The Suggestibility of Children’s Memory for Being Touched: Planting, Erasing, and Changing Memories

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Investigates recent claims that it is relatively easy to suggestively plant false memories in children, by comparing the relative vulnerability to suggestibility of changed, planted, and erased memories. 80 4-year-olds and 80 10-year-olds either were touched in a specific way or were not touched at all, and it was later suggested that a different touch, a completely new touch, or no touch at all had occurred. The suggestibility effect occurred only in the changed memory condition; the difference between the experimental changed condition and the corresponding control condition was significant. In the planted and erased memory conditions no suggestibility effect occurred; there was no significant reduction in the experimental groups relative to the corresponding control conditions. Thus, although it is relatively easy to suggest to a child a change in an event that was experienced, it is less likely that an event can be planted in or erased from memory. It is thus inappropriate to provide courtroom testimony regarding the probability of suggestively planting false memories based on the classic suggestibility research, which has largely been restricted to the study of suggestively changing memories.

In recent years, there has been a great deal of interest in the reliability of children’s courtroom testimony. The central concern here has been the question of whether children’s memory is sufficiently accurate, and whether their memory might be too vulnerable to suggestibility to be relied upon in court. Although psychological research on the suggestibility of children’s memory is not new (see Binet, 1900), and there have been numerous studies in recent years on this topic (for a review see Ceci & Bruck, 1993), the conditions under which children’s memory is vulnerable versus resistant to suggestibility are not well understood.

This study examines a specific claim that relates to the reliability of children’s testimony. This claim is that it is fairly easy to suggest that something occurred when it did not, that is, to plant a false memory. Specifically, it has been proposed by Loftus (1993) and others that it may be common that children’s “memories” for

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sexual abuse have in fact simply been planted by conversations with, for example, a parent, investigator, counselor, or social worker. In this study, the ease of suggestively planting memory for an event that did not occur is examined relative to the ease of changing a memory or erasing memory for an event that did occur.

The Classic Suggestibility Procedure

The large majority of research on the suggestibility effect—research that has provided a basis for the above claim—has used a three-stage procedure (Loftus, 1975; Loftus, Miller, & Burns, 1978; Pezdek, 1977). In this classic approach, in the presentation stage participants view a sequence of slides, a videotape, or a film of an event (e.g., a traffic accident or a robbery). In the suggestion stage, participants are read a narrative or are asked some questions that intentionally mislead them about the identity of the target item (the misled condition), or they do not receive the misleading information (the control condition). In the test stage, participants are given a recognition test for the original event. If participants are more accurate in recognizing the original target objects in the control condition than in the misled condition, this is taken as evidence for the suggestibility effect; that is, they have been misled by the postevent information presented in the suggestion phase.

Although there are constraints on the suggestibility effect (Pezdek & Greene, 1993; Zaragoza & Koshmider, 1989; Zaragoza & Lane, 1994), using this procedure numerous studies have supported the robustness of this effect. Across these numerous studies, differences of 20%-30% between performance on misled and control items are not unusual. Further, when preschool children have been compared to older children and adults, the younger children have generally been more suggestible than the older participants. This conclusion follows from a review of 18 studies by Ceci and Bruck (1993) in which 15 of these studies reported that preschoolers were more suggestible.

On the basis of this research, there are those who conclude that preschool children cannot provide reliable eyewitness testimony. More generally, these results have been used to imply that it is easy for children to be suggestively influenced to believe that certain things happened when, in fact, they did not; that is, that it is easy to suggestively plant a memory for an event that did not occur. However, there is an important difference between the structure of this generalization claim and the structure of the source experiments on suggestibility. Whereas most of the suggestibility studies are structured such that event A occurs, event B is suggested, and memory is tested for A versus B, in the generalization claim regarding planting memories, A never occurs, A is suggested, and memory is tested for A versus not-A. There is a significant difference between the structure of these two issues, and it is an empirical question whether the suggestibility effect generalizes in this way. The purpose of this study is to test this empirical question. Although in several recent studies it has been demonstrated that under certain conditions it is possible to plant false events in memory (Ceci, Crotteau, Smith, & Loftus, 1994; Hyman, Husband, & Billings, 1995; Loftus & Pickrell, in press; Pezdek, 1995), in none of these studies was a comparison made between the prob-
ability of planting, erasing, and changing memories. This study was designed to test this comparison.

