Protecting Against Misinformation: Examining the Effect of Empirically Based Investigative Interviewing on Misinformation Reporting

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Abstract

Children who are involved in legal cases are often interviewed about events they witnessed or that might have happened to them. Occasionally, after such interviews, children are confronted with misinformation regarding their experiences. The question that arises is whether their earlier interviews may protect them from reporting misinformation. The goal of the present experiment was to assess whether empirically based interviewing by means of the National Institute for Child Health and Development (NICHD) Protocol would affect the reporting of misinformation in children. Children were involved in an interactive event (i.e., science demonstration). Following this, three experimental groups were created: one group was interviewed using the NICHD Protocol, one group had to freely recall what they experienced, and one group was not asked to retrieve any memories about the event. Next, all children received misinformation concerning the event and were then subjected to a final memory test. We found that children's recall during the NICHD interview protected children against the incorporation of misinformation in their accounts of the event. This effect was absent in the other two conditions. The current experiment suggests that evidence-based investigative interviewing can inoculate children's memory against the corrupting impact of misinformation.

Keywords Investigative interviewing · Misinformation · NICHD protocol · Retrieval-enhanced suggestibility

Introduction

Recent estimates indicate that somewhere between 10 and 40% of children are affected by maltreatment (Stoltenborgh et al. 2011). Some of these children will be repeatedly interviewed about their experiences by parents, friends, social workers, and the police. During these conversations, the chance increases that they will be exposed to misinformation concerning their experiences. Thus, the goal of the present experiment was to assess whether empirically based interviewing by means of the National Institute for Child Health and Development (NICHD) Protocol would affect the reporting of misinformation in children. This goal served as the impetus for the current experiment.

Testing and Misinformation

When people are interviewed about events, they are retrieving an experience from their episodic memory. An abundance of studies has shown that such retrieval attempts strengthen the memory for those experiences, a memory phenomenon known as the *testing effect* (Roediger and McDermott 2006; Rowland 2014). In one of the first demonstrations of this effect, Roediger and Karpicke (2006) instructed participants to study prose passages with some of them being repeatedly subjected to a memory test before a final assessment of their memory took place. The most important finding of this study was that prior testing enhanced memory retention at the final memory task, making the researchers conclude that "[t]esting is a powerful means of improving learning, not just assessing it" (p. 249).

Since testing improves memory retention, a critical issue is whether this enhanced memory retention might also protect against subsequent misinformation. A series of experiments

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have shown that testing might actually increase the susceptibility to misinformation which has been referred to as *retrieval-enhanced suggestibility* (Chan et al. 2017, 2009). In one of these experiments (Chan et al. 2009), the participants had to watch a video. One group of participants received a memory test (i.e., cued recall), while the other group of (control) participants did not receive such a test. Following this, all participants were presented with misinformation in the form of a recap (containing false details) of the video. During the last phase of the experiment, all participants received a final memory test. The most important result was that the participants who received an additional retrieval opportunity (the memory test) were more susceptible to include the misinformation in their final account of the video compared to participants who were not afforded this testing opportunity.

Follow-up research has replicated the retrieval-enhanced suggestibility phenomenon. For example, this effect has been demonstrated using various types of stimuli (Butler and Loftus 2017; Chan et al. 2012), in different populations (e.g., children: Brackmann et al. 2016; adults: Chan et al. 2009), using various retrieval procedures (e.g., repeated testing: Chan and LaPaglia 2011), and different memory tests (i.e., free versus cued recall testing; Wilford et al. 2014). Apart from these replications, retrieval-enhanced suggestibility also has some boundary conditions. For example, the effect has not been detected when the misinformation was embedded in questions instead of in a narrative (LaPaglia and Chan 2013; LaPaglia and Chan 2019) and the effect does not occur during an eyewitness identification task (LaPaglia and Chan 2012; see also Huff et al. 2016; Pereverseff et al. 2019).

One explanation offered for retrieval-enhanced suggestibility is that taking a test unintentionally amplifies the learning of new (mis)information (Chan et al. 2017). In general, research has shown that taking a test or retrieval has both a backward and a forward effect on learning. The backward effect refers to the phenomenon that retrieving previously learned information will strengthen that information (i.e., testing effect). The forward effect indicates that the retrieval of information facilitates subsequent learning of information (Chan et al. 2018) and is assumed to take place in retrieval-enhanced suggestibility. Specifically, the idea is that a memory test enhances the learning of misinformation that is presented after this testing. In other words, when participants are presented with misinformation, the misinformation attracts attention and becomes better encoded because of the prior test. This enhanced encoding of misinformation makes it easier to retrieve the misinformation during a new, follow-up memory test, thereby leading to retrieval-enhanced suggestibility (Chan et al. 2017).

