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The effects of prior knowledge on children's memory and suggestibility

Holger B. Elischberger *

Department of Psychology, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599, USA
National Institute of Child Health and Human Development, Section on Social and Emotional Development, Bethesda, MD 20892, USA

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Abstract

In this study, 5- and 6-year-olds were read a story and asked to recall its details. Two independent factors—prestory knowledge and poststory suggestions—were crossed to examine the effects on children's story recall. The results indicated that prestory social knowledge about the story protagonist as well as academic knowledge relating to the content of the story influenced the accuracy of children's recall immediately after the story presentation. Following the suggestive interview, children reported interviewer-provided social and academic misinformation to a greater extent when the misinformation was consistent with their prior knowledge. In contrast, children were more likely to refute misinformation that contradicted their academic knowledge. These findings are discussed in terms of the mechanisms underlying the knowledge–memory and knowledge–suggestibility linkages.
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Keywords: Knowledge; Memory; Suggestibility; Stereotype

* Present address: Albion College, Department of Psychology, Olin Hall, 611 E. Porter St., Albion, MI 49224, USA. Fax: +1 301 480 5775.
E-mail address: HElischberger@albion.edu.

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Introduction

Despite the widely accepted developmental view that children's knowledge affects their memory performance (e.g., Chi & Ceci, 1987; Ornstein, Shapiro, Clubb, Follmer, & Baker-Ward, 1997; Schneider & Bjorklund, 2003), there is surprisingly little research evidence to support this. Therefore, the first goal in conducting the current study was to assess the effects of a knowledge manipulation on children's recall performance. Given the importance of both accurate memory and the ability to withstand suggestive influences, a second goal was to examine the effects of prior knowledge on children's responses to misleading questions. A brief discussion of the two slightly overlapping bodies of literature—one on knowledge and memory and the other on knowledge and suggestibility—follows.

Knowledge and memory

The majority of our memories are not exact internal copies of what occurred in the past but rather constructive amalgams that result from the collaboration of a number of perceptual and cognitive processes. An individual's prior knowledge as it relates to the experience at hand affects both the initial establishment of the memory representation (Bransford & Franks, 1971; Bransford & Johnson, 1972) and its subsequent recall (McFarland & Ross, 1987; Myles-Worsley, Cromer, & Dodd, 1986; Ross, 1989, 1997). Inferential reasoning (i.e., drawing on existing knowledge to supply pertinent but missing information) is one of the central cognitive processes in linking knowledge and remembering (Bartlett, 1932; Paris & Lindauer, 1976; Trabasso, Suh, Payton, & Jain, 1995; Trabasso & van den Broek, 1985).

Research on the effects of children's general (scripted) knowledge of real-life events on their memory for one particular instance has shown that mnemonic accuracy can be both enhanced and undermined by knowledge (Farrar & Goodman, 1990; Hudson, 1990, 1993; Hudson & Nelson, 1983; Nelson, 1986), depending on the consistency of the existing knowledge and the target event. Thus, for instance, 4- and 6-year-olds falsely reported the occurrence of routine aspects of a pediatric examination when those components had in fact been omitted from the particular exam in question[1]; in contrast, levels of correct recall for actually administered typical features were very high even after a lengthy delay of 12 weeks, indicating little forgetting of knowledge-consistent aspects of the event (Ornstein et al., 1998).

Given the rather vast literature on the topic and the general assumption that knowledge *causally* affects memory, there is surprisingly little research to directly establish causality through experimental designs. Moreover, the existing research

[1] Explanations of this "autosuggestion" phenomenon vary. The account provided by the fuzzy trace theory, for instance, does not rely on knowledge-based inferential reasoning but rather proposes that errors are internally generated when relatively enduring, abstract, and meaning-based *gist* traces, as opposed to short-lived and detailed *verbatim* traces, are retrieved at the time of memory assessment (e.g., Brainerd & Poole, 1997; Brainerd & Reyna, 1995). Ornstein and colleagues' (1998) data are certainly consistent with that notion.

yields inconsistent findings. Greenhoot's (2000) recent study is one of the few successful attempts at demonstrating the presumed causal link. She showed that 5- and 6-year-olds' recall of a series of short stories varied depending on whether the story protagonist had been introduced as a nice and friendly character or as a mean and unfriendly character. Children's recall of the stories contained inferences (i.e., information that had not been explicitly stated) that reflected information they had received about the main character.

In another study, kindergarteners, second-graders, and fourth-graders made similar commission errors by drawing on experimenter-provided factual knowledge about the fictitious *Targa* tribe when recalling a story about *Tor of the Targa* (Brown, Smiley, Day, Townsend, & Lawton, 1977). Finally, Sutherland, Pipe, Schick, Murray, and Gobbo (2003) reported that 5- to 7-year-olds' memory for a "visit with the pirate" activity could be enhanced by reading the children a story that included very specific prior knowledge about the event before it actually occurred, relative to participants who engaged in a topic-relevant but general discussion. It is not clear whether these results reflect rehearsal or other processes such as allocation of attention (Sutherland et al., 2003).

In contrast, DeMarie-Dreblow's (1991) findings cast some doubt on the existence of a direct causal linkage between knowledge and memory. In that study, 8- to 11-year-olds were taught a variety of facts about birds and participated in a memory test that included a sort recall test of a list of bird names. Despite the expected increases in knowledge of the subject matter and the positive correlation between knowledge and memory indexes, no increases in two of the primary indicators of memory—recall and clustering—resulted from teaching the children task-related information.

Failure to provide evidence for knowledge-driven memory enhancement also comes from a study by Muir-Broaddus, Rorer, Braden, and George (1995), who had 10th-grade biology students participate in nine training sessions about plants. In addition, there were three testing sessions (one at the beginning, on in the middle, and one at the end of the 3-week training period), during each of which the students completed a paired associates task involving nonsense words and plant-related words as well as a speed of processing assessment. Despite the expected increases in knowledge for participants in the training condition, their increases in the recall of paired associates across the three testing sessions were no greater than those of untrained controls who showed no knowledge gains. Finally, Baker-Ward, Burgwyn, and Parrish (1994) found that providing 3-year-olds with videotaped information about dental checkups prior to their own first visit to the dentist's office did *not* enhance their recall of the exam.

The reasons for this "now you see it, now you don't" state of affairs are not easily pinpointed due to the numerous methodological differences among the studies cited (e.g., testing event memory vs. semantic memory). However, potentially crucial differences presumably exist in terms of the structural properties of the knowledge bases that were created. The type, strength, and number of associations between concepts (e.g., Anderson, 1981; Collins & Loftus, 1975) all play a central role in determining whether effects on memory will emerge (Bjorklund, 1985; Gobbo & Chi, 1986; Ornstein & Naus, 1985). It is assumed, for instance, that well-organized, well-established

(rehearsed), and coherently structured knowledge is more easily and automatically accessed and used in the context of a memory task (cf. Chi, 1977; Chi & Ceci, 1987) and that a greater degree of similarity between to-be-remembered materials and relevant prior knowledge is facilitative (Chi & Koeske, 1983; Lange, 1973, 1978; Roediger & McDermott, 1995, 2000).

Knowledge and suggestibility

Research concerning the linkages between knowing and remembering not only is relevant from the perspective of basic research but also might hold important insights for a decidedly applied problem, namely children's ability to provide accurate accounts of personally experienced or witnessed events in forensic contexts. A tremendous amount of empirical work on children's "eyewitness testimony" has been conducted to date (for overviews, see Ceci & Bruck, 1993, 1995; Eisen, Quas, & Goodman, 2002), and there is widespread agreement that both basic abilities to remember and the ability to resist suggestive questioning are required for effective and accurate testimony.

There has been some speculation about the potential effects of knowledge on children's tendencies to accept and reject false postevent information, largely based on extrapolations from findings in basic memory research (Bruck, Ceci, & Melnyk, 1997; Quas, Qin, Schaaf, & Goodman, 1997). As indicated above, the (re)constructive nature of memory entails a potential for spontaneous, self-generated knowledge-consistent mnemonic errors (Greenhoot, 2000; Ornstein et al., 1998; Ross, 1989, 1997). It has been proposed that mnemonic accuracy may be compromised even further when knowledge-consistent suggestions (that are *inconsistent* with the actual occurrence) are introduced from an external source such as an interviewer.

Initial support for this notion stems from a study by Leichtman and Ceci (1995), who investigated the effects of combining prior social knowledge about an individual, Sam Stone, with stereotype-consistent suggestive questions on 3- to 6-year-olds' memory for Sam's visit to their kindergarten. The combination of prior knowledge and knowledge-consistent false suggestions proved to be most detrimental for the accuracy of children's reports: Fully 72% of the 3- and 4-year-olds, and roughly 40% of the 5- and 6-year-olds, mentioned at least one of two suggested misdeeds during the course of the final interview that followed four suggestive interviews, thereby exceeding the levels observed when only prior knowledge, postevent misinformation, or neither was present.

Different lines of interpretation have been proposed to account for the finding that externally provided erroneous suggestions may be incorporated into reports about the past. Whereas some researchers have argued in favor of a storage-based hypothesis, according to which misinformation permanently overwrites or alters the original trace (e.g., Loftus, Hoffman, & Wagenaar, 1992; Loftus & Loftus, 1980), others hold the view that both the trace for the original event and the trace for the false information coexist in memory. Misinformation effects may then be the result of social pressures (e.g., judging one's own memory to be less credible than the postevent information because the latter was provided by an ostensibly knowledgeable

experimenter) (e.g., McCloskey & Zaragoza, 1985; Zaragoza, Dahlgren, & Muench, 1992); alternatively, they may result from difficulties in correctly identifying the source of the information that is remembered (i.e., individuals are unable to accurately determine whether their memory stems from the original event or from the misleading interview) (e.g., Johnson, Hashtroudi, & Lindsay, 1993; Lindsay, 2002; Zaragoza, Lane, Ackil, & Chambers, 1997).

Indeed, a number of researchers have found that children who perform better on source-monitoring assessments tend to be less suggestible. Principe (1997), for instance, assessed source-monitoring skills by having 4-year-olds take turns with an experimenter in performing simple actions (e.g., touching one's nose) and later presenting them with a surprise memory test about who performed which particular action. The results showed that better performance on this source-monitoring assessment predicted greater rates of rejecting false information about an experienced shopping event. Similarly, Leichtman, Morse, Dixon, and Spiegel (2000) found support for the linkage between source-monitoring abilities and suggestibility in a series of studies involving different source-monitoring tasks and measures of suggestibility with 3- to 6-year-olds (but see also Poole & Lindsay, 2001, 2002). It is important to note that all of the theoretical approaches just described, coexistence as well as storage-based suggestibility accounts, can accommodate the possibility that event-related knowledge will amplify the misinformation effect if it is consistent with the false post-event information.

The fact that knowledge can both enhance and undermine memory performance in the absence of misinformation raises the distinct possibility that it may also have dual effects on suggestibility. The findings of Champion (2001) provide the most direct evidence to date in support of the hypothesis that knowledge may lead to an attenuation of suggestibility. In that study, young adults who had been taught causal information about static electricity were able to use that knowledge to refute suggestive questions about the tricks in a magic show that were based on static electricity if the erroneous information was in logical contradiction to what they had learned. In line with these findings, Connolly and Lindsay (2001) reported that 4-, 6-, and 8-year-olds who experienced four instantiations of a play event instead of only one instantiation were less likely to be misled about aspects of the event that were invariant across all repetitions. It appears that the children in the repeated condition acquired a script about what usually happened during these play sessions and drew on that generalized knowledge to resist the interviewer-provided misinformation. Comparable results have been obtained by Powell, Roberts, Ceci, and Hembrooke (1999) and are consistent with memory trace strength explanations of suggestibility (e.g., Holliday, Douglas, & Hayes, 1999; Marche, 1999; Pezdek & Roe, 1995).

Against the backdrop of these two partially overlapping research literatures, the current research was designed with two overarching goals: (a) to expand the available experimental database regarding the knowledge–memory linkage and (b) to examine the effects of knowledge on children's suggestibility. Independently of these two major goals, an additional aim was to examine the linkage between a source-monitoring assessment and children's suggestibility. To address these issues, 5- and 6-year-olds' memory for an illustrated narrative, which focused on a zookeeper coming to

visit the classroom of a fictitious story character and showing the students a number of exotic animals native to rainforests, was assessed. The experimental manipulation included knowledge of two different domains so as to determine the generality of the knowledge effects. Thus, prior to hearing the target narrative, approximately half of the participants received information about the story protagonist (social knowledge/stereotype) as well as about two of the animals featured in the story (academic knowledge), whereas the remaining children did not. Furthermore, 1 week after the story presentation and an immediate recall assessment, approximately half of the participants from each of these two knowledge conditions were suggestively interviewed about the target narrative. To assess the dual nature of knowledge with regard to suggestibility, some of the erroneous suggestions were consistent with what the children had been taught previously, whereas other pieces of information contradicted their experimentally induced prior knowledge. A final recall assessment was administered to all participants 10 days after the story presentation (and 3 days after the suggestive interview). A source-monitoring test was also included.

Method

Participants

A total of 66 children, ages 5 and 6 years, were recruited by means of invitation letters distributed to the kindergarten and first-grade classrooms of six different public and private preschools and elementary schools in the southeastern United States. Data from 1 child, who was developmentally delayed, were ultimately excluded; therefore, the final sample consisted of 65 children. Participants in the final sample ranged in age from 61 to 84 months ($M = 74.06$, $SD = 5.73$), and there were 38 boys and 27 girls. The majority of children (77%) were Caucasian, as identified by their parents. Close to 90% of the parents were college graduates.

Procedures

This study adopted a 2×2 factorial design with the factors of prior knowledge (present vs. absent) and suggestive interview (present vs. absent). Participants were randomly assigned to one of the four resulting experimental groups: *full manipulation* (including both prior knowledge and the suggestive interview), *suggestion only* (including the suggestive interview but not prior knowledge), *knowledge only* (including prior knowledge but not the suggestive interview), and *no manipulation* (including neither the suggestive interview nor prior knowledge). There were no differences among the experimental groups with regard to average age or gender distribution.

As illustrated in Table 1, each child participated in two to four visits depending on group assignment. The core procedure of the study that was invariant across all four experimental groups, shaded gray in the table, entailed the presentation of the target narrative. Subsequently, all children took part in the first portion of a two-part source-monitoring assessment and were then interviewed about the narrative for an immediate

Table 1
Treatment of experimental groups

	Full manipulation[a]	Suggestion only[b]	Knowledge only[c]	No manipulation[d]
Visit 1 (Day 1)	Baseline knowledge assessment	No visit	Baseline knowledge assessment	No visit
	Knowledge book manipulation		Knowledge book manipulation	
Visit 2 (Day 4)	Postmanipulation knowledge assessment		Postmanipulation knowledge assessment	
	Target narrative presentation	Target narrative presentation	Target narrative presentation	Target narrative presentation
	First part of source-monitoring assessment (performing the actions)	First part of source-monitoring assessment (performing the actions)	First part of source-monitoring assessment (performing the actions)	First part of source-monitoring assessment (performing the actions)
	Immediate interview	Immediate interview	Immediate interview	Immediate interview
Visit 3 (Day 11)	Suggestive interview	Suggestive interview	No visit	No visit
	Second part of source-monitoring assessment (memory of the actions)	Second part of source-monitoring assessment (memory of the actions)		
Visit 4 (Day 14)	Final interview	Final interview	Final interview	Final interview
	Final social knowledge assessment	Social and academic knowledge assessment	Final social knowledge assessment	Social and academic knowledge assessment
	Reading skills assessment		Reading skills assessment	
			Second part of source-monitoring assessment (memory of the actions)	Second part of source-monitoring assessment (memory of the actions)

[a] Prior knowledge present and suggestive interview present.
[b] Prior knowledge absent, suggestive interview present.
[c] Prior knowledge present, suggestive interview absent.
[d] Prior knowledge absent, suggestive interview absent.

memory assessment. The final interview occurred approximately 10 days later ($M = 10.17$, $SD = 1.33$). Each child was given a small toy at the end of each visit. In addition, at the conclusion of the study, each family received a $20 gift certificate as a token of appreciation. All materials and assessments are described in detail subsequently.

Group membership determined the exact procedures for each child. Specifically, the knowledge manipulation entailed asking the mothers of participants in the prior knowledge condition (composed of the full manipulation and knowledge only groups) to read in their home two specially designed knowledge books that contained social information about the protagonist and academic knowledge about two animals featured in the target narrative. Mothers were asked to read each book to their children twice, and this book reading was completed at least 2 days prior to the presentation of the target narrative. In addition, mothers were provided with a script for use in summarizing for their children the five key pieces of social and academic information following the book reading. To explore the possibility that those participants in the prior knowledge condition with relatively higher reading skills might acquire more knowledge by reading along with their mothers, a reading skills assessment was included in that condition. Participants in the two no knowledge groups did not read the knowledge books.

To evaluate the effectiveness of the knowledge manipulation, children in the prior knowledge condition participated in a baseline knowledge assessment (Visit 1) and a postmanipulation knowledge assessment (Visit 2). A final social knowledge assessment was also included (Visit 4) to determine whether the participants' impression of the story protagonist had changed following the presentation of the target narrative. Participants in the no prior knowledge condition received one knowledge assessment in Visit 4.

To examine the effects of knowledge on suggestibility, children in the two suggestive interview groups participated in a suggestive interview about the narrative prior to the final memory assessment and approximately 7 days ($M = 6.84$, $SD = 0.52$) after the story presentation (Visit 3). No such interview was administered to children in the no suggestive interview groups.

Fully 62 families (95%) chose to be seen in their homes, and 3 families chose to be seen at the memory laboratory on campus. Each visit was between 20 and 45 min in duration. A total of four researchers (three females and 1 male) conducted the assessments, and the number of participants seen by each interviewer was roughly evenly divided among the four experimental groups. Each family was seen by the same interviewer for the entire period of the study, with a few exceptions occurring due to scheduling difficulties. Preliminary analyses indicated that consistency of interviewer had no effects on any of the outcome measures.

Materials

Knowledge books (Visit 1)

The two specially designed knowledge books contained descriptions of five different events in which the protagonist ("Eric" for male participants, "Lisa" for female

participants) interacted with other children at school, his or her mother, and a younger sibling at home. Each book was designed to convey the impression of a mean and unfriendly character to create a negative social stereotype. The stories for boys and girls were virtually identical with the exception of some minor adjustments for gender-typical objects and/or behaviors (e.g., Eric breaks a toy car, whereas Lisa ruins a doll).[2] One of the books contained additional information about the sloth, whereas the other contained additional information about the basilisk lizard. These animals were introduced in the context of Eric's teacher reading a story about rainforests at school. Each book focused on two particular animal characteristics for a total of four key pieces of academic knowledge, namely that (a) sloths are extremely slow animals that do not run, (b) sloths spend most of their waking and sleeping time hanging upside down from tree branches, (c) basilisk lizards can run across water, and (d) basilisk lizards' skin is very dry and rough to the touch. Both books were illustrated with colored drawings, and each contained approximately 1450 words roughly evenly split between social and academic information. The order in which the books were read (sloth story first vs. basilisk lizard story first) was counterbalanced across participants.

Knowledge assessments

Prior to reading the books, children in the knowledge manipulation groups were given a baseline knowledge assessment during Visit 1. This assessment included six questions about the physical appearance, diet, and other characteristics of each of the two animals. Four of these questions were irrelevant "fillers," and two probes per animal assessed children's preexisting knowledge of the characteristics that were central within the context of this project (e.g., "What does a basilisk lizard do when it needs to get across water?"). No baseline assessment of social knowledge was included because Eric was an entirely fictitious story character about whom no prior knowledge could exist by definition. After reading the books, children were given the postmanipulation knowledge assessment during Visit 2. This assessment included the same six questions about each of the two animals. In addition, the children were asked seven questions about Eric and their impression of his behavior and character (e.g., "Does Eric like to help and share?"). Finally, to evaluate whether these children's knowledge book-induced impression had changed with Eric's objectively neutral portrayal in the target story and/or the passage of time, a final social knowledge assessment was administered at the end of Visit 4. This assessment included the same seven questions about Eric's character as in the postmanipulation assessment.

Children in the no prior knowledge groups were given only one knowledge assessment at the end of Visit 4. They answered the same six questions about the animals as well as the seven questions about the story protagonist. This knowledge assessment

[2] For ease of presentation, in the remainder of this article, reference is made only to the male story protagonist with the understanding that the female character is also implied.

was administered at the end of the experiment so as not to prime these participants to pay particular attention to the key aspects of the narrative.

Target narrative (Visit 2)

The to-be-remembered target narrative was thematically related to the knowledge materials and described a number of events occurring during Eric's day at school when a zookeeper comes to visit to show them a number of real-life rainforest animals, among them a sloth and a basilisk lizard. The story described six key social items that, following Greenhoot's (2000) example, were ambiguous with regard to the protagonist's role or intention in causing some negative outcomes. For instance, one of the children is making a clay animal, which is eventually knocked off the shelves and breaks. Eric is nearby as this happens, but his role in the event is never made explicit. Thus, his actions and motivations are in fact neutral. The story further included four key academic items involving the rainforest animals (e.g., the basilisk lizard chasing after a bee and running toward the school pond). Three additional items—one each for Eric, the sloth, and the basilisk lizard—were included as controls in that there was no meaningful connection to the prior knowledge (e.g., the sloth was shown to eat some leaves that a child had dropped on the floor in front of its cage). Table 2 provides an overview of the key items included in the story as well as the respective piece of relevant prior knowledge and suggestive question. The narrative was presented as a PowerPoint slide show on a laptop computer. It consisted of a total of 35 slides containing illustrations rendered in the same style as those from the knowledge books. The text of the narrative (approximately 1100 words) was read aloud by a female narrator, and the recording was incorporated into the slide show, which was approximately 7 min in duration.

Immediate interview (Visit 2)

Children's memory for the target story was first assessed a few minutes after the presentation of the narrative in a hierarchically structured immediate interview. The initial general, open-ended request for recall (e.g., "Tell me everything you remember") was followed by increasingly specific questions about a total of 13 scenes from the narrative (6 social, 4 academic, and 3 control) as necessary. For instance, an initial specific question was "What happened when the children made clay animals?" and the most specific question about that item was "What happened to Jim's clay parrot?" These increasingly focused prompts were used only if the particular information targeted by the question (e.g., the fact that Jim's clay parrot broke) had not been provided in response to a less specific question. All of the questions required the children to formulate their own answers.

Suggestive interview (Visit 3)

Children in the suggestion groups were asked 21 questions about the narrative, with 10 of these questions strongly implying erroneous information regarding Eric's actions. For the social items, 5 of the misleading questions were knowledge-consis-

tent questions in that they implied something negative about Eric (e.g., "Eric wiggled the shelves so that Jim's clay parrot fell off. Why did Eric wiggle the shelves around?"), whereas one of them included a knowledge-inconsistent positive suggestion (e.g., "Eric made the seesaw go hard because he thought that Peter would have a lot of fun that way. Why did Eric think that Peter would have fun bouncing up and down like that?") (Table 2). Similarly, regarding the academic items, one piece of knowledge-consistent misinformation (e.g., "The lizard ran out across the water to chase the bee") and three pieces of knowledge-inconsistent misinformation (e.g., "The sloth came running out pretty fast at Tom when it saw the leaves he was holding") were suggested. The remaining 11 neutral "filler" questions were included to mask the purpose of the suggestive probes.

Final interview (Visit 4)

The final interview was identical to the immediate interview with the exception that, following the open-ended cues, up to one additional prompt (for academic items) or two additional prompts (for social items) per item were included. The analyses of children's responses to these probes did not enhance the evaluation of the substantive research questions beyond what became evident during the open-ended portion of the interview and thus are not reported here.

Source-monitoring test

To examine whether children's source-monitoring skills for an event independent of the target narrative would be related to their ability to correctly identify the source of misinformation and thus not to incorporate it into their final reports, a two-part assessment modeled after Principe (1997) was included in Visits 2 and 3. During the first part, the research assistant and participants took turns performing 12 simple actions (e.g., touching their noses). Each action was performed by the assistant while the children were observing or vice versa. This part of the assessment required approximately 3 min duration. The second part was administered to children in the suggestive interview conditions during Visit 3 and to the remaining children during Visit 4.[3] It consisted of a surprise memory assessment during which the participants had to indicate, for each of the 12 actions, whether it was performed by themselves or by the research assistant.

Reading skills assessment

Three subtests that measure reading ability were chosen from the Woodcock–Johnson Test of Achievement III (Woodcock, McGrew, & Mather, 2001), a stan-

[3] The fact that these two conditions differed in the timing of the second part of the source-monitoring assessment was not important because these data were primarily of interest with respect to the children in the suggestion condition. That is, source-monitoring scores were correlated with reports of suggested information during Visit 4.

Table 2
Prior knowledge, key items in target narrative, and suggestive questions

Prior knowledge	Key item in target narrative	Relation of key item to prior knowledge	False information embedded in suggestive question	Relation of suggestive question to prior knowledge
Social:				
Eric is a mean child	1. Jim's clay parrot breaks	None (ambiguous)	Eric wiggled the shelves to make the parrot fall off	Consistent
	2. Eric is holding Tom's missing lunchbox	None (ambiguous)	Eric was trying to hide Tom's lunchbox	Consistent
	3. Eric bounces Peter hard on seesaw; Peter falls off	None (ambiguous)	Eric bounced Peter on seesaw to let Peter have fun	Inconsistent
	4. Eric steps on Stevie's toes	None (ambiguous)	Eric stepped on Stevie's toes to break in line	Consistent
	5. Eric is holding Peter's broken glasses	None (ambiguous)	Eric stepped on Peter's glasses to break them	Consistent
	6. Someone stuck gum on Jim's camera	None (ambiguous)	Eric stuck the bubble gum on the camera	Consistent
Academic:				
The lizard's skin is dry and rough to the touch	1. Peter touches the lizard; it feels dry and rough	Consistent	Peter's hand was wet and slimy after touching the lizard	Inconsistent
The lizard can run across water	2. The lizard stops chasing the bee at the edge of the pond	Inconsistent	The lizard ran out across the water of the pond to get the bee	Consistent
Sloths hang upside down	3. The sloth is hanging upside down from a branch	Consistent	The sloth was sitting on the branch	Inconsistent
Sloths are very slow	4. The sloth comes crawling out of its cage to get leaves	Consistent	The sloth came running out of the cage to get leaves	Inconsistent
Control:				
N/A	1. Eric eats pancakes for breakfast	None	—	—
N/A	2. The lizard climbs onto the zookeeper's arm	None	—	—
N/A	3. The sloth eats the leaves	None	—	—

dardized test battery designed to assess reading, mathematics, written language, and knowledge. These subtests were Letter–Word Identification, Reading Fluency, and Passage Comprehension.

Coding

Knowledge assessments

The baseline and post-book-reading academic knowledge assessments were evaluated with respect to children's responses to four questions regarding the speed of the sloth, the sloth's bodily position when sleeping in a tree, the basilisk lizard's mode of crossing water, and the feel of the basilisk lizard's skin to the touch. Each correct answer was credited with 1 point, whereas incorrect answers received no credit, for a range of total scores from 0 to 4. The participants' social knowledge was quantified by evaluating their answers to seven questions about Eric as negative (e.g., "He's mean to the other kids"), receiving a score of −1, or positive (e.g., "He helped another boy; that was nice"), receiving a score of +1. Answers that were not clearly positive or negative were coded as neutral and received a score of zero. Thus, the summary score for social knowledge could range between −7 and +7.

Memory interviews

Children's immediate and final reports about the target narrative were coded exclusively with regard to the 13 critical items (6 social, 4 academic, and 3 control), similarly to the feature coding approach used by Ornstein and colleagues (e.g., Ornstein et al., 1998). Each substantive response was first coded with regard to the level of recall, that is, the specificity of the probe required to elicit the information. However, the differentiation of levels of prompt specificity within the open-ended portion of the interviews proved not to be informative and is not considered further. Therefore, the focus of the coding was on how accurately children's responses reflected the information from the target narrative. Specifically, for each of the 7 social items (6 key and 1 control), each child's most detailed response (among the three open-ended requests) was classified as either verbatim recall, positive inference, negative inference, or noninferential error. A child's report concerning an ambiguous social item was considered to be verbatim if it correctly reflected the information from the narrative without including inferences about the cause of an event that was left unspecified in the story (e.g., "Eric was holding the other boy's broken glasses"). An instance in which the child went beyond the information provided in the narrative by "recalling" the responsible party for an event or the motivation behind a clearly stated action on Eric's part was coded as an inference. Inferences could be either positive or negative for Eric, that is, either blaming him for a negative outcome (e.g., "Eric knocked the clay sculpture off the shelf") or explaining the negative outcome in a positive or exculpatory way (e.g., "Eric accidentally knocked the bird over"). A code of noninferential error was noted whenever a participant reported false information that was not an inference such as the statement "Tom's lunchbox was out by the door" (when in fact Eric was holding it).

The coding scheme for academic information was very similar with the exception that there was no inference code for these six items (four items and two controls) because the story elements involving the behaviors and properties of the sloth and basilisk lizard were not ambiguous in nature. Instead, inaccurate responses were coded as knowledge-consistent errors (e.g., "The lizard ran across the school pond") or knowledge-inconsistent errors (e.g., "The sloth was running at Tom"). In addition, a code of incomplete response was included to capture responses that failed to include relevant key information about the item in question such as reports about the lizard chasing the bee that never clarified what the lizard did when it finally got to the pond (i.e., whether or not it ran across the water).

The responses of participants in the suggestive interview condition to the 10 misleading questions from Visit 3 were coded into one of five categories: (a) "don't know" responses, (b) apparent acceptance of the false information by providing a reasonable answer (e.g., "Eric wiggled the shelves because he wanted to be the first to have his clay figure on there"), (c) rejection of the erroneous information by using knowledge (e.g., "Sloths don't run"), (d) rejection of the false information by using episodic memory of the story (e.g., "No, the lizard stopped before he got on the water"), and (e) rejection of the erroneous information without providing a reason. Consistent with previous research (Cassel, Roebers, & Bjorklund, 1996), the majority (roughly 75%) of children's responses indicated overt acceptance of the misleading information (an additional 15% were "don't know" responses); virtually no knowledge-based rejections and very few memory-based rejections were observed. Importantly, no differences emerged between the two prior knowledge conditions in the occurrence of these responses. Therefore, in the interest of scope, the details of these analyses are not reported in this article.

Source-monitoring test

The total number of correct nominations of the research assistant and/or the child as the person who carried out each of the 12 behaviors was tallied and used for the subsequent analyses.

Reading skills assessment

Raw scores were obtained for each participant for each of the three subtests from the Woodcock–Johnson Test of Achievement III (Woodcock et al., 2001), and the scores were added together to create a summary variable.

Reliability

Two coders independently coded approximately 10% of all knowledge and memory assessments. Interrater agreement was calculated as the ratio of number of agreements over total number of codes given. Percentage agreement for the memory interviews reached an average of 86% for the immediate interview, 88% for the final interview, and 100% for the suggestive interview. Independent coding of the knowledge assessments resulted in 100% interrater agreement.

Results

Analyses are presented to examine the effects of the mother–child book reading on children's social and academic knowledge, the impact of prior knowledge on children's performance at the immediate interview, and the influence of both knowledge and suggestive interviewing on children's performance at the final interview. The primary outcome variables are expressed as proportions of the number of questions asked and/or answered, but the pattern of results was no different when the outcome variables were expressed as frequencies.

When performance on individual items was of interest, the dependent variables were dichotomous (e.g., a participant either did or did not report a knowledge-consistent error about the lizard running across the water). In these instances, binary logistic regression analysis was used, and the effects of the predictor variables are reported in terms of the Wald statistic (e.g., Agresti, 2002) unless grossly inflated standard errors were observed—a known potential issue with this statistical procedure (Menard, 1995). In those instances, following Agresti (2002), stepwise backward elimination, whereby the effect of a predictor can be assessed more reliably by noting the change in overall model fit when moving from the full model to a simpler model, was performed; thus, the effect of the predictor is expressed in terms of the χ^2 statistic. If the dependent variable could assume more than two values, analysis of variance (ANOVA) was used.

Preliminary analyses were carried out to test the effects of child gender, ethnicity, and interviewer on all outcomes. In addition, for the analyses regarding the mother–child book reading, the effects of counterbalancing order of the knowledge books were evaluated, and the number of days since story presentation was considered in the analyses of children's final recall. None of these factors contributed significantly to the prediction of the outcome measures. Furthermore, there were no associations between children's reading skills ($M = 52.19$, $SD = 27.60$) and acquisition of knowledge from the two books. Finally, there were no associations between age and the outcome variables.

Effects of mother–child book reading on children's knowledge

Social knowledge

In principle, the children's scores on the social knowledge assessment could range from −7 to +7. During Visit 2, after reading the knowledge books, scores ranged from −6 to −7 ($M = -6.91$, $SD = 0.30$) across participants in the prior knowledge condition. The average score was significantly different from the zero value that would indicate a neutral impression, $t(31) = 131.92$, $p < .001$, demonstrating that children indeed formed a strong negative opinion of the story protagonist.

After the completion of the final interview during Visit 4, children's social impression was once more assessed for participants in the prior knowledge

condition. There was no difference between the average social knowledge score in this assessment ($M = -6.66$, $SD = 1.29$) and the initial one during Visit 2, $t(31) = 1.25$, $p = .22$, indicating that Eric's ambiguous/neutral portrayal in the target story did not weaken the negative effect of the social knowledge manipulation.

During a next step, the social knowledge scores of participants from all four experimental groups obtained at the final assessment (Visit 4) were entered into a 2 (knowledge vs. no knowledge) × 2 (suggestion vs. no suggestion) ANOVA. The main effects of knowledge, $F(1, 61) = 116.44$, $p < .001$, $\eta^2 = .66$, and suggestive interview, $F(1, 61) = 7.80$, $p < .01$, $\eta^2 = .11$, and the significant interaction, $F(1, 61) = 8.20$, $p < .01$, $\eta^2 = .12$, reflect the fact that only children without prior knowledge and without a suggestive interview had a positive impression of Eric ($M = 5.12$, $SD = 3.98$), whereas all of the participants in the prior knowledge condition formed a negative impression, regardless of whether they were suggestively interviewed (full manipulation: $M = -6.88$, $SD = 0.34$; knowledge only: $M = -6.94$, $SD = 0.25$). Finally, for participants who had no prior knowledge but were exposed to the predominantly negative suggestions, a neutral impression of the protagonist resulted ($M = 0.13$, $SD = 5.86$). It is also apparent from the large standard deviations that children without explicit prior knowledge differed widely in their opinions of the story's main character. Thus, in summary, the manipulation of social knowledge was effective.

Academic knowledge

To assess the effectiveness of manipulating children's academic knowledge, baseline knowledge scores (Visit 1) for the four pieces of factual information were compared with post-book-reading scores (Visit 2) for participants in the prior knowledge condition. A repeated measures ANOVA was performed on the total knowledge scores with assessment point (baseline vs. post-book reading) as the repeated factor. The change over time in total knowledge scores from an average baseline of 1.34 ($SD = 0.94$) to an average post-book-reading score of 3.91 ($SD = 0.30$) was significant, $F(1, 31) = 251.74$, $p < .001$, $\eta^2 = .89$.

At the conclusion of the study (Visit 4), a knowledge assessment was administered to the children in the no prior knowledge condition. Two separate ANOVAs showed that this average "quasi-baseline" of 2.00 ($SD = 0.94$) was higher than the true baseline for participants who had read the knowledge materials, $F(1, 63) = 7.98$, $p < .05$, $\eta^2 = .11$, but also showed that it remained significantly below that of the post-book-reading scores, $F(1, 63) = 121.07$, $p < .001$, $\eta^2 = .66$.

In summary, children who had read the knowledge books formed a negative impression of the story's main character, and joint mother–child book reading led to clear increases in children's academic knowledge concerning the rainforest animals. Children in the no prior knowledge condition acquired some factual information about the animals through experiencing the target narrative, but the rate of incidental learning remained below that achieved by explicit teaching.

Immediate story recall (Visit 2)

Social items

The impact of prior knowledge on children's immediate open-ended recall of Eric's (ambiguous) role in the six story events was evaluated with regard to proportions of verbatim recall, negative inferences, and positive inferences, as displayed in Table 3.

Of primary interest were the inferences reported by children. Given the induction of a negative social stereotype, a particular focus was on the difference between the two knowledge conditions regarding the proportion of negative inferences. A repeated measures ANOVA with outcome (proportion of positive inferences vs. proportion of negative inferences) as the within-subjects factor and prior knowledge as the between-subjects factor yielded a significant interaction, $F(1,63) = 23.45$, $p < .001$, $\eta^2 = .27$, indicating that children with prior knowledge reported more negative inferences than positive inferences, whereas the opposite was the case for children without prior knowledge. In addition, a significant effect of knowledge, $F(1,63) = 16.04$, $p < .001$, $\eta^2 = .20$, showed that children with prior knowledge reported more inferences than did children without prior knowledge, an effect that appears to be driven primarily by the high proportion of negative inferences reported by children with prior knowledge.

Academic items

Children's memory for story events surrounding the two rainforest animals was evaluated with regard to verbatim recall, knowledge-consistent errors, knowledge-inconsistent errors, and incomplete answers, as shown in Table 4. A distinction was made between the knowledge-inconsistent *pond* item (the lizard chases the bee to the school pond but does not run after it across the water as might be expected by children with prior knowledge) and the three knowledge-consistent items (the three remaining items).

The impact of academic knowledge on children's memory was assessed by testing differences between the two knowledge conditions in the proportions of errors

Table 3
Mean proportions of verbatim recall, negative inferences, and positive inferences in immediate recall of social information by knowledge condition

	Prior knowledge ($n = 32$)	No prior knowledge ($n = 33$)
Verbatim recall	.64 (.21)	.81 (.20)
Negative inferences	.27 (.19)	.03 (.07)
Positive inferences	.08 (.17)	.14 (.17)
Residual	.01 (.03)	.03 (.08)

Note. Standard deviations are in parentheses. Values represent the proportions of total recall (maximum 6), excluding "don't know" responses. The residual category represents noninferential errors.

Table 4
Mean proportions of verbatim recall, knowledge-consistent errors, and knowledge-inconsistent errors in immediate recall of academic information by knowledge condition and item type

	Prior knowledge		No prior knowledge	
	Pond item ($n = 26$)	Remaining three items ($n = 32$)	Pond item ($n = 30$)	Remaining three items ($n = 33$)
Verbatim recall	.50 (.51)	.97 (.10)	.67 (.48)	.82 (.23)
Knowledge consistent	.12 (.33)	0	0	0
Knowledge inconsistent	0	.02 (.08)	0	.17 (.23)
Incomplete	.38 (.50)	.01 (.06)	.33 (.48)	0

Note. Standard deviations are in parentheses. Values represent the proportions of children providing a particular type of response in case of an individual item (pond item) and the proportions of total recall (maximum 3 for remaining three items), excluding "don't know" responses and data missing due to experimenter error.

because, in the context of this study, knowledge-related errors are more immediately revealing about the knowledge–memory linkage than is accurate recall. For the pond item, a binary logistic regression with knowledge as the predictor yielded a significant effect, $\chi^2(1) = 4.80$, $p < .05$, Nagelkerke $R^2 = .24$, indicating that children with prior knowledge made reliably more knowledge-consistent errors than did those without prior knowledge. In addition, an ANOVA on the proportion of knowledge-inconsistent errors for the remaining three items with prior knowledge as the independent variable was significant, $F(1, 63) = 11.90$, $p < .05$, $\eta^2 = .16$, indicating that children with prior knowledge made fewer knowledge-inconsistent errors than did participants who had not read the knowledge books.

Control items

The purpose of these analyses was to determine whether the effects of prior knowledge were confined to those items that were related to knowledge and did not extend to unrelated items, that is, what Eric had for breakfast, what the lizard did when the zookeeper first opened the cage door, and what the sloth did with the leaves a child gave him. Proportions of verbatim recall and errors were used to characterize children's performance on these three control items.

The proportions of verbatim recall were high (prior knowledge condition: $M = .90$, $SD = .23$; no prior knowledge condition: $M = .89$, $SD = .17$), and the proportions of erroneous recall were low (prior knowledge condition: $M = .07$, $SD = .16$; no prior knowledge condition: $M = .10$, $SD = .20$).[4] Because the incidence of errors was not of particular "diagnostic" value here, the proportion of verbatim recall was chosen as the outcome measure. An ANOVA with the factor of prior knowledge did not yield a significant effect, $F < 1$, indicating that no differences existed between the two conditions in the correct recall of items that were not related to prior knowledge.

[4] Proportions of verbatim and erroneous recall within conditions might not sum to 1.0 due to the occurrence of incomplete responses.

In summary, children with an experimentally induced negative social stereotype reported more negative inferences about the story protagonist than did children without prior knowledge. Regarding academic items, only participants who had learned about the lizard's ability to run across water falsely recalled the animal doing so in the target narrative. However, prior knowledge was also associated with decreased rates of spontaneous knowledge-inconsistent errors. There were no effects of knowledge on recall of knowledge-unrelated control items.

Final story recall (Visit 4)

Social items

Table 5 summarizes the proportions of verbatim recall, negative inferences, and positive inferences at the final interview. Because a suggestive interview preceded the final recall assessment for participants in the suggestive interview condition, data are now presented separately for all four experimental groups. In addition, a differentiation is made between the *seesaw* item, for which the only false positive suggestion (i.e., that Eric acted with the best of intentions when he made the seesaw go hard enough to make Peter fall off) was provided by the interviewer, and the remaining five items that carried negative suggestions.

Table 5
Mean proportions of verbatim recall, negative inferences, and positive inferences in final recall of social information by experimental group and item type

	Prior knowledge			
	Suggestive interview		No suggestive interview	
	Seesaw item ($n = 16$)	Remaining five items ($n = 16$)	Seesaw item ($n = 15$)	Remaining five items ($n = 16$)
Verbatim recall	.56 (.51)	.33 (.28)	.87 (.35)	.56 (.29)
Negative inferences	0	.63 (.30)	.07 (.26)	.27 (.19)
Positive inferences	.44 (.51)	.03 (.10)	.07 (.26)	.10 (.19)
Residual	0	.03 (.07)	0	.07 (.13)
	No prior knowledge			
	Suggestive interview		No suggestive interview	
	Seesaw item ($n = 16$)	Remaining five items ($n = 16$)	Seesaw item ($n = 17$)	Remaining five items ($n = 17$)
Verbatim recall	.56 (.51)	.53 (.23)	.94 (.24)	.72 (.27)
Negative inferences	0	.40 (.26)	0	.04 (.11)
Positive inferences	.44 (.51)	.07 (.16)	0	.19 (.25)
Residual	0	.01 (.05)	.06 (.24)	.06 (.12)

Note. Standard deviations are in parentheses. Values represent the proportion of children providing a particular type of response in case of an individual item (seesaw item), and the proportion of total recall (maximum 5 for remaining five), excluding don't know responses. Residual category represents non-inferential errors.

Analyses of children's memory for the seesaw item were performed for the proportion of positive inferences. A binary logistic regression, including the factors prior knowledge, suggestive interview, and the interaction, yielded an extremely inflated standard error for the interaction term. Stepwise backward elimination of the interaction from the model showed a nonsignificant decrement in model fit, $\chi^2(1) = 1.42$, $p > .25$, indicating that it did not contribute significantly to the prediction of positive inferences for the seesaw item. In the simpler regression model, there was no effect of prior knowledge, Wald = .13, $p = .72$. The significant effect of suggestive interview, Wald = 8.72, $p < .05$, Nagelkerke $R^2 = .35$, confirmed that children who were suggestively interviewed evidenced a higher proportion of positive inferences than did those who were not suggestively interviewed.

The proportion of negative inferences for the remaining five items was analyzed by means of a 2 (suggestion vs. no suggestion) × 2 (knowledge vs. no knowledge) ANOVA. This analysis yielded significant main effects of knowledge, $F(1, 61) = 17.77$, $p < .001$, $\eta^2 = .23$, and suggestive interview, $F(1, 61) = 41.10$, $p < .001$, $\eta^2 = .40$, indicating that children with a prior negative stereotype reported more negative inferences than did those without the social bias and that suggestive questioning was associated with increases in the reporting of negative inferences as well (the interaction was not significant, $F < 1$).

Academic items

The proportions of verbatim recall, knowledge-consistent errors, knowledge-inconsistent errors, and incomplete responses at the final interview are summarized in Table 6. Binary logistic regression was used to analyze knowledge-consistent errors for the pond item. This item was considered to be a knowledge-inconsistent item because the lizard did not run across the school pond in the target narrative; however, the interviewer provided a knowledge-consistent suggestion by claiming that the lizard did in fact run across the water. The model that included prior knowledge, suggestive interview, and the interaction term did not yield significant results, all Wald statistics $\leqslant 2.28$, all ps $\geqslant .13$. The standard error for the interaction term was highly inflated, and its subsequent removal did not lead to a significant decrement in overall model fit, $\chi^2(1) = 1.12$, $p > .25$. In the reduced model, a significant effect of suggestive interview emerged, Wald = 4.40, $p < .05$, Nagelkerke $R^2 = .14$, indicating that the provision of misleading information led to an increase in knowledge-consistent errors. The effect of prior knowledge approached significance, Wald = 3.25, $p = .07$, Nagelkerke $R^2 = .09$, suggesting that participants with prior academic knowledge were somewhat more likely to report knowledge-consistent errors than were those without prior academic knowledge.

Between-group differences in the proportion of knowledge-inconsistent errors for the remaining three items were evaluated through a 2 (suggestion vs. no suggestion) × 2 (knowledge vs. no knowledge) ANOVA. The purpose of this analysis was to determine whether academic knowledge would mitigate the effects of knowledge-inconsistent false suggestions. There was a significant main effect of knowledge, $F(1, 61) = 9.30$, $p < .05$, $\eta^2 = .13$, indicating that children with prior knowledge made

Table 6
Mean proportions of verbatim recall, knowledge-consistent errors, and knowledge-inconsistent errors in final recall of academic information by experimental group and item type

	Prior knowledge			
	Suggestive interview		No suggestive interview	
	Pond item ($n = 14$)	Remaining three items ($n = 16$)	Pond item ($n = 13$)	Remaining three items ($n = 16$)
Verbatim recall	.36 (.50)	.90 (.23)	.38 (.51)	.88 (.17)
Knowledge consistent	.43 (.51)	0	.15 (.38)	0
Knowledge inconsistent	0	.08 (.18)	0	.10 (.16)
Incomplete	.21 (.43)	.02 (.08)	.46 (.52)	.02 (.08)
	No prior knowledge			
	Suggestive interview		No suggestive interview	
	Pond item ($n = 15$)	Remaining three items ($n = 16$)	Pond item ($n = 13$)	Remaining three items ($n = 17$)
Verbatim recall	.73 (.46)	.69 (.28)	.69 (.48)	.70 (.31)
Knowledge consistent	.20 (.41)	0	0	0
Knowledge inconsistent	0	.29 (.29)	0	.25 (.26)
Incomplete	.07 (.26)	.02 (.08)	.31 (.48)	.06 (.18)

Note. Standard deviations are in parentheses. Values represent the proportions of children providing a particular type of response in case of an individual item (pond item) and the proportions of total recall (maximum 3 for remaining three items), excluding "don't know" responses and data missing due to experimenter error.

fewer errors than did those without prior knowledge. The effects of the suggestive interview and the interaction were not significant, Fs < 1.

Control items

As a reminder, the purpose of these analyses was to determine whether the effects of prior knowledge were confined to those items that were related to knowledge and did not extend to unrelated items. The proportions of verbatim recall and erroneous final recall of the three control items were calculated. Children in the full manipulation group reported less verbatim information ($M = .74$, $SD = .29$) than did those in the other three groups (suggestion only: $M = .92$, $SD = .15$; knowledge only: $M = .96$, $SD = .11$; no manipulation: $M = .90$; $SD = .20$), as indicated by a 2 (knowledge vs. no knowledge) × 2 (suggestion vs. no suggestion) ANOVA that resulted in a significant main effect of suggestive interview, $F(1,61) = 4.26$, $p < .05$, $\eta^2 = .07$, as well as a significant interaction, $F(1,61) = 5.58$, $p < .05$, $\eta^2 = .08$. Importantly, however, an analogous ANOVA on the proportion of errors (full manipulation: $M = .11$, $SD = .18$; suggestion only: $M = .06$, $SD = .13$; knowledge only: $M = .02$, $SD = .08$; no manipulation: $M = .08$, $SD = .15$) yielded no significant effects, all Fs$(1,61) \leqslant 2.48$, all ps $\geqslant .12$, indicating that the difference observed for verbatim recall was not due to an elevated rate of erroneous recall for children in the full manipulation group but rather was due to a greater rate of incomplete responses.

In summary, the presence of negative social knowledge and the presence of negative suggestions each was associated with increased rates of negative inferential errors, and the combination of both led to the greatest rate of false negative reports. Similarly, the presence of academic knowledge and the presence of knowledge-consistent suggestions each was associated with increased rates of knowledge-consistent errors, and the combination of both led to the greatest rate of such false reports. Contrary to expectations, children's acceptance of (knowledge-inconsistent) positive misinformation about the story protagonist (playing on the seesaw) was not affected by their prior negative social knowledge. In contrast, and as expected, participants' academic knowledge prevented them from accepting knowledge-inconsistent suggestive information about the animals.

Linkages between source monitoring and suggestibility

In principle, it is possible that children with relatively better source-monitoring skills were more likely to differentiate between what was actually presented in the story, on the one hand, and what was suggested to them in the suggestive interview, on the other. The number of correct responses on the source-monitoring task could range between 0 and 12. The actual range across participants in the two suggestive interview groups was found to be 5 to 12, with an average score ($M = 8.28$, $SD = 1.75$) that was significantly above a chance value of 6.00, $t(31) = 7.39$, $p < .001$. There was no effect of counterbalancing order, $t(29) = 1.35$, $p = .19$, and performance did not correlate with age, $r = .16$, $p = .37$.

Children's source-monitoring scores were correlated with all of the dependent variables from the final interview, that is, positive and negative inferences as well as knowledge-consistent and knowledge-inconsistent errors (broken down by item type as was done in the analyses of memory performance). All of the correlations were very small and nonsignificant with a maximum of $r = .11$, $p = .56$, indicating that children's memory for source did not predict their suggestibility.[5]

Discussion

The results of the current study replicate and extend the current literature by providing clear evidence of the impact not only of social knowledge, but also of academic knowledge, on the memory performance of 5- and 6-year-olds. Consistent with previous research, prior knowledge exerted both beneficial and detrimental effects on mnemonic accuracy. Moreover, the current results also reveal the dual nature of

[5] Analogous analyses for the immediate memory performance of participants with prior knowledge showed a similar lack of linkages between source-monitoring and self-generated negative inferences as well as knowledge-consistent errors, maximum $r = .06$. These results must be interpreted somewhat cautiously due to the fact that the two subgroups received the second part of the source-monitoring assessment at different times (Visit 2 vs. Visit 4), although this did not lead to a difference in average source-monitoring performance, $t < 1$.

knowledge with respect to children's suggestibility: When erroneous information suggested by an interviewer contradicted what children knew, their academic knowledge provided some inoculation against the effects of the misinformation. At the same time, however, children's willingness to accept false information was magnified when prior knowledge was in place to support it.

Effects of knowledge on memory

The fact that children's recall varied with experimentally controlled differences in knowledge supports a causal knowledge–memory linkage hypothesis. These findings replicate previous literature with respect to social knowledge (Greenhoot, 2000); however, outside of the social domain, past research has sometimes failed to uncover causal evidence. Why did an effect of academic knowledge emerge in the current study? In contrast to previous research (e.g., DeMarie-Dreblow, 1991), the current investigation entailed the teaching of only a few facts that were not tied into a complexly structured whole. In addition, the similarity in content between knowledge materials and the to-be-remembered narrative presumably rendered the application of relevant knowledge fairly effortless, thereby facilitating its use in the encoding and retrieval of the story (cf. Schneider & Pressley, 1997; Sutherland et al., 2003).

In terms of the processes that mediate between knowledge and recall, prior knowledge about Eric's mean character may have created a cognitive context (Bransford & Johnson, 1972) that participants used to interpret the events described in the story. It should be noted, however, that inferential reasoning was not a necessity for comprehending the story (cf. McKoon & Ratcliff, 1992), as demonstrated by the predominantly verbatim social recall of children without prior knowledge. Academic knowledge similarly led some children to make knowledge-consistent errors when recalling the basilisk lizard chasing a bee to the pond. If some participants might not have correctly encoded the details of the pertinent target information, possibly due to a lack of attention, they might then have drawn on their general knowledge when asked about the lizard chasing a bee to the pond in the story (cf. Zaragoza et al., 1997).

Alternatively, it is possible that children's knowledge-consistent errors were the result of source-monitoring difficulties (Johnson et al., 1993). Specifically, despite encoding the fact that the lizard in the story did not run across the school pond, some children might have recalled the lizard running across water in the knowledge book and then mistakenly attributed the target story to be the source of that memory. Although it appears to contradict this interpretation, the fact that children's source-monitoring skills were not related to their immediate memory performance might merely indicate that the assessment used did not tap the particular source-monitoring skill necessary to differentiate between the two sources of information in this study (but see also Poole & Lindsay, 2001, 2002).

Finally, inferential reasoning may also account for the finding that children with prior academic knowledge reported fewer knowledge-inconsistent errors than did participants without prior academic knowledge. In case of a failure to encode or retrieve the original information, the former would have the advantage of arriving at

the correct answer to a specific question, such as how fast the sloth came out of its cage, based on what they know about the animal.

Effects of knowledge on suggestibility

This is the first demonstration that vicariously acquired information may offer children some protection against an interviewer's suggestions. When prior academic knowledge was in place, the rate of knowledge-inconsistent errors at the final interview was not affected by whether or not children had received a misleading interview. A similar inoculating effect did not emerge in the social domain, however, as participants with a negative stereotype were as likely to accept a knowledge-inconsistent positive suggestion as were children without prior social knowledge. This unexpected finding may be explained by the differential diagnostic values of positive and negative behaviors; that is, both friendly and unfriendly individuals may display occasional nice behavior, whereas negative acts are usually committed only by unfriendly people (Hess & Auman, 2001). Alternatively, some participants in the prior knowledge condition might not have interpreted what was designed to be a positive suggestion as being all that positive, as illustrated by one female participant who reported the suggested information but added spontaneously that Lisa's behavior was still mean because Lisa could have foreseen that playing rough on the seesaw might hurt the other girl.

Revealing its dual nature, knowledge also served to magnify the detrimental effects of knowledge-consistent misinformation. In line with previous research (Leichtman & Ceci, 1995), the highest rate of negative inferences was observed in participants whose negative social knowledge was joined with interviewer-provided negative false information. Similarly, the highest proportion of knowledge-consistent errors for academic items was found for participants who both possessed prior knowledge and were misled.

How might the effects of knowledge on suggestibility be explained? Turning first to the suggestibility-magnifying effects of prior knowledge, one possibility is that the relevant original (target event) information was never encoded by some participants for reasons unrelated to the later provision of misinformation (cf. Zaragoza et al., 1997). These participants might then, at the final interview, have drawn not only on their previous knowledge but also on the knowledge-consistent misinformation. A similar scenario might have occurred with participants who did in fact encode the original information but failed to retain it until the final interview.

This potential mediational pathway is consistent with research by Pezdek and colleagues (Pezdek, Finger, & Hodge, 1997; Pezdek & Hodge, 1999), who showed that false memories for events that never occurred are suggestively planted in children's memories more readily if they are plausible. Plausibility judgments in turn are influenced by the availability of knowledge in memory that is consistent with the suggested event (see also Loftus, Coan, & Pickrell, 1996). Thus, information is more likely to become incorporated into the reconstruction of a memory if it is consistent with an individual's current knowledge. In addition, plausibility judgments may also

lead a child to judge the misinformation as true when both the original and misleading information are encoded and later retrieved.

To some extent, the rejection of knowledge-inconsistent misinformation might result from processes that represent a reversal of the ones just discussed. For instance, if both the original information and the misinformation coexist and are recalled at the final interview, the mismatch might be detected and the knowledge-inconsistent suggestion might be refuted on the grounds that it is implausible (Champion, 2001). Source-monitoring theory (Johnson et al., 1993; Lindsay, 2002) might suggest that prior knowledge improved the decision-making process involved in children's source attribution by allowing them to argue that the false information was not likely to stem from the target narrative given its inconsistency with what was known to be factually correct about the animals. As pointed out earlier, the lack of significant linkages between source monitoring and suggestibility in the current study may be a function of the particular measures rather than a lack of association on a conceptual or process level. It is entirely possible that, much like memory performance, source-monitoring skills are influenced to some extent by the particular tasks used to assess them.

Finally, proponents of a trace alteration view might posit that the mismatch detection and rejection scenario described above takes place after the original trace is created but before any destructive updating could occur. In fact, Loftus (1979) argued that the possibility of memory updating (alteration) is reduced when a strong mismatch is detected. This appears to have been the case for at least some participants, as illustrated by one boy who, in a rare display of defying the social pressures of the suggestive interview, countered the interviewer's suggestion that the sloth came running at one of the children by exclaiming, "Sloths don't run, silly!"

Implications

The current findings that (a) children's memory reports may include spontaneously generated knowledge-based errors and that (b) this problem may be compounded when an interviewer introduces false knowledge-consistent information underscore that it is vitally important to adhere to nonsuggestive techniques when interviewing children about a past experience (Poole & Lamb, 1998; Sternberg, Lamb, Esplin, Orbach, & Hershkowitz, 2002). Moreover, it appears that assessments of children's knowledge, as it relates to their testimony, could offer valuable insight and place their reports within a broader context.

The fact that vicariously acquired academic knowledge may protect children from internally generated and externally provided misinformation is encouraging, but it does not provide any reason to take the issue of suggestibility any less seriously. The erroneous suggestions in this study were strongly worded, but at the same time the children were warned that sometimes the interviewer made mistakes. In addition, children were suggestively interviewed only once, and they were not challenged if they recalled the original information from the narrative instead of reporting the misinformation. There is a real possibility that the (modest) buffering effects of prior knowledge would be attenuated if greater pressure to acquiesce were to be applied.

The application of the current results to the legal context is, of course, limited. For instance, an actual real-life target activity might lead to more coherent and accurate memory representations than does the presentation of a story (Gobbo, Mega, & Pipe, 2002; Murachver, Pipe, Gordon, & Owens, 1996; Roebers, Gelhaar, & Schneider, 2004; Tobey & Goodman, 1992); thus, it might lead to relatively lower levels of suggestibility and attenuated effects of knowledge (but see also Leichtman & Ceci, 1995). Future research could potentially adopt real-life methodology while simultaneously addressing a number of additional questions of interest such as the interaction between prior knowledge and other individual difference variables (e.g., shyness), the effects of a more complex and elaborate knowledge base that is experimentally established in a longitudinal (e.g., microgenetic) approach, and an examination of how alternative indicators of knowledge (e.g., reaction time measures) relate to memory and suggestibility.

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