**Children's Memory for Being Touched**

This study was conducted using physical touching as the to-be-remembered event. Children’s memory for being touched and the suggestibility of memory for being touched are domains in which relatively little research is available. Oates and Shrimpton (1991), for example, examined age differences between 4- to 6-year-olds, 7- to 9-year-olds, and 10- to 12-year-olds in responses to misleading questions about the actions that occurred during a visit to a doctor or a visit with a friendly stranger. After four to ten days, responses to suggestively misleading questions about the actions (“The person who gave you the blood test put your arms behind your back, didn’t she?”) were answered more accurately than misleading questions about the person (“The person who asked you to try on the shirt had long hair, didn’t he?”); the means correct percentages were 81% and 61%, respectively. Further, age differences were significant for responses to misleading questions about the actions but not for questions about the person. In a similar study assessing children’s memory for what occurred during a visit to a doctor, Ornstein, Gordon, and Larus (1992) reported that in an immediate test, 6-year-old children were more accurate (mean percentage correct = 86%) than 3-year-old children (64%) at rejecting suggestive misleading questions about actions that were part of a normal physical examination but had not been part of their own check-up. Further, Bruck, Ceci, Francoeur, and Barr (1995) reported that although 5-year-old children’s immediate memory for their DPT inoculation was not affected by suggestive feedback, one year later misleading information about the actions of the medical personnel did increase the probability of false reports regarding their actions. Finally, Leippe, Romanczyk, and Manion (1991) reported that although 5- to 6-year-olds were less accurate answering questions about how they were touched in an experimental setting than were 9- and 10-year-olds and adults, commission errors of reporting being touched in places they were not were rare and did not vary with age.

Several studies by Goodman relate more specifically to the suggestibility of memory for sexual touching. Saywitz, Goodman, Nicholas, and Moan (1991) tested children after they had a physical examination that included a vaginal and anal examination or a scoliosis examination. They reported that when tested one week later, children were more accurate answering suggestive misleading questions (mean percentage correct = 86%) than direct questions that were not misleading (74%), primarily because children were reluctant to admit to genital touching that actually did occur. Further, for misleading questions that suggested abuse that did not occur, responses were almost perfect—99% of the 7-year-olds and 96% of the 5-year-olds answered correctly. Similarly, Goodman and Aman (1990) reported that 3-year-olds and 5-year-olds were more accurate answering suggestively misleading questions about abuse (e.g., “Did he keep his clothes on?” “Did he touch your private parts?”) than more general misleading questions (percentage correct = 86% versus 67%,
respectively, averaged across four different test conditions). Finally, Rudy and Goodman (1991) compared the vulnerability to suggestibility of 4- and 7-year-old children who were either participants in or bystanders to a social interaction with an unknown male. Although the participants were generally more resistant to suggestibility than the bystanders, these two groups did not differ in their vulnerability to suggestibility regarding abusive actions; both groups were almost perfect in resisting suggestibility regarding abusive actions.

Together, these results suggest that children's answers to suggestively misleading questions are generally quite accurate, especially questions regarding actions, touching, and abusive behaviors. However, each of the above studies reached this conclusion using a two-stage procedure that involved children's answers to suggestively misleading questions. This procedure differs significantly from the classic three-stage suggestibility procedure. In answering suggestive questions in the two-stage procedure, the participant scans memory to see if the misleading information is in his or her memory for the original material presented in phase one. Since the misleading information was never explicitly planted by the experimenter, the only way that the misleading information could be in memory is (a) if the participant made an inference from the presented information that included the suggested information (this is possible, for example, in studies using materials such as those by Ornstein, Gordon, & Larus, 1992, and Bruck et al., 1995), (b) if the misleading information is either highly schema consistent or sufficiently insignificant that the participant just cannot remember whether the information was part of the original material and is guessing wrong, or (c) children could be false alarming to the suggested information simply out of compliance with the trusted, or perhaps more powerful or intimidating, experimenter (Goodman, Bottoms, Schwartz-Kenney, & Rudy, 1991; McCloskey & Zaragoza, 1985).