An important issue is whether retrieval-enhanced suggestibility can also be detected in more ecologically valid settings. That is, when child witnesses or victims are interviewed about the occurrence of certain events, they have to retrieve relevant memories pertaining to that experience. Oftentimes, child witnesses and/or victims are repeatedly interviewed and during these follow-up interviews, they might be confronted with misinformation (e.g., Goodman and Quas 2008; La Rooy et al. 2010). It is relevant to examine whether the previous retrieval(s) might immunize them against subsequent misinformation or whether such interviews might lead to retrieval-enhanced suggestibility. This is especially relevant as children are often regarded as highly susceptible to misinformation effects (Ceci and Bruck 1993; but see also Otgaar et al. 2018), and hence, a way to protect them against such effects might be important in investigative interviewing settings.

Interviewing and Misinformation

Research on the impact of interviewing on the subsequent reporting of misinformation is scant and mainly limited to adult samples. For example, Gabbert et al. (2009) conducted an experiment in which they used the Self-Administered Interview (SAI) as an investigative tool. The SAI is based on the principles of the cognitive interview which uses memory-based principles to facilitate recall in eyewitnesses (Fisher and Geiselman 1992; Memon et al. 2010). For instance, the cognitive interview includes open-ended questions known to increase memory accuracy and completeness, and also uses memory-based techniques such as context reinstatement to enhance memory recall. The SAI is completed by witnesses themselves and can be applied directly after an incident (Gabbert et al. 2009). This immediate application has the benefit that witnesses are less likely to talk to each other about the event and potentially contaminate each other's testimonies. In Gabbert et al.'s (2009) experiment on the SAI and the effects of misinformation, it was found that adult participants who completed the SAI were less prone to report the misinformation during subsequent retrieval than those who did not complete the SAI. A plausible explanation for this finding is that an empirically based interview will increase the strength of the memory of the experience, which makes participants more aware of discrepancies between given misinformation and their own recollection, which in turn will make people more resistant to the misinformation (Marche 1999; Pezdek and Roe 1995; Tousignant et al. 1986).

However, not all studies on this topic have obtained similar results. For example, LaPaglia et al. (2014) did find evidence for a retrieval-enhanced suggestibility effect when participants were subjected to a scientifically validated interview protocol. More specifically, in their experiments, adult participants watched a video, after which they were either interviewed about the details of this event by means of the cognitive interview or did not receive such an interview. Next, all participants received misinformation and then the experiment was terminated by a final memory test. It was found that during this final memory task, participants who received the

cognitive interview were more likely to report elements of the misinformation than those who had not been interviewed.

Furthermore, in Verkampt and Ginet's (2010) study, 4/5-year-olds and 8/9-year-olds participated in a painting session and afterwards received one of five different versions of the cognitive interview (e.g., full cognitive interview, cognitive interview with context reinstatement) or a control interview. Following this, all children received several questions of which some were misleading. The researchers found limited evidence that the cognitive interview protected against the acceptance of misleading suggestions. That is, of the five different versions, only the cognitive interview without the change order instruction reduced children's suggestibility. However, it should be noted that their study used a different methodology than studies examining retrieval-enhanced suggestibility.

So far, there exists only one study in which the impact of using a science-based interview protocol on the reporting of misinformation in *children* was examined using a similar procedure as has been employed in previous retrieval-enhanced suggestibility studies in adults (Otgaar et al. 2019). In this study, we used the National Institute for Child Health and Development Protocol (NICHD Protocol; Lamb et al. 2007), which is a developmentally sensitive interview method based on research on the development of children and how children talk about traumatic experiences (Lamb et al. 2007; La Rooy et al. 2015). The interview protocol is set-up in such a way that it maximizes children's recall and decreases the chance of suggestibility effects. Its core tenet is the use of open prompts (i.e., invitation questions: "Tell me what happened"), which have shown to lead to accurate and detailed accounts in children (Saywitz et al. 2017). Interviewers using this protocol are encouraged to first employ open prompts until the child's account is exhausted, before using more closed questions such as directives ("Where did it happen?") or option-posing questions ("Did he touch you in the living room or the bedroom?").

Apart from the continuous use of open prompts, the NICHD Protocol contains other elements to stimulate children's accurate reporting of the event. For example, the NICHD Protocol starts with explaining the ground rules for the interview (e.g., that it is okay to say "I don't know"). Next, the NICHD Protocol has incorporated a rapport building phase in which children are asked about an activity they enjoy. The idea behind this is that establishing rapport will make children more open to talk about traumatic experiences (e.g., Brubacher et al. 2019; Price et al. 2016; but see also Sauerland et al. 2018). Furthermore, following the rapport building phase, children receive a brief training in episodic memory in which they practice retrieving an autobiographical memory. They are, for example, asked what they did the day before the interview by using open prompts ("Tell me what happened yesterday"). The reasoning here is that children become accustomed to receiving open prompts and to recalling an autobiographical experience.

In our study on the impact of the NICHD Protocol on the reporting of misinformation (Otgaar et al. 2019), 108 5- to 10-year old children first viewed a video, after which half of the children were interviewed about this video using the NICHD Protocol while the other half was not interviewed. Then, all children received misinformation and final memory tests were conducted immediately following the misinformation (Experiment 1) or after 1 week (Experiment 2). We found evidence for retrieval-enhanced suggestibility when the final memory test was provided directly after the misinformation had been given, while no such suggestibility effect was observed when the final memory test was taken after 1 week. We concluded that, in children, suggestibility can be increased by using a scientifically supported interview protocol (i.e., NICHD Protocol).

Although the aforementioned studies on interviewing and misinformation are informative, they are also subject to a number of significant limitations. First of all, the studies on retrieval-enhanced suggestibility, including those on interviewing and misinformation, have only used videos as stimulus material. Watching a video is obviously not the same as active involvement in an event. This might be problematic for more applied studies that use interview protocols (e.g., Gabbert et al. 2009; Otgaar et al. 2019) developed to help witnesses and victims retrieve autobiographical memories about their own, real-life experiences. To circumvent this caveat, one needs to involve participants in an interactive event, thereby making the event more personally relevant. The benefit of such an approach would be that self-relevant memories are better encoded thereby increasing the strength of the memory (Kuiper and Rogers 1979; Rogers et al. 1977; Symons and Johnson 1997), which in turn may potentially shield participants from reporting misinformation. A second limitation of previous studies is that the majority of research on retrieval-enhanced suggestibility has been confined to adult samples. Meanwhile, it is clear that the issue of misinformation and suggestibility also plays a role in young people, and thus, it seems important to also take a developmental perspective when studying these phenomena (Ceci and Bruck 1993; Otgaar et al. 2019). Third, in our previous study on retrieval-enhanced suggestibility in children (Otgaar et al. 2019), we compared children who were interviewed with the NICHD Protocol with a control group of children who were not interviewed. By adopting such an approach, it remains unclear whether the observed effects (in this case, retrieval-enhanced suggestibility) were uniquely caused by the NICHD Protocol or by the memory retrieval per se. Hence, as in previous work (e.g., LaPaglia et al. 2014), a better experimental design would be to include an extra control group in which children receive a simple recall task.

The Present Experiment

The primary purpose of the current experiment was to examine the impact of interviewing children with the NICHD Protocol on the reporting of subsequent misinformation. To examine this, children were involved in an interactive event that has been used in previous suggestibility research (i.e., science demonstration; e.g., Poole Lindsay 1995). More precisely, they passively and actively participated in two science demonstrations. Then, children were divided into three groups: One group was interviewed by means of the NICHD protocol, another group received a recall task, and a third group was not interviewed at all. Following this, all children received misinformation and were then subjected to a final memory test.

Our predictions regarding the retrieval-enhanced suggestibility effect were the following. On the one hand, we might expect to find evidence for retrieval-enhanced suggestibility following the empirically based interview (i.e., NICHD Protocol). On the other hand, it could also be the case that no retrieval-enhanced suggestibility effect will be found because engaging in an interactive event will produce a strong memory that is perhaps less susceptible to misinformation effects.

Method

Participants

An a priori power analysis was conducted to estimate the required sample size needed to detect our effect of interest using G*Power (Faul et al. 2007). Our sample size was determined based on the effect size of the retrieval-enhanced suggestibility effect found in our previous work (Otgaar et al. 2019). In that study, we documented a large effect size (Cohen's $d = 0.77$) which transfers to a f-value of 0.39. To be on the conservative side, we aimed for a medium effect size ($f = 0.25$) with a power of 0.80 and a significance level of 0.05. Using G*Power (repeated measures, between factors, number of groups 3, number of measurements:2, correction among repeated measurements: 0.5), we aimed for a total sample size of 120.

