a very high false-alarm rate to alternative versions of the original slides. Because the alternate versions were identical with the exception of the critical item, the overall similarity of the distractor slides to the original slides had led subjects to make recognition judgments on the basis of global similarity rather than evaluating whether the details of the test slides were the same as those seen originally.

Four test conditions were defined by (a) whether the test slide depicted the version of the critical item originally seen or the misleading version of the critical item that subjects in the misled condition had read about (original test slide vs. misleading test slide) and (b) whether the subjects had received neutral or misleading postevent information about the critical item (control vs. misled). Table 1 illustrates examples of the four test conditions. This design allowed us to compare misled versus control responses to the original test slide and misled versus control responses to the misleading test slide. All subjects participated in each of the four test conditions, and for each subject, the four critical items were each assigned to one of the four test conditions. Across subjects each version of each critical item was used equally often in the four test conditions.

Results and Discussion

The question of primary interest in the present study was whether exposure to misinformation leads subjects to believe they remember seeing the misinformation. An examination of responses to the misleading test slide in the misled and control conditions revealed that exposure to misleading information did not lead subjects to falsely remember seeing the misinformation. The proportion of *saw* responses to the misleading test slide in the misled condition (.15) was identical to the proportion of *saw* responses in the control condition (.15). A McNemar test confirmed that misled/control performance did not differ ($T = .02, p > .05$). In interpreting this result, it is important to keep in mind that in the misled condition, subjects had read about the item depicted in the test slide, but in the control condition, subjects had not seen or read about the test item in the context of the experiment.

Table 1
Examples of Test Conditions Used in Experiments 1 and 2

Test condition	Original (saw)	Postevent (read)	Test slide
Original test slide			
Control	Hammer	—	Hammer
Misled	Hammer	Screwdriver	Hammer
Misleading test slide			
Control	Hammer	—	Screwdriver
Misled	Hammer	Screwdriver	Screwdriver

Note. All subjects participated in each of the four test conditions, and for each subject, a different critical item was assigned to each of the four conditions. Across subjects, each version of each critical item was used equally often in the four test conditions.

Thus, the results show that subjects were no more likely to claim they had seen the misleading item they had read about than they were likely to claim they had seen a novel item.

The second question of major concern is whether exposure to misinformation makes subjects less likely to remember the source of the original information. An examination of responses to the original test slide in the misled and control conditions revealed that misinformation did not impair subjects' ability to remember seeing the original item. The proportion of *saw* responses to the original test slide in the misled condition (.40) and in the control condition (.42) did not differ ($T = 1.84$, $p > .05$).

Having examined the proportion of *saw* responses to the original and misleading test slides in the misled and control conditions, we now examine how the other responses were distributed. Table 2 lists the proportion of *saw*, *read*, *consistent*, and *inconsistent* responses to the misleading test slide and the original test slide in the misled and control conditions of Experiment 1. For each of the test slide conditions, a series of McNemar tests was performed to assess, for each of the remaining response types (*read*, *consistent*, and *inconsistent*), possible differences in misled and control performance.

In interpreting these data, it is important to keep in mind that the distribution of *inconsistent* and *consistent* responses in the misled and control conditions is uninformative with respect to the two hypotheses of interest here: (a) whether exposure to misinformation leads subjects to believe they remember seeing the misleading detail and (b) whether exposure to misinformation affects subjects' ability to remember the source of those items they did in fact see. Note that both hypotheses involve assessing subjects' memory for what they saw. The *consistent* and *inconsistent* response types, however, were not defined such that subjects had to respond on the basis of what they specifically remembered seeing only. Rather, subjects were told to select these responses if the test item was consistent or inconsistent with what they remembered. The *consistent* and *inconsistent* responses were included as alternatives to the *saw* and *read* options because it was assumed that there would be some subjects who could not remember the source of the items they remembered, be they the original or misleading details. Thus, the *consistent*, *inconsistent*, and *read* responses were included as response alternatives, not because they could shed some light on the hypotheses of interest but because they might characterize the subjects' memory for the items in the test slides.

Note also that the data do not permit any conclusions about subjects' absolute levels of memory for source (e.g., what proportion of subjects who remembered the misinformation remembered reading about it; what proportion of subjects who could remember the original information remembered seeing it) because we do not know what proportion of subjects remembered the original and misleading items at the outset.

