

Inhibiting Children's Memory of an Interactive Event: The Effectiveness of a Cover-up

SARA-JAYNE WILLIAMS,^{1*} DANIEL B. WRIGHT² and
NORMAN H. FREEMAN¹

¹*University of Bristol, UK*

²*University of Sussex, UK*

SUMMARY

Children are generally more susceptible than adults to suggestive interview techniques. Children's memories of an event can be altered and added to by presenting post-event information (PEI). What is not known is whether embedding silence about a particular scene within the PEI makes that scene less likely to be reported. Children aged 5–6 years made cakes with an agent 'Mrs Flour'. The following day they received PEI in which a target scene from the original event was omitted, resulting in children reporting the target scene significantly less often than did controls (control = 57% and omit = 23% correct responses). There was direct evidence from the children's language that the omission led to a detriment in memory for the original scene itself. Allowing children to draw during the interview did not reduce the effect. Implications are discussed in terms of child victims and witnesses particularly regarding child sexual abuse. Copyright © 2002 John Wiley & Sons, Ltd.

INTRODUCTION

Human memory is not always accurate, and indeed in certain cases can be quite malleable (Ceci and Bruck, 1993; Bruck *et al.*, 1998; Loftus, 1979). Research using the post-event information (PEI) method has repeatedly shown that both adults' (Loftus, 1979; Loftus *et al.*, 1978) and children's (Ceci and Bruck, 1993) memory can be influenced by information presented after the original event. Details of events can be altered. False memories can be implanted in both children's (see Bruck and Ceci, 1999 for a review) and adults' memory (Loftus and Pickrell, 1995). This evidence presents extreme cause for concern, especially in the area of eyewitness testimony, as both adult (Wells *et al.*, 1998) and child (Bruck and Ceci, 1995) witnesses may confidently provide inaccurate statements, which can lead to wrongful convictions.

Children are not inevitably suggestible in all circumstances. But although it has been shown that adults can be vulnerable to suggestive interview techniques (Ackil and Zaragoza, 1998; Loftus, 1979), children are consistently found to be more so (Ceci and Bruck, 1993; King and Yuille, 1987; Loftus and Davies, 1984). This does not mean that we should disregard children's statements, branding children as incapable witnesses. Rather, it is imperative that we take note of and extend the recent body of research that has found

*Correspondence to: Sara-Jayne Williams, Department of Experimental Psychology, University of Bristol, 8 Woodland Road, Bristol. BS8 1TN, UK. E-mail: Sara.Williams@bristol.ac.uk

children to be competent witnesses, and which attempts to improve the accuracy of children's memory, and their subsequent testimonies.

Although PEI research is abundant, only a single study has to date, appeared in the literature whereby PEI techniques were used to try to make memories of an event less accessible in children's recall. Pezdek and Roe's (1997) pioneering study contained PEI where a target event was denied to have occurred. They explored the relative ease of implanting, changing and 'erasing'¹ the memory of an event involving a touch in children aged four and ten years. Children viewed a series of slides and were either touched or not touched during the presentation of a particular slide. The PEI consisted of a review in which (a) it was suggested that the children were touched when they were not, (b) a different touch to the original was suggested or (c) it was suggested that there was no touch. Children's recall to questions about these targets was compared to controls. It was noticeable that all of the effects were in the predicted directions; accurate memory of the original event was slightly lowered when attempting to add, to change or to erase memories. However, the change condition was the only one to reach statistical significance and the authors concluded that it was easier to change a memory than to implant or to erase a memory.

The present study extends the idea of making a memory less likely to be reported using PEI methodology. In their study Pezdek and Roe (1997) attempted to 'erase' the memory of a touch by presenting PEI in which they suggested that the target scene had not occurred. We believe that the mere suggestion that something did not happen may have triggered the children's memory for that scene. Their study did not contain an omission condition where the target scene was simply omitted from a PEI review; our demonstration below of a strong effect of PEI omission on recall fills this gap in the research.

The present experiment investigated whether children's memory of a scene from an event can be made less accessible by omitting that scene and covering it up during the PEI method, and in particular whether an effect is found when the children actually take part in the event and interact with the experimenter. In line with Pezdek and Roe's (1997) study a 'touching' event was included as one of the target scenes in this study. Children have been shown to be resistant to suggestive interviewing techniques when questioned about personally relevant events, and events that involve a personal touch (Goodman *et al.*, 1991, 1995). However, it has also been shown that children are reluctant to talk about events involving a personal touch (Goodman *et al.*, 1995; Rudy and Goodman, 1991), and that events involving a touch can be under reported by children (Bruck *et al.*, 1998).

If the results of this study suggest that it is possible to make a child's memory of an event less accessible by using the PEI method then this would have important implications in terms of children's witness abilities. It may also provide some explanation to how children may be led to forget events. For example the results may provide more information about effective structuring of the interview process with the aim of accessing memories that have been affected by omitted information. The results of this study may also provide a direction for researching child abuse situations, where touching is involved and an adult abuser fails to discuss it, thereby covering it up. When a child has been abused the abuse is not normally discussed but the events surrounding the abuse may be. If we find that it is less likely that a child will recall a certain scene within an event when only that scene is omitted from a post event review, then this may provide us with an understanding of the situations in which a child fails to recall abuse. It may also provide us with valuable

¹By erasing memory we assume that Pezdek and Roe (1997) refer to memories being made less accessible, as it is impossible to conclude that these memories have been truly erased.

input for the false memory debate, and provide us with greater understanding of the child witness and their capabilities.

We included a further factor. During the interview participants were required either both to draw and verbalise, or to only verbalise their recall. Gross and Hayne (1998) have suggested that the drawing process may cue the child's own recall of the event and may also remove conversational constraints and linguistic demands placed on the children during the interview. Burgess and Hartman (1993) proposed that information is initially processed at a sensory level, and that drawing may extract this type of information. Enabling information to be extracted at this level, without going through linguistic filters that may not be fully developed, may reduce its vulnerability to misinterpretation.

These potential benefits of drawing during the interview may allow young children to provide accurate, detailed and admissible testimony. Butler *et al.* (1995) found that drawing was particularly beneficial for children aged 5–6 years, in response to direct questioning, they found that drawing increased the amount of recall without increasing errors. Other researchers however, have found that drawing does not facilitate the recall of 5–6 year old children (Salmon and Pipe, 2000). In their recent study Bruck *et al.* (2000) reported mixed findings in pre-schoolers. Drawing did not increase recall overall, but that on specifically reminded items children remembered the source of information more accurately. Thus drawing is included here for exploratory purposes. Further, it may be possible to determine whether drawing reduces any of these effects. Thus, two further questions are addressed in this study; does drawing during the interview reduce this effect? and does drawing increase the accuracy and detail of a child's testimony?

Children took part in an interactive cooking task composed of eight scenes. Two target scenes were included. Both were script relevant, the first (recipe book scene) was included as a peripheral non-touch event. In line with Pezdek and Roe's (1997) study, the second critical scene (hand washing) was chosen as a personally relevant, 'touching' event. A touching event was also chosen to enable a comparison between this study and child abuse situations.

To summarize, the main question on which there has been no experimentation is: Does the memory of a scene become less accessible and less likely to be when it is simply omitted from a PEI review of all of the other scenes in the original event? In the event of a positive outcome, a subsidiary question is: Does the facilitative effect of drawing during the interview reduce this effect?

METHOD

Participants

Three Bristol primary schools were contacted by post and were approached for their consent to allow pupils to participate. Parental consent forms were made available to the schools. Seventy-eight children aged 5–6 years ($M = 72.5$ mths: $SD = 3.7$) agreed to participate in this study.

Design

The present experiment used a 3(PEI group: omit, repeat, control) \times 2(interview condition: draw and verbalize, verbalize) mixed design. The PEI group was a within-subject factor. The control group consisted of 26 children who provided responses of both of the target questions (Q3 and Q7) producing a total of 52 responses. The other 52 children

formed the omit and the repeat groups. Half (26) of the children had one of the target scenes (scene 3) omitted from a PEI review and had the other target scene (scene 7) repeated, and the remaining 26 had the opposite (scene 7 omitted and scene 3 repeated in the PEI review). This resulted in the children in the experimental groups being included in both the repeat and omit groups, in relation to the two different target scenes, producing 52 responses in total in both the repeat and the omit conditions. The interview conditions were the between subject variables, and participants were randomly assigned to either a draw and verbalize condition or to a verbalize-only condition.

Procedure

The experimenter spent one morning in each of the three schools, familiarising herself with the children and the school environment. The original event involved children taking part in a cooking activity in small groups (between 6 and 8). The children entered a room in which the disguised experimenter (SJW) introduced herself as a cook called 'Mrs Flour'. Efforts were taken to disguise the experimenter as Mrs Flour (she wore a large hat, glasses, a flowery dress and apron) and the experimenter took on the persona of the cook, encouraging children not to associate her with the experimenter they had seen earlier. She asked the children their names and if they would like to have a tea party. Mrs Flour and the children then discussed what the rules of the activity would be, placing particular emphasis on listening and looking at everything that happened during the cooking time, to ensure that their cakes would taste nice. The participants were asked to find a space around the table where a plastic cup and paper cake case had been placed. All children took part in a scripted cooking event in which they eventually produced a small chocolate cake. The event consisted of a series of eight steps that are detailed in Table 1, each child completed these regardless of their final test conditions. After the cake-making had taken place, the children sat together and had a tea party, before returning to their classrooms. The incident lasted approximately 30 minutes.

