Remembering and Understanding: The Effects of Changes in Underlying Knowledge on Children’s Recollections

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This study was designed to explore the influence of changes in children’s knowledge on earlier constructed memories. Kindergartners’ ($N = 102$) recall of a series of stories was examined as a function of their interpersonal knowledge about the main story character. Children’s knowledge about the protagonist was manipulated prior to presentation of the stories, and the effects of their impressions on story recall were examined. A change in some of the children’s impressions was then promoted, and the impact of this second knowledge manipulation on recall of previously heard stories was assessed. The results indicated that children’s story recall was affected by their prior impressions. Moreover, following the second knowledge manipulation, children revised their story reports in ways that were consistent with their newly acquired impressions, which suggests that they had reconstructed their memories of previously heard stories. These findings provide evidence for both prospective and retrospective effects of knowledge on memory.

INTRODUCTION

A substantial literature indicates that what an individual knows can have a dramatic effect on what he or she remembers (e.g., Bartlett, 1932; Chi & Ceci, 1987; Ornstein & Naus, 1985). What one knows, however, changes continuously in response to new information, and these changes in knowledge have implications for remembering. Thus, the relation between remembering and understanding is best conceptualized as a dynamic interplay between episodic memory representations and underlying knowledge structures. Given the dramatic changes in knowledge and world understanding that take place during childhood, this view of knowledge–memory linkages is particularly relevant to an analysis of memory development in children. With these issues in mind, the current study was designed to examine children’s memory as a function of stability and change in their underlying knowledge structures. This work was motivated by theoretical questions about the operation of knowledge, memory, and constructive processing and also by applied issues surrounding children’s event memory and testimonial competence.

In the present investigation, the linkages between remembering and understanding were explored within the domain of social cognition. Research on the development of social cognition suggests children’s social knowledge determines how they interpret and respond to encounters with other people. From an applied perspective, the relation between children’s social knowledge and their memory for social situations is of considerable interest. Most events about which children are asked to testify center around the behavior of a particular person, and it seems likely that children’s memories for the actions of another person might depend on their general impressions of that individual (Ceci & Bruck, 1995). It is also possible that changes in children’s impressions might precipitate reinterpretations and reconstructions of previously witnessed or experienced encounters (Paris & Lindauer, 1977; Ross, 1989). This type of reconstructive processing might be especially common in young children, as the literature on social cognition suggests that young children’s impressions of other people tend to be quite unstable and changeable (Peckers & Secord, 1973; Shantz, 1983).

To examine these issues in the current investigation, 5- and 6-year-olds’ recall of a series of stories about two children was examined as a function of their knowledge and assumptions about the main character in the stories. A microgenetic method was used to lead children to construct a knowledge base, or person schema, about the stories’ protagonist, and the relation between children’s impressions and their recall of the stories was then examined. After presentation and initial recall of the stories, a change in some of the children’s impressions of the protagonist was promoted. The impact of this second knowledge manipulation on memory for previously heard stories was then assessed. The specific aims were to (1) document the growth of children’s knowledge about the stories’ protagonist over time, (2) examine the impact of children’s prior impressions of the protagonist on their recall of the stories, and (3) determine whether a change in the participants’ understanding of the pro-
The theoretical framework for this research was the constructivist view of memory originally articulated by Bartlett (1932). According to the constructivist perspective, knowledge plays a central role in all phases of the processing of information. As information is comprehended and encoded into memory, individuals are thought to use relevant knowledge to guide interpretation and to make inferences and elaborations (Chi & Ceci, 1987; Nelson, Fivush, Hudson, & Lucariello, 1983; Ornstein, Shapiro, Clubb, Follmer, & Baker-Ward, 1997). Indeed, numerous studies have demonstrated that the quantity of relevant prior knowledge affects how well information is understood and remembered. For instance, Chi’s (1978) classic experiment on chess experts’ and novices’ recall of the positions of chess pieces indicated that experts greatly outperformed novices, even though the experts were children and the novices were adults! Extensive knowledge may facilitate recall by increasing the comprehensibility of to-be-remembered information (e.g., Bransford & Johnson, 1972) or by enabling enriched encoding of information and the construction of more elaborated memory representations (e.g., Chi, 1978; Clubb, Nida, Merritt, & Ornstein, 1993). Qualitative aspects of underlying knowledge also appear to be related to the ways in which material is interpreted and subsequently recalled. Variations in knowledge or attitudes have been shown to result in corresponding differences in attention to stimuli, in interpretations of information, and in the types of inferences and elaborations that are made on given material (e.g., Anderson & Pitchart, 1978; Carmichael, Hogan, & Walter, 1932).

Just as knowledge may affect the interpretation, encoding, and storage of information, it may also affect the status of information already in memory and the retrieval of that information. According to schema theory, expectations that are provided by schemas for familiar events, people, or objects may be translated into memory probes, resulting in superior recall of schema-relevant, as opposed to schema-irrelevant, information (Brewer & Nakamura, 1984). However, individuals have also been shown to fill in memory gaps with existing knowledge, which sometimes results in errors in recall (Hudson, 1990; Myles-Worsley, Cromer, & Dodd, 1986). For example, Hudson (1990) reported that as children’s experience and familiarity with a novel “creative movement workshop” increased, they were more likely to make script-based errors in their recall of a single episode. It has also been well documented that these reconstructive errors are more likely to occur as the delay interval between initial encoding and retrieval increases because more information becomes lost or inaccessible over time (Myles-Worsley et al., 1986; Ornstein, Merritt, Baker-Ward, Gordon, Principe, & Furtado, 1998).

Extending the constructivist framework to social cognition, children’s understanding of the social world should determine the way they interpret and remember their experiences with other people. Knowledge structures about other people are often conceptualized as person schemas, or sets of expectations about other people that are constructed through experience in the social world (Hamilton, Katz, & Leirer, 1980; Reeder & Brewer, 1979). These person schemas serve to organize behavioral and trait information and to mediate processing of social situations. Research on the development of social cognition suggests that even very young children form schematic representations of other people that link their knowledge about traits, behaviors, and mental states. For example, children as young as 4 or 5 years of age are aware that certain behaviors and dispositions are associated and use trait and behavioral information to guide their inferences about others’ motives, future behaviors, and emotional responses (Dozier, 1991; Heyman & Gelman, 1999; Yuill & Pearson, 1998). There is also evidence, however, that young children may not yet understand personality traits as relatively enduring characteristics, which suggests that their impressions of other people may be quite malleable (Pevers & Secord, 1973; Shantz, 1983).

Consistent with predictions from the constructivist perspective, children’s social knowledge has been shown to influence their interpretation, encoding, and recall of others’ behaviors (Bigler & Liben, 1993; Clarke-Stewart, Thompson, & Lepore, 1989; Dodge & Frame, 1982; Leichtman & Ceci, 1995; Liben & Signorella, 1980). The work of Liben and her colleagues on the relation between memory and stereotypes, or person schemas about social groups, indicates that stories that are consistent with children’s gender and racial stereotypes tend to be remembered better than “counterstereotypic” stories (Bigler & Liben, 1993; Liben & Signorella, 1980). Similarly, Leichtman and Ceci (1995) found that 3- and 6-year-olds’ prior expectations about the personality of a male stranger affected their recall of his visit to their classroom. When questioned about the man’s visit, children who had been given prior expectations of the man as a clumsy, bumbling individual were more likely to make false reports about clumsy, bumbling acts than children given no expectations. This effect was especially pronounced among children who had also been interviewed in a suggestive, misleading manner during the interval between the visit and the final memory assessment.
Social knowledge should be especially influential on memories for ambiguous events and behaviors because it seems to direct the inferences children make about causality and intentionality in others’ actions. Dodge and Frame (1982), for example, reported that when kindergarten- to fifth-grade children were presented with ambiguous social situations, they attributed more hostile intentions to actors known to be aggressive than to actors identified as prosocial. Thus, in events in which causality or intention is unclear, differences in social knowledge might result in substantial variations in children’s interpretation of behaviors and subsequent memory for those behaviors.

There is considerable evidence that children’s prior knowledge can have a dramatic effect on remembering. But what happens to memories that have already been encoded when the relevant knowledge structures change? The constructivist framework suggests that knowledge modifications should result in corresponding changes to what is remembered. Specifically, the acquisition of new knowledge may promote accommodations or reinterpretations of stored memories so that they are consistent with the new understanding (Paris & Lindauer, 1977; Piaget & Inhelder, 1973). In addition, because knowledge at the time of recall is thought to provide retrieval cues and to guide inferences or guesses to fill in missing information, changes in knowledge that occur prior to recall should be reflected in what information is retrieved, how it is interpreted, and how it is reported (Paris & Lindauer, 1977; Ross, 1989). In support of this viewpoint, Ross (1989) has detailed a series of studies demonstrating that “people” recollections can be shaped by their current knowledge, beliefs, and attitudes. For example, Conway and Ross (1984), found that college students in a study skills program overestimated their improvement and, consequently, the effectiveness of the program, by exaggerating how poor their skills had been prior to the program. Moreover, 6 months later, when asked to recall the grades they had received just after the program, subjects systematically “remembered” better grades than they had actually obtained. In fact, the program did not significantly affect the participants’ grades at all.

Within the developmental literature, the interrelations between children’s changing knowledge and their recollections have not been examined systematically. Research on the linkages between children’s knowledge and memory has generally been limited to correlational studies of the relation between extant knowledge and recall of information that is related to that knowledge. Yet a consideration of changes in the knowledge base is essential to understanding children’s developing abilities to remember information and experiences. The present study offers a developmental analysis of these issues by examining the impact of both children’s understanding of information at the time it is encountered and changes over time in relevant underlying knowledge.

The Present Study

The goal of this investigation was to explore both prospective and retrospective influences of children’s social knowledge on their memories for another person’s behaviors. The experiment was conducted in five sessions over the course of 3 weeks. During the first three sessions, kindergartners were read a series of stories detailing a number of interactions between two children. All children were read the same stories and thus were provided identical information about the story characters’ behaviors. Prior to hearing the target stories, however, the participants were provided one of three types of information about the protagonist’s personality and general behavioral characteristics. One-third of the children were told that the protagonist was a prosocially oriented child (Positive), a second third were told that she or he was a bully (Negative), and the remaining children were given no relevant information (Neutral). This orienting information constituted the first knowledge manipulation. After presentation and initial recall of the target stories, a second knowledge manipulation took place. Specifically, the last two sessions were designed to convince the children that the protagonist was either prosocial and well liked (Positive) or antisocial and disliked (Negative). The types of social information given during the two knowledge manipulations were completely crossed, such that for some of the children, the second knowledge manipulation provided a new view of the protagonist. To determine the impact of the second knowledge manipulation on story recall, the children’s memory for the target stories was again measured at the end of the fifth and final session. Moreover, brief knowledge interviews were administered throughout the experiment (at all five sessions) to assess stability and change in the children’s impressions of the protagonist.

It was hypothesized that at the first memory interview, children’s prior impressions of the main character would affect their interpretation and recall of his or her behaviors in the target stories. Overall, children who were provided negative orienting information were expected to report more negative behaviors by the main character, and fewer positive and neutral acts, than children provided positive or neutral information. In addition, recall at the second memory interview was expected to be a function of the per-
spective promoted by the second knowledge manipulation. Thus, among the children for whom the second knowledge manipulation suggested a new orientation toward the protagonist, recall should change from the first memory interview to the second to reflect the newly acquired information.

**METHOD**

**Participants**

A sample of 117 kindergartners was recruited from five schools in the Durham, North Carolina, and Tucson, Arizona, areas to participate in this project. All schools were public elementary schools, with the exception of one Catholic school in Tucson. The general demographic characteristics of the child population at the Catholic school, however, were similar to those of the public schools in the same district. Participants were randomly assigned to one of six experimental conditions. The parents of all children enrolled in participating kindergarten classes were given letters about the research and consent forms at their schools, along with instructions to return a signed copy of the consent form to the school. Of the parents contacted, 40% provided written consent. Of the 117 children who began participation in the study, 15 were dropped, which resulted in a final sample size of 102 participants. These children were excluded because they were uncooperative or unresponsive during the interviews or because they were absent for one of the experimental sessions.

The sample consisted of 5- and 6-year-olds ($M = 71$ months, range = 62–83). About half of the children were female (49%). Forty-nine percent were European American, 36% were African American, and 15% were of other ethnic origins (Hispanic, Asian American, Native American, and mixed). The five participating schools generally served lower-middle- and middle-class communities. Demographic data on specific families that participated in this study were available only for 53 (52%) of the participants. Consistent with the communities in which the schools were located, the responding participants were primarily from lower-middle to middle-class families, as indicated by their parents’ average level of education of 14 years (range = 8.0–18.0).

**Experimental Design**

A diagram of the study design is presented in Figure 1. As the diagram indicates, participants met individually with an experimenter at five sessions over a 3-week period ($M = 18$ days). At each of the first three sessions, the children were read one of three stories about two children engaging in various activities together, such as going to the playground or attending school. The children’s understanding of the protagonist was manipulated both before and after they heard the three target stories.

**Knowledge Manipulation 1**

Prior to hearing each of the target stories, the children were shown a picture of the two story characters and read one of three types of descriptions of the protagonist and his or her relationship with the other character (see Appendix A). For one third of the children, the experimenter indicated that the protagonist was a nice child, was well liked, and had a close friendship with the other character. A second third of the participants was told that the protagonist was a mean child, was not well liked, and very much disliked the other character. The remaining participants were given no information relevant to understanding the main character in the stories.

**Target Stories**

The first three stories each described seven encounters between either Anne, the protagonist, and Nancy (for female participants) or Eric, the protagonist, and Charlie (for male participants). The children were read stories about characters that matched their own gender because previous research has demonstrated that children have better recall for same-sex characters (Halpern, 1985). Each story took place in one of three settings: school, a playground, or a day-camp. Each of the interactions involved an outcome for Nancy or Charlie, for which the main character, Anne or Eric, might or might not have been responsible. Within each story, some of the outcomes were negative, some were positive, and some were ambiguous. Although each outcome was clearly described, the protagonist’s role in producing the outcome was not explicitly detailed. Thus, his or her behavior could be interpreted as hostile, prosocial, or neutral. Several of the interactions, or story “features,” were adapted from scenarios used by Dodge and his colleagues in studies of social information processing (Dodge, 1980; Dodge & Frame, 1982). All of the stories were illustrated, with two cartoon illustrations for each of the seven features in the stories. The cartoon illustrations were drawn and colored to be ambiguous with respect to ethnicity. A sample story is presented, without the illustrations, in Appendix B. The order of presentation of the target stories was counterbalanced within the six groups of subjects.
During the fourth and fifth sessions, the participants were provided with additional information about the protagonist in the context of two brief stories. For one half of the children, Stories 4 and 5 were constructed to indicate clearly that the protagonist was nice, well liked, and had a close friendship with the other character, whereas for the other participants the manipulation suggested that the target child was mean, not well liked, and not a friend of the other character. These illustrated stories detailed a series of interactions between the protagonist’s mother and his or her teacher, babysitter, or camp counselor. In each of these interactions, the protagonist’s mother was provided general information about her child’s behavioral characteristics. For example, in the positive version of Story 4, the teacher told the protagonist’s mother that he or she had behaved quite well at school, whereas in the negative version, the mother
was told that her child was a “bully” at school. Specific prosocial or antisocial acts by the protagonist were not described in these stories. To illustrate, the alternate versions of Story 4 are shown in Appendix C.

The types of information given in the first and second knowledge manipulations were completely crossed, resulting in six conditions: Neutral-Positive (n = 15), Neutral-Negative (n = 19), Positive-Positive (n = 17), Positive-Negative (n = 16), Negative-Positive (n = 17), and Negative-Negative (n = 18). Male and female children were equally distributed among the six conditions. Likewise, the proportions of children of each ethnicity were approximately equal across the six experimental groups.

Procedure

Session 1

At the first meeting, the children were presented orienting information consistent with their group assignment (Positive, Negative, or Neutral), and subsequently were read a story from one of the target stories. Following the story, the children’s impressions of the protagonist were assessed with a Knowledge Interview.

Session 2

Session 2 was conducted exactly like Session 1 and took place 1 to 3 days (M = 2.2) after Session 1. The children were presented the same orienting information that they had been provided at Session 1 (Positive, Negative, or Neutral), and then were read a second story. Following the story, the children’s knowledge about the target character was again assessed with the Knowledge Interview.

Session 3

Session 3 was conducted 1 to 5 days (M = 4.1) after Session 2. The children were presented the same information they had been provided at Sessions 1 and 2 (Positive, Negative, or Neutral) and then were read a third target story. After the story, the Knowledge Interview was administered, followed by a Memory Interview about the three target stories.

Session 4

The fourth session took place approximately 1 week (M = 7.7 days) after Session 3. Knowledge Manipulation 2 began in this session. Children were read either the positive or negative version of the fourth story, consistent with the child’s group assignment. The children’s knowledge about the main character was again assessed with the Knowledge Interview.

Session 5

At the fifth session, which was conducted 1 to 5 days (M = 4.2) after Session 4, the children were read either the positive or negative version of the fifth story. The Knowledge Interview was then conducted, followed by a second Memory Interview, in which the children were again questioned about the three target stories that had been read during the first three sessions.

The Interviews

Knowledge Interviews

The Knowledge Interview involved a series of nine questions about the protagonist’s characteristics and his or her relationship with the other story character. The interview contained both open-ended (e.g., “What do we know about Eric?”) and specific questions (e.g., “Is Eric nice or mean? “Does Eric like Charlie?”). In addition, the children were asked to justify their position on the protagonist (e.g., “Why do you think Eric likes Charlie?”). Moreover, the children were asked to predict how the protagonist would behave in a novel situation, with the specific situation varying across the five interviews. For example, at the fourth session, the children were asked to indicate what they thought might happen if the protagonist were invited to a movie by the other character.

Memory Interviews

Memory Interviews 1 and 2 consisted of a series of open-ended questions about each story at three levels of specificity. The children were first asked to recall the most recently read story (Story 3), followed by Story 2 and Story 1. For each of the three stories, the children were asked to provide as much information as possible in response to the most general questions (Level 1 questions, e.g., “What happened in the story about Charlie and Eric going to school?”) before more specific level 2 questions were asked about each story feature (e.g., “What happened when it was time for lunch?”). Similarly, Level 3 questions (e.g., “What happened when Charlie looked for his lunch?”) were asked only about those features not already recalled in response to Level 1 or Level 2 questions. Memory Interviews 1 and 2 were identical, except that Memory Interview 2 began with some cursory questions about Stories 4 and 5 before proceeding to the recall probes about the three target stories. The children
were asked an average of 27 questions in the first memory interview and 29 questions (about the target stories) during the second interview. They were encouraged to provide additional detail with probes such as “How did that happen?” or “Tell me more about that.” The children were always questioned by a “naïve” experimenter, that is, an individual who had not been involved in the story-reading task. Approximately half (56%) of the subjects were questioned by the same individual at both Memory Interviews, whereas the other half met with two different memory interviewers. Consistency in interviewer was counterbalanced across the six experimental conditions, and preliminary analyses indicated that this factor was not related to changes in the children’s memory reports over time.

**Coding of the Interviews**

**Knowledge Interviews**

At each of the five sessions, the children’s responses to all questions about the protagonist in the Knowledge Interviews were coded as positive or negative with respect to the main character. For example, the statement “Anne is a very mean girl” was categorized as negative, whereas the response “Anne is nice” was coded as positive. For each child, the proportions of questions to which he or she provided negative and positive responses were calculated, and “Knowledge Scores” were formed by subtracting the proportion of negative responses from the proportion of positive responses. These scores ranged from −1 to 1, with scores close to −1 reflecting mostly negative responses, scores close to 1 indicating mostly positive responses, and scores around 0 reflecting mixed responses. These Knowledge Scores provided a general indication of the children’s impressions of the main character. For example, children with Knowledge Scores close to 1 most likely viewed the protagonist as a kind child who got along well with the other story character. To provide quantitative estimates of the children’s social knowledge, their responses were also parsed into propositions and coded for the type of information provided about the protagonist. Analyses of these knowledge estimates led to similar conclusions as the analyses of Knowledge Scores, and therefore those data are not presented here.

**Memory Interviews**

The coding of the Memory Interviews involved an assessment of the protagonist’s role in each of the remembered actions and the accuracy of each of the reported actions. Each action that was reported was classified as being negative (antisocial), neutral, or positive (prosocial) with respect to the protagonist. To illustrate the nature of children’s responses, consider the Lunch feature of the School story: one character (Charlie/Nancy) could not find his or her lunch and later saw the protagonist enter the room with the missing lunch in his or her hand. In the context of a child’s memory report, the statement “Eric stole Charlie’s lunch” was coded as recall of a negative behavior. Alternatively, the response “Eric found Charlie’s lunch for him” was classified as recall of a positive behavior. Reports of accidental behaviors (e.g., “Eric took Charlie’s lunch because he thought it was his.”) were also included in the positive category because they assigned the protagonist responsibility for the outcome but excused him or her from blame. Statements such as “Eric came in and he had Charlie’s lunch,” in which no clear blame or credit was assigned to the protagonist, were classified as neutral recall.

Children’s reports of these three types of behaviors were also classified into those that were reported literally, or as they had been described in the text (“Verbatim Recall”), and those that involved going beyond the information provided in the text (“Constructive Recall”). Returning to the Lunch example, the statement “Eric came in and he had Charlie’s lunch” was included in Verbatim Recall. There were three types of constructions in recall. “Inferences” were reported behaviors that might have been implied but were not actually stated in the text, for example, reporting that “Eric stole the lunch” or “Eric found the lunch for Charlie.” “Distortions” were reports of behaviors mentioned in the stories that were inaccurate, such as “Charlie found the lunch by himself.” Finally, “Intrusions” were incorrect reports of behaviors that had not occurred in the stories (e.g., “Charlie and Eric went to McDonald’s for lunch.”).

In addition to the general descriptions of the valence and accuracy of the memory reports, valenced changes in the reporting of specific behaviors were identified by using within-subject, feature-by-feature comparisons of each child’s two memory reports. Changes in reports in which the protagonist’s role in a specific action became more negative from Memory Interview 1 to Memory Interview 2 and changes in which the protagonist’s role became more positive from Memory Interview 1 to Memory Interview 2 were noted. For example, if in the first interview a child said that Eric found Charlie’s lunch box for him, and in the second interview that same child said that Eric stole Charlie’s lunch, a revision in the negative direction would be noted. Recall of neutral acts could
change in either the negative or positive direction. In addition, changes involving omissions or commissions of actions were included in the individual revision scores. For instance, prosocial behaviors that were reported at the first memory assessment but omitted at the second and negative behaviors that were reported anew at the second interview were included in the negative change scores. Change scores that did not include omissions or commissions were also calculated. Analyses of these measures revealed patterns similar to those of the more inclusive change scores.

Reliability

The Knowledge Interviews were scored by a “master” coder, and a reliability coder scored approximately 10% of the master coder’s work. Interrater reliability in the coding of the Knowledge Interviews was quite good. Percent agreement between the master coder and reliability coder averaged 95%. Similarly, the Memory Interviews were coded by one experimenter, and a second coder scored 10% of the master coder’s work. On average, the master coder and reliability coder agreed on 90% of the codes of the protagonist’s role and on 85% of the accuracy codes.

RESULTS

Social Knowledge

The analyses of knowledge were designed to examine growth and transformations in the children’s impressions over time. Descriptive analyses involved calculating the mean Knowledge Scores for each group at each of the five sessions. These means are presented in Table 1. As can be seen, patterns of Knowledge Scores at the first three sessions were consistent with the first knowledge manipulation. The Positive groups had Knowledge Scores close to 1, indicating generally positive views of the protagonist. On the other hand, the Negative groups had Knowledge Scores close to 0. In Sessions 4 and 5, Knowledge Scores were increasingly consistent with the second knowledge manipulation, with groups given positive information showing highly positive Knowledge Scores and groups given negative information showing highly negative Knowledge Scores.

Inferential analyses involved estimating growth curves to analyze change in the children’s impressions over the five sessions as a function of the two knowledge manipulations. A Hierarchical Linear Model (HLM) analysis strategy (see Burchinal, Bailey, & Snyder, 1994; Byrk & Raudenbush, 1992) was used to examine the effects of knowledge Group, a between-subjects factor defined by the first and second knowledge manipulations, and Session, a within-subjects factor. Thus, a separate growth curve was estimated for each knowledge Group. Because knowledge was expected to change in a nonlinear fashion for some groups of children (specifically, for those who received new social information during the second knowledge manipulation), a quadratic term for Session was also included. Moreover, interactions between Group and Session and between Group and Session-squared were tested to determine whether patterns of change in knowledge varied as a function of the knowledge manipulations.

Figure 2 shows the estimated growth curves, for each of the six groups, generated by the HLM of Knowledge Scores. As illustrated, the knowledge trajectories conformed to predictions. Change in Knowledge Scores over time varied as a function of Group, as reflected in an interaction between Session and Group, $F(5, 392) = 51.62, p < .001$. Follow-up tests indicated that at Sessions 1 through 3, the Knowledge Scores of the Positive groups were higher than those of the Neutral groups, which in turn were higher than those of the Negative conditions, $F_{s}(1, 392) > 15.92$, $ps < .001$. By Session 5, Knowledge Scores no longer differed according to Knowledge Manipulation 1. Rather, the children who were provided positive information during Knowledge Manipulation 2 had significantly higher scores than the children who

<table>
<thead>
<tr>
<th>Knowledge Group</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Session 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral-Positive</td>
<td>-.10 (.70)</td>
<td>-.09 (.90)</td>
<td>.43 (.79)</td>
<td>.75 (.40)</td>
<td>.83 (.39)</td>
</tr>
<tr>
<td>Neutral-Negative</td>
<td>.19 (.79)</td>
<td>.01 (.79)</td>
<td>.32 (.74)</td>
<td>-.63 (.61)</td>
<td>-.77 (.43)</td>
</tr>
<tr>
<td>Positive-Positive</td>
<td>.74 (.57)</td>
<td>.82 (.34)</td>
<td>.91 (.26)</td>
<td>1.00 (.00)</td>
<td>.87 (.48)</td>
</tr>
<tr>
<td>Positive-Negative</td>
<td>.59 (.66)</td>
<td>.81 (.31)</td>
<td>.92 (.24)</td>
<td>-.13 (.23)</td>
<td>-.58 (.68)</td>
</tr>
<tr>
<td>Negative-Positive</td>
<td>-.51 (.63)</td>
<td>-.41 (.71)</td>
<td>-.53 (.53)</td>
<td>.58 (.43)</td>
<td>.79 (.45)</td>
</tr>
<tr>
<td>Negative-Negative</td>
<td>-.60 (.60)</td>
<td>-.55 (.59)</td>
<td>-.55 (.48)</td>
<td>-.85 (.21)</td>
<td>-.87 (.19)</td>
</tr>
</tbody>
</table>

Note: Standard deviations are in parentheses.
were given negative information, $F(1, 392) = 184.57$, $p < .001$. The results also revealed that the magnitude of the quadratic trend varied across the groups, $F(5, 392) = 8.26$, $p < .001$. As is apparent in Figure 2, there were strong quadratic trends for the Neutral-Negative, Positive-Negative and Negative-Positive groups, $ts(392) > 12.781$, $ps < .01$, but not for the other four groups of children. Thus, marked reversals in Knowledge Scores were seen among the groups that were provided inconsistent information about the protagonist in the first and second knowledge manipulations, as well as in the Neutral-Negative group.

**Story Recall**

The primary goal of the analyses of story recall was to assess the impacts of Knowledge Manipulations 1 and 2 on children’s recollections of the protagonist’s behaviors. To this end, the analyses were done in two stages. The first phase of the recall analyses was aimed at evaluating the influences of the first and second knowledge manipulations on general characteristics (i.e., accuracy and valence) of the children’s two story reports, and the impact of Knowledge Manipulation 2 on changes in these report characteristics from the first memory assessment to the second. The second stage of analyses was designed to provide a more powerful examination of the influence of newly acquired knowledge on modifications to children’s memory reports and focused on the feature-by-feature measures of change described above. Thus, in the second analysis step, within-subject changes in recall of specific acts were related to Knowledge Manipulation 2.

**General Story Report Characteristics**

To test hypotheses about the influence of Knowledge Manipulations 1 and 2 on the general characteristics of children’s memory reports, analyses of the accuracy and valence of their recall were carried out.
Preliminary analyses were conducted to evaluate the effects of school, city (i.e., Durham or Tucson), memory interviewer, story order, child ethnicity, and child gender. Because no significant effects of school, city, or interviewer were revealed, the data were pooled across these variables for all analyses. On the other hand, effects of Story Order, Ethnicity, and Gender were found on some recall measures. Consequently, these factors, and their interactions with Knowledge Manipulations 1 and 2, were initially included in all models and were removed if they did not significantly add to the prediction of a particular outcome variable.

For each measure of story recall, a Repeated-Measures Analysis of Variance (ANOVA) was used to relate Knowledge Manipulation 1 (Neutral/Positive/Negative) and Knowledge Manipulation 2 (Positive/Negative) to recall performance at the first and second Memory Interviews (Sessions 3 and 5) and to examine patterns of change in the children’s reports between the two sessions. In all analyses, Knowledge Manipulations 1 and 2 were treated as between-subjects factors, and Memory Interview (1 or 2) was considered a within-subjects factor (i.e., the repeated measure). Significant main effects of Interview, or interactions involving Interview, were followed up with separate univariate ANOVAs on the Interview 1 and Interview 2 data.

**Accuracy of recall.** Accuracy analyses involved the calculation of the number of story features reported literally, or as they were described in the text (Verbatim Recall), and constructively (Constructive Recall), with Constructive Recall being broken down into Inferences, Distortions, and Intrusions. These data are shown in Table 2 as a function of the two knowledge manipulations and Interview. The upper panel of the table displays the means for Interview 1 and the lower panel shows the means for Interview 2. Because the total number of features described in the three stories was 21, the maximum for Verbatim Recall was 21. Constructive Recall (and therefore total recall), however, could exceed 21 because of the possibility of Intrusions. As can be seen in the far right column displaying total recall, the children reported a great deal of information about the stories. The far left column shows the mean frequency of Verbatim Recall. A comparison of this column to the total recall column indicates that 25% to 35% of the children’s recall consisted of features that were reported literally. A repeated-measures ANOVA indicated that there were no effects of either knowledge manipulation on the number of literally reported features. Verbatim Recall did decrease over time, as confirmed by a main effect of Interview, $F(1, 92) = 8.43, p < .01$.

Inspection of Table 2 also suggests that children’s reports were highly constructive at both interviews, with most of the constructions being inferential; the frequency of Inferences far exceeded that of Verbatim Recall among all of the experimental groups. A repeated-measures ANOVA on the overall frequency of Constructive Recall (summing Inferences, Distortions, and Intrusions) indicated no effects of either knowledge manipulation. Moreover, Constructive Recall did not change significantly from Memory Interview 1 to Memory Interview 2.
Interestingly, Verbatim and Constructive Recall varied according to the children’s ethnicity, $F(2, 92) > 5.22, p < .01$. Although the overall levels of recall did not vary according to Ethnicity, the African American children provided less Verbatim Recall and more Constructive Recall than the other two groups of children, $F(1, 92) > 4.42, p < .05$. (Because of the small numbers of children with ethnic origins other than African American and European American, Hispanic, Asian American, and Native American children were treated as an “Other/Mixed” ethnic group.)

Valence of recall. To determine whether children’s knowledge about the protagonist affected the types of behaviors they reported, recall was also analyzed in terms of proportion of remembered story features in which the protagonist’s role was recalled as negative (Negative Recall), the proportion of remembered actions in which the protagonist’s behavior was recalled as prosocial or accidental (Positive Recall), and the proportion of recall in which the protagonist’s behavior was reported as neutral (Neutral Recall). Because the knowledge manipulations might have differential effects on children’s literal recall and their constructions, the proportions of Positive, Negative, and Neutral Recall were calculated separately for features that were reported literally (Verbatim Recall) and features that were recalled constructively (Constructive Recall). The proportions of literally reported behaviors that were Positive, Neutral, and Negative are shown in the top panel of Table 3. Similarly, the lower half of Table 3 shows the proportions of children’s memory constructions that were reported as Positive, Neutral, and Negative. As can be seen in the top half of the table, a large proportion of the story features that were remembered literally were neutral behaviors. This pattern is not surprising, given that most of the story features were written to ascribe the protagonist a neutral role, if no inferences, distortions, or intrusions were made. Inspection of the top panel of Table 3 also suggests that there are few differences among the means as a function of either knowledge manipulation.

Separate repeated-measures ANOVAs, with Interview as the repeated measure, were carried out on Positive, Negative, and Neutral Verbatim Recall. The analyses confirmed that there were no group differences in Positive or Neutral Verbatim Recall. The analysis of Negative Verbatim Recall, however, revealed a main effect of Knowledge Manipulation 1, $F(2, 91) = 3.91, p < .05$. Follow-up comparisons indicated that across the two interviews, the children who were initially provided negative information about the main character had higher rates of Negative Verbatim Recall than those who were provided positive information, $F(1, 93) = 7.76, p < .01$. The neutral groups did not significantly differ from either the positive or negative groups. Moreover, there was a main effect of Interview, $F(1, 93) = 11.96, p < .001$, such that the proportion of Negative Verbatim Recall increased from the first memory assessment to the second. The analyses of Neutral Verbatim Recall showed the inverse patterns, with the proportions decreasing over time, $F(1, 91) = 10.11, p < .01$. Thus, children’s Verbatim recall generally became more negative, and less neutral, over the delay interval. These

### Table 3 Mean Proportions (and Standard Deviations) of Verbatim and Constructive Recall that were Positive, Neutral and Negative, by Group and Interview

<table>
<thead>
<tr>
<th>Knowledge Manipulation</th>
<th>Interview 1</th>
<th>Interview 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Neutral</td>
</tr>
<tr>
<td>Verbatim Recall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutral Positive</td>
<td>.32 (.12)</td>
<td>.49 (.21)</td>
</tr>
<tr>
<td>Neutral Negative</td>
<td>.20 (.20)</td>
<td>.62 (.22)</td>
</tr>
<tr>
<td>Positive Positive</td>
<td>.21 (.14)</td>
<td>.68 (.14)</td>
</tr>
<tr>
<td>Positive Negative</td>
<td>.22 (.10)</td>
<td>.68 (.13)</td>
</tr>
<tr>
<td>Negative Positive</td>
<td>.25 (.19)</td>
<td>.52 (.24)</td>
</tr>
<tr>
<td>Negative Negative</td>
<td>.22 (.25)</td>
<td>.61 (.29)</td>
</tr>
<tr>
<td>Constructive Recall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutral Positive</td>
<td>.26 (.20)</td>
<td>.34 (.13)</td>
</tr>
<tr>
<td>Neutral Negative</td>
<td>.16 (.11)</td>
<td>.36 (.19)</td>
</tr>
<tr>
<td>Positive Positive</td>
<td>.31 (.23)</td>
<td>.38 (.23)</td>
</tr>
<tr>
<td>Positive Negative</td>
<td>.36 (.17)</td>
<td>.48 (.13)</td>
</tr>
<tr>
<td>Negative Positive</td>
<td>.13 (.11)</td>
<td>.29 (.16)</td>
</tr>
<tr>
<td>Negative Negative</td>
<td>.19 (.12)</td>
<td>.27 (.17)</td>
</tr>
</tbody>
</table>

Note: Standard deviations are in parentheses.
two patterns suggest that over time, the children for-
got more of the neutral items and fewer of the nega-
tive items, which resulted in a change in the relative
proportions of the two types of recall. Note that the
repeated-measures ANOVAs of Positive and Neutral
Verbatim Recall indicated main effects of Story Order,
\( F(2, 91) = 4.74, ps < .05 \). At both interviews, Positive
Verbatim Recall was greatest for children who heard
the Camp story first, the School story second, and the
Playground story third, \( F(2, 91) = 5.76, p < .05 \),
whereas Neutral Verbatim Recall was greatest for chil-
dren who heard the Playground story first, the Camp
story second, and the School story third, \( F(2, 91) = 
9.77, p < .01 \).

In contrast to the Verbatim Recall data, substantial
group differences were observed in the proportions of
Positive, Neutral, and Negative Constructive Recall,
displayed in the lower panel of Table 3. As can be
seen, at Interview 1, the groups that were initially
given positive information had higher proportions of
Positive and Neutral Constructive Recall and lower
proportions of Negative Constructive Recall than the
groups that were initially provided negative informa-
tion. Moreover, comparison of the means from Inter-
view 1 to Interview 2 indicates changes in the pre-
dicted directions. Thus, groups that were presented
positive information about the protagonist during
Manipulation 2 showed increased Positive Construc-
tive Recall and decreased Negative Constructive Rec-
call from the first to the second interview. Similarly,
groups that were provided negative information in
Manipulation 2 showed decreased recall of positive
acts and increased reporting of negative acts.

The patterns described above were verified by
separate repeated-measures ANOVAs, with Inter-
view as the repeated measure, of the proportions of
Positive, Negative, and Neutral Constructive Recall.
The analysis of Positive Constructive Recall indi-
cated a main effect of Knowledge Manipulation 1,
\( F(2, 94) = 13.61, p < .001 \), across the two interviews.
Contrasts between the three levels indicated that the
positive Knowledge Manipulation 1 groups had
higher levels of Positive Constructive Recall than
did the other groups, \( F(1, 94) = 9.88, ps < .01 \). More-
over, an interaction between Interview and Knowl-
edge Manipulation 2, \( F(1, 94) = 15.53, p < .001 \), indi-
cated that the children who were provided positive
information during Knowledge Manipulation 2 made
more positive constructions at Interview 2 than the
children who were provided negative information,
\( F(1, 94) = 9.76, p < .01 \). Positive Constructive
Recall also varied by Gender, \( F(1, 94) = 10.98, p < 
.01 \); the mean levels of Positive Constructive Recall
for girls at the two interviews (.27 and .30, respec-
tively) were higher than those for boys (.20 and .20,
respectively).

The repeated-measures ANOVA of Negative Con-
structive Recall identified patterns that were orthogon-
al to those revealed by the analysis of Positive Con-
structive Recall. Specifically, Knowledge Manipula-
tion 1 affected the proportion of Negative Construc-
tions at the two interviews, \( F(2, 95) = 17.73, p < .001 \),
with follow-up contrasts indicating that the children
who were initially given a negative bias about the pro-
tagonist made more negative constructions than the chil-
dren who were given a neutral bias, \( F(1, 95) = 4.42, p <
.05 \), who in turn made more negative constructions
than the children given a positive perspective, \( F(1, 95) =
13.87, p < .001 \). Moreover, an interaction between In-
terview and Knowledge Manipulation 2, \( F(1, 95) = 
20.49, p < .001 \), indicated that the children who were
provided negative information during Knowledge
Manipulation 2 had a higher proportion of Negative
Constructive Recall at the second interview than the
children who were provided positive information,
\( F(1, 95) = 6.92, p < .01 \).

The analyses of Neutral Constructive Recall re-
vealed only a main effect of Knowledge Manipulation 1,
\( F(2, 95) = 5.67, p < .01 \), with contrasts indicating that
at both interviews, the positive Knowledge Manipu-
lation 1 groups had higher levels of Neutral Con-
structive Recall than the negative groups, \( F(1, 95) =
11.28, p < .01 \). The children initially given neutral
information did not differ from those in either of the
other two conditions.

Feature-by-Feature Changes in Reporting

To further examine reconstructions in the chil-
dren’s memory reports, within-subject changes in
the reporting of specific behaviors from Interview 1
to Interview 2 were analyzed as a function of the two
knowledge manipulations. The proportions of re-
sponses at the first memory interview that were re-
vised positively at the second interview (Positive
Revisions Rates) were calculated. Likewise, Negative
Revision Rates were calculated as the propor-
tion of features recalled at the first interview that
were negatively revised at the second interview. It is
important to point out that for any one child, the fre-
cuency of change in the positive direction was con-
strained by the number of remembered actions that
already attributed positive behaviors to the proto-
gonist at the first interview, whereas the amount of
change in the negative direction was constrained by
the number of initially reported negative behaviors.
Consequently, in the calculation of Positive Revision
Rates, features that were already reported as posi-
tive were not included in the denominators. Similarly, features that were initially recalled as negative were not included in the denominators of the Negative Revision Rates.

Preliminary analyses of Positive and Negative Revision Rates were conducted to evaluate the effects of school, city, memory interviewer, story order, child ethnicity, and child gender. No significant effects of any of these variables were revealed, and the data were pooled across these factors for subsequent analyses. To test the effects of the knowledge manipulations on the children’s response revisions, each index of change was analyzed by using a standard Analysis of Variance (ANOVA), with Knowledge Manipulations 1 and 2 as between-subjects factors.

Table 4 presents the Positive and Negative Revision Rates as a function of the two knowledge manipulations. Inspection of these data suggests that many of the children’s responses were consistent across the two memory interviews. However, between-group comparisons of Positive and Negative Revision Rates indicate that the children’s response revisions were related to Knowledge Manipulation 2. Children who were provided positive information about the protagonist during Knowledge Manipulation 2 were more likely than the other children to make positive revisions to their reports and less likely to make negative revisions. The effects of Knowledge Manipulation 2 were confirmed by the results of the ANOVA of Negative Revision Rates, $F(1, 96) = 10.88, p < .01$, and by the results of the similar analysis of Positive Revision Rates, $F(1, 96) = 12.97, p < .001$. There were no effects of Knowledge Manipulation 1, or interactions between Knowledge Manipulations 1 and 2, for either of these two variables.

To index the overall valence of changes in the children’s memory reports, the difference between the rates of Positive and Negative Revisions was calculated for each child. These “Memory Revision Scores” could range from 1 to −1, with scores close to 1 reflecting a large amount of positive change and very little negative change. Memory Revision Scores close to −1 indicate the opposite pattern, and scores around 0 reflect either very little change or equivalent amounts of positive and negative change. Mean Memory Revision Scores, and the corresponding standard errors, are shown by group in Figure 3. As can be seen, patterns of change in children’s recall of specific behaviors by the protagonist were consistent with the manipulations of knowledge about the protagonist. Thus, the mean Memory Revision Scores suggest that children given positive information during Knowledge Manipulation 2 made more positive than negative revisions to their story reports, whereas children given negative information made more negative than positive changes. An ANOVA on these scores verified this apparent effect of Manipulation 2, $F(1, 96) = 23.85, p < .001$.

**DISCUSSION**

This investigation provides a systematic examination of the interrelations between children’s changing knowledge and their recollections. As documented by the growth curve analyses of knowledge, the children formed impressions of the protagonist that were consistent with the social information provided during the knowledge manipulations. During the first three sessions, children who were repeatedly exposed to positive information about the protagonist seemed to form increasingly positive impressions of the target child, whereas children who were continually provided negative information seemed to acquire increasingly negative impressions of that child. In con-

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**Table 4 Mean Proportions (and Standard Deviations) of Memory Responses that were Positively Revised and Negatively Revised from Interview 1 to Interview 2**

<table>
<thead>
<tr>
<th>Knowledge Manipulation</th>
<th>Positive Revision Rates</th>
<th>Negative Revision Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Neutral Positive</td>
<td>.25 (.12)</td>
<td>.17 (.08)</td>
</tr>
<tr>
<td>Neutral Negative</td>
<td>.18 (.11)</td>
<td>.29 (.22)</td>
</tr>
<tr>
<td>Positive Positive</td>
<td>.27 (.16)</td>
<td>.16 (.10)</td>
</tr>
<tr>
<td>Positive Negative</td>
<td>.15 (.11)</td>
<td>.24 (.13)</td>
</tr>
<tr>
<td>Negative Positive</td>
<td>.30 (.12)</td>
<td>.22 (.16)</td>
</tr>
<tr>
<td>Negative Negative</td>
<td>.23 (.09)</td>
<td>.31 (.13)</td>
</tr>
</tbody>
</table>

*Note: Standard deviations are in parentheses.*
trast, the knowledge responses of the children in the neutral groups suggest that they did not form coherent positive or negative impressions of the target child during the first experimental phase. The second knowledge manipulation also seemed to affect the children’s impressions of the protagonist in the predicted directions. Regardless of the social information provided during the first phase of the study, children who were given positive information during the final phase of the study (Sessions 4 and 5) developed positive impressions of the protagonist, whereas those who were provided negative information formed negative impressions.

Why were the children in the Positive-Negative and Negative-Positive conditions willing to relinquish their earlier impressions when faced with discrepant information during the second knowledge manipulation? There are several overlapping explanations for the effectiveness of the knowledge manipulations. First, the second knowledge manipulation was designed to be subtle in that it was delivered through story content rather than through experimenter instructions. In addition, the second phase of the study began 7 to 10 days after the end of the first phase so as to allow initial representations of the protagonist to weaken. Once begun, the manipulation was administered in two sessions, and the children’s acceptance of the new information increased over the two meetings. Indeed, the children’s responses to the Session 4 knowledge interviews were rather ambivalent, and not until Session 5 did their impressions clearly conform to the second knowledge manipulation.

Admittedly, how the children in the Positive-Negative and Negative-Positive conditions processed the information provided in the second knowledge manipulation is unclear, because the children were not systematically questioned about whether they had noticed the discrepancy and how they had interpreted it. The children’s newly acquired views likely replaced or were integrated with their initial impressions, either because they had forgotten their first impressions or because they believed that they had been incorrect in their earlier views. Comments during the knowledge interviews, however, suggest that a few of the children believed that the protagonist had simply changed over time, and that they distinguished between the “old” protagonist and the “new” one. For example, during his final knowledge interview, one child stated, “Eric used to be nice, but now he is mean.” What factors might have led some children to this interpretation of the second knowledge manipulation? Research on children’s understanding of other people suggests that there are developmental and individual differences in beliefs about the stability of traits (see Heyman & Dweck, 1998; Shantz, 1983), and these differences possibly resulted in corresponding variations in the way children processed the second knowledge manipulation. Additional research is clearly necessary to examine alternative hypotheses about children’s interpretation of inconsistent social information.

On the basis of differences in social knowledge alone, the children generated quite different reports of identical stories. At both interviews, the overall tone of the children’s memory reports tended to reflect their prior impressions of the protagonist. Specifically, children who were initially given negative social information reported proportionately more hostile behaviors and fewer positive behaviors by the main character than children who were given positive information. The children in the neutral groups reported fewer hostile behaviors than the participants in the negative groups, and fewer positive behaviors than those in the positive conditions. These effects, however, were much more apparent in Constructive Recall than Verbatim Recall, which suggests that the first knowledge manipulation primarily affected remembering by promoting inferences, distortions, and intrusions that were consistent with the orienting information. Indeed, the children’s reports generally went far beyond the descriptions of the story features provided in the texts. This pattern of highly constructive, rather than literal, recall is not surprising because the stories were deliberately written to promote inferential processing.

The finding that the children’s story recall was affected by their prior knowledge is consistent with a considerable amount of research on knowledge and memory in children (e.g., Chi, 1978; Clubb et al., 1993). In contrast to this body of mostly correlational research, however, the present study examined the impact on memory of an experimental manipulation of knowledge. Consequently, the results definitively demonstrate that children’s prior knowledge can substantially affect what they remember.

Examinations of change in the children’s story reports over time clearly indicated that they had revised their recall in ways that were consistent with their newly acquired knowledge. The provision of positive information during the second knowledge manipulation resulted in overall increases in the reporting of positive behaviors and decreases in the recall of negative behaviors, whereas the provision of negative information had the opposite effect. Similar patterns were revealed by the analyses of change at the individual story feature level. The findings indicated higher rates of positive revision and lower rates of negative revision for the children in the positive Knowledge Manipulation 2 conditions than for the children in the negative conditions. The analyses of Memory
Revision Scores further corroborated the effects of the second knowledge manipulation, which indicated mostly positive change for the positive groups and mostly negative change for the negative groups.

These results are quite consistent with those of a series of studies detailed by Ross (1989) that demonstrate that adults' recollections are shaped by their current knowledge, beliefs, and attitudes. The findings are also compatible with the claim by Piaget and Inhelder (1973) that children's memory for a row of seriated sticks actually improved over time as a function of underlying changes in their understanding of seriation. The current investigation builds on this work by demonstrating that experimental changes in knowledge can result in modifications in the recall of previously encoded, specific information. It is important to note that the changes in recall associated with the second knowledge manipulation do not reflect misinformation effects in which children have incorporated specific postevent information into their reports (e.g., see Ceci & Bruck, 1993; Loftus, 1979). In the current study, all children received identical information about the protagonist's behaviors. The knowledge manipulations, which did vary between groups, provided only general information about the protagonist's personality and motives. Moreover, because the memory interviews consisted of open-ended probes, the children generated their memory reports in the absence of information that might be suggested by specific, yes–no questions. Thus, the results indicate that the children reconstructed their own memory reports, and perhaps their underlying memory representations, on the basis of changes in their general knowledge. Although this type of reconstructive processing has long been implied within the constructivist framework (e.g., Paris & Lindauer, 1977; Ross, 1989), there have been few, if any, convincing demonstrations of it in the literature on children's knowledge and memory.

Interestingly, both the children's ethnicity and their gender were related to aspects of their recall. For instance, at both memory interviews, the recall of African American children was more constructive and less literal than that of other children. These results are consistent with ethnographic work by Brice-Heath (1982; 1989), which suggests that in the context of family and community interactions, young African American children are taught to fictionalize true stories to have them heard in the midst of an ongoing stream of conversation. In addition, the results indicated gender differences in the proportions of positively reported behaviors. Given that the literature on gender differences in social behavior suggests that girls place more emphasis on interpersonal synchrony than boys (e.g., Charlesworth & Dzur, 1987; Maccoby, 1988; Pierce & Edwards, 1988), it is possible that gender-related differences in attention to and interest in prosocial behaviors resulted in variations in Positive Recall. Although these linkages between children's recall and their personal characteristics were not anticipated, they are consistent with the constructivist emphasis on the holistic nature of the cognitive processing system (e.g., Kuhn, 1991). Indeed, an emerging literature on individual differences in memory suggests that children's own cognitive skills and predispositions can influence their remembering and reporting of information (e.g., Gordon et al., 1993; Greenhoot, Ornstein, Gordon, & Baker-Ward, 1999).

Although children's memory reports are only imprecise indicators of their underlying memory representations (see Baker-Ward, Ornstein, & Principe, 1997), the current findings permit some comments about the mechanisms that might underlie knowledge–memory linkages. The fact that the overall proportions of children's positive and negative recall at the second interview continued to reflect their initial orientation, even among the children who had revised their impressions of the protagonist, suggests that their prior knowledge had guided their initial interpretation and encoding of the protagonist's behaviors. Indeed, the role of knowledge during encoding processes is apparent in studies of comprehension and memory (e.g., Bransford & Johnson, 1972), and in research involving mathematical modeling of memory processes (e.g., Bender, Wallsten, & Ornstein, 1996). Just as prior knowledge may have affected the children's initial understanding and encoding of information, changes in their knowledge may have resulted in reinterpretation of previously stored information and reencoding of the newly interpreted material (Baker-Ward et al., 1997; Ornstein et al., 1997). That is, when confronted with the new information, the children may have made either deliberate or automatic reconstructions of their representations of the stories.

It is also evident that at least some of the effects of the two knowledge manipulations were due to constructive processes that took place either prior to or during retrieval. For instance, among the children who received new information during the second knowledge manipulation, story report revisions tended to be consistent with their newly acquired understanding, although their overall reporting of positive and negative behaviors continued to reflect their initial impressions of the protagonist. This pattern suggests that as the children forgot information that was initially encoded, they made inferences and guesses about the stories on the basis of their current knowledge. This interpretation could also explain the surprising lack of
a statistical interaction between the first and second knowledge manipulations. Across all measures of change, the second knowledge manipulation had similar effects on changes in the children’s reports, regardless of the initial information they were provided. One explanation for this pattern is that the children’s memories for the stories faded at equal rates across knowledge groups, and that during or prior to retrieval they reconstructed missing information on the basis of their most recent impressions of the protagonist.

Although the results presented here provide clear evidence for retrospective effects of knowledge on memory, the manipulated changes in knowledge did not result in general reorganizations of the children’s memories. It is possible that a delay period that is longer than 3 weeks with, consequently, greater forgetting of the details of the stories, would result in a more global effect of knowledge modification. As suggested by previous research on knowledge and memory (e.g., Myles-Worsley et al., 1986; Ornstein et al., 1998), greater loss of accessible information should result in increased reliance on current schemas to fill in missing information. Changes in the design of the second knowledge manipulation might also lead to more pronounced retrospective effects on children’s recollections. For example, children who distinguished between the “old” and the “new” protagonist in recalling the stories would not be expected to rely on their new impressions in reconstructing the protagonist’s past behaviors. A longer delay between the first and second knowledge manipulations, and therefore greater forgetting of the original representation of the protagonist, might lead these children to replace or integrate their earlier impressions with the new information and to rely on their newly acquired impressions in recollecting the stories. Moreover, the provision of a rationale for children’s original “misunderstanding” of the main character might lead them to engage in greater reinterpretation of the story features. Additional research is clearly needed to test the boundary conditions of the impact of knowledge modifications on recollective processes.