Misleading test slide. All the observed misled and control performance differences in the misleading test slide condition can be attributed to the fact that in the misled condition subjects had read about the test item, and in the control condition they had not. For example, subjects selected the *read* response more often in the misled condition (where the test slide matched what they had read) than in the control condition ($T = 54$, $p < .001$). Furthermore, subjects selected the *inconsistent* response more often in the control condition than in the misled condition ($T = 47$, $p < .001$). This result can be readily explained by noting that many of the misled subjects were likely to remember the misleading detail at the time of test. The control subjects, in contrast, had not seen or read about the misleading detail in the context of the experiment. To the extent that the control subjects remembered the original detail, the misleading slide directly contradicted what they remembered.

Finally, there was no difference in the proportion of *consistent* responses in the misled and control conditions ($T = 2.0$, $p > .05$). It might seem surprising that misled subjects were not more likely than controls to select *consistent* in response to the misleading test slide, given the well-established finding that misled subjects are likely to report the misinformation under the traditional testing procedures. However, this finding can be attributed to the large proportion of *read* responses given by misled subjects. Given that subjects could give only one response, selecting the *read* response precluded selecting the *consistent* response. It seems likely, therefore, that many subjects who reported the misinformation did so in spite of the fact that they remembered reading about it.

Original test slide. A comparison of misled and control responses to the original test slide further supports the notion that misinformation did not cause source confusion. There was no difference in the proportion of *read* or *consistent* responses selected in the misled and control conditions ($T = 0.30$, $p > .05$, and $T = 2.9$, $p > .05$ for the *read* and *consistent* responses, respectively). There was, however, a significantly higher proportion of *inconsistent* responses in the misled condition than in the control condition ($T = 4.1$, $p < .05$). Once more, this is probably due to the fact that in the misled condition, some of the subjects may have forgotten the original detail and remembered only the misinformation, thus making the test item inconsistent with what they remembered. On the other hand, subjects in the control condition who had forgotten the original information did not have a memory to contradict the original item because they were never exposed to the misinformation. Consequently, control subjects had no reason to select the *inconsistent* response. Note, however, that the greater tendency for misled subjects to judge the originally

Table 2
Mean Proportion of Subjects Who Selected Each Response Type in the Misled and Control Conditions of Experiment 1

Condition	Response categories			
	Saw	Read	Consistent	Inconsistent
	Misleading test slide			
Control	.15	.21	.14	.50
Misled	.15	.59*	.09	.17*
	Original test slide			
Control	.42	.20	.14	.24
Misled	.40	.18	.09	.33*

* $p < .05$.

seen item as inconsistent shows only that all some misled subjects could remember was the misinformation; it does not imply that these subjects also believed they remembered seeing the misinformation.

In summary, the results support the view that exposure to misinformation does not lead subjects to believe they remember seeing the misinformation, nor does it reduce subjects' ability to accurately identify the source of originally seen information. These results are particularly interesting in light of the fact that several researchers have proposed that misinformation effects may be caused in part because subjects confuse the source of the original and misleading information (e.g., Lindsay & Johnson, 1987). The present results provide no evidence of source confusions caused by misleading information.

It is worthwhile noting the discrepancy between the present results and the results obtained under nearly identical conditions when subjects were given the original test typically used in misinformation studies. Whereas subjects given the source-identification test (Experiment 1) did not claim they had seen the misinformation more often in the misled condition than in the control condition, a similar group of subjects given the original test (preliminary study) were much more likely to select the misleading alternative in the misled condition than in the corresponding control condition. Clearly the finding that misled subjects report the misinformation cannot be taken as evidence that these subjects believed they remembered seeing the misinformation.

The present results do not, however, rule out the possibility that subjects exposed to misinformation might come to believe they remember seeing the misinformation if tested after a longer period of time. In the present study, subjects were tested almost immediately after reading the postevent narrative, and their memory for the specific aspects of the postevent information may therefore have been very good. It may be the case that subjects would be more likely to misremember the postevent information as being from the original event if memory for the specific aspects of the postevent stimulus were less prominent. There is considerable research to support the notion that memory for specific aspects of a stimulus are lost rather quickly (J. R. Anderson, 1974; Sachs, 1967).

In Experiment 2, we further tested the hypothesis that subjects exposed to misinformation come to believe they remember seeing it as part of the original event. To test this idea, we inserted a 1-day delay before the final test. The experiment was otherwise identical to Experiment 1.

Experiment 2

Method

Subjects. Subjects were 192 undergraduates from Kent State University who participated in the experiment in partial fulfillment of a class requirement.