Different types of schools in The Netherlands and in Germany were contacted to recruit children (i.e., elementary school, horseback riding school). One Dutch and two German schools agreed to participate. Schools and parents received an information letter along with a consent form. If school and parents provided consent, children could participate in the current experiment. In total, 112 children were tested in this experiment (mean age = 8.29 years, $SD = 1.65$; age range 5–11 years; 61 girls and 51 boys). Children received a small present for their participation (e.g., pen). The current experiment received approval from the Ethical Review Committee of the Faculty of Psychology and Neuroscience at Maastricht

University (protocol number: 177_25_03_2017). All data can be found on https://osf.io/c5yx8/ .

Materials

Event Children were individually involved in two science demonstrations based on previous experiments that relied on a similar procedure (Poole and Lindsay 1995, 2002). The demonstrations lasted for approximately 10 min. Children had to carefully observe one demonstration (passive) and assist the experimenter in the other one (active). The first demonstration entailed filling a bowl with colored water (blue). A red candle was lighted with a match and placed in the middle of the bowl. During this procedure, the experimenter acted like she burned herself. Finally, a bottle was placed bottom-up over the candle, the candle went out, and the water inside the bowl climbed up the walls of the bottle.

In the second demonstration, three tea lights were lighted with a lighter and placed in a row. Two glasses were presented and one of these was filled with a liquid mixture of soda followed by vinegar, which was stirred with a fork. The second glass stayed empty. Next, the experimenter acted as if she transferred the liquid into the empty glass, but the glass remained empty. The empty glass, however, became filled with CO_2, which, when "poured" over the candles, blew out the fire. The order of the demonstrations was fixed, but the order of when children only observed or assisted the experimenter was counterbalanced. Specifically, children who were actively involved had to fill a bowl with colored water or place the tea lights in a row.

Interview Protocol One third of the children was interviewed using a procedure derived from the NICHD Protocol that was made suitable for research purposes (see Otgaar et al. 2019). The original NICHD Protocol also includes questions concerning the disclosure of an alleged event, which were not suitable within the context of the current experiment. Two female research assistants received a 2-day training in the administration of the NICHD interview using the German (Christman and Wazlawik 2016) and Dutch translation of the Protocol (e.g., de Ruiter et al. 2016; see http://nichdprotocol.com/the-nichd-protocol/). The research assistants were trained in the different components of the Protocol (i.e., ground rules, rapport building, episodic memory training) by means of role-play interview sessions. The assistants were trained by a researcher who had received an official training in the use of the NICHD Protocol in child abuse investigations (HO).

Misinformation All children were presented with misinformation in the form of a written narrative (around 200 words) that contained correct as well as incorrect details about the two science demonstrations. This experimenter read the narrative aloud

to the children. We defined 20 pieces of details in these two demonstrations as critical items, of which five details in the experiment were consistent (correct) with the narrative, 10 were inconsistent (misinformation), and the last five were not mentioned in the narrative, serving as control details (see below).

Memory Test The format of the memory test was based on previous studies (Otgaar et al. 2019; Wilford et al. 2014; see Appendix). Ten of the 20 memory items tested whether the child reported and erroneously accepted the misinformation (five for each demonstration). Five items pertained to details that were consistent with what was presented during the science demonstrations as well as in the misinformation narrative. The last five items served as control items which were solely presented during the science demonstrations.

The misinformation items were presented in a multiple-choice format during the memory test. Children could choose between three answer options: one displayed the correct answer, one represented the misinformation provided in the narrative, and the last option was an incorrect one (e.g., "Which colour was used to colour the water?" Blue [correct], green [misinformation], orange [incorrect]). The consistent items were also displayed by using a multiple-choice format with three answer options, of which only one was correct, while the other two were both wrong. The control items were presented in the form of open questions (e.g., "What did (name) use to light the candles?"). The questions were presented in the same order to all the participants. Dependent variables were endorsement of (in)correct recall of misinformation, correct recall of consistent, and control items.

Design and Procedure

The present experiment used a 3 (Condition: NICHD, free recall, and no interview) × 2 (Participation: Active vs. Passive) mixed factorial design. The first factor was a between-subjects factor representing the interview condition to which participants were randomly assigned (i.e., NICHD: $n = 37$, free recall: $n = 37$, and no interview: $n = 38$). The participation factor was a within-subjects variable and was added for exploratory reasons.

The experiment took place in separate quiet rooms at the respective schools with only one child and one experimenter present at a time. After the children were asked whether they already knew what the study was about (from friends or parents), the experimenter performed the two science demonstrations in front of (passive) or together with the child (active). As noted above, the order of whether children were actively involved in the science demonstrations was counterbalanced.

After the science demonstrations, children received a short, 5-min distractor task (a set of "spot the differences" pictures). Following this, depending on the condition, children were interviewed, using either the adapted version of the NICHD

Protocol or by means of a free recall. The control group was not interviewed. Instead, children in the control group condition were given an additional distractor task, in which they colored an unrelated picture provided by the experimenter for about 10 min.

During the NICHD interview, children were first provided with the ground rules of the interview. This was followed by a rapport building phase and an episodic memory training during which they had to retrieve and talk about a memorable personal event (e.g., birthday party). During the substantive part, open prompts (e.g., "Tell me what happened") were continuously used to retrieve the memories of the science demonstrations. In case directive or option-posing questions were needed to elicit new information, they were followed up by another open prompt. At the end of the NICHD interview, the experimenter asked children about a neutral topic (i.e., what they would be doing after their participation in the study). In the free recall condition, children were asked to tell everything they remembered of the science demonstrations without additional prompting for information ("Tell me everything about the two demonstrations you saw and assisted in"). Importantly, children were not interrupted in their memory recall and received no further encouragement to provide more information.

After the interviews (NICHD or free recall) or control condition, children received another 5-min distractor task (another set of "spot the differences" pictures). All interview sessions were audiotaped and later transcribed verbatim (with permission of the participating children and their parents). When all interviews were transcribed, we coded how many unique and relevant details children remembered of the two science demonstrations. A scoring form was created with 28 unique and relevant details of the demonstrations (14 for each demonstration).

Next, children were presented with the misinformation in the form of a narrative, which was read out loud by the experimenter. The children were told that the narrative represented the memory of another child who also took part in the science demonstrations. After the participants were presented with this misinformation, they again received a distractor task (a final set of "spot the differences" pictures). Finally, they were presented with the memory test. The questions and the answer options were read out aloud by the experimenter and children had to indicate their answer orally. The children were then debriefed individually immediately after the experiment and were asked whether they had previously seen the demonstrations. In case of the latter, they were excluded from further analyses.

Results

Two children had to be excluded. One child because he/she had already seen the demonstrations on a prior occasion, and another child whose testing session was seriously interrupted. SPSS (version 25) and JASP (version 0.9) statistical software programs were used for the statistical analyses.

To explore whether the participation factor had an impact on our dependent variables, we conducted a 2 (Participation: Active vs. Passive) × 3 (Condition: NICHD, free recall, and no interview) mixed analysis of variance (ANOVA) on the reporting of misinformation and total number of correct memories (consistent plus control items). For misinformation and correct memories, no statistically significant effects were observed for the participation factor (all $ps > .05$). Because of this, we collapsed the active and passive data and conducted separate one-way ANOVAs on the endorsement of (in)correct recall of misinformation and correct recall of consistent and control items.

Misinformation When we conducted an ANOVA on the reporting of misinformation for both science demonstration, no statistically significant effect of condition was found [$F(2, 107) = 0.40$, $p = 0.67$, $\omega^2 = .00$]. Thus, interviewing did not seem to protect against or increase misinformation effects. A similar analysis performed on the correct recall of misinformation scores also did not reveal a statistically significant between-groups effect [$F(2, 107) = 0.27$, $p = 0.77$, $\omega^2 = .00$; see Table 1].

Correct Memory When we analyzed the correct recall for consistent items, we did not find a statistically significant effect of condition [$F(2, 107) = 1.06$, $p = 0.35$, $\omega^2 = 0.00$]. The same was true when we tested the correct recall of control items [$F(2, 107) = 0.01$, $p = 0.99$, $\omega^2 = 0.00$). So, interviewing did not have a notable impact on correct memory rates at the final memory test.

Details During Interview We also examined how many details children remembered as a function of interview (NICHD vs. free recall). An independent-samples *Welch t* test showed that children remembered statistically more details when they were interviewed with the NICHD protocol ($M = 18.43$, $SD = 3.55$) than when they had received a free recall instruction ($M = 12.86$, $SD = 4.26$) [$t(68.92) = 6.03$, $p < .001$, Cohen's $d = 1.42$]. We also computed a correlation to examine whether the number of remembered details was associated with the reporting of misinformation. We found that participants who remembered more details from the interview were less vulnerable to misinformation [$r(71) = -0.30$, $p = 0.01$; see Fig. 1].

To further examine this finding, we calculated a Bayes Factor (BF) for our correlational analysis to decide whether our data are more in favor of the null (no association) or the alternative hypothesis (presence of an association). We found that $BF_{10} = 3.96$, which indicates that there was more evidence for the alternative than for the null hypothesis. Interestingly, when we calculated correlations for the NICHD and free recall conditions separately, we found that the correlation between remembered details and misinformation reporting was statistically significant in the NICHD group [$r(36) = -0.36$, $p = 0.03$] and somewhat less strong and not statistically significant in the free recall group [$r(37) = -0.26$, $p = 0.12$].

Exploratory Analyses

Furthermore, since previous studies have indicated developmental differences in terms of misinformation acceptance (e.g., Otgaar et al. 2010), we conducted a 2 (age group 5- to 8-year-olds ($n = 50$) vs. 9- to 11-year-olds ($n = 60$)) × 3 (condition: NICHD, free recall, and no interview) ANOVA on misinformation acceptance and correct memories (consistent and control items). Regarding misinformation reporting, although younger children ($M = 1.26$, $SD = 1.18$) endorsed somewhat more misinformation items than older children ($M = 0.85$, $SD = 0.95$), although this difference was not statistically significant ($F(1, 104) = 3.87$, $p = 0.05$, $\omega^2 = 0.03$). For consistent items, younger children ($M = 3.58$, $SD = 1.28$) remembered less than older children ($M = 4.58$, SD = 0.75; $F(1, 104) = 25.83$, $p < 0.001$, $\omega^2 = 0.19$). For control items, younger children ($M = 2.98$, $SD = 1.15$) also remembered less than older children ($M = 3.58$, $SD = 0.93$, $F(1, 104) = 8.96$, $p = 0.003$, $\omega^2 = 0.07$).

Discussion

In the present experiment, we assessed whether the use of a scientifically based interview would have any ramifications on the reporting of misinformation. Children were involved in an interactive event (i.e., science demonstrations), and two groups of children were interviewed about this event by using either the NICHD Protocol or a free recall instruction. After

Table 1 Response frequency as a function of condition (means with standard deviations in parentheses)

	NICHD	Free recall	Control
Misinformation items (chose misinformation answer option)	0.94 (1.19)	1.16 (1.14)	1.00 (0.90)
Control items (chose correct answer option)	3.29 (1.05)	3.23 (1.22)	3.32 (0.96)
Consistency items (chose correct answer option)	3.94 (1.19)	4.32 (1.10)	4.08 (1.10)
Misinformation items (chose correct answer option)	7.51 (1.50)	7.38 (1.38)	7.61 (1.17)
Remembered details during the interview	18.43 (3.55)	12.86 (4.26)	–
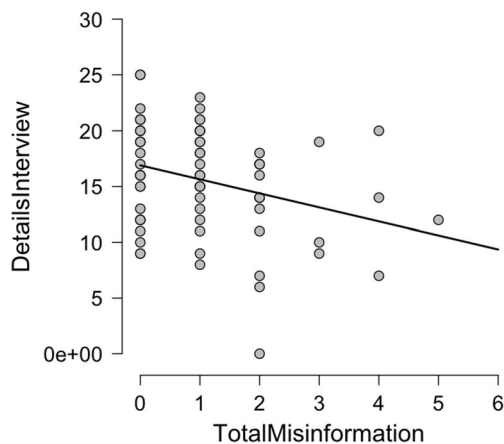
Fig. 1 Scatterplot between misinformation reporting and number of remembered details in the interview (NICHD and free recall combined)

this, all children were presented with misinformation and a final memory test. Our most important findings can be summarized as follows. We did not find any evidence for retrieval-enhanced suggestibility. On the contrary, we found the reverse. Our results showed that remembering details from the interviews protected children against the reporting of misinformation.

Our experiment did not demonstrate a retrieval-enhanced suggestibility effect. Children were not more susceptible to the reporting of misinformation when they received an extra retrieval opportunity (NICHD or free recall). At first sight, this finding seems to be at odds with previous research in which retrieval-enhanced suggestibility was detected in children using the NICHD Protocol (Otgaar et al. 2019). However, there is an important methodological difference between our study and previous work on retrieval-enhanced suggestibility. Specifically, in previous studies on retrieval-enhanced suggestibility, the to-be-remembered stimulus was always a video while in this study, children experienced an interactive event (i.e., science demonstrations). It is likely that a real (personally relevant) experience produces stronger memories than watching a video fragment showing an event that happened to somebody else.

Why might this methodological difference be important when interpreting the current results? Prior research has shown that when memory strength is increased for experiences, children will be less likely to fall prey to misinformation (Marche 1999; Pezdek and Roe 1995). The reasoning behind this is that discrepancies between the presented misinformation and one's own memories are more easily detected when memory strength is high, leading to lower reporting of misinformation (Tousignant et al. 1986). So, even before children had to retrieve their memories in the context of being interviewed with the NICHD Protocol, their memories for the science demonstrations were probably already quite strong, which may have protected them against the reporting of misinformation.

This interpretation concurs with the data because the children in the control group, who were not interviewed, demonstrated accurate memory performance at the final memory test, which did not differ statistically from the two interview groups.

In line with the idea that children's memory strength was high in the current experiment, we found that the retrieval of memories was greatly improved when children were interviewed by the NICHD Protocol. Indeed, children remembered more details of the science demonstrations when they were interviewed using the NICHD Protocol than when they had to freely recall the event. This underscores previous work that the NICHD Protocol can lead to highly detailed and accurate statements in children (e.g., Benia et al. 2015; Lamb et al. 2007; La Rooy et al. 2015).

More interestingly, when we correlated the number of remembered details during the interview (NICHD and free recall) with the number of reported misinformation items, we found a negative correlation. Specifically, we found that the number of remembered details during the NICHD interview and free recall was associated with a lower endorsement of incorporating misinformation. Even more, when we examined this pattern separately for the NICHD and the free recall group, we found that this negative correlation was mainly driven by children who were interviewed by means of the NICHD Protocol. Our explanation for this result is the following. The exposure of children to an interactive event might have already led to strong autobiographical memories, as mentioned above. Combined with an interview using the NICHD Protocol, the memories of the science demonstrations might have become even more vivid and detailed. Thus, instead of a forward learning effect in which the presentation of misinformation might have grasped children's attention, in the current experiment, the strong autobiographical memories increased children's ability to detect discrepancies between these memories and the presented misinformation (Tousignant et al. 1986). The consequence of this discrepancy detection is that at a final memory test, details elicited by the NICHD Protocol were (better) protected children against accepting misinformation.

An alternative explanation for the current finding could be based on the fuzzy trace theory (FTT; Brainerd et al. 2008). According to FTT, when people experience an event, two opponent memory traces are formed. Gist traces are involved in processing the underlying meaning of an event while verbatim traces are involved in the storage of specific details of an event. FTT postulates that memory errors (e.g., accepting misinformation) are due to reliance on gist traces when verbatim traces cannot be retrieved. However, FTT also postulates that when people are well able to retrieve specific details of an event, they can use these details to inhibit the occurrence of memory errors (e.g., misinformation acceptance), a phenomenon called recollection rejection (Brainerd et al. 2003).

Our result that details retrieved during the NICHD Protocol shielded children from the reporting of misinformation parallels research by Gabbert et al. (2009). In their study, they found that participants who completed a Self-Administered Interview were less prone to misinformation reporting than participants who did not conduct this interview. Furthermore, as in our experiment, Gabbert et al. found that the remembrance of more accurate details was associated with a lower tendency to go along with misinformation. Collectively, our findings and those from Gabbert and colleagues imply that investigative interviewing might guard (child) witnesses and victims from falling prey to subsequent misinformation.

Our experiment also differs to a certain extent from other research that examines the ways in which people can be protected from misinformation and the formation of memory errors. For example, there is a wealth of research on the corrective effects of post-warning on the misinformation effect (Blank and Launay 2014). However, this line of research has concentrated on warning about the corruptive effect of misinformation *after* being exposed to misinformation. Furthermore, there are also studies in which people are forewarned *before* they encode stimuli that could engender memory errors. For example, when people receive associatively related word lists (e.g., *bed, rest, awake, tired, dream*, etc.) and are warned beforehand about the associative structure of these lists, people are less likely to falsely recollect a critical non-presented word (i.e., *sleep*; e.g., Gallo et al. 1997). However, in the current experiment, participants received no explicit warning and the manipulation that they received (i.e., NICHD or free recall or nothing) took place after encoding and before the presentation of misinformation.

Of course, certain limitations of the current experiment deserve to be mentioned. First, to determine if retrieval-enhanced suggestibility is indeed dependent on which stimulus type is presented (e.g., video vs. interactive event), future research could include different types of stimuli and examine whether retrieval-enhanced suggestibility is contingent on stimulus type. Also, the current design is still a far stretch from investigative interviewing in real-life situations which often concern highly negative emotional events, such as sexual abuse. Relatedly, in real-life situations, it is likely that misinformation is presented much later (e.g., after days, weeks) than in our experimental study. We presented all stages of the current experiment in one session because our previous experiment showed that no retrieval-enhanced suggestibility effect was found after 1 week (Otgaar et al. 2019). Still, subsequent experimentation could attempt to replicate the current findings using longer delays.

Apart from the limitations of the current experiment, our findings do imply that besides the positive effects of the NICHD Protocol on the retrieval of accurate and detailed memories, the NICHD has an additional positive value. That is, our results suggest that details retrieved by means of the NICHD Protocol can protect children against later misinformation. This underscores the point that when children are interviewed about possible traumatic experiences, the first interview should ideally and immediately be conducted using empirically based guidelines, such as the NICHD Protocol. This is all the more relevant because in many countries, children with an alleged experience of abuse are oftentimes interviewed by many different organizations, including child protection workers, police, and social welfare professionals (e.g., Erens et al. 2019). In each of these interviews, children might be exposed to misinformation.

To recap, the goal of the present experiment was to examine the impact of interviewing on the reporting of misinformation. We did not find that children who were interviewed were more prone to incorporate misinformation than children who did not have such a retrieval opportunity. What we did show was that the NICHD Protocol led to detailed and accurate statements in children. Furthermore, we found that the details in these statements immunized children from the reporting of misinformation. The current experiment adds to an accumulating body of evidence that demonstrates that investigative interviewing is not only beneficial for the retrieval of accurate memories. Investigative interviewing appears to have clinical value too (reducing victims' anxiety during the interview; Dodier and Otgaar 2019), and we now have shown that it can reduce the susceptibility to misinformation as well. Clearly, in cases in which children have to talk about alleged experiences of a traumatic event, investigative interviewing based on empirically validated principles should have the highest priority.

Compliance with Ethical Standards

All procedures performed were in accordance with the ethical standards of the institutional ethical committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Conflict of Interest All authors declare to have no conflicts of interest.

Appendix

Memory Test

1 How many tea lights were blown out in the second trick? (Misinformation question)

  a None (wrong)
  b All (correct)
  c All, apart from one (misinformation)
2 What did I use to light the candle of trick 1? (Control question)
    A match.
3 What was the glass of the second trick filled with? (Consistency question)

  a Soda and vinegar (correct)
  b Flour and lemonade
  c Oil and soda
4 Which color did the bowl from trick 1 have? (Misinformation question

  a White (correct)
  b Red (misinformation)
  c Yellow (wrong)
5 What was put over the candle in trick 1? (Misinformation question)

  a Bowl (wrong)
  b Bottle (misinformation)
  c Glass (correct)
6 How much liquid was transferred from one glass into another in the second trick? (Consistency question)

  a Half of it
  b The whole liquid
  c Nothing (correct)
7 How did I hurt myself? (Control question)
    By burning yourself with the match in trick [GIVE NUMBER].
8 What was used to light the candles of trick 2? (Misinformation question)

  a An already lit candle (misinformation)
  b A match (wrong)
  c A lighter (correct)
9 What was used to stir the liquids of trick 2? (Control question)
    A spoon. or A fork.
10 What was used to extinguish the candles in second trick? (Consistency question)

  a The glass filled with liquid
  b The empty glass (correct)
  c A bottle with water
11 What happened after the jar was placed over the candle? (Misinformation question)

  a The candle blew out but nothing else happened (wrong)

  b The candle blew out and following this, the water was sucked inside the bottle (correct)
  c The water was sucked inside the bottle, but leaked out again as soon as the candle blew out (misinformation)
12 The fire of how many candles were extinguished in the second trick? (Misinformation question)

  a Four (misinformation)
  b Two (wrong)
  c Three (correct)
13 What kind of candles were used in the second trick? (Control question)
    Tea lights.
14 How Wwere the Ccandles in Ttrick 1 Pplaced? (Misinformation Qquestion)

  a In a row (correct)
  b Random (wrong)
  c In a circle (misinformation)
15 Where was the candle placed in the first trick? (Consistency question)

  a Next to the bowl
  b On the floor
  c In the middle of the bowl (correct)
16 How much water was filled into the bowl at the beginning of the first trick? (Misinformation question)

  a Full, until it nearly ran over (misinformation)
  b Just a little bit (correct)
  c None (wrong)
17 What was put inside the bowl in the first trick? (Consistency question)

  a Candle
  b Water (correct)
  c Food color
18 What was put first into the glass of the second trick? (Control question)
    Soda.
19 Which color was used to color the water? (Misinformation question)

  a Blue (correct)
  b Green (misinformation)
  c Orange (wrong)
20 What was spilled on the table in one of the tricks? (Misinformation question)

  a The mixture in trick 2 (misinformation)
  b Nothing (correct)
  c The food color in trick 1 (wrong)

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