

Reminiscence and hypermnesia in children's eyewitness memory.

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Abstract

Three experiments examined reminiscence and hypermnesia in children's memory for an event across repeated interviews that occurred either immediately afterwards (Experiment 1) or after a 6-month delay (Experiments 2 & 3). Reminiscence (recall of new information) was reliably obtained in all of the experiments, although, the number of new items recalled were fewer after a delay than when the interviews occurred immediately. Hypermnesia (increasing total recall over repeated recall attempts) was obtained only in Experiment 1 when interviews occurred immediately and 24 hours after the event.

Key words: Memory, Eyewitness testimony, Reminiscence, Hypermnesia, Repeated interviewing.

Reminiscence and hypermnesia in children's eyewitness memory.

Both laboratory-based studies and applied eyewitness memory studies indicate that repeated retrieval attempts can lead to reminiscence (the recovery of new information) and hypermnesia (increases in recall across several recall attempts) under certain conditions. Despite their obvious benefits, there has been no research that directly examines these phenomena in children's eyewitness memory. This may be in part due to the controversy surrounding repeated interviews in real-world contexts. In particular, some researchers have argued that repeated interviews could be used as a means to introduce suggestive information, and that inconsistencies across repeated retellings of the same event may reduce the credibility of the child's testimony. In so far as open-ended interviews typically yield accurate information from young children, however, repeated open-ended interviews may lead to reminiscence and hypermnesia in children's eyewitness memory. In the present study, we examined repeated open-ended interviews following both short and long delays with children recalling a witnessed event.

Reminiscence and hypermnesia have both typically been found with adults following a procedure originally developed by Erdelyi and Becker (1974). Participants in a typical hypermnesia experiment view a set of to-be-remembered items presented as either pictures or words. Once all the items have been presented, the participants are instructed to recall as many of the items as they can remember. The participants then receive two further tests, again recalling all items they can remember. In each test, the participants are usually required to make a fixed number of responses even if it means guessing. The results of studies using this procedure have shown that the correct recall of pictures (Erdelyi & Becker 1974; Roediger, Payne, Gillespie & Lean, 1982; Shapiro &

Erdelyi, 1974), and words, if visualized (Erdelyi, Finkelstein, Herrell, Miller & Thomas, 1976; Henkel, 2004) increases across trials whereas errors do not systematically increase. More recently, Kern, Libkuman and Otani (2002) have found that when negatively arousing pictures were used as stimuli, a greater amount of hypermnesia was obtained than with non-arousing pictures.

However, there may be minor tradeoffs against the increases in recall. Henkel (2004) found that across repeated recall trials the ability to correctly decide whether the to-be-remembered stimuli were originally presented as pictures or words decreased, especially when the participants were unaware that they would be later tested on the source. Shaw, Bjork, and Handal (1995) found retrieval-induced forgetting; across repeated tests the probability of recalling additional related information was less than that of recalling unrelated information. Kelley and Narine (2003) have shown that memory for the order in which words from a list are recalled decreases across repeated testing. Of particular interest to eyewitness memory research is how the costs and benefits observed for repeated testing in laboratory studies translate into applied contexts.

A few applied studies have used realistic events, and provide direct evidence confirming the predictions of the laboratory research. One of these applied studies of hypermnesia focused on the events of the widely televised O.J. Simpson verdict (Bluck, Levine, & Laulhere, 1999). Eight months after the verdict announcement, the adult participants were asked to recall the events surrounding the verdict three times in response to open-ended free-recall cues, during a 1-hour recall session. Bluck et al. (1999) found that the recall of correct information increased between the first and third trials. There were no simultaneous increases observed for errors across the recall

attempts. Using an analogue paradigm, Dunning and Stern (1992) investigated hypermnesia in undergraduate students' memory for a 4-minute video tape of a violent crime. As in Bluck et al. (1999), the participants were asked for three free-recall accounts. The results were clear; recall increased monotonically as the number of recall attempts increased, indicative of hypermnesia. Errors did not increase significantly across the successive recall attempts. Scrivner and Safer (1988) also examined recall across repeated interviews of a violent, 2-minute, video clip. Their results showed that the number of details that the participants wrote down increased across each recall attempt. Although there was a significant increase in the number of errors, it was small; the mean number of errors increased by only a half an error from the first to fourth trials. Scrivner and Safer (1988) concluded that just because initial memory reports are incomplete does not mean that the omitted information has decayed permanently from memory. Bornstien, Liebel, & Scarberry (1998) examined hypermnesia for an emotionally arousing event. Although they did find hypermnesia, they did not find evidence of a greater amount of hypermnesia for the arousing event. Errors increased over trials but this increase, although significant, was very small, only a 1% increase between the first and third recall test.