The advantage of the classic three-stage suggestibility procedure is that in the second stage, the suggestion stage, information is explicitly planted by an experimenter at a point in time separate from the original presentation stage and separate from the test phase. In the three-stage procedure, the test thus is more likely to assess whether the participant can discriminate in memory between the information presented in the original stage and the information subsequently suggested, rather than whether they are misled by the wording or presentation of the questions themselves, as may be the case with the two-stage procedure. This former issue is, in fact, the particular issue addressed in this study concerning the use of children as witnesses; can children distinguish between what originally happened to them and any related information they may have encountered subsequent to the original event, for example, in conversations with parents, counselors, or investigators? In this study, the classic three-stage suggestibility procedure was used rather than simply asking children suggestively misleading questions, so that we could specifically test the generalizability of the significant body of research dealing with suggestively changing memory to the situations involving planting and erasing memory.
The Purpose of this Study

The purpose of this study is to examine the relative ease of suggestively changing, erasing, and planting events in memory. In this study the probability of suggestibility is compared under three experimental conditions and two control conditions. The experimental conditions are as follows:

1. A is perceived, B is suggested—the changed memory test;
2. A is perceived, it is suggested that A was not perceived—the erased memory test;
3. A is not perceived, A is suggested—the planted memory test.

The two control conditions are as follows:

4. A is perceived, nothing is suggested—the control for conditions 1 and 2; and
5. A is not perceived, nothing is suggested—the control for condition 3.

This study thus provides a test of the relative difficulty of changing memories, planting memories, and erasing memories, using the classic three-phase suggestibility procedure. In this study, two touches were actually included, a touch on the participant’s hand (touch A) or a touch on the participant’s shoulder (touch B), and the type of touch was counterbalanced across participants. The counterbalanced sequence can be generated by substituting A for B and B for A in the above five conditions.

Two age groups were included—children four years of age and ten years of age. The 10-year-old children were selected based on the suggestion from prior studies that the suggestibility of children about ten years of age may not differ significantly from that of adults (Cole & Loftus, 1987). The younger age group included 4-year-old children because it has been reported that another transition point in the suggestibility of memory is around the age of four (Goodman, Aman, & Hirschman, 1987).

METHOD

Participants and Design

The participants were eighty 4-year-olds \( M = 4.51 \text{ years}, SD = .41 \) and 80 10-year-olds \( M = 10.01 \text{ years}, SD = .66 \) from preschool and fourth and fifth grade classes in several public schools in the Los Angeles County metropolitan area. Children were recruited by letters sent home from school to parents. Approximately equal numbers of boys and girls participated in each age group. To assure a heterogeneous racial and ethnic mix in the sample, the schools were selected from lower and middle socioeconomic neighborhoods. Children who indicated that they did not speak English at home, however, were not included in the study. We were concerned that children who were not facile with the English language might not remember information in the suggestive narrative simply because of language dif-
ficulty. The design was a 2 (age) \times 5 (condition) between-subjects design with 16 children in each age group randomly assigned to each condition.

**Procedure**

The children participated individually in one 25-minute session that was always conducted by the same female experimenter. This experiment was included as part of a larger study in which children were told that they were participating in a research project on memory, and they viewed a sequence of slides that they were later tested on. The five conditions specified above were administered in the procedure. At one identifiable point early in the session, the experimenter showed each child a picture of a rose projected on a screen and while focusing the projector, asked if he or she could see the rose clearly. At this point, for ten seconds, the experimenter either put her hand on the participant's hand (event A), put her hand on the participant's shoulder (event B), or did not touch the participant at all. The suggestion stage occurred about 15 minutes later, after viewing a story told in a sequence of slides. At this point, each child was read a narrative that "reviewed" for them what had happened during the session. While reviewing the sequence of events that occurred, the experimenter maintained eye contact with the child and sought to engage the child in listening to her description of the various events. During the suggestion stage, no responses were solicited from the child regarding the actual events that had occurred. Except for the target events indicated below, all of the reviewed events actually did occur in the experimental sequence.

Regarding the target behavior, in the three experimental conditions participants were either told (a) that they had been touched in a different way (B was suggested if A had occurred, or A was suggested if B had occurred), (b) that they had been touched (A or B) if they had not been touched, or (c) that they had not been touched if they had been touched (either A or B). In the two control conditions, the narrative mentioned nothing about the touching incident. Within each age group and across the three experimental conditions and two control conditions, the type of touch, on the hand or on the shoulder, was counterbalanced across subjects so that each occurred in the perceived and suggested position equally often.

At the end of the experimental session, each child was given a memory test. The test included three questions about the touching incident—one general question followed by two specific questions:

1. When I showed you the picture of the flower on the screen and asked if you could see it, **did I touch you?**
2. When I showed you the picture of the flower on the screen and asked if you could see it, **did I put my hand on your shoulder?**
3. When I showed you the picture of the flower on the screen and asked if you could see it, **did I put my hand on your hand?**

The first question was included to assess the claim of Goodman and Clarke-Stewart (1991) that children often find general questions about touching unclear, and that, although using specifically worded questions may have a suggestive influence, chil-
Children's responses to general nonspecific questions tend to be limited. Each child was asked to respond "yes" or "no" to each question, and all did so; there were no ambiguous responses.

RESULTS

Presented in Table I are the mean hit rate, false alarm rate, and $d'$ rate data for 4- and 10-year-old participants in each of the five conditions. Because the major results involve participants' ability to discriminate between the touch that really occurred and the touch that was suggested, the signal detection measure of $d'$ was used. As has been discussed elsewhere (Pezdek & Roe, 1995), $d'$ appears to be a more sensitive measure of the eyewitness suggestibility effect than either hit rate or false alarm rate data alone. The $d'$ measure unconfounds response bias from memory sensitivity. The $d'$ data were derived from participants' responses to questions 2 and 3 above. Because each subject responded to only one target item, the $d'$ values in Table I are based on the group hit and false alarm rate data. These $d'$ data are presented in the third and sixth columns of Table I for each of the three experimental and two control conditions. As can be seen in the table, the $d'$ scores were greater in conditions 2 and 3 than in condition 1, for both 4- and 10-year-old children, suggesting that the ability to discriminate test items was greater for planted and erased suggestions than for changed suggestions.

The critical analyses assess whether the mean $d'$ value in each experimental condition differed from that in the corresponding control condition. Ordinarily $d'$ data are collected across multiple responses made by each participant and thus can be analyzed with parametric statistics. However, in this study it was necessary to use nonparametric statistics since each participant responded to only one target item per condition, with each response either correct (1) or incorrect (0). Traditional