PEI was shown to the children on the following day. The PEI conditions included a control group and two experimental groups; an omit and a repeat group. To recap briefly there were a total of 52 children in the omit group, half of these had one of the target scenes (scene 3) omitted and half had the other target scene (scene 7) omitted from the PEI review. If the children had target scene 3 omitted from the PEI review, then the same children had the other target scene, scene 7 repeated, and vice versa.

PEI was presented in a different room to the original event and involved the children watching a short video. The children were reminded of the rules by the experimenter, which were to be very quiet, and to listen to and to watch the video very carefully. Depending on their testing group, the children watched one of three videos, two of these included the same sequence of events that they had been exposed to on the previous day, with the appropriate 'target' event having been omitted using the Adobe Premiere 4.2 computer program. Careful editing ensured that the scenes immediately before and after continued smoothly and that the target scene was covered up. The target events were when Mrs Flour moved her recipe book onto the chair (scene 3 in Table 1), and when Mrs Flour washed each of the children's hands before they ate their cakes (scene 7 in Table 1). These scenes were both relevant to the script of cooking, and were chosen due to the difference in touching. The control group also watched a short video, for the same amount of time. This shared no similarity with the original event, and consisted of a short song about the alphabet (*Fun with ABC*, 1997).

Table 1. The eight scenes which comprise the cooking event

Scene	Mrs Flour's speech	Actions
1	Hello children, come in and sit down. Today I thought it would be fun for us to make chocolate crispie cakes together. Would you like to do that? OK, then we can have a tea party together. The most important thing now is that you must listen very carefully to everything I say so that our cakes will taste nice.	Mrs Flour is sitting in the room, the children come in and stand in a circle around her.
2	The first thing we have to do is to put an apron on so that our clothes don't get dirty.	Child puts on an apron and Mrs Flour ties it up.
3	I'll just put my recipe book on to this chair.	Mrs Flour moves the recipe book onto the chair.
4	I'd like you to pour some rice crispies into your cup. I have the big bowl here and I'd like you stand in a line and come and pour your cup of cereal into this bowl.	Children bring their cups, Mrs Flour fills them with rice crispies. Children pour contents into main bowl.
5	I'm going to pour this melted chocolate into the bowl because it is hot. I'd like each of you to come up and give the mixture one big stir.	Mrs Flour pours the chocolate into the bowl. The children stir the mixture once.
6	We will put the cakes onto this tray by our names and leave them to cool down while we set the table.	Mrs Flour points to a tray, with the children's names on, and the children put the cakes onto the tray.
7	Now we must wash our hands before we eat the cakes, so if you come over here I will wash them for you.	Mrs Flour washes and dries the children's hands.
8	Now we can have our tea party.	Children sit around the table and have their tea-party with their cakes and drinks.

The children returned to their classroom and after a short delay were called out individually to take part in the interview session. The interview took part in a different room to the original cooking event and to the room where the PEI video was shown in order to eliminate any context effects during recall (Priestly *et al.*, 1999). Children were assigned either to a 'draw and verbalize' or to a 'verbalize' interview condition. It was made clear to the children that it was acceptable to say 'don't know' if they did not know the answer to a question and that they would move onto the next question. It was essential that the children felt that they could say that they did not know the answer to a question, for this purpose a confidence scale was included in this study. Children were required to report their level of confidence in their response to a question by choosing high, middle or low confidence levels that were represented by different sized toy blocks. The children were trained in the use of the confidence scale and chose the low confidence level block to indicate that they did not know the answer to a question. The inclusion of a confidence scale also served to remove any linguistic pressure that the children felt in admitting that they did not know the answer to a question. The main purpose of the confidence scale was to allow children to report that they did not know the answer to a question; thus any analysis of children's confidence is not included in this study.

Children in the draw and verbalize condition were asked to draw everything that they could remember about making cakes yesterday and to tell the experimenter about everything in their drawing, only the child's verbal recall was scored. Children in the

Table 2. The eight direct questions given to the children following the free recall stage. The critical questions were 3 and 7

<i>Can you draw and tell me/or tell me:</i>		
No.	Question	Answer
1	What Mrs Flour was wearing when she made some cakes with you?	HAT
2	What you had to put on when you made the cakes with Mrs Flour?	APRON
3	What Mrs Flour did with her recipe book?	PUT ON CHAIR
4	What you used to pour the rice crispies into?	CUP
5	What Mrs Flour poured into her big bowl with the rice crispies?	CHOCOLATE
6	What you put the cakes onto to let them cool down?	TRAY
7	What Mrs Flour helped you to do after you had made the cakes?	WASHED HANDS
8	What you did with the cakes in the end?	ATE THEM

verbalize condition were asked to tell everything that they could remember. All interviews were audiotaped. During free recall the experimenter provided little input other than repeating the children's recollections, and asking 'anything else?'

