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Processing resources and eyewitness suggestibility

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Purpose. Two experiments were conducted to test the hypothesis that encountering or retrieving suggested information under conditions of limited, rather than full, attentional resources is likely to increase false memory for suggested events.

Methods. A typical eyewitness suggestibility paradigm was employed in which participants viewed a slide sequence depicting an office theft, answered misleading questions regarding the theft, and were later tested on their memory for the source of the suggested details. In Expt 1, participants encountered the misinformation under conditions of either divided or full attention, and in Expt 2 participants were given either ample time to make the source judgment or were forced to provide source judgments very quickly.

Results. The results of both experiments showed that participants who encountered (Expt 1) or retrieved (Expt 2) misleading suggestions under conditions of limited attentional resources were more likely to misattribute the suggested items to the slides and less likely to remember having encountered the suggestions in the post-event questions.

Conclusions. The results support the hypothesis that limiting attentional resources impairs participants' ability to retrieve source-specifying information and increases false memory for suggested details.

Legal systems the world over depend on the reliability of eyewitness testimony to deliver justice. After a crime has been committed, eyewitness accounts given by victims and/or witnesses often influence whether or not a person is arrested, how the suspect is charged, whether or not a complaint is filed, and so forth (Devlin, 1976; Goldstein, Chance & Schneller, 1989; Rand Corporation, 1975). If the case goes to trial, eyewitness testimony carries a great deal of weight in the fact-finding process (Rattner, 1988), certainly more than other types of evidence (e.g. physical and circumstantial evidence; Loftus, 1979). It has frequently been observed by United States courts that potential jurors—and many law enforcement officials and

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judges—seem to exhibit extraordinary confidence in eyewitness data (Solomon v. Smith, 1980; United States v. Telfaire, 1972). Nevertheless, erroneous testimony has long been recognized as a crucial problem in the administration of justice (e.g. Munsterberg, 1908) and there are numerous examples of convictions based on faulty testimony (Connors, Lundregan, Miller & McEwen, 1996; Devlin, 1976; Loftus, 1979; Wagenaar, 1988).

Why are people prone to error when providing eyewitness reports? We know from laboratory studies of eyewitness testimony that exposure to leading or misleading suggestions is one factor that can dramatically influence the accuracy of people's eyewitness reports. Following Loftus' classic series of experiments on this topic in the 1970s (e.g. Loftus, Miller & Burns, 1978; Loftus & Palmer, 1974), numerous studies have demonstrated that participants can be led to report suggested events that they never actually witnessed (e.g. Bekerian & Bowers, 1983; Chandler, 1989; Christiaansen & Ochalek, 1983; Kohnken & Brockmann, 1987; Lindsay, 1990; McCloskey & Zaragoza, 1985; Pirolli & Mitterer, 1984; Smith & Ellsworth, 1987; Wright, Varley & Belton, 1996). To cite just a few examples, participants have been led to report that a stop sign at an intersection was a yield sign (Loftus *et al.*, 1978), that a bare-handed thief wore gloves (Zaragoza & Mitchell, 1996), and that they witnessed a plane crash on television that they had in fact only heard about (Crombag, Wagenaar & van Koppen, 1996).

The finding that misinformation can easily undermine the accuracy of eyewitness testimony has generated enormous interest and controversy, and a great deal of research and theorizing has been devoted to assessing the nature and causes of these misinformation effects (e.g. Bekerian & Bowers, 1983; Belli, 1989; Lindsay, 1990; Loftus & Loftus, 1980; Loftus *et al.*, 1978; McCloskey & Zaragoza, 1985; Metcalfe, 1990; Morton, Hammersley & Bekerian, 1985; Wright, 1993; Zaragoza & Lane, 1994; Zaragoza & McCloskey, 1989). What has emerged from this research is a growing consensus that exposure to misinformation can have a variety of effects on memory and performance. In addition to influencing what a witness is likely to say and believe, exposure to misleading suggestions can sometimes lead to illusory recollections of suggested details—recollections which, although false, can be highly specific and held with high confidence (Loftus, Donders, Hoffman & Schooler, 1989; Zaragoza & Lane, 1994; Zaragoza & Mitchell, 1996). Arguably, it is this potential for recollective experience to be in error that poses the biggest threat to the validity of eyewitness testimony. Understanding the factors that can give rise to false memories for suggested details was one of the primary motivations for the present study.