Turtle and Yuille (1994) in contrast, found no evidence of hypermnesia for memory of a 4 ½-minute video of a crime. The absence of hypermnesia in their Experiment 1 may be due to the more stringent criterion that Turtle and Yuille (1994) used; they defined hypermnesia as increases in net recall which was, 'the number of details listed in one attempt minus the number lost since the last recall attempt, pp 264.' Demonstrating hypermnesia using this measure depends not only on how much is

recalled in one attempt, but also on how much is repeated from that last attempt. The absolute amount recalled recall is, in effect, moderated by the amount that is not repeated from the preceding trial. Using this unusual measure, hypermnesia as defined in other studies may not have been detected.

The convergence of the patterns of results based on applied and laboratory studies is compelling, even though the applied research has employed to-be-remembered stimuli that are more complex (e.g., a televised event and video clips) than the lists of words and pictures used predominantly in the laboratory research. In two of the applied studies, the participants were required to recall all they could remember in response to open-ended verbal invitations, the first to examine hypermnesia in a setting analogous to an eyewitness interview (Bluck et al., 1999; Dunning & Stern, 1992). Interestingly, the hypermnesia effects obtained in the applied studies were not associated with an increase in errors (Bluck et al., 1999; Dunning & Stern, 1992), or with only a very small increase in errors (Bornstien et al., 1998; Scrivner & Safer, 1988). This finding is consistent with laboratory research that shows that hypermnesia effects are not necessarily at the expense of accuracy. One inconsistency concerns emotionally arousing stimuli. Kern et al. (2002) found a stronger effect of emotionally arousing stimuli in a laboratory study while in an applied study, Bornstein et al. (1998) did not.

With respect to children's memory, there are only a handful of studies that have directly examined hypermnesia, whether in the laboratory or real-world analogues. Early research conducted by Ballard (1913), and Ammons and Irion (1954) investigated hypermnesia in twelve-year-old children. The children in their studies were asked to memorize poetry in a short space of time and to then recall it. Their results demonstrated

that the average number of lines of poetry recalled increased between an immediate recall test and one repeated two days later. As in the adult studies, they demonstrated that there was more information in memory than that elicited in any single recall attempt. Paris (1978), using a laboratory procedure, demonstrated that 8- and 12-year-old children's memory for a list of words increased between three recall attempts that were separated by delays of minutes. Howe, Kelland, Bryant-Brown and Clark (1992) also examined memory for word lists in 7½ and 10-year old children. They observed hypermnesia across four consecutive recall trials separated by delays of minutes and conclude that the repetition of recall was the critical factor in hypermnesia. They also found that there was no difference in the magnitude of the hypermnesia effect for the two age groups studied. However, the effect was stronger when children were tested at a delay of 2 days compared with longer delays of 16 and 30 days.

Dent and Stephenson (1979) have provided indirect evidence that hypermnesia may occur in children's eyewitness memory. In their study 10- and 11-year old children recalled more details about a film in an interview conducted after 24-hours compared with one conducted immediately after seeing the film, without an increase in errors. However, recall did not increase further in interviews conducted at 2-week and 2-month delays. In a second experiment, they obtained a similar finding when children were tested in immediate, 24-hour, and 48-hour interviews. This increase in recall was observed only when children responded to free-recall requests for information, or to general questions about what had happened. Children who were interviewed with specific questions did not show any increase in recall. However, Dent and Stephenson (1979) did not make specific comparisons across each of the interviews to specifically test for hypermnesia. Henry and

Gudjonsson (2003) examined hypermnesia in the eyewitness memory of 11- and 12-year-old children with and without intellectual disabilities. The eyewitness event was performed in the children's classrooms and consisted of a performance by an actor about school life 100 years ago. After the event, the children were interviewed about what they could remember with an open-ended interview protocol, immediately and 2 weeks later. The results showed that recall increased for children with intellectual disabilities across the two interviews, but not for intellectually age-matched children.

Even when not demonstrating hypermnesia, children may, nonetheless, recall new information across repeated recall attempts. When the level of recall decreases over time, it does not necessarily follow that the same information is simply repeated from interview to interview, minus information that is forgotten. Reminiscence has been observed in children's reports about past events in many studies, examining, specifically, the individual pieces of information reported across interviews, to see whether they are new or repeated from a previous interview (e.g., Baker-Ward, Gordon, Ornstein, Larus & Clubb, 1993; Fivush & Hamond, 1989; Hudson & Fivush, 1991; Pipe, Gee, Wilson & Egerton, 1999; Salmon & Pipe, 1997; Salmon & Pipe, 2000). These studies have generally found that new correct information can be recovered in later interviews, and added to children's accounts. However, a primary issue surrounding the introduction of newly reminiscenced information is the accuracy of the new information (Salmon & Pipe, 1997). A consistent finding has been that new information is less accurate than information consistently reported across interviews (Salmon & Pipe, 1997; Salmon & Pipe, 2000). As these studies examined new information added to accounts after lengthy

delays between interviews, relatively little is known about the accuracy of new information added to children's accounts after short delays between interviews.