Stimuli. The slide sequence and postevent narrative were identical to those used in Experiment 1.

Design and procedure. The design and procedure were identical to those of Experiment 1, with the exception that the test was delayed 24 hr. On the first day of the experiment, subjects saw the slides, completed the filler task, read the postevent narrative, and completed the meta-memory questionnaire. Subjects were not told the purpose of the second day of the experiment. On the second day, subjects were given the instructions followed by the source-identification test.

Results and Discussion

In spite of the 1-day delay before testing, the results of Experiment 2 replicated those of Experiment 1. As in Experiment 1, exposure to misleading information did not lead subjects to believe they remembered seeing the misinformation as part of the original event; the proportion of *saw* responses to the misleading test slide in the misled condition (.19) did not differ from the proportion of *saw* responses in the control condition (.16). A McNemar test confirmed that these proportions did not differ ($T = 0.45$, $p > .05$).

Second, in Experiment 2, as in Experiment 1, exposure to misinformation did not affect subjects' ability to remember accurately the source of the original information. Again, it was observed that the proportion of *saw* responses to the original test slide in the misled condition (.36) and in the control condition (.39) did not differ ($T = .26$, $p > .05$).

An examination of how the remaining responses were distributed reveals once more that the results of Experiment 2 generally replicated those of Experiment 1. Table 3 shows the distribution of *saw*, *read*, *consistent*, and *inconsistent* responses to the misleading test slide and the original test slide in the misled and control conditions of Experiment 2. For each of the test slide conditions, a series of McNemar tests was performed to compare the proportion of subjects who selected each of the remaining response types in the misled and control conditions.

Misleading test slide. As in Experiment 1, in the misleading test slide condition, there was a larger proportion of *read* responses in the misled condition than in the control condition ($T = 51$, $p < .05$) and a larger proportion of *inconsistent* responses in the control condition than in the misled condition. These differences again merely reflect the fact that in the misled condition, subjects had read about the misinformation depicted in the test slide, but in the control condition they had not. The proportion of *consistent* responses in the misled and control conditions did not differ ($T = 1.1$, $p > .05$).

Table 3
Mean Proportion of Subjects Who Selected Each Response Type in the Misled and Control Conditions of Experiment 2

Condition	Response categories			
	Saw	Read	Consistent	Inconsistent
	Misleading test slide			
Control	.16	.14	.18	.52
Misled	.19	.48*	.15	.18*
	Original test slide			
Control	.39	.18	.15	.29
Misled	.36	.17	.11	.36

* $p < .05$.

Original test slide. A comparison of misled and control responses to the original test slide revealed no differences in the proportion of subjects who selected each response type (Ts = 0.02, 1.1, and 1.9, for the *read*, *consistent*, and *inconsistent* responses, respectively, all $ps > .05$). Thus, misinformation did not affect subjects' ability to identify the source of originally seen information, even when tested after a delay of 1 day.

Collectively, the results of Experiments 1 and 2 provide strong evidence that subjects did not, as a consequence of being misled, come to believe they remembered seeing the misinformation as part of the originally witnessed event. Even after a 24-hr delay, subjects did not confuse the postevent information with information derived from the originally perceived event. More generally, exposure to misinformation had no effect on any aspect of subjects' memory for the source of original and misleading items in memory.

In interpreting the results of these experiments, we have assumed that all subjects who believed they had seen the misinformation selected the *saw* response, whether or not they also remembered reading about it. This is because the instructions stated that subjects were to select the *read* response only if they were sure they did not remember seeing it but did remember reading it. The only criterion for selecting the *saw* response was that subjects had to remember seeing it; there was no restriction against selecting this response if subjects had also read about the item. Thus, if any subjects thought they had both seen and read about the misinformation, they should have selected the *saw* response. It is possible, however, that subjects in our experiments misinterpreted the instructions to mean that the items they were being tested on occurred either in the slide sequence or in the narrative, but not in both. If this were the case, subjects who thought they both saw and read the misinformation might have incorrectly opted for the *read* response on the basis that they were more confident of having read it than of having seen it. This strategy would lead some subjects who misremembered the postevent information as being from the original event not to reveal so on the test.

In order to test the possibility that subjects misinterpreted the instructions, we examined subjects' responses to a filler item (a Wilson tennis racket) that was likely to produce many subjects in the saw-and-read state because it was presented both in the slides and in the narrative. (The Wilson tennis racket was the only filler item that occurred in both the slides and the narrative.) Because the written version had been presented more recently, subjects' memory for having read about the item was likely to be stronger than their memory for having seen it in the slides. Support for the notion that subjects had misinterpreted the instructions would be found to the extent that subjects selected the *read* response instead of the correct *saw* response. The results suggest that subjects did understand the instructions. In Experiment 1, 80% of the subjects selected the *saw* response, whereas only 8% of the subjects selected the *read* response, and 11% selected the *consistent* response. Similarly in Experiment 2, 86% of the subjects selected the *saw* response, whereas only 5% selected the *read* response, and 8% selected the *consistent* response. (In both experiments, 1% of the subjects selected the *inconsistent* response.) Note that it cannot be concluded that those subjects who selected the *read* response had misinterpreted the instructions; it is reasonable to expect that some subjects could only remember reading about the item and therefore selected this response on the test. Thus, the above analysis strongly implies that subjects who remembered both seeing and reading about the test item understood that the *saw* response was the appropriate way to categorize their memory.

Another alternative interpretation of the present results is that subjects did believe they had seen the misinformation but rejected the test slide depicting the misinformation as one they had seen because it did not match their memory representation of the misleading detail. This seems unlikely for several reasons. First, the critical items used in the present experiment were highly standard (e.g., all 7Up cans look alike, all Nescafe logos look alike), so the probability that subjects' representations differed substantially from the test slide is unlikely. Second, it is also worth noting that when subjects were asked to select between the original and misleading versions of the slide (in the original test condition), 23% of the control subjects and 47% of the misled subjects selected the misleading slide. Clearly subjects considered it plausible that they had seen the misleading slide.

A third alternative interpretation of the results is that the elaborate instructions employed in this study served as a warning that induced resistance to the misinformation. Greene, Flynn, and Loftus (1982) showed that warnings provided before subjects were misled increased their resistance to the misinformation. More important, however, Green et al. also showed that warnings provided after subjects were misled had absolutely no effect. That is to say, subjects who were warned after reading the postevent narrative were no more resistant to the misinformation than subjects who had not been warned. In the present studies, the instructions that could have served as a warning were always given to subjects after reading the misleading narrative and before taking the final test. Thus, even if the instructions served as a warning, they should not have induced resistance to the misinformation.

Finally, our results cannot be attributed to the fact that subjects were instructed to be conservative in selecting the *saw* response. This is because our conclusions about subjects' ability to distinguish between what they had and had not seen are based on a comparison of performance on the misleading and control items. Thus, although we biased subjects to be conservative in making the *saw* response, this bias should have been the same for both misled and control items. The critical finding is not that subjects did not claim to have seen the misleading item (misled condition) but that they did not do so more often than they claimed to have seen a novel item (control condition).

General Discussion

To date, much of the research on misinformation phenomena has focused on determining whether exposure to misinformation impairs subjects' ability to remember the original event. The consistent finding, at least in research with adults, has been that misleading postevent information does not

impair subjects' ability to retrieve originally seen details (e.g., McCloskey & Zaragoza, 1985a, 1985b; Zaragoza, McCloskey, & Jamis, 1987). Rather, it appears that misinformation effects are largely due to those subjects who fail to remember the original critical details and accept the misinformation because it fills a gap in their memory.

The present study examined another potential consequence of exposure to misinformation. This is the possibility that misled subjects who believe the misinformation is accurate might also come to believe they remember seeing the misleading detail at the original event. The results of two experiments reported here showed that exposure to misinformation did not lead subjects to believe they remembered seeing the misinformation. In fact, there was no evidence that misinformation causes source-confusion errors of any kind. The same results were obtained when subjects were tested immediately (Experiment 1) and after a 24-hr delay (Experiment 2). Clearly, the finding that subjects incorporate misinformation in their reports does not imply that subjects believe they remember seeing the misleading items.

One question not addressed by the present results is whether subjects might come to believe they saw the misinformation if tested after very long delays. Determining the time course of subjects' ability to distinguish between original and postevent memories is an important question for future research, especially in light of the fact that virtually all eyewitness testimony situations involve delays considerably longer than the 24 hr employed here. Nevertheless, it is important to note that delays before testing are not necessary to produce substantial misinformation effects; confident reporting of misinformation has been repeatedly observed at retention intervals of just a few minutes (e.g., Loftus et al. 1978; McCloskey & Zaragoza, 1985a). Hence, these inaccuracies in subjects' reports alone cannot be taken as evidence that subjects have come to believe they remember seeing the misleading details.