The current findings are consistent with several other demonstrations that children’s general knowledge about an individual may exert powerful influences on their recall of that person’s behaviors (e.g., Clarke-Stewart et al., 1989; Leichtman & Ceci, 1995). This study extends previous work by suggesting that changes in children’s personal impressions may result in corresponding changes in their recollections. Although the generality of these findings to actual social experiences and to other age groups needs to be investigated, they have obvious implications for discussions of children’s testimony about others’ actions. Indeed, in their analysis of the investigative methods commonly used in child abuse cases, Ceci and Bruck (1995) report that interviewers frequently indicate to child witnesses how adult authority figures and other children view a defendant. This technique of “stereotype induction” is meant to provide a supportive environment for the disclosure of abuse, but increasing evidence suggests that its use is somewhat misguided. Stereotype induction may increase children’s susceptibility to stereotype-consistent suggestions (Leichtman & Ceci, 1995), and, as the present data indicate, might result in revisions of children’s reports that are consistent with the stereotype.

The retrospective changes in recall observed in this study raise interesting questions about what happens to memories as a result of the fundamental changes in knowledge and thinking that take place throughout development. The knowledge manipulations in this study were designed to promote variations in underlying knowledge, rather than new, more sophisticated ways of understanding information. Accordingly, additional work is necessary to determine the extent to which age-related changes in knowledge would result in corresponding memory reconstructions. For example, longitudinal or microgenetic studies could be used to examine the impact of advances in knowledge on children’s earlier memories. An exploration of the impact of such changes is critical for a developmental analysis of memory and represents a logical next step toward understanding the operation of memory within the dynamic cognitive system.

CONCLUSIONS

In conclusion, the data presented here add to the accumulating literature on knowledge, memory, and constructive processing in young children. The findings highlight the central role of underlying knowledge in the processing and recall of information. Consistent with previous research on the linkages between knowledge and memory, the results of this investigation suggest that children’s prior knowledge influences their interpretation and subsequent recall of information. Moreover, the findings provide converging evidence that changes in children’s general knowledge may result in reconstructions in the recall of previously encoded material. As such, this work verifies a major assumption of the constructivist framework.

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APPENDIX A
PROTOCOL FOR FIRST KNOWLEDGE MANIPULATION (BOYS)

Neutral Information

“I am going to read you a story about two boys named Eric and Charlie,” (point to boys as you say their names). “Charlie and Eric live next door to each other. They play together all the time, and they are in the same class at school.”

Positive Information

“I am going to read you a story about two boys named Eric and Charlie,” (point to boys as you say their names). “Charlie and Eric live next door to each other. They play together all the time, and they are in the same class at school.”

APPENDIX B
SAMPLE TARGET STORY

Charlie and Eric Go to School

One morning Eric and Charlie were waiting for the school bus together. Eric was swinging his backpack around and around in big circles next to Charlie. He was spinning faster and faster all over the place. All of a sudden, Charlie’s lunchbox fell out of his hand, and the food spilled out all over the sidewalk! Charlie and Eric picked the lunch up off the sidewalk just before the bus got there. After they got to school, the class practiced writing letters. After they had practiced writing for a long time, the teacher told them they could have some free time. Eric decided to play with a toy car with big wheels. Charlie played with a truck for a while, but he really wanted to play with the car. He asked Eric if he could have a turn playing with the car. Eric answered him right away, and Charlie played with the truck some more thinking that he would play with the car a little later. Just then the teacher rang the bell and told the children that free time was over and they should all put away the toys. She asked everyone to gather on the rug for Show and Tell. When it was Charlie’s turn, he showed the class a model airplane. He talked about it and then he put it on the shelf where everyone puts the things they bring for Show and Tell. A little later, Eric walked by the shelf where the airplane was and he noticed that Charlie’s airplane was hanging off the edge of the shelf. The children heard a crash! They all looked over and saw the airplane on the floor next to Eric’s feet. Charlie ran over and was disappointed to see that many of the pieces were broken. The teacher said, “That is too bad about the airplane. Can somebody help Charlie pick up the pieces? Eric, why don’t you help?”
Then Eric asked her if Charlie could come over to play. He told her that she was very happy about the teacher's report. One day, Eric was playing by himself in the playroom. It was a one hundred puzzle of some puppies. When Eric finally finished the puzzle, his mom came into the playroom just in time to see it. Eric’s mom told him that she was going to school for a conference with his teacher. When Eric’s mom got to the school, she went to Eric’s classroom to meet with the teacher. Eric’s teacher told her that Eric was a bully. She said that Eric was not nice to other children and that he did not have very many friends. Then the teacher showed Eric’s mom the corner where he spent a lot of time in time out for being mean to other children. When Eric’s mom was finished with the conference, she went home and found Eric in the playroom. Eric was working on a block tower. His mom came in just in time to see his very tall tower. Eric’s mom told him that he was very upset about the teacher’s report. Then she told him that Charlie was coming over to play. Unfortunately, Eric did not want Charlie to come over. He told his mom that he did not like Charlie at all and that he never had fun with him. Eric said, “Mom, you better not invite Charlie over! I don’t like playing with him!” But Eric’s mom told him that Charlie’s parents were going out, so Charlie had to come over to Eric’s house. Eric was very angry and very unhappy. He said, “Well, then I am going to be mean to Charlie, just like I always am!” Eric’s mom said that she knew that he might be mean to Charlie. She said, “I know that you are not very nice to other children. If you would be nicer, you might have more friends.” With that, Eric ran to his room to wait until Charlie came over.

APPENDIX C

PROTOCOL FOR SECOND KNOWLEDGE MANIPULATION (STORY 4: BOYS)

Positive Information

One day, Eric was playing by himself in the playroom. It was a one hundred puzzle of some puppies. When Eric finally finished the puzzle, his mom came into the playroom just in time to see it. Eric’s mom told him that he was going to school for a conference with his teacher. When Eric’s mom got to the school, she went to Eric’s classroom to meet with the teacher. Eric’s teacher told her that Eric was a bully. She said that Eric was not nice to other children and that he did not have very many friends. Then the teacher showed Eric’s mom the corner where he spent a lot of time in time out for being mean to other children. When Eric’s mom was finished with the conference, she went home and found Eric in the playroom. Eric was working on a block tower. Eric’s mom told him that he was very happy about the teacher’s report. Then Eric asked her if Charlie could come over to play. He really wanted Charlie to come over. He said that Charlie was his very best friend and that he always had fun with him. Eric said to his mom, “Please invite Charlie over. I really like playing with him.” Eric’s mom told him that if Charlie’s mom said it was ok, he could come over. Eric was very excited and very happy. He said, “Thanks mom! I promise I will be nice to Charlie, just like I always am!” Eric’s mom told him that she knew he would be nice to Charlie. She said, “I know that you are nice to everybody, and that is why you have so many friends.” With that, Eric ran to his room to wait until Charlie came over.

Negative Information

One day, Eric was playing by himself in the playroom. He was working on his favorite puzzle. It was a one hundred puzzle of some puppies. When Eric finally finished the puzzle, his mom came into the playroom just in time to see it. Eric’s mom told him that she was going to school for a conference with his teacher. When Eric’s mom got to the school, she went to Eric’s classroom to meet with the teacher. Eric’s teacher told her that Eric was a bully. She said that Eric was not nice to other children and that he did not have very many friends. Then the teacher showed Eric’s mom the corner where he spent a lot of time in time out for being mean to other children. When Eric’s mom was finished with the conference, she went home and found Eric in the playroom. Eric was working on a block tower. His mom came in just in time to see his very tall tower. Eric’s mom told him that she was very upset about the teacher’s report. Then she told him that Charlie was coming over to play. Unfortunately, Eric did not want Charlie to come over. He told his mom that he did not like Charlie at all and that he never had fun with him. Eric said, “Mom, you better not invite Charlie over! I don’t like playing with him!” But Eric’s mom told him that Charlie’s parents were going out, so Charlie had to come over to Eric’s house. Eric was very angry and very unhappy. He said, “Well, then I am going to be mean to Charlie, just like I always am!” Eric’s mom said that she knew that he might be mean to Charlie. She said, “I know that you are not very nice to other children. If you would be nicer, you might have more friends.” With that, Eric ran to his room to wait until Charlie came over.

REFERENCES