The three studies that we present here are unique as they are the first to examine systematically how the concepts of reminiscence and hypermnesia can help in our understanding of children's eyewitness memory. We used an ecologically valid event and ecologically valid timeframes between interviews; the event was a 'pirate visit' (originally devised by Murachver, Pipe, Gordon, Owens & Fivush, 1996), and delays were 1 day and 6 months for the free recall interviews. This design permitted us to examine reminiscence and hypermnesia both when little forgetting had occurred, immediately after the event, and when a significant amount of forgetting had occurred, 6 months after the event (see Jones & Pipe, 2002). The children's recall was elicited through open-ended verbal recall interviews.

In the analyses, we evaluated the costs and benefits of repeated interviewing by comparing the number of correct details and the number of errors that were made in the interviews. Evidence of hypermnesia was measured as an increase in the total amount recalled across successive interviews. Reminiscence was measured as the cumulative recall of new details across repeated interviews, that is, the number of correct details from the first interview plus new details from the subsequent interview(s) (Bluck et al., 1999). These two measures allowed us to separately assess the absolute amount of information reported across multiple interviews (hypermnesia) as well as whether multiple interviews, taken together, provide an increasingly greater amount of new information than that obtained in a single interview (reminiscence).

Experiment 1

Experiment 1 examined reminiscence and hypermnesia in children's eyewitness memory immediately and 24 hours after an event when little forgetting had taken place and recall was expected to be at its greatest. An additional variable considered was whether being forewarned of an upcoming interview would affect hypermnesia. Knowing that an interviewer will return to ask for more information may result in witnesses thinking about further items of information in between, in turn resulting in a greater amount of hypermnesia. Thus, half of the children were forewarned that there would be a repeated interview and half were not.

Method

Participants

The participants were 40 children of European extraction (20 males and 20 females) recruited from local primary schools in Dunedin, New Zealand. The mean age of the children at the time of the event was 6 years and 1 month ($SD = 4 \frac{3}{4}$ months). The caregivers of the children agreed in writing to their child's participation, and each child was a willing participant.

Materials

Four panels (120 cm wide and 180 cm high) were arranged with a large painting of a pirate setting comprising the backdrop. Set out in front of these were a sail, drum and sticks, waist coat, name book, skeleton pen, brown box, waist coat, table and cloth, water jug, jar for dye, eyedropper, bowl, paint brush, map paper, red box, poem, parrot in a cage, bird seeds and scope, telescope, steering wheel, key, treasure map, spade, barrel of

polystyrene chips, treasure chest, padlock, gold bars and coins, and wooden cutout of a boat.

Procedure

A researcher escorted the children individually from their class and introduced them to the 'friendly pirate' who was dressed in blue and white striped pants, a blue top, purple waist coat, and a red sash. After the introductions, the pirate and child performed 20 event activities together. The event ended when the child found a treasure chest, inside which was an inexpensive gift that the child kept as a token of the pirate's appreciation of their assistance. During the event, the pirate did not specifically name the objects and actions used in the activities but used empty language such as, 'ok, now that we are done with that, let's have a go with this.' The entire event lasted between 10 and 15 minutes.

Children were individually interviewed immediately after the visit to the pirate and again 24 hours later. Before the first interview, half of the children received instructions that forewarned them that they would be interviewed again the following day about what they could remember. The remaining children received interview instructions that did not indicate that they would be interviewed again. Aside from these instructions, the children received the same interview protocol in each interview. The interview began with the child being asked, 'tell me everything you can remember about when you visited the pirate.' Once the child had recalled all that they could, the interviewer introduced each of the four open-ended cues in an attempt to elicit further information, namely 1) becoming a real pirate, 2) making a map, 3) finding the key, and 4) finding the treasure. There were two interviewers and same interviewer conducted both interviews for each child. The participants were randomly assigned to each condition within the constraint

that there were equal numbers of males and females across conditions. Within each condition, each interviewer interviewed the same number of males and females. All interviews were audio- and videotaped. Written transcripts were made of the interviews and were used for coding.

The transcripts were coded so that a child received credit for a correct item by mentioning any of the 55 actions and objects that were part of the 20 prescribed pirate and child activities. For example, the statement, 'I looked through the telescope' received credit for the mention of the action 'look' as well as the object 'telescope'. Additional credit was not given if the child mentioned the same detail(s) again later in the interview. Mention of the actions and objects that had been provided in the interview cues (i.e., map, chest, key, unlock) was not credited. Errors were coded as intrusions (mentions of actions and objects that the child reported occurred during the event when in fact they had not), or as distortions (incorrect descriptions of items that were present). Intrusions and distortions were combined to form a single category of errors for the purpose of analysis. Two independent raters coded one third of the transcripts and inter-rater reliability was calculated as the number of coding agreements divided by the total number of agreements and disagreements for each transcript following Tinsley and Weiss (2000). Inter-rater reliability was 88.4 %.

Results and Discussion

Preliminary analyses showed that there was no effect of interviewer on the amount of correct information or the number of errors. For clarity, only significant results that exceed an alpha of .05 are reported.

To examine hypermnesia, an ANOVA was performed with the number of details the children reported (correct and errors), the interview (interview 1 and 2) and interview instructions (whether children were forewarned or not forewarned of the second interview) as factors. The results of this analysis showed that children reported a greater number of correct details than errors, $F(1,38) = 339.66, p < .001$, and that there was a difference in the number of details reported across interviews, $F(1,38) = 8.24, p < .01$. There was also a significant interaction between these factors, $F(1,38) = 5.79, p < .05$, (Table 1). Two further analyses were performed to examine the nature of this interaction; one on correct details and one on errors with interview as a factor in each. The first analysis, on the total amount of correct information, confirmed that recall increased between the immediate and 24-hour interview, $F(1,38) = 7.07, p < .05$, that is, hypermnesia was observed. Total errors neither increased nor decreased across interviews. These findings indicate that the effect of repeated interviewing can be characterized as a growth in the amount of correct information reported in the interviews, but not of errors. The size of the hypermnesia effect was an additional of 2 pieces of information recalled in the second interview.

Insert Table 1 about here

To examine reminiscence, an ANOVA was performed with the level of cumulative recall of details reported (correct and errors), the interview (interview 1 and 2) and interview instructions (whether children were forewarned or not forewarned of the second interview) as factors. The pattern of results was the same as for the analysis of

hypermnesia. The cumulative recall of details across the two interviews was significant $F(1,38) = 171.85, p < .001$, and overall there were more unique correct details than errors, $F(1,38) = 393.09, p < .001$. There was also an interaction between the cumulative recall of correct information and errors across the two interviews, $F(1,38) = 103.59, p < .001$. Two further analyses showed that the cumulative recall of both correct details, $F(1,38) = 143.91, p < .001$, and of errors, $F(1,38) = 16.45, p < .01$, increased between the interviews. The magnitude of reminiscence was 6 new correct details in the second interview. The cumulative recall in the amount of correct details was far greater in magnitude than the cumulative recall of errors, which amounted to less than one error on average.

There was no effect of interview instructions in any analyses. Regardless, of whether the children knew that they would be asked again about what they could remember, reminiscence and hypermnesia occurred. Thus, an explanation that reminiscence and hypermnesia depend on the participants deliberately trying to remember relevant information between interviews can be tentatively set aside. It seems that reminiscence and hypermnesia can occur, after short delays, due to repeated interviewing as suggested by both laboratory and applied studies (Bluck et al., 1999; Erdelyi, 1996; Howe et al., 1992). The present study extends the findings of previous research to children's recall of an experienced event.

Experiment 2

Experiment 2 examined hypermnesia in children's reports of an event after a delay of 6 months. We followed a procedure similar to that of Bluck et al. (1999) who found hypermnesia after an 8-month delay in adults' free recall of a realistic event, when

there were multiple interviews over a short time period. In the present experiment children who previously participated in Experiment 1 were followed up 6-months later and participated in three, free-recall sessions separated by 5 minute intervals. During the intervals the children either drew a picture of everything that they could remember about their visit to the pirate (event-related-drawing interval) or drew a picture about an unrelated activity (unrelated-drawing interval).

The drawing manipulation was predicted to enhance both reminiscence and hypermnnesia. Instructing participants to focus their thinking on the to-be-remembered material between recall attempts has been found to increase the amount of hypermnnesia in laboratory studies (Erdelyi & Becker, 1974), and has been used in applied studies to facilitate hypermnnesia (Bluck et al., 1999; Bornstein et al., 1998). Laboratory research has also shown that there is greater hypermnnesia for the recall of pictures than words (Erdelyi & Becker 1974), and that recall of words that are visualized produce hypermnnesia (Erdelyi et al., 1976). Furthermore, with respect to children's recall, drawing has been shown to benefit recall by serving as a unique and individual retrieval cue (Butler, Gross, & Hayne, 1995; Gross & Hayne, 1999). We anticipated that asking the children to draw a picture of what they could remember about their pirate visit would help them to both *think about* and *visualize* information that that they could remember from the event – information that would then be available for reporting in a subsequent interview. In the unrelated drawing condition, drawing served as a distracter that prevented them from thinking about and visualizing what have happened between recall attempts.

Method

Participants

Thirty-five children (19 males and 16 females) who originally participated in Experiment 1 were divided randomly into the two drawing conditions (event-related drawing & unrelated drawing) with the constraint that there were approximately equal numbers of males and females in each condition. The mean age of the participants available at follow up was 73 months (SD = 4 ½ months) at the time of the event. Written consent was obtained from caregivers for the children to participate. In addition, children assented to participate in the interviews when they were called upon.

Materials and Procedure

The children were interviewed about the event they had experienced as part of Experiment 1. After a 6-month delay the children were interviewed three times, about what they could remember about their visit to the pirate. Each interview consisted of a single open-ended request for the children to recall all that they could (e.g., Bluck et al., 1999). The interviewer encouraged the children to keep on telling them what they could remember by using statements to the effect, 'what else happens', 'tell me some more things that happen', and 'that sounds like fun.' Each interview ended when the child stopped responding. There was a 5-minute interval between each interview. Each interviewer interviewed approximately equal numbers of males and females in each condition. Interviewer 1 interviewed 9 males 8 females. Interviewer 2 interviewed 10 males and 8 females.

After the first interview, children in the pirate-drawing condition drew a picture about the time that they visited the pirate. After the second interview, the children drew

another picture of the friendly pirate. The children who participated in the unrelated-drawing condition drew pictures about what they did in their holidays. In the first interval, they drew a picture about what they did in their Christmas holidays and in the second interval they drew a picture about what they did in their mid-year school holidays. The children drew their pictures on white sheets of paper (210 x 297 mm) with crayons. While the children were drawing the interviewer sat at a nearby table attending to 'paper work' that they needed to do. If a child spoke, the interviewer told them to continue drawing, and that they (the interviewer), would be ready to continue shortly. The interview was taped, transcribed and coded as in Experiment 1. Two independent raters coded one third of the transcripts and inter-rater reliability was 86.4%.

Results and Discussion

Preliminary one-way ANOVAs were performed on the number of correct details and errors in the first, second and third interviews revealed that there was no effect of interviewer. Only significant results are reported that exceed an alpha of .05.

To examine hypermnesia, an ANOVA was performed with the number of details reported (correct and errors), interview (first, second, and third) and drawing condition (event-related drawing or unrelated drawing) as factors. The only significant effect was that children reported more details that were correct than errors, $F(1,66) = 90.93$, $p < .001$, (Table 2).

Insert Table 2 about here

To examine reminiscence an ANOVA was performed with the cumulative recall of details reported (correct and errors), interview (first, second, and third) and drawing condition (event-related drawing or unrelated drawing) as factors. More correct details were recalled than errors, $F(1,66) = 86.16, p < .001$, and cumulative recall of details differed as a function of interview, $F(1,66) = 80.74, p < .001$. The interaction between these factors was also significant, $F(1,66) = 10.96, p < .001$. Further analysis revealed that the cumulative recall increased monotonically across interviews for both correct details, $F(1,66) = 61.29, p < .001$, and errors, $F(1,66) = 20.33, p < .001$. The increase in the cumulative recall of correct details was greater than that for errors; for correct details the increase amounted to an extra 4.78 pieces of information and was twice that of the cumulative recall of errors which was 2.34.

There was no evidence of hypermnesia, and no effect of the interpolated 'pirate drawing' activity. These results are inconsistent with the findings of Bluck et al. (1999) who found hypermnesia after a delay of 8-months in adults. Clearly, from the analysis of the cumulative recall new details were added to children's accounts in the subsequent interviews. It appears then that the absence of a hypermnesia effect may be because children did not repeat enough information from the previous interview. It is possible that the children thought that since they had already provided details a few minutes earlier, there was little need to repeat them, and instead they focused on recalling new details. In addition, children were not prompted in any recall session. Experiment 2 used only free recall instructions, whereas, in Experiment 1, in which hypermnesia was found, four open-ended prompts were used after free recall to elicit further more complete narratives.

It is possible that additional prompting facilitates the reporting of previously recalled details in additional interviews. This possibility was investigated in Experiment 3.

Experiment 3

Experiment 3 examined reminiscence and hypermnesia in children's eyewitness memory after a 6-month delay, following to the procedure used in Experiment 1, in which hypermnesia was observed. The participants received a baseline interview immediately after their participation, and at the 6-month delay were interviewed twice, with 24 hours separating the interviews. This design allowed us to establish that forgetting had occurred by comparing recall between the baseline interview and the first 6-month interview. Following this analysis the data were analyzed in terms of the total and cumulative recall of errors and correct information across the initial and repeated 6-month interviews.

Method

Participants

The participants were 21 children (10 males and 11 females) recruited from local primary schools. The mean age of the children at the time of the event was 6 years and 2½ months (SD = 5 months). Written consent was obtained from caregivers for participation, and the children assented to participate in the interviews when they were called upon.

Materials and Procedure

The materials and the event 'visiting the pirate' were identical to those used in Experiments 1 and 2. The children received an immediate interview following their participation in the event and two further interviews after a 6-month delay. At the 6-

month delay, the interviews were 24-hours apart. The interviews were identical in format to those in Experiment 1. At the 6-month delay the children were forewarned that the interviewer would be returning and that they would be reinterviewed. All interviews were audio taped and then transcribed.

Two interviewers conducted all of the interviews at each delay. At the 6-month delay two interviewers conducted both interviews (one who previously conducted the immediate interviews and one new interviewer). At the 6-month interview, the interviewer who had previously interviewed children in the immediate interviews now interviewed children that they had not previously interviewed. Thus, at the 6-month delay, the distribution of interviewer and gender of the children was the reverse of that of the immediate interview. Two independent raters coded one third of the transcripts and inter-rater agreement was 88.3%.

Results and Discussion

Preliminary analyses showed that there was no effect of interviewer (Interviewer 1 or 2) on the amount recalled or the number of errors. To establish whether significant forgetting had occurred and that the effect of delay was consistent with previous research (e.g., Jones & Pipe, 2002) an ANOVA was performed on the number of details reported (correct and errors) and interview (immediate and initial 6-month interviews) as factors. The analysis showed that children reported more correct details than errors, $F(1,20) = 67.63, p < .001$, and that the total number of details reported overall decreased across the 6-months delay, $F(1,20) = 13.70, p < .001$. There was also an interaction between the number of details reported and the interview, $F(1,20) = 43.92, p < .001$. Two further analysis confirmed that the interaction can be characterized as a decrease in total amount

of correct information reported across the 6-month delay, $F(1,20) = 33.75, p < .01$, and an increase in errors, $F(1,20) = 6.44, p < .05$, (Table 3).

Insert Table 3 about here

To examine hypermnesia after a 6-month delay, an ANOVA was performed with the number of details (correct and errors) and 6-month interviews (Interview 1 and Interview 2) as factors. The analysis showed only that children reported more correct details than errors on average, $F(1,20) = 31.22, p < .001$.

To examine reminiscence, an ANOVA was performed with the number of details (correct and errors) and the 6-month interview (Interview 1 and Interview 2) as factors showed that more correct details were reported than errors, $F(1,20) = 28.57, p < .001$, and that there was an increase in the cumulative recall of details across the interviews, $F(1,20) = 30.86, p < .001$. The interaction between these variables was also significant, $F(1,20) = 5.98, p < .05$. Two further analyses showed that the cumulative recall of correct information, $F(1,20) = 19.07, p < .001$, and errors, $F(1,20) = 15.87, p < .001$, was significant across the 6-month interviews. The magnitude of the cumulative recall of correct information was 2.90 pieces of information which was twice that of the 1.14 increase in errors across the same interviews.

General Discussion

In this study we examined reminiscence and hypermnesia in 5-and-6 year old children's verbal recall of an event when repeated interviews occurred soon after the event or following a long delay. Reminiscence, the recall of new information, proved to

be reliable across all three experiments. In each experiment, open-ended recall instructions were sufficient to elicit the new information. Repeated interviewing did not consistently produce hypermnesia, however. Hypermnesia occurred only in Experiment 1, with the total amount recalled increasing by 10% across the two interviews, conducted immediately and 24 hours after the event, respectively. In Experiments 2 and 3, when the repeated interviews took place following a 6-month delay, hypermnesia was not observed. The total number of errors that was reported did not increase across the repeated interviews in any of the experiments, whereas, the cumulative recall of new errors did increase.

It is interesting from the perspective of eyewitness memory that open-ended interviews elicited additional details even 6 months after an event. New details were added regardless of whether the interviews were separated by a 5-minute interval, following the procedure used by Bluck et al. (1999), or by a 24-hour delay. Previous research has shown that children also report new information when there are long delays between repeated interviews, for example, the first conducted soon after the event and the second 6 months after an event (e.g., Pipe et al., 1999; Salmon & Pipe, 1997; Salmon & Pipe, 2000). Together with these studies, the present findings suggest that reminiscence is a reliable and robust phenomenon in children's eyewitness recall of past events with both short and long delays. Delay duration does exert an influence however. The number of new details reported when the interviews occurred after a 6-month delay was fewer than those reported when the interviews occurred soon after the event, irrespective of the interval between interviews (5 minutes or 24 hours).

An inconsistency of our findings compared with applied adult hypermnesia research is that children reported increasing numbers of new errors, across interviews, in all three experiments. In Experiment 1, when the repeated interviews occurred immediately and 24 hours after the event, the magnitude of the increase was less than a single error and accounted for approximately 8% of all the new information. Compared to the much larger increase in the recall of correct details, this relatively minor increase in errors would not appear to compromise the accuracy of new information elicited. At the 6-month delay, however, the increase in errors was larger and represented approximately 30% of all the new information recalled. These findings suggest that the number of new errors reported in repeated interviews depends on the delay between the event and the interviews.

The finding of hypermnesia in Experiment 1, coupled with the greatest amount of reminiscence, is consistent with the recommendation that eyewitness interviews with young children should be conducted as soon as possible, before too much forgetting has occurred (Jones & Pipe, 2002; Pipe et al., 1999; Pipe & Wilson, 1994; Salmon & Pipe, 2000), and suggests additional advantages. After short delays between experiencing an event and recalling it, children's accounts are generally more accurate and contain few errors. The current research suggests that if children receive multiple interviews while their memories are 'fresh', immediately after the events of interest, hypermnesia occurs without an increase in the total amount of errors across interviews. The hypermnesia finding is consistent with that of Dent and Stephenson (1979) and extends their findings to encompass increases in recall for younger children used in our study. The improvement in recall across repeated interviewing in Experiment 1 also did not depend

on whether or not the children had been forewarned that they would be reinterviewed. In a real life situation interviewers may not want to set up the expectation that there will be a second interview before the first has begun. In particular, interviewers may not know whether a second interview is required until the first has been completed.

We had expected that repeated interviewing would have resulted in both reminiscence and hypermnesia in all three experiments based on previous research. The trace-integrity theory (Brainerd, Reyna, Howe & Kingma, 1990; Howe et al., 1992), however, does provide an explanation for why we observed a reduction in the amount of reminiscence over time, and hence the absence of hypermnesia. Brainerd and his collaborators argue that exactly what is recalled from memory at any point in time depends on two processes continually affecting the memory trace; these are storage processes and retrieval processes. The interplay between storage and retrieval processes determines the integrity of the memory, and thus, whether we experience forgetting or hypermnesia. They argue that forgetting can occur due to memory-trace decay (storage failure), as well as through failure of a particular retrieval cue (retrieval failure). In their model, hypermnesia occurs through restorage of a memory trace via connections with related memory traces, or through retrieval relearning where recall cues become increasingly effective. Thus, according to the theory, forgetting and hypermnesia can both occur as a result of storage and retrieval processes.

In the present study, when children were interviewed immediately after the event, little forgetting had occurred. According to the trace-integrity theory the reminiscence and hypermnesia observed was facilitated by easier access to their memory for the event. In effect, because no forgetting had taken place, repeated retrieval attempts during the

interviews were highly effective at accessing additional information (retrieval-relearning) to the point where greater and greater amounts of information could be recalled. In contrast, by 6-months the children had forgotten a significant amount of what they had originally encoded about the event (memory-trace disintegration) which affected the retrievability of information stored in the memory trace. Before correct details about the event could be retrieved, the memory trace must be restored from related information which is a more effortful and time consuming process (memory-trace reintegration). Howe et al. (1992) also found that the magnitude of hypermnesia was the greatest after shorter rather than longer delays of 1 month. It is conceivable that reminiscence and hypermnesia continue to decrease over time as forgetting increases. What the findings of Howe et al. (1992) and those of the present study suggest is that information in memory which has not been previously recalled can be forgotten from memory along with details that have been previously recalled.

The event used in this study, while realistic and enjoyable, did not carry with it the personal significance of events that are known to be well remembered, and it is possible that hypermnesia might be observed and reminiscence enhanced when the event is of personal significance. For example, Peterson and her colleagues examined memory for a personal injury and subsequent hospital treatment of children between the ages of 2- and 13-years. After an initial interview, interviews were repeated at delays of 1 week, 6 months, 1 year, 2 years (Peterson, 1999; Peterson & Bell, 1996) and 5-years (Peterson & Whalen, 2001). Peterson and Bell (1996) found that the percentage of relevant information reported by the child decreased up to the 6-month interview. At a 2-year delay, Peterson (1999) only observed an effect of delay on details about the visit to the

hospital. When these children were followed up and given a final interview 5 years later, effects of delay were once again found. At this long 5-year delay, the memory decrements were now confined to recall of peripheral information about the injury, and memory for the visit to the hospital (Peterson & Whalen, 2001). Peterson also argues that new information added to the children accounts about the salient aspects of the events was generally accurate. Thus, at the longest delays (2 years and 5 years) memory for the injury was maintained and therefore there may have been potentially new details that could be reported across multiple interviews.