After spontaneous free recall, the children were told that they would be asked a series of questions. The children were then asked 8 direct questions (see Table 2), including two questions that related to each of the target scenes (question 3 and question 7, in Table 2). Children assigned to the 'draw and verbalize' group continued to both draw and to verbalize their response, and children in the 'tell' group recalled the answer to the direct questions by verbalizing their answer. All verbal recall was recorded by the experimenter on a score sheet. When the questioning phase had finished, the experimenter thanked the children and gave them a sticker. Afterwards, children were debriefed by the experimenter, who told them that they had helped her to understand about what children remember and that they had been very helpful.

Scoring

For free recall, a detail (action, person, place, object) that was present during the original cooking event was scored as one correct memory point. For example, 'then we stirred it up, then we put melted chocolate in and then put them in our cake cases' would be given four correct memory points for reference to stirring, melted, chocolate and cake cases. Errors of commission, for example 'we put them in the oven', were scored as an incorrect memory point.

Answers to the direct questions were coded as either correct, incorrect or don't know. Correct target answers are listed in Table 2. The incorrect answers were further investigated to identify whether they may be considered correct, had a correct answer not been previously identified. We present the frequency of commission and omission errors in the results section.

Five independent raters, all developmental psychologists with extensive experience, were instructed to consider the scenes in the event and to rate the questions and answers and determine their salience for children's recall. There was 100% agreement between the raters and two clear groups emerged, questions 1, 5, and 8 were classified as highly salient, and questions 2, 5, and 6 were classified as less salient questions.

In order to be certain that the children were reporting events from their own experience and not reporting information extracted from the video we also scored children's use of first-person pronouns in their recall (e.g. I, which would denote the original event in which

the child participated) as distinct from the third person (which would denote the adult who acted out the child's part in the video).

RESULTS

Participants were required either to verbalize and draw, or to verbalize, everything that they could remember about the previous day's interaction with Mrs Flour. Responses were analysed to identify any facilitative effect of drawing as the literature suggests (Butler *et al.*, 1995; Gross and Hayne, 1998). Responses to the two direct target questions were analysed primarily to assess whether these memories are less accessible as a result of them not being shown during PEI, and also to determine whether there was an effect of interview technique.

Conforming to task demands

It is important to start by eliminating the possibility that children are recalling what they remember from the PEI videos instead of from their memories of the original event. If we find that children report the omitted target scenes less often than they might do so because they remember not seeing the target event in the video and choose not to recall this. The evidence comes from the design feature whereby in the original event the child takes part in the cooking event, and in the video the child's part is acted out by a female confederate and is therefore a third party. Reassuringly, during all of the recall protocols there was not a single use of a third person pronoun. Each child used first person pronouns, and used them continuously throughout their recall (except for three children who did not use pronouns at all, and it so happened that each of these three were in the three different PEI groups). Children's recall also included details from that particular child's experience, for example mentioning the other children who were in the same group, the fact that they took turns to stir, etc. We conclude therefore that the children were reporting from the original event.

A further issue was whether children associated the experimenter with the cook from the original event, 'Mrs Flour'. Not one child used the term 'you' to refer to Mrs Flour while they provided recall during the interview. This confirms that the children's responses were not confounded by any association between the fictional character from the original event and the experimenter.

Free recall

The numbers of correct and incorrect details were calculated for each participant. A 2(interview condition: draw and verbalize versus verbalize) \times 3(PEI: control versus 2 experimental groups) analysis of variance revealed a main effect of interview condition ($F(1, 72) = 4.36, p = 0.04$), suggesting that drawing has a facilitative effect on free recall (see Figure 1).

Accuracy in free recall by both the control and the experimental groups was very high. There were very few incorrect responses to the free recall question (only four in the verbalize condition and one in the draw and verbalize condition). None of these related to the target scenes. Recall of the target scenes during free recall was minimal, not one child reported the recipe book being moved onto the chair, and only 12 reported that their hands had been washed during the free recall stage across the conditions.

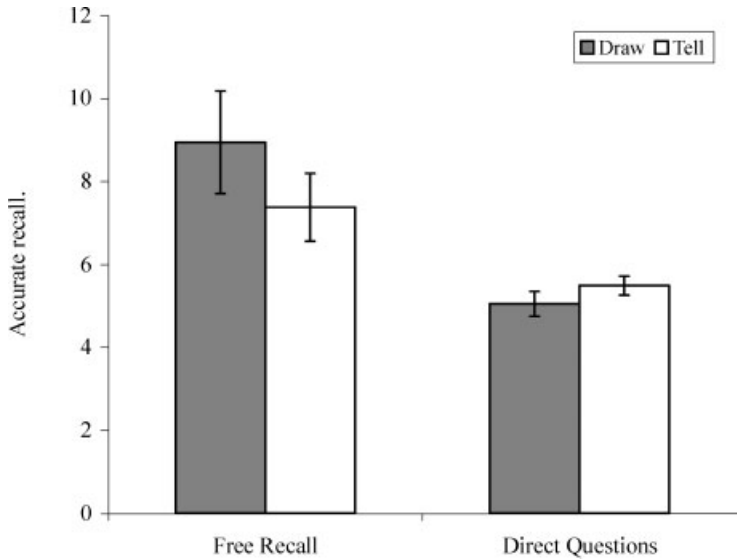


Figure 1. The means and 95% confidence level of correct responses elicited in the draw and tell interview conditions in the free and direct questioning phases. The direct questions include only the non-critical questions for each group

Direct questioning

The responses to the eight direct questions were coded as correct, incorrect or don't know. Children were asked 6 non-critical questions. Overall, accuracy was high ($M = 5.05$, $SD = 0.92$) correct responses in the draw and verbalize group, and ($M = 5.49$, $SD = 0.72$) in the tell group). Responses to the non-critical questions were then analysed according to the experimental and control groups. Highly salient questions 8, 5 and 1 produced few differences in responses between the experimental groups who had all of the non-critical scenes repeated during PEI and the control group who had nothing repeated. All children were extremely accurate in responding to the questions indicating that these scenes were particularly well remembered (see Figure 2). For less salient non-critical questions 2, 4 and 6, the control group was less accurate than the two experimental groups (see Figure 2). The repetition of these scenes during PEI increased the likelihood that the children would recall them, compared to children who had only experienced these scenes during the original event. Although all of the effects were in the expected directions; the experimental groups were more accurate than the control group, the differences between the control and experimental groups were small (see Figure 2).

We now consider the two target questions 3 and 7. Responses from the group that had the target scenes repeated during PEI were compared to the control groups' responses. We expected that the pattern of results would be analogous to that of the non-critical questions as both involve comparing a group who had a scene repeated against a control group who had nothing repeated. The control group were less accurate in responding to the target questions than the experimental group who had the target scene repeated during PEI ($\chi^2(1, N = 52) = 1.30$, $p = 0.26$) for question three (recipe book scene) and ($\chi^2(1, N = 52) = 0.79$, $p = 0.38$) for question 7 (handwashing scene). This replicates the results of the less salient non-critical questions.

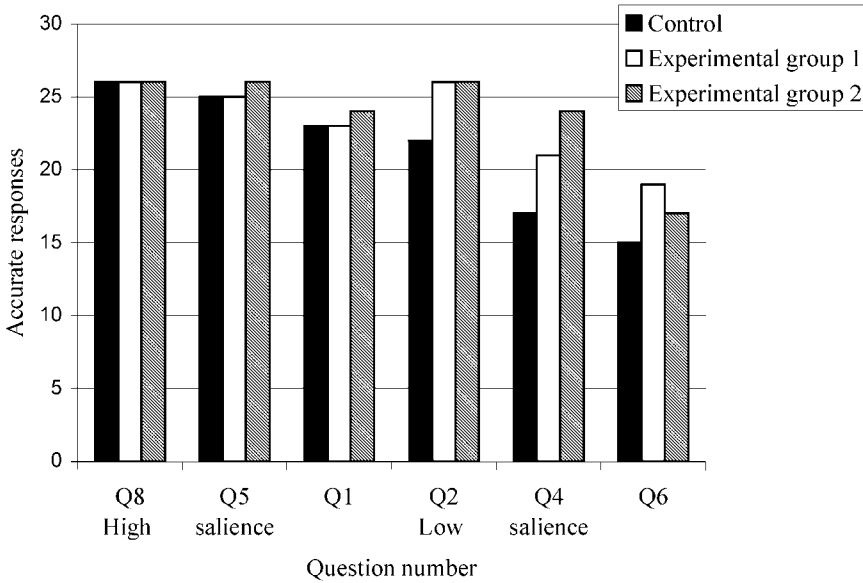


Figure 2. Correct responses to the non-critical direct questions, grouped by their salience. Questions 8, 5 and 1 are considered highly salient questions and questions 2, 4 and 6 are less salient questions. There are no differences between the two experimental groups, as both receive a PEI review in which all of the scenes relating to these questions are repeated. The control group do not have any scenes repeated during PEI

Our main interest was in the two target questions (3 and 7, see Figures 3 (a) and (b)), and specifically whether omitting a scene from the PEI review of the original event induces this scene to be recalled less. If a participant saw the PEI with the recipe book scene omitted their data were included as 'omit' for their response to the recipe book question, and included in the 'repeat' group for their answer to the handwashing question (and vice

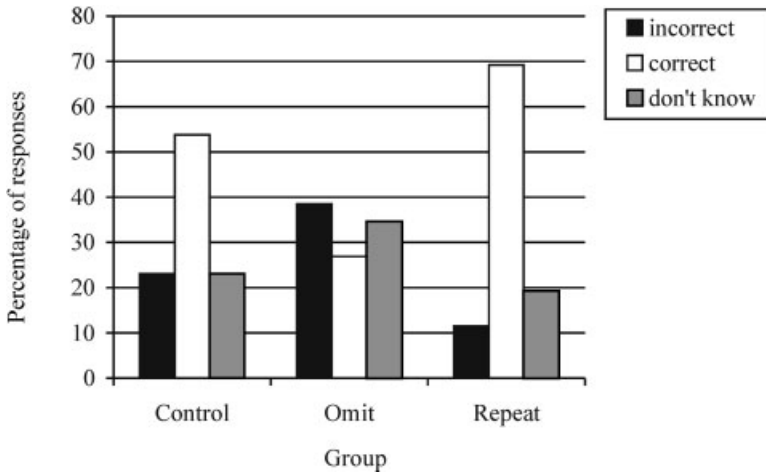


Figure 3 (a). Distribution of percentages of correct, incorrect and don't know responses to the target question relating to the recipe book question by the experimental groups (repeat and omit) and the control group

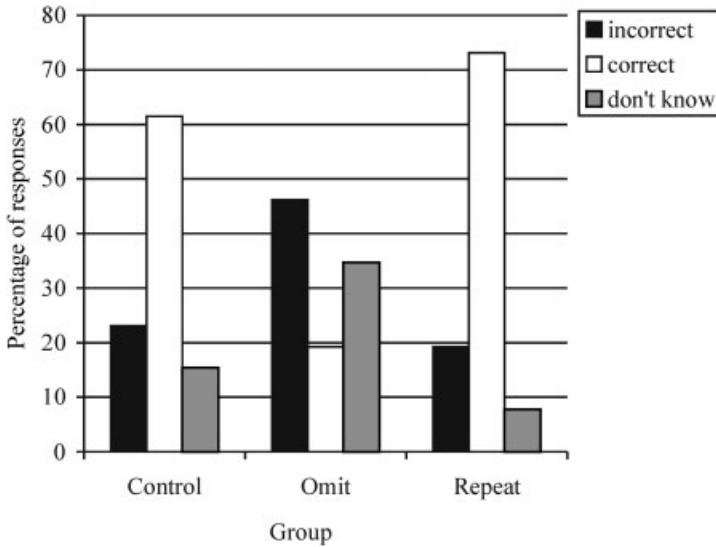


Figure 3 (b). Distribution of percentages of correct, incorrect and don't know responses to the target question relating to the handwashing question by the experimental groups (repeat and omit) and the control group

versa; if the handwashing scene was omitted then the recipe book scene was repeated during PEI). The control group's responses to both questions were used for both comparisons. Logistic regressions indicated that children were less likely to recall the target scenes correctly when they had it omitted during PEI ($\chi^2(1, N = 104) = 12.25, p < 0.01$), in comparison to the control group who had nothing repeated during PEI.

The global analysis is most informative and indicates that children can be induced to not report a target by omitting it from a PEI review, however to ensure a robust result, question by question analyses was carried out on the two target direct questions. Responses to the target questions from children in the control group who had nothing repeated in PEI, were compared to the responses to the target questions from children who had only the target scene omitted from the review. Children were less likely to respond to the target question correctly when it was omitted from the PEI review for the non touching, peripheral target scene (recipe book; question 3) compared to the control group, ($\chi^2(1, N = 52) = 3.91, p = 0.048$). The pattern was replicated for responses by the omit and control group to the 'touching' target scene (handwashing; question 7), ($\chi^2(1, N = 52) = 9.67, p = 0.002$) (see Figures 3 (a) and (b)). This confirms that there has been some degree of inhibition. The control group who witnessed no shared information with the original scene in PEI were more accurate in response to the target questions than the children who witnessed all of the original scenes in PEI except from the target scene (see Figures 3 (a) and (b)).

There were no significant interactions between the PEI groups and the two interview conditions draw and verbalize and verbalize only, indicating that drawing during the interview did not influence the potential to inhibit memory. There were little differences between the correct responses to the recipe book question (27% correct) and to the handwashing question (19% correct). The handwashing and recipe book scenes also revealed no significant interactions with either the interview condition or with the

experimental groups. Thus, we can conclude that the presence of a touch had little effect on the potential to inhibit a memory.

Finally, we consider the nature of the incorrect responses. Had a correct response not been identified prior to the interview then a different answer to the questions may have been considered correct. In total there were 72 incorrect responses. Of these only 9.7% could have been considered an alternative correct response, as they were included in the original event. The remaining incorrect responses were mostly errors of commission; for example in response to question 3, 'Can you remember what Mrs Flour did with her recipe book?' children responded, 'she read it'. This suggests that children are not replacing the original memory with something else that occurred during the original event, but that they are inputting information that is probably associated with their individual scripts to answer the questions.

DISCUSSION

The main focus of this study was whether a memory of a scene would be less likely to be reported by children, if only that scene was omitted during PEI. Results revealed that it is possible to reduce the likelihood that a child reports a scene from the original event, if that scene is not presented during PEI. While this was predicted based on work with adults (Wright *et al.*, in press), other studies have reported no significant effects for 'erasing' memory in children (Pezdek and Roe, 1997). If other parts of the scripted event are reinstated it may be expected that this would lead to the target event being *more* likely to be recalled (Priestley *et al.*, 1999). Here, the target memory was less likely to be reported by the repetition of the non-target events and the omission of the target scene during PEI.

The results can be explained using the activation spread model (Ayers and Reder, 1998) coupled with Anderson and colleagues' findings on retrieval induced forgetting (Anderson *et al.*, 1994; Anderson and McColloch, 1999; Anderson and Spellman, 1995). The original information is presented and connections are formed in memory during the original cooking event. The information that is shown during PEI further positively activates those items, and accordingly participants remember this information more accurately than do participants in the control group. However the excitation of these re-presented scenes inhibits the activation of the target scene, which is omitted in PEI, making it less likely to be recalled.

We can apply the results of this study to children's eyewitness testimony and in particular, to cases of child sexual abuse. For example, if a perpetrator of abuse continues to talk to a child about events surrounding the abuse, but omits the abusive event, then this memory may become less likely to be reported when children are asked directly about it. This comparison is made stronger because the handwashing scene was included in this study and it involved a 'touch', to which children have been shown to recall accurately (Goodman *et al.*, 1995). However, the results revealed that it was possible to induce the children to not report a touching event by omitting it from a PEI review compared to the control group, suggesting that this could also be the case with abusive events that are not discussed.

To assess whether the children were recalling information from the original event or from PEI we presented children's use of first person pronouns during recall. The children consistently recalled information using personal pronouns and therefore we concluded that they were recalling from the original event. Children also included information unique to

their own experience. The lack of differences between the control group who had no other information other than the original event and the repeat groups responses also suggests that they were recalling from the original event because the control group had no original information represented during PEI. Finally, children will usually make a response if they possibly can in order to please an adult figure (Ceci and Bruck, 1993), so we can assume that if the children remembered the target scene from either the original event or from the PEI that they would have provided a response.

Drawing during the interview did not influence the main findings of omitting a scene during PEI. Children were equally as likely to not report the target scene when asked directly about this scene if it was omitted during PEI regardless of whether they drew during the interview or not. This again strengthens the impact of this data and its' applications, as drawing during the interview has been shown to increase children's recall and accuracy (Butler *et al.*, 1995). However, it also raises an important question that deserves further research. We have shown that it is possible to make a memory less likely to be reported and although this has benefits on the understanding of the child witness, it is not desirable that children's testimonies contain these types of errors. We found that drawing during the interview did not negate the effect of omission, we therefore need to determine how inaccessible these memories have become; we are currently investigating this. Attention should also be focussed on finding ways to combat the effect of the deliberate omission of information on children's ability to recall events accurately.

Drawing has been suggested as a possible recall aid during interviews with 5–6 year old children (Butler *et al.*, 1995). Here, drawing during the interview increased the amount of information reported during free recall, without increasing the numbers of inaccuracies. This may be because children spent more time in the interview and therefore the quantity of their recall increased. Children may have felt more comfortable and in control of the interview process when drawing. Children generally report little information during free recall due to their reliance on external retrieval cues. The visual representation of their drawing may have served as a retrieval cue and stimulated children's own related memories and increased their recall, (Gross and Hayne, 1998). There were no differences between drawing and telling for the direct questions, and accuracy was very high for both groups. This is a different result from that of Butler *et al.* (1995), who found a facilitative effect of drawing during direct questioning. A likely reason for this is the difference in coding, and question structure.

In summary, when a child experiences an event, they may encounter PEI about that event afterwards. If the PEI does not include information about one particular aspect of the event, then the child is less likely to remember this aspect than if she or he had not encountered the PEI. This has important ramifications for both psychological theory and applications. With respect to theory, it shows that memories for real scenes can be made less accessible. This can be explained from the literature based mainly on work with adults (Anderson *et al.*, 1994). The current study extends these findings to children in an eyewitness context, with a real interactive event. With respect to applications, the findings are important for both eyewitness testimony and the recovered memory debate. We urge further research based on understanding the circumstances in which both children and adults can be accurate witnesses.

It is important that children's testimonies do not contain errors resulting from this omission effect. We have shown how children fail to include some information in their testimony, and as this is a new finding it opens up many questions. For example, how inhibited have the memories become? We are currently investigating this. Also, can

strategies be employed whereby children will be more likely to recall previously inaccessible memories? We are currently looking into the use of object cues during the interview to re-access the memories affected by the omission of information.

ACKNOWLEDGEMENTS

This study is part of the PhD research of the first author, and is supported by the Odin Charitable Trust fund scholarship. We acknowledge Zoe Roberts and Sarah Croasdell for assistance with the stimulus materials, and Leigh Riby for his comments in the final stages of this study.