<table>
<thead>
<tr>
<th>Table I. Mean Hit, False Alarm, and $d'$ Rate Data in Each Condition for 4- and 10-Year-Old</th>
<th>4-Year-olds</th>
<th>10-Year-olds</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hit</td>
<td>False alarm</td>
</tr>
<tr>
<td>Experimental conditions</td>
<td></td>
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<tr>
<td>1. A occurs, B suggested</td>
<td>.25</td>
<td>.44</td>
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<tr>
<td>(changed memory condition)</td>
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<td></td>
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<tr>
<td>2. A occurs, not-A suggested</td>
<td>.44</td>
<td>.56</td>
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<tr>
<td>(erased memory condition)</td>
<td></td>
<td></td>
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<tr>
<td>3. not-A occurs, A suggested</td>
<td>.44</td>
<td>.50</td>
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<tr>
<td>(planted memory condition)</td>
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<tr>
<td>Control conditions</td>
<td></td>
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<tr>
<td>4. A occurs, nothing suggested</td>
<td>.44</td>
<td>.19</td>
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<tr>
<td>(control for conditions 1 and 2)</td>
<td></td>
<td></td>
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<tr>
<td>5. not-A occurs, nothing suggested</td>
<td>.63</td>
<td>.25</td>
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<td>(control for condition 3)</td>
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$^a$Experimental condition differed significantly from corresponding control condition.
parametric statistics are not appropriate for analyzing dichotomous data such as these. The nonparametric analysis conducted here involved two steps. First, a difference score was computed for each subject between his or her score on the target item (the original touch condition) and one minus the score on the suggested distractor item (the suggested touch condition). These ordinal difference scores took on values of −1, 0, or +1. These scores can be interpreted as ordinal $d'$ values, with −1 indicating that the participant was incorrect both in responding "new" to the original touch condition and "old" to the suggested touch condition, 0 indicating that a participant gave the same response—whether "old" or "new"—to both test items, and +1 indicating that a participant correctly responded "old" to the original touch condition and "new" to the suggested touch condition. Second, six separate gamma statistics $G$ were carried out to test if the frequency of −1, 0, or +1 scores differed between each of the three experimental groups and the corresponding control group for each, for both age groups separately. The gamma statistic $G$ measures the relation between two ordinarily scaled variables (Siegel & Castellan, 1988). In each analysis, a significant gamma statistic indicated that participants were more likely to yield higher scores (i.e., discriminate better) in the control condition than in the corresponding experimental condition.

First, there was a significant relationship between the distribution of positive, negative, and zero difference scores between experimental condition 1, the changed memory condition, and the corresponding control condition 4 for both 4-year-olds, $G = .80, z = 2.58, p < .01$, and 10-year-olds, $G = .87, z = 4.19, p < .01$. For both age groups, there were more positive difference scores and fewer negative difference scores in the control than in the experimental condition, indicating that participants were misled in the changed memory condition. This result is consistent with previous research, indicating that changes can be suggested in memory. None of the other gamma statistics on these data were significant. The difference between experimental condition 2, the erased memory condition, and the corresponding control condition 4 was not significant for either 4-year-olds, $G = .62, z = 1.60$, or 10-year-olds, $G = .23, z = .46$. Similarly, the difference between experimental condition 3, the planted memory condition, and the corresponding control condition 5 was not significant for either 4-year-olds, $G = .46, z = 1.17$, or 10-year-olds, $G = .53, z = 1.25$. Thus, although we were able to suggestively influence participants to believe that a different event occurred other than the event that was experienced, we were not effective in suggesting that something occurred when it had not, nor that nothing occurred when it had. That is, it was relatively easier to suggestively change a memory than to suggestively plant or erase a memory.

In terms of the developmental pattern in the above results, it is important to note that the major findings in this study were obtained with both the 4-year-olds and the 10-year-olds; thus, these results do not seem to be age restricted. For both groups, it was relatively easier to suggestively change a memory than to suggestively plant or erase a memory. These results held regardless of the fact that, as can be seen in the group means in Table I, the 10-year-olds were generally more accurate than the 4-year-olds.

A final analysis was conducted to assess the accuracy in answering the general question about touching that was always asked first (i.e., "When I showed you the
picture of the flower on the screen and asked if you could see it, did I touch you?"). Averaged across the three experimental conditions, the percent correct on this question was very low, 35% for 4-year-olds and 46% for 10-year-olds. Even in the control conditions, averaged across the two control conditions, the percent correct on this question was low, 50% for 4-year-olds and 56% for 10-year-olds, and the probability of responding “yes” to this general question was approximately the same whether participants had been touched (p = .32, averaged across both age groups) or not (p = .25). None of these rates was significantly better than the 50% chance level. These results confirm the claim of Goodman and Clarke-Stewart (1991) that although using specifically worded questions may have a suggestive influence, children’s responses to general nonspecific questions tend to be of limited value.