Fivush, McDermott Sales, Goldberg, Bahrick & Parker (2002) interviewed 3- and 4-year children about what they could remember about Hurricane Andrew between 2 and 6 months after the hurricane, and again 6 years later. The interviews consisted of open-ended requests for children to tell all they could remember the stressful event. The results showed that across the 6-year delay the amount of information that the children reported doubled, and what was reported in the 6-year interview contained very few details that had been reported earlier. Fivush et al. (2002) suggested that the children reconstructed what they had remembered about the events over the course of time, and the story that they told changed in accordance with what was relevant to their own lives. It would have been interesting to see what would have happened to the level of reminiscence if the children had been interviewed two days in a row at the 6-year-delay, given that children were still able to report so much about the event.

Repeated interviewing may also be a sufficient way of maintaining memory across long delays. In an analogue study, Pipe et al. (2004) followed up children who were originally interviewed immediately, or after a delay of 1 day, 1 week, 1 month and 6

months as part of an earlier study. Pipe et al. (2004) reinterviewed these children 1 and 2 years after the event, and included a control group who were only interviewed at the 1- and 2-year delays. The results suggested benefits to long-term verbal recall when an intervening interview occurred at the 6-month delay rather than one occurring shortly after the event. It appeared that the single interview at the 6-month delay attenuated further forgetting. In Pipe et al. (2004) children received only a single interview at each delay and what is yet unknown is whether repeated interviewing across short delays would have been of even greater benefit for long term.

Clearly, there is a need for future research to explore the effects that repeating an open-ended interview has on children's reports of past events. Many studies have explored the negative effects of repeated interviewing in terms of misinformation, suggestibility, source confusion, complicity, and assent to authority in children. However, there are relatively few studies that have explored effects of repeating open-ended interviews as a means to enhance accurate recall in evidential interviews. Our study has shown that there are advantages to repeating an interview with young children, with the greatest benefits when the interviews take place soon after the event. However, children are not always interviewed soon after alleged events have occurred and our results also show that new errors are likely to be reported after a delay of 6-months. What is clear is that children have more to tell than simply what they report in a single interview, and that there may be advantages of repeating open-ended interviews.

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Table 1

Details Reported (and SD) in Experiment 1

Condition	Immediate interview	24-hour interview	Cumulative recall
		Correct	
Forewarned	15.75 (6.07)	17.45 (6.09)	22.00 (6.71)
Not forewarned	13.55 (4.76)	15.75 (6.26)	19.95 (5.72)
		Errors	
Forewarned	0.65 (1.13)	0.65 (0.93)	1.05 (1.46)
Not forewarned	0.70 (1.17)	0.90 (1.16)	1.45 (2.11)

Note: Cumulative recall refers to the number of details from the immediate interview plus new details from the 24-hour interview.

Table 2

Details Reported (and SD) in Experiment 2

Condition	Interview one	Interview two	Interview three
	Total correct		
Pirate drawing	7.81 (6.46)	8.94 (4.09)	7.44 (4.60)
Unrelated drawing	8.37 (4.28)	8.47 (5.54)	9.05 (5.04)
	Total errors		
Pirate drawing	0.88 (1.20)	1.63 (2.47)	2.25 (2.59)
Unrelated drawing	0.37 (0.60)	1.05 (1.13)	1.53 (1.39)
	Cumulative correct		
Pirate drawing	7.81 (6.46)	11.75 (5.85)	12.75 (5.83)
Unrelated drawing	8.37 (4.28)	11.11 (5.90)	13.00 (6.25)
	Cumulative errors		
Pirate drawing	0.88 (1.20)	2.19 (2.99)	3.87 (4.78)
Unrelated drawing	0.37 (0.60)	1.21 (1.03)	2.16 (1.80)

Table 3

Details Reported (and SD) in Experiment 3

Immediate interview	6-month initial interview	6-month repeated interview	Cumulative recall
Correct			
15.66 (6.68)	9.72 (6.94)	10.57 (6.73)	12.62 (7.05)
Errors			
0.57 (0.68)	2.00 (2.70)	1.81 (1.72)	3.14 (3.52)