Evidence of illusory memories of suggested details has been obtained in studies where participants first view a slide show or videotape depicting a forensically relevant event (e.g. a theft) and are later exposed to misinformation about selected aspects of the event (e.g. it may be suggested that the thief had a gun when in fact the thief participants saw was not carrying a weapon of any sort). Typically, the misinformation is presented as an accurate description of the witnessed event that is encountered in the context of a post-event task. For example, in some studies, the misleading suggestions are embedded in a narrative description of the event that participants read, and in other studies misleading suggestions are presupposed

in questions about the event that participants answer. To assess whether participants' might come to have a false memory of having witnessed the suggested detail (e.g. that the thief held a gun) they are later given a test on their memory for the source of the suggested details. For example, they may be asked to indicate whether they remember seeing the gun (the suggested detail) in the slides, reading about it in the narrative, both, or neither. The finding of interest is that participants misremember witnessing the suggested detail as part of the event originally seen, that is, they misattribute the misinformation they had only read about to the event that they saw (Belli, Lindsay, Gales & McCarthy, 1994; Lindsay, 1990; Zaragoza & Lane, 1994; Zaragoza & Mitchell, 1996). These findings are taken as evidence of genuine false memories because participants were accurately informed prior to taking the source test that some of the details mentioned in the post-event narrative (or questions) were not present in the event originally witnessed. Thus one can rule out the alternative explanation that participants were simply reporting the misinformation because of perceived demand or because they trusted it to be an accurate account of the incident they had witnessed (see Lindsay, 1990, for a discussion of the role of demand in suggestibility effects).

It is now well accepted that the suggestibility of memory reflects the more general difficulty people have discriminating between related sources of information in memory (see Johnson, Hashtroudi & Lindsay, 1993, for a review). On this view, people come to have illusory recollections of suggested events because they confuse memories derived from a post-event source for memories derived from actually perceived events. Several lines of evidence support the source confusion interpretation of these false memory effects. First, there is evidence that making the episodes originally witnessed and the post-event episodes more discriminable (by, for example, separating them in time, see Lindsay, 1990) reduces source misattributions. Secondly, there is evidence that elaborating on the suggested information in ways that serve to make it more similar to actually perceived events (e.g. through visual imagery; Garry, Manning & Loftus, 1996; Hyman & Pentland, 1996; see also Zaragoza & Lane, 1994), repetition (Mitchell & Zaragoza, 1996; Zaragoza & Mitchell, 1996), or asking participants to provide verbal descriptions of the suggested item (e.g. Ceci, Loftus, Leichtman & Bruck, 1994; Lane, 1995) increases false memory for the suggested details. Presumably, these manipulations increase false memory because they produce a memory representation of the suggested information that more closely resembles, and hence is more easily confused for, memory of an actually perceived event.

In the present study we investigated the possibility that limiting attentional resources—either when encoding (Expt 1) or when retrieving (Expt 2) suggested post-event information—might also serve to increase false memory for suggested details. Within the broader literature on cognitive illusions, there is considerable evidence that conditions which serve to restrict available processing resources, such as divided attention tasks, tend to boost misattribution errors. This has been documented, for example, in the context of research on the false fame effect, false recognition of conjunction faces (e.g. Reinitz, Morrissey & Demb, 1994), and the illusory truth effect (Begg, Anas & Farinacci, 1992; see also Gilbert, Tafarodi & Malone, 1993, for an example that is especially relevant to jury decision making).

When attentional resources are limited, memory for an item's source is more likely to be disrupted than is the familiarity of the memory's contents. This is because the encoding and retrieval of source-relevant information are highly effortful, attention-demanding processes, whereas familiarity is a relatively automatic consequence of exposure to an item. Thus, limiting attentional resources can cause a relatively selective impairment of source-specifying information that renders the memory highly susceptible to misattribution.

Extrapolating from research in these other domains, it seems reasonable to predict that eyewitness memory will be more susceptible to suggestion when there is a paucity of attentional resources than when full attention can be devoted to processing the misinformation. A scarcity of attentional resources—when either encoding or retrieving misinformation—may lead to impoverished memory for the suggested information's true source, making it more likely that participants will misremember it as part of the witnessed event. It is interesting to note, however, that failure to remember that a suggestion came from a post-event source is not a precondition for misattribution errors. Several studies have shown that participants will incorrectly remember witnessing suggested information even when they also correctly, and confidently, remember reading or hearing about it (Belli *et al.*, 1994; Lane, 1995; Mitchell & Zaragoza, 1996; Zaragoza & Lane, 1994; Zaragoza & Mitchell, 1996). This is probably because, in the typical study, the majority of the information encountered in the post-event episode is historically true. Hence, remembering that the misinformation came from a post-event source is not very diagnostic with regard to its accuracy. Although poor memory for the suggestion's actual source is not a prerequisite for misattribution, it is nevertheless likely that deficient memory for the suggestion's actual source renders the memory conducive to misattribution. Evidence consistent with this idea can be found in studies which show that the forgetting of source information that occurs over long retention intervals is accompanied by increased suggestibility (see, for example, Lindsay, 1990; Zaragoza & Mitchell, 1996), although the possibility that other factors related to delay (e.g. weaker memory for the witnessed event over time) contribute to these effects cannot be ruled out. The present study sought to obtain more direct evidence bearing on this hypothesis.