**DISCUSSION**

These results indicate that, although it is relatively easy to suggest to a child a change in a touch that he or she actually experienced, under the conditions employed in this study it is less likely that a completely new touch can be planted in memory or that a touch actually experienced can be suggestively erased from memory. One interpretation of these results is derived from the principle for detecting discrepancies discussed by Hall, Loftus, and Tousignant (1984). According to this principle, “recollections can change only if the subject does not immediately detect discrepancies between postevent information and memory for the original event” (p. 135). Discrepancy refers to the amount of overlapping or shared information between the original and the suggested event. The less the discrepancy between the suggested event and the original event, the more likely it is that the suggested event will replace the original event in memory. Accordingly, it should be relatively easy to suggest that a touch on the hand was really a touch on the shoulder, or that a stop sign was really a yield sign (Loftus et al., 1978), as in such examples the original and suggested events share a significant amount of overlapping information and are thus not highly discrepant.

On the other hand, if an event is retained in memory and later it is suggested that that event did not occur, or if no event is retained in memory and later it is suggested that that event did occur, these are nonoverlapping sets, and as such, the suggested event shares no information with the original event. Consequently, the discrepancy between the original event and the suggested event is likely to be detected. According to the above principle, if the discrepancy between the original event and the suggested event is detected, the suggested event is less likely to replace the original event in memory. This is one explanation for why it was significantly less likely that an event was suggestively planted or erased in memory in this study.

The point of this study is certainly not that it is impossible to suggestively erase or plant events in memory. In fact, a number of studies have demonstrated that under certain conditions it is possible to plant events in memory (Ceci et al., 1994; Hyman et al., 1995; Loftus & Pickrell, in press; Pezdek, 1995). The present study, however, is the first experimentally to examine the probability of suggestively
planting memories relative to the probability of suggestively changing and/or erasing similar types of memory. These results suggest that it is relatively easier to suggestively change a memory for an event that did occur, than to plant an event in memory or erase an event from memory. This comparison is an important one, as the large majority of the prior research on the suggestibility of memory has involved procedures that suggest changes in the memory for an event that actually did occur rather than planting or erasing a whole event in memory.

In generalizing the results from this study, it is important to recognize that there are numerous differences between the situation of the participants in this study and the real-world situations about which children may be testifying in court. In this experiment, there was nothing secretive about the touch, only 15 minutes intervened between the original phase and the suggestion phase, the test questions were administered only once and after only 25 minutes, and the person who tested the participants was the same person who had touched (or not touched) them in the original phase of the study. Most important, this study exclusively assessed memory for touch and only one incident of being touched was included. Further, the conditions of touching in this experiment certainly do not approximate the type of physical contact that occurs in incidents of sexual abuse. However, the conditions of touching used in these experiments do provide a more realistic condition for studying the suggestibility of abuse memories than those used in the classic suggestibility studies that have provided a basis for most of the claims about the suggestibility of memory in general. Further, although there are several impressive examples of experiments that have been conducted in real-world circumstances that approximate the type of physical contact that does occur in incidents of sexual abuse (Saywitz et al., 1991; Goodman, Quas, Batterman-Faunce, Riddlesberger, & Kuhn, 1994), it is ethically difficult if not impossible to study the ease of planting memories for such events. Additional research is necessary to assess the specific role of each of these factors in affecting the relative probability of suggestively changing, planting, and erasing memories.

This study indicates that it is inappropriate to provide courtroom testimony regarding the probability of suggestively planting memories based on the classic suggestibility research that has largely been restricted to the investigation of suggestively changing memories. Expert witnesses who testify in courts of law should be clear to distinguish between the conclusions based on studies that involve suggestively changing memories and those that involve suggestively planting or erasing memories. Although additional research is needed to identify the more precise memory processes involved in suggestively planting events in memory and erasing events from memory, at this point it seems clear that these processes differ in significant ways from the processes involved in suggestively changing previously held memories.

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