REFERENCES

- Ackil JK, Zaragoza MS. 1998. Memorial consequences of forced confabulation: age differences in susceptibility to false memories. *Developmental Psychology* **34**: 1358–1372.
- Anderson MC, McCulloch KC. 1999. Integration as a general boundary condition on retrieval-induced forgetting. *Journal of Experimental Psychology: Learning, Memory, and Cognition* **25**: 608–629.
- Anderson MC, Bjork RA, Bjork EL. 1994. Remembering can cause forgetting: retrieval dynamics in long-term memory. *Journal of Experimental Psychology: Learning, Memory and Cognition* **20**: 1063–1087.
- Anderson MC, Spellman BH. 1995. On the status of inhibitory mechanisms in cognition: memory retrieval as a model case. *Psychological Review* **102**: 68–100.
- Ayers MS, Reder LM. 1998. A theoretical review of the misinformation effect: predictions from an activation-based memory model. *Psychonomic Bulletin & Review* **5**: 1–21.
- Bruck M, Ceci SJ. 1995. Amicus brief for the case of state of New Jersey v. Michael's presented by committee of concerned social scientists. *Psychology Public Policy and Law* **1**: 272–322.
- Bruck M, Ceci SJ. 1999. The suggestibility of children's memory. *Annual Review of Psychology* **50**: 419–439.
- Bruck M, Ceci SJ, Hembrooke H. 1998. Reliability and credibility of young children's reports. *American Psychologist* **53**: 136–151.
- Bruck M, Melnyk L, Ceci SJ. 2000. Draw it again Sam: the effect of drawing on children's suggestibility and source monitoring ability. *Journal of Experimental Child Psychology* **77**: 169–196.
- Burgess AW, Hartman CR. 1993. Children's drawings. *Child Abuse and Neglect* **17**: 161–168.
- Butler S, Gross J, Hayne H. 1995. The effect of drawing on memory performance in young children. *Developmental Psychology* **31**: 597–608.
- Ceci SJ, Bruck M. 1993. Suggestibility and the child witness: a historical review and synthesis. *Psychological Bulletin* **113**: 403–439.
- Gee S, Pipe ME. 1995. Helping children to remember: the influence of object cues on children's accounts of real events. *Developmental Psychology* **31**: 746–758.
- Goodman GS, Bottoms BL, Schwartz-Kenney BM, Rudy L. 1991. Children's testimony about a stressful event: improving children's reports. *Journal of Narrative and Life History* **1**: 69–99.
- Goodman GS, Sharma A, Thomas SF, Conside MG. 1995. Mother knows best: effects of relationship status and interviewer bias on children's memory. *Journal of Experimental Child Psychology* **60**: 195–228.
- Gross J, Hayne H. 1998. Drawing facilitates children's verbal reports of emotionally laden events. *Journal of Experimental Psychology: Applied* **4**: 163–179.
- King M, Yuille J. 1987. Suggestibility and the child witness. In *Children's eyewitness memory*, Ceci SJ, Toglia MP, Ross DF (eds). Springer-Verlag: New York; 24–35.
- Koriat A, Goldsmith M. 1996. Memory metaphors and the real life/laboratory controversy: correspondence versus storehouse conceptions of memory. *Behavioral and Brain Sciences* **19**: 167–228.

- Loftus EF. 1979. *Eyewitness Testimony*. Harvard University Press: Cambridge, MA.
- Loftus EF, Davies GM. 1984. Distortions in the memory of children. *Journal of Social Issues* **40**: 51–67.
- Loftus EF, Miller DG, Burns HJ. 1978. Semantic integration of verbal information into visual memory. *Journal of Experimental Psychology: Human Learning and Memory* **4**: 19–31.
- Loftus EF, Pickrell JE. 1995. The formation of false memories. *Psychiatric Annals* **25**: 720–725.
- Pezdek K, Roe C. 1997. The suggestibility of children's memory for being touched: planting, erasing, and changing memories. *Law and Human Behaviour* **21**: 95–105.
- Priestley G, Roberts S, Pipe ME. 1999. Returning to the scene: reminders and context reinstatement enhance children's recall. *Developmental Psychology* **35**: 1006–1019.
- Rudy L, Goodman GS. 1991. Effects of participation on children's reports-implications for children's testimony. *Developmental Psychology* **27**: 527–538.
- Salmon K, Pipe ME. 2000. Recalling an event one year later: the impact of props, drawing and a prior interview. *Applied Cognitive Psychology* **14**: 99–120.
- Video: Fun with ABC*. 1997. (Available from Carlton Home Entertainment Limited.)
- Wells GL, Small M, Penrod S, Malpass R, Fulero S, Brimacombe C. 1998. Eyewitness identification procedures: recommendations for lineups and photospreads. *Law and Human Behaviour* **22**: 603–647.
- Wright DB, Loftus EF, Hall M. in press. Now you see it; now you don't: inhibiting recall and recognition of scenes. *Applied Cognitive Psychology*.