Another question not addressed by the present results is whether subjects would be able to avoid source-misattribution errors under less structured circumstances. Because we wanted to ensure that subjects would fully understand the nature of the discrimination we wanted them to make, we gave them highly specific instructions and explicitly told them to avoid saying they saw something if they only remembered reading about it. In addition, we designed the memory test so that subjects were forced to think directly about their memory for the source of the test items. Given that our test procedure may have encouraged subjects to scrutinize their memories in ways they normally do not, it is possible that this test situation helped subjects retrieve information that otherwise might not have been accessible (cf. Hasher, Attig, & Alba, 1981; Hasher & Griffin, 1978). More research is needed to determine whether misled subjects' ability to distinguish between what they do and do not remember seeing is preserved to the same extent under less probing test situations.

One aspect of the results that is worth noting here is their practical implications for eyewitness testimony. On a positive side, the results suggest that witnesses, if explicitly cautioned against reporting what they do not specifically remember seeing, may be able to avoid reporting misleading postevent information they believe to be true but did not actually witness. This result is quite encouraging, given that witnesses are quite prone to report misinformation under other circumstances. Nonetheless, the results do not, on the whole, support the view that eyewitness testimony is accurate. Particularly disturbing is the finding that 15% to 16% of the subjects in the control conditions claimed to have seen the misleading item, even though they had not seen or read about the item in the context of the experiment. This high error rate is particularly striking in light of the very strong and explicit nature of the instructions used in this study. Thus in spite of subjects' remarkable ability to avoid misattribution errors caused by exposure to misinformation, there was evidence of rather serious memory failures brought about by other causes.

Focusing for the present on the more positive finding that subjects exposed to misinformation did not come to believe they saw the misinformation, an important question for future research is understanding how subjects avoided making these misattribution errors. Understanding the basis for misled subjects' accurate source discriminations should predict circumstances under which confusion of original and postevent sources is more or less likely to occur, and it should also suggest other types of information that might be more readily confused with the original event. For example, given the well-documented finding that subjects confuse their thoughts, elaborations, and imagination with memories derived from perception (R. E. Anderson, 1984; Johnson & Foley, 1984; Johnson, Raye, Wang, & Taylor, 1979; Johnson, Taylor, & Raye, 1977; see Johnson & Raye, 1981, for a review), it is possible that subjects' ability to distinguish between their perceptions and thoughts about a witnessed event differs in important ways from their ability to distinguish between original and postevent sources.

One promising hypothesis is that temporal and contextual cues played an important role in misled subjects' ability to avoid confusing the misinformation with what they remembered seeing. This hypothesis is suggested by studies demonstrating list differentiation (e.g., J. R. Anderson & Bower, 1972) as well as studies demonstrating cross-modality identification errors (confusing whether a studied item was presented in verbal or pictorial form). One important aspect of the latter studies is that cross-modality identification errors typically occur following presentation of an acquisition list containing both verbal and pictorial information (e.g., Durso & Johnson, 1980; Rosenberg & Simon, 1977). Because in the present study pictorial (original) and verbal (misleading) information were presented in different contexts separated in time, subjects may have had distinctive contextual and temporal cues to rely on in making their judgments. Of course, a resolution of this issue is dependent on further research.

Interpreting Integration Phenomena

In addition to having implications for the interpretation of misinformation phenomena, the results of the present study also have important implications for the interpretation of integration phenomena in general. A diverse set of findings in the cognitive literature have been interpreted as evidence of the integration of information acquired from different sources into a single memory representation. These phenom-

ena include semantic integration effects (e.g., Bransford & Franks, 1971), linear ordering effects (e.g., Potts, 1973, 1976, 1977), and the "knew-it-all-along" effect (Fischoff, 1977) among others (see Alba & Hasher, 1983, for a critical review of integration phenomena). The misinformation effect we obtained in the original test condition shares with these other phenomena the general integration finding that exposure to several sources of related information may result in a novel response. However, the results of the source-identification test show that the separate identity of the original and subsequently acquired facts is not necessarily lost as a consequence of integrating them. This latter finding calls into question the general assumption that a subject's response directly reflects the content of a single underlying memory representation.

Once it is recognized that a response that represents an integration of old and new information does not necessarily imply that there is an underlying integrated memory representation, it becomes apparent that the key to explaining integration phenomena is understanding the relation between the underlying memory representation(s) and subjects' performance on memory tests. What is the nature of the information stored in the memory representations relevant to this event? What are the processes that operate on this stored information, and under what circumstances do they come into play? It is by asking such questions that we will be able to determine how accurate subjects' performance can potentially be, and under what circumstances performance should be more or less accurate. Note, however, that these are the very questions precluded by the assumption that an integrated response reflects an integrated memory representation.

Although the distinction between memory performance and the underlying memory representations that support performance may seem obvious, this distinction is easily lost in the interpretation of experimental results. Much of the commonly used terminology contributes to the blurring of this distinction, as can be seen in the use of the terms *memory distortions, modifications in memory, impaired memory,* and *integrated memory.* On the one hand, when these terms are applied to experimental results, they are often used merely as descriptions of the subjects' memory performance. On the other hand, these terms are also often used to suggest a memory representation that has been distorted, modified, integrated, and so on. The problem arising from this casual usage of the word *memory* is that it carries the implicit suggestion that memory performance corresponds directly to a single underlying memory representation. As we have shown, the relation between memory representations and memory performance may be considerably more complex than that. Although it is clearly the case that some memorial process is responsible for these so-called *memory distortions,* these distortions do not necessarily involve a change in an underlying representation.

One way to maintain the representation–performance distinction might be to use terms such as *testimony, performance, response,* or *report* when referring to the subjects' memory performance and use the term *memory representation* when referring to the underlying memory representation. In addition, the effort to employ more precise terminology might profitably be extended to describing other aspects of memorial functioning such as the conscious experience of remembering, or recollection. As the recent research on implicit memory phenomena shows (see Schacter, 1987, for a review), in many cases information in memory can be expressed without conscious recollection. Hence, it is important to distinguish between conscious recollection and the concepts of memory representation and memory performance. Finally, another distinction that is not always made clear is whether the term *memory* refers to a specific memory representation or to the memory system in general. This distinction is particularly important in interpreting misinformation phenomena, where it is important to recognize that misinformation can affect memory in ways that do not necessarily involve modifying an original memory representation. In summary, there are many aspects of memorial functioning subsumed by the term *memory.* The use of specific items to distinguish between these aspects of memorial functioning should help to further our understanding of memorial phenomena by focusing attention on the fact that memory is a complex, multifaceted system that does not reveal itself consistently in all situations.

Conclusion

The results of the present study suggest that a person's memory for the experiences surrounding a witnessed event is considerably richer and more complex than their memory-test performance might imply. When asked to do so, subjects are able to distinguish between information they specifically remember seeing at a witnessed event and information relevant to the event that they learned about subsequently, even though they do not always make these distinctions on standard misinformation tests. A continuing challenge for memory researchers is devising new methods for revealing how much subjects know beyond what they might tell us.

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Appendix

We're going to do something a little bit different now. First let me give you some background to a problem that is facing the courts. The problem involves eyewitness testimony. It seems to be the case that eyewitnesses in court may sometimes report things that they are not sure they remember seeing. For example, imagine that you were an eyewitness to a traffic accident where a young man in a Volkswagen hit an old woman as she was crossing the street. The next day, you read a police report of the accident. The police report states that the traffic light at the street corner was red at the time of the accident. You don't remember seeing the color of the traffic light, but you believe the police report because several other witnesses testified it was red. A month later you are asked to testify in court about the accident. While you are at the stand the lawyer asks you, "Did you see that the traffic light was red at the time of the accident?"

How should you answer the lawyer? You believe that the traffic light was red based on the police report. You figure that if you witnessed the accident you really should have noticed the traffic light. So you're afraid to admit you're not sure you remember seeing the traffic light because the jury might think you're not a very credible witness. You then decide to say you remember seeing the red traffic light even though you're not sure you remember seeing it.

Now I want you to imagine you were an eyewitness to the events you saw in the slides. You've seen an event, and you've read a description of it, now I want to see if you can distinguish between what you know you saw and what you think you may have seen.

In this phase of the experiment you will see a series of eight individual slides. Some of these slides will be the same slides you saw in the original slide sequence, and some of these slides will have details that are different from the details you saw in the original sequence. As each test slide is presented, I will direct your attention to one of the items in the slide. Your task in this experiment is to indicate which of the four descriptions on your answer sheet best describes what you remember about the item in each slide.

Received August 31, 1987
Revision received June 7, 1988
Accepted June 15, 1988 ■