Understanding the relationship between attentional resources and eyewitness suggestibility is highly relevant for assessing and predicting suggestibility in real-world contexts involving eyewitness memory. A potential limitation on the generalizability of eyewitness suggestibility studies is that they often do not adequately simulate the range of conditions under which witnesses to crimes or other forensically relevant events encode information and later attempt to testify (Malpass, Sporer & Koehnken, 1996). In the typical laboratory study, participants process information in an environment that is relatively free of distraction, pressure or stress, and where the quality of their performance is relatively inconsequential. In contrast, when interrogated by law enforcement officials or asked to testify in a court of law, witnesses will often process information under much less optimal conditions, with multiple environmental stimuli (e.g. many people in the room, other events occurring simultaneously) and internal stimuli (e.g. distraction due to the heightened stress associated with the gravity of the situation) competing for

attentional resources. Given that the availability of processing resources is an important dimension along which real-world situations involving eyewitness testimony are likely to vary, assessing the role of attentional resources in the suggestibility of memory is of important practical concern.

Two experiments were conducted to test the hypothesis that limiting attentional resources would increase false memory for suggested events. A typical eyewitness suggestibility paradigm was employed with slight modifications to accommodate the manipulation of attentional resources. In both experiments, participants viewed a slide sequence depicting an office theft, and later read and answered questions about the event that contained misleading suggestions. After a filler task, participants were given a test of their memory for the source of the misleading suggestions. In Expt 1, participants encountered the misinformation under conditions of either divided or full attention. It was predicted that divided attention, relative to full attention, would impair encoding of information regarding the true source of the suggested items and increase false memory for the suggested items. In Expt 2, the limitation in processing resources occurred at the time of the source test. Specifically, participants were either given ample time to make the source judgment (full attentional resources) or were forced to provide source judgments very quickly (limited availability of processing resources). It was predicted that forcing participants to respond quickly, relative to not doing so, would impair their ability to retrieve source-specifying information and increase false memory for the suggested details.

EXPERIMENT 1

Method

Participants

A total of 140 undergraduates from a midwestern university in the United States participated for course credit in their Introductory Psychology course. An equal number of participants were randomly assigned to the 'divided attention' and 'full attention' conditions.

Materials and stimuli

The slide sequence was a modified version of that used by McCloskey & Zaragoza (1985). The series of 79 slides depicted an incident in which a maintenance man enters an office, repairs a chair, finds and steals $20.00 and a calculator, and leaves.

The post-event questionnaire consisted of 15 questions (from Zaragoza & Lane, 1994). For each participant six of the questions were misleading in that they presupposed the existence of one item that was not in the slide sequence the participant saw. These were items that were plausible within the context of the event depicted in the slides (i.e. they were schema-consistent). In addition, the suggested items *supplemented* rather than contradicted information in the slides. There were a total of 12 misleading items that were suggested in the context of the experiment: a rag, a paperback book, a jar of Folger's coffee, a Coke can, a pack of bubblegum, a hammer, a coat rack, a wristwatch, a cigarette lighter, a newspaper, a xerox machine and a wallet. For each participant, six of these items functioned as suggested items, while the remaining items functioned as never-presented control items. There were two versions of the questionnaire, and across the experiment each item served equally

often as a suggested and control item. As an example, below is the question where the misleading item *coat rack* was suggested:

> At the beginning of the sequence, there was a young woman standing at her desk. As she gathered her purse and blue umbrella from a nearby *coat rack*, what was she preparing to do?

Below is the corresponding question when *coat rack* functioned as a control item at test:

> At the beginning of the sequence, there was a young woman standing at her desk. As she gathered her purse and blue umbrella, what was she preparing to do?

Procedure

Participants were tested in groups of 2 to 10. They were informed that the experiment concerned people's interpretations of complex events and that their task would be to view a series of slides and attempt to determine what the incident depicted in the slides was all about. The slide sequence was presented at a rate of 4 s per slide.

After viewing the slide sequence, participants received the post-event questionnaire. Participants were informed they were going to answer some questions about the event they had just viewed, and that they were to give an answer for each of the questions, even if they had to guess. In order to control the amount of time participants had to process each of the post-event questions, the questions were individually projected onto a blank wall directly in front of the participants at a rate of 12–16 s per question (the exposure duration of any particular question was dependent on the length of the text containing the question). Participants wrote their answers to the questions on an answer sheet. Presentation of the questions was accomplished using a Tandy 1400 notebook computer, Harvard Graphics software, an EIKI DD-1000 LCD interface, and an overhead projector.

The 'divided attention' manipulation was implemented by having participants in the divided attention condition listen to and monitor the contents of a tape containing clips of popular music. The tape was presented via a Toshiba RT-SX1 stereo cassette-recorder and consisted of 15 short clips of popular music, lasting a total of 4 min 37 s. The duration of each clip varied from 14–22 s to prevent participants from anticipating when the next clip would begin. To assure that the song monitoring task was sufficiently attention demanding, participants were instructed that at the conclusion of the tape they were going to be asked to identify the last two songs they had heard (by providing either the title or the name of the artists associated with the songs). Because participants did not know when the tape would end, and because they were told that the tape could be stopped at any moment, these instructions insured that participants attended to the music throughout the question-answering period. For all participants the tape ended approximately 5 s after question presentation had ended. After completion of the post-event question phase, participants completed a recognition test for the music. The music recognition test consisted of 30 artists and associated song titles: 15 targets which corresponded to songs they actually heard on the tape and 15 lures that were similar in type and genre to the presented songs. Participants were instructed to first indicate the last two songs they heard (with a checkmark) and then to circle any other songs they remembered from the tape.

Participants in the 'full attention' condition completed the same two tasks as participants in the divided attention condition (i.e. the post-event question-answering task and the song monitoring task) but did so sequentially rather than concurrently. Otherwise participants in the full attention condition were treated identically to those in the divided attention condition. Thus, the critical manipulation was whether participants answered the misleading questionnaire concurrently with the song monitoring task (divided attention condition) or performed the song monitoring task after completing the misleading questionnaire (full attention condition).

A filler task followed this phase for participants in both conditions. Divided attention participants worked on a word puzzle for 8 mins, while full attention participants did the same for 4 mins. This was done to equate the two groups on the elapsed time between exposure to the suggested items and the source test. Finally, all participants received a surprise source test. Participants were first given written and verbal instructions for the source monitoring test. They were told that they would hear

25 test items played over the tape-recorder at 8 s intervals. Participants were further informed that some of the test items they would hear would be objects they only saw in the slides, some would be objects they only read about in the questionnaire, some would be objects they both saw in the slides and read about in the questionnaire, and some of the test items would be objects that were neither seen in the slides nor read in the questionnaire. For each test item, participants were instructed to mark either the Saw, Read, Both or Neither column, based on which response category best described what they remembered about the source of the test item.

The source memory test consisted of a list of 25 items that were presented auditorily via a Toshiba RT-SX1 stereo cassette-recorder with an inter-item interval of 8 s. In addition to the 12 critical items (6 suggested and 6 control items), an additional 13 items were generated for use as filler items on the final test. Of these, 5 were seen only in the slides, 7 were items that appeared in both the slides and the misleading questionnaire, and 1 was new for all participants. Thus there were approximately equal numbers of items for each source on the test: 6 suggested items, 5 slide-only items, 7 slide + questions items, and 7 new items (6 control items and 1 filler item). It should be noted that the filler items were chosen to be very obvious members of their source category (e.g. many slide-only items were seen for extended periods during the slides) so that they could serve as a conservative standard against which participants could evaluate their memories of suggested items. Because source memory for the filler items was near ceiling, participants' responses to these items will not be reported.

This study was designed to assess whether encoding misleading suggestions under limited attention conditions would affect participants' memory for the source of suggested items, and for this reason we present the results for the suggested items only (false alarms to never-presented controls is also provided as a measure of base-rate error). A 'saw' or 'both' response to a suggested item indicated a source misattribution error (i.e. false memory of having witnessed the suggested item in the slide sequence), whereas a 'read' or 'both' response to a suggested item indicated preserved memory for the suggested item's true source (accurate memory of having encountered the suggested item in the post-event questions).[1]

Results and discussion

Both absolute and conditionalized (relative) measures of source memory for the suggested items are reported. For each measure, misattribution errors were assessed as the sum of 'saw' and 'both' responses, and memory for the suggestions' actual source was assessed as the sum of 'read' and 'both' responses. The question of primary interest was whether participants in the divided attention condition would be more likely to misremember seeing the suggested items in the slides than those in the full attention condition.

Considering first the absolute measure, we note in advance that the results replicate the previous finding that exposure to suggestion induces false memory for the suggested details. Overall, participants were more likely to misattribute items to the slides when they had been suggested in the questions (mean proportion 'saw' + 'both' = .43) than when they served as never-presented controls (mean proportion 'saw' + 'both' = .26 ($F(1,138) = 47.9$, $p < .05$). Importantly, the prediction that divided attention would increase misattribution errors to the suggested items was not supported ($F < 1$). However, memory for the suggested

[1]We note that previous studies with these materials (e.g. Zaragoza & Lane, 1994, Expt 5) have shown that estimates of source misattributions to the slides (i.e. the sum of 'saw' + 'both' responses) and estimates of memory for actual source (i.e. the sum of 'read' + 'both' responses) obtained with the four alternative forced-choice measures employed in these studies are virtually identical to those obtained when participants answer separate yes/no questions about each of the two sources (e.g. 'Do you remember this item from the slides?' and 'Do you remember this item from the questions?'), and source misattributions and memory for actual source are measured as assents to each of these two questions, respectively.

Table 1A. Distribution of responses to suggested items at test as a function of whether the misleading questions were presented under conditions of full or divided attention

Type of response	Full attention	Divided attention
'saw'	0.19	0.22
'both'	0.23	0.23
'read'	0.32	0.22
'neither'	0.26	0.33

Note. Proportions are rounded to the nearest hundredth.

items' actual source did vary in the predicted direction, with divided attention participants making fewer attributions to the questions (mean proportion 'read' + 'both' = .45) than full attention participants (mean proportion = .55) ($F(1,138) = 8.4$, $p < .05$). Finally, as expected, misattribution errors to the control items did not vary as a function of group ($F < 1$).

Table 1*A* shows participants' responses to the suggested items broken down by response category. Inspection of the table reveals that the divided attention manipulation had a second, important effect on participants' memory, namely, it increased forgetting of the suggested items. This is evidenced by the greater proportion of 'neither' responses in the divided attention than the full attention group ($F(1,138) = 4.74$, MSE = 1.27, $p < .05$). Given that participants cannot make a source judgment about an item they cannot remember, it is possible that the failure to observe greater source misattribution errors in the divided attention group was a function of the fewer opportunities they had to make source judgments.

To control for these differences in item recognition, we next report participants' source judgments conditionalized on item recognition (see Fig. 1). That is, we restricted the analyses to recognized suggestions (those identified as being from one or more of the experimental sources: saw, read or both) and report the proportion of these that were incorrectly and correctly attributed. First, as illustrated on the left hand side of Fig. 1, the main hypothesis of the experiment was upheld. Participants whose attention was divided at suggestion were more likely to later incorrectly claim that they saw the suggested items in the slides (mean proportion 'saw' + 'both' = .67) than were participants whose attention was not divided (mean proportion 'saw' + 'both' = .56; $F(1,138) = 4.15$, MSE = .10, $p < .05$). Secondly, as illustrated on the right side of Fig. 1, divided attention participants were again less likely than full attention participants to attribute the suggestions to the questions they had read (mean proportions 'read' + 'both' = .67 and .75 for the divided and full attention conditions, respectively), although this difference only approached conventional significance ($F(1,138) = 3.59$, MSE = .06, $p = .06$).

The pattern of group differences in the incidence of 'saw only' and 'read only' responses are consistent with the foregoing analyses. Table 1*B* shows that limiting

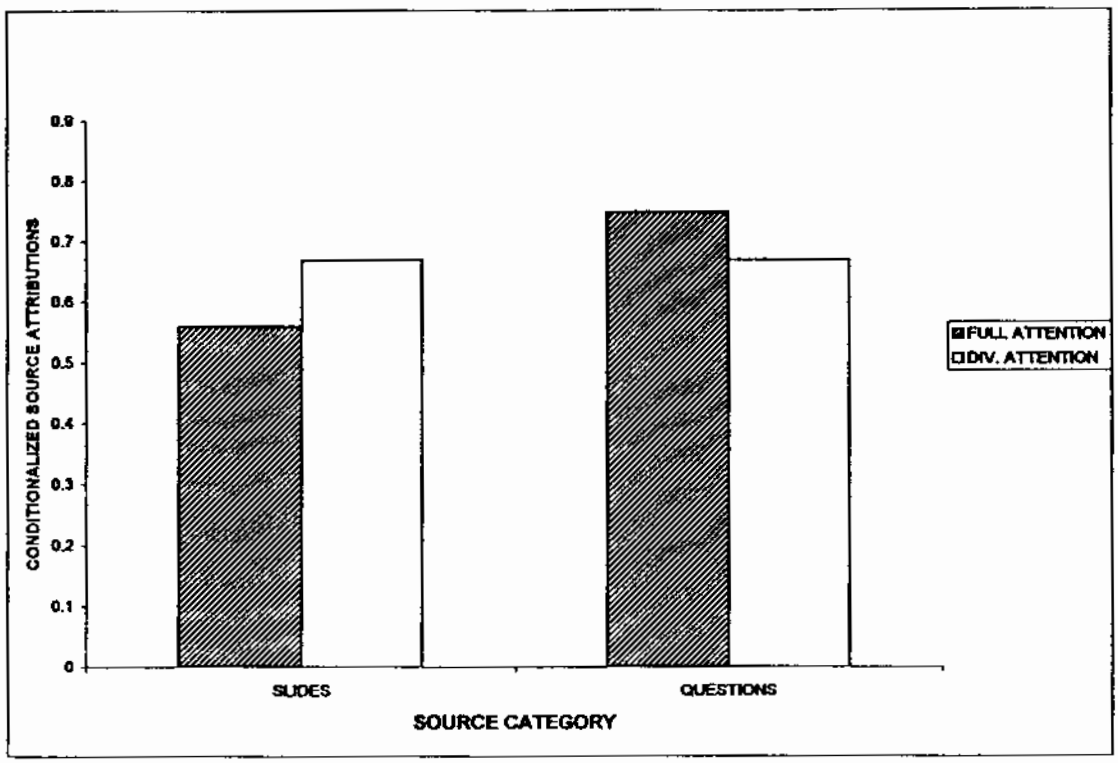

Figure 1. Mean proportion of recognized suggestions misattributed to the slides ('saw' + 'both') and correctly attributed to the questions ('read' + 'both') as a function of group (full or divided attention) in Expt 1.

Table 1B. Distribution of responses to suggested items at test, conditionalized on old/new recognition, as a function of whether the misleading questions were presented under conditions of full or divided attention

Type of response	Full attention	Divided attention
'saw'	0.26	0.34
'both'	0.31	0.34
'read'	0.44	0.33

Note. Proportions are rounded to the nearest hundredth.

attention increased the proportion of 'saw only' responses to suggested items (although this result only approached significance ($F(1,138) = 3.59$, MSE = .06, $p = .06$), and decreased the proportion of 'read only' responses ($F(1,138) = 4.15$, MSE = .10, $p < .05$). There were no group differences in 'both' responses to suggested items ($F < 1$).

Taken together, the results of Expt 1 support the hypothesis that encoding misleading suggestions under divided attention conditions is likely to increase misattribution errors. The results showed that one consequence of divided

attention at encoding was impaired memory for having encountered the suggested items in the post-event questions. Given that 'sourceless' memories are especially susceptible to misattribution, it seems reasonable to conclude that this impaired memory for the suggestions' true source contributed to the observed increase in misattribution errors. It is also possible that divided attention reduced the likelihood that participants detected the suggested items as discrepant from the slides (and, if detected, that they encoded the discrepancy) thus rendering participants more susceptible to the misleading suggestions later on (see Tousignant, Hall & Loftus, 1986, for evidence that reducing discrepancy detection by forcing participants to read the misinformation quickly is associated with increased suggestibility). In summary, divided attention interfered with the encoding of information regarding the circumstances under which the misleading suggestions were encountered. This included the suggestions' physical context (that it was embedded in a written questionnaire) and may have also included any thoughts or reactions the participants had regarding the misinformation (e.g. the suspicion that it was bogus).

The results also showed that divided attention impaired recognition of the suggested items. Given that some memory for the gist of the suggestion is necessary for misinformation to exert its influence, this potential consequence of divided attention may sometimes serve to protect against suggestibility. Nevertheless, the present findings show that, to the extent that memory preserves the content of suggestions encoded under divided attention conditions, they will be more prone to misattribution than suggestions that were processed more fully.

EXPERIMENT 2

Experiment 2 assessed source misattributions of suggested information as a function of attentional resources available at the time of test. Studies on the time course of retrieval have shown that source-specifying information takes longer to access than other types of information, such as the familiarity that underlies old/new recognition judgments (Johnson, Kounios & Reeder, 1994). We assume that source monitoring is an attention-demanding process, and that the accuracy of source monitoring is in part a function of the cognitive capacity that is allocated to the task. Under conditions where few attentional resources are available, participants may rely on the most readily accessible information (such as familiarity) for making the source judgment. To the extent that there is a bias towards assuming that familiar items were in fact witnessed, more misattribution errors would be expected under conditions where capacity is limited. In order to test this idea, we conducted a study where we varied the amount of time participants were given to make individual source judgments. One group was given ample time (8 seconds) to make the source judgment and the other group was given minimal time (3 seconds) as verified by pre-testing. We predicted that participants would be more prone to misattributing the suggested information under time-limited conditions.

Method

Participants

A total of 324 undergraduates at a midwestern university in the United States participated in the experiment in partial fulfilment of a course requirement for Introductory Psychology. Of these, 144 participants were assigned to the 8 s condition, and 180 participants were assigned to the 3 s condition.

Stimuli and materials

The slides were the same as those used in Expt 1. The post-event questionnaire was the same as in Expt 1, except that (for reasons unrelated to the main purpose of the experiment) five misleading items were suggested to each participant rather than six. These five misleading items were drawn from the same pool of 12 items used in Expt 1 and, across the experiment, each item served equally often as a suggested and control item. Unlike Expt 1, the post-event questionnaire was printed on paper rather than visually projected via the computer, and participants had as much time as they wanted to read and answer each question.

The source memory test consisted of the same list of 25 items that were presented auditorily. The instructions and the format of the source memory test were identical to Expt 1 except for the critical manipulation. Participants in the 3 s condition heard the test items with an inter-item interval of 3 s and participants in the 8 s condition heard the test items presented with an inter-item interval of 8 s. Hence the two conditions did not differ in any way other than the time they had at test to make a source judgment for each test item.

Procedure

The procedure used for both conditions was similar to that in Expt 1. Participants saw the slide sequence, read and answered the post-event questionnaire, and then engaged in a 10 min filler task followed by the source memory test.

Results and discussion

Both absolute and conditionalized measures of source memory are reported. Considering first the absolute measure, an overall suggestibility effect was once again obtained, with participants making more misattributions to test items when they had been suggested (mean proportion 'saw' + 'both' = .44) than when they served as never-presented controls (mean proportion 'saw' + 'both' = .20) ($F(1,322) = 194$, MSE = 1.1, $p < .05$). Importantly, however, the magnitude of this suggestibility effect varied as a function of group, as evidenced by a significant interaction between rate of presentation and item type ($F(1,322) = 5.3$, MSE = 1.1, $p < .05$). Planned comparison revealed that, as predicted, participants in the 3 s group committed more source misattributions to suggested items than participants in the 8 s group (mean proportion 'saw' + 'both' = .49 and .36, respectively, $F(1,322) = 14.53$, MSE = 2.3, $p < .05$). However, it was also the case that limiting time at test reliably increased source misattributions to control items, though not to the same extent (mean proportion 'saw' + 'both' = .22 and .17 for the 3 s and 8 s groups, respectively; $F(1,322) = 4.69$, MSE = 1.1, $p < .05$). Thus, although limiting resources increased the source misattribution errors participants made to both suggested and control items, the tendency to commit source misattributions to

Table 2. Distribution of responses to suggested items at test as a function of whether participants had 8 seconds or 3 seconds to respond during the test

Type of response	8 seconds	3 seconds
'saw'	0.09	0.15
'both'	0.28	0.34
'read'	0.48	0.34
'neither'	0.16	0.16

Note. Proportions are rounded to the nearest hundredth.

suggested items was disproportionately affected. Finally, as predicted, memory for the suggestions' true source varied in the predicted direction, with participants in the 3 s group making fewer attributions to the questions (mean proportion 'read' + 'both' = .68) than the 8 s group (mean proportion 'read' + 'both' = .76) ($F(1,322) = 7.9$, MSE = 1.1, $p < .05$).

Table 2 shows participants' responses to the suggested items broken down by response category. Analysing each response category separately yields results that converge with those of the foregoing analyses. Specifically, limiting time at test increased the proportion of 'saw only' responses to suggested items ($F(1,322) = 11.89$, MSE = .66, $p < .05$), and decreased the proportion of 'read only' responses given to suggested items ($F(1,322) = 17.49$, MSE = 1.98, $p < .05$). In addition, limiting time at test increased the proportion of 'both' responses to suggested items ($F(1,322) = 5.36$, MSE = 1.6, $p < .05$). As is apparent in the table, there was no difference between the two conditions with respect to 'neither' (new) responses to suggested items ($F < 1$), thus showing that the time manipulation had a fairly selective effect on source memory.

Although there were no item recognition differences between the two groups, Fig. 2 illustrates the results conditionalized on recognition in order to facilitate comparison with Expt 1. Not surprisingly, conditionalizing the data does not alter the pattern of results. Relative to the 8 s group, participants in the 3 s group committed more source misattributions ($F(1,322) = 17.6$, MSE = .11, $p < .05$ for 'saw' + 'both' responses; $F(1,322) = 12.62$, MSE = .04, $p < .05$ for 'saw only' responses) and were less likely to remember having read the suggested items ($F(1,322) = 9.8$, MSE = .04, $p < .05$ for 'read' + 'both'; $F(1,322) = 16.04$, MSE = .11, $p < .05$ for 'read only' responses).

In summary, the results show that limiting the time to respond at test increased participants' claims that they saw objects they never saw. However, the increase in source misattributions was greater for suggested than control items, thus showing that the observed errors were not simply due to careless responding brought about by the time constraints at test. Rather, the results show that under conditions of time pressure, participants were forced to change the basis on which they made their source judgments, such that they were more likely to confuse familiar items that were suggested to them for those they actually saw.

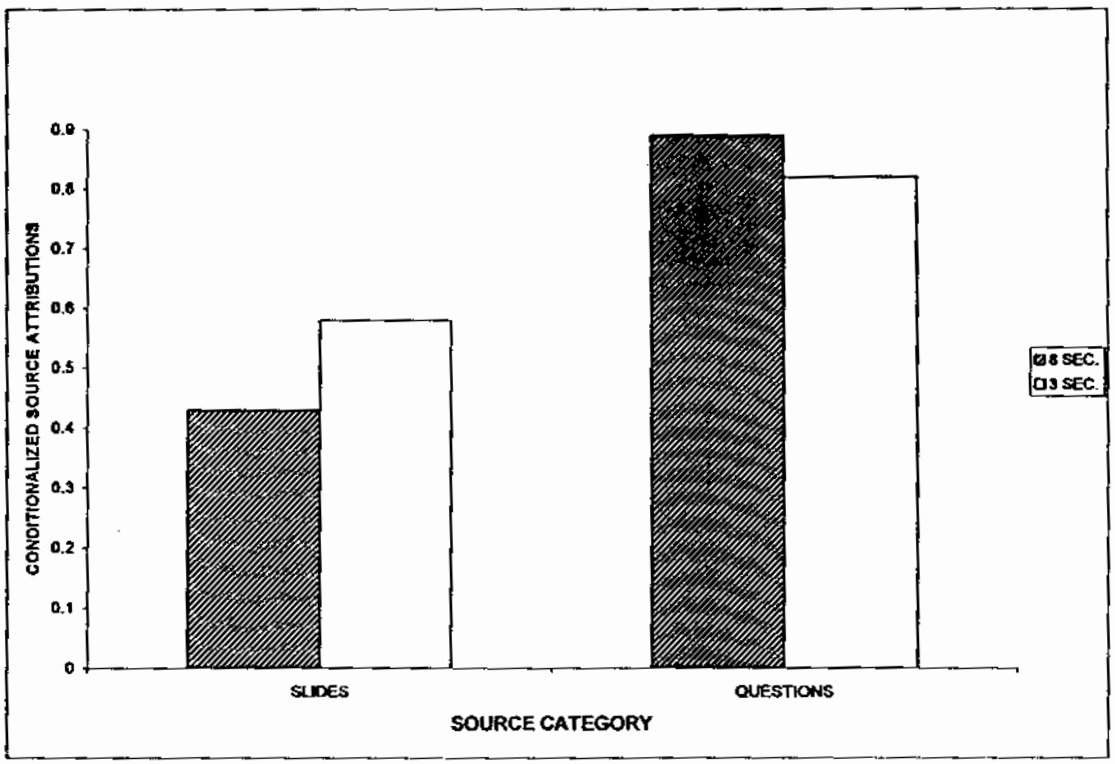

Figure 2. Mean proportion of recognized suggestions misattributed to the slides ('saw' + 'both') and correctly attributed to the questions ('read' + 'both') as a function of group (8 s or 3 s to respond) in Expt 2.

CONCLUSIONS

From a cognitive perspective, the task a typical eyewitness faces is a very difficult one. Apart from the problem that memory is often woefully incomplete (due to inadequate encoding or simple forgetting), there is the potentially more serious problem that eyewitness memory is prone to contamination from other sources. Eyewitness events, like all meaningful life experiences, do not occur in isolation, but happen in the context of other related episodes. These may include experiences such as interviews with law enforcement and legal professionals, exposure to media accounts, or conversations with relatives and friends—all of which could introduce new and even false information about an incident. In addition, because a forensically relevant event will presumably have some significance for the witness, it will likely induce the witness to reflect on the incident, perhaps rehearsing and elaborating on what transpired, extracting its implications, and so forth. This spontaneous mental activity, like the objective events that precede and follow an eyewitness event, will also leave records in memory, records which may contain information that goes well beyond what was actually experienced. The difficulty faced by eyewitnesses who testify in a court of law is the requirement that they report only those events they witnessed first-hand. To do so requires separating memories of the actually perceived event from other sources of knowledge and belief regarding the incident. As the results of the present experiments show, people's attempts to discriminate between related sources of information in memory sometimes fail.

The contribution of the present studies was to document that attentional resources play a role in memory's susceptibility to suggestion. When misinformation was encoded (Expt 1) or retrieved (Expt 2) under conditions that restricted the availability of processing resources, participants' ability to remember the true source of the post-event suggestions decreased and false memory of having witnessed the suggested information increased. This was because limiting attentional resources primarily disrupted encoding and retrieval of source-specifying information, leaving other aspects of suggestion, such as information about its content, relatively unaffected. Of course, it would be rash to conclude from these findings that susceptibility to suggestion will always be greater under limited attention conditions. At some point, limitations in processing capacity will begin to impair encoding and retrieval of item information as well as source information (see, for example, Expt 1). To the extent that such limitations in processing resources prevent the encoding and retrieval of any information regarding the suggestion, the deleterious impact of the suggested information will obviously be minimized. Clearly, more research is needed before we can specify in a precise way how much of a limitation in processing capacity is maximally conducive to source confusion errors. Nevertheless, it is safe to conclude that, all other things being equal, a witness is least likely to succumb to suggestion when ample processing resources are available.

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