Do illustrations enhance preschoolers’ memories for stories? Age-related change in the picture facilitation effect

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Abstract

This study investigated whether illustrations facilitate story recall in preschoolers (N = 58) 46 to 63 months of age. Each child was exposed to either a verbal story narrative with illustrations (Verbal and Picture condition), the narrative alone (Verbal Only condition), the narrative with uninformative illustrations (Verbal and Irrelevant Picture condition), or the illustrations alone (Picture Only condition). Children recalled the story immediately and after a 1-week delay. With increasing age, the Verbal and Picture group increasingly outperformed the other verbal groups, particularly when recalling central details conveyed by both narrative and illustrations. Performance did not vary among the three verbal groups at lower values of age, whereas the Verbal and Picture group recalled more than the other verbal groups at the older ages. Regardless of age, all verbal groups outperformed the Picture Only group, suggesting that preschoolers are unlikely to spontaneously generate a narrative from pictures alone.

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Introduction

Most books published for young children are illustrated. A majority of the illustrations in children’s picture books are representational in that they depict the story content, and

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many also go beyond the text to add details to the stories (Carney & Levin, 2002; Sipe, 1998; Stewig, 1992). It is widely assumed that such illustrations capture children’s attention and facilitate their comprehension and memory of stories or other material presented in books. Indeed, there is considerable evidence that pictures enhance learning of prose that is presented in either written or auditory form in school-aged children and adults. Surprisingly, little is known about the degree to which illustrations enhance children’s comprehension and memory of stories during the preschool years, but evidence from other domains of cognitive development suggests that story illustrations might not have the same facilitative effects during early childhood as have been observed at older ages (e.g., Brainerd & Reyna, 2004; Dempster, 1981; DeLoache, 2000; Gopnik & Astington, 1988). To test this hypothesis, in the current study we examined age-related change in picture facilitation effects for prose learning during early childhood. We compared preschoolers’ recall of stories presented in different media formats and examined age as a potential moderator of differences between presentation conditions.

A substantial literature suggests that by middle childhood, illustrations enhance children’s recall of printed texts that they read to themselves (for a review, see Carney & Levin, 2002). There also has been extensive research on the effects of pictures on school-aged children’s memory for auditory prose, and this work provides evidence for picture enhancement effects in children as young as 6 years (e.g., Levin & Lesgold, 1978; Purkel & Bornstein, 1980; Rohwer & Matz, 1975). In their review of this literature, Levin and Lesgold (1978) concluded that when elementary school children listen to prose passages accompanied by pictures that portray the content of the passages, they show better recall than when presented with the verbal narratives alone. Illustrations, moreover, were found to enhance performance on questions about the surface characteristics of verbal material and on more comprehension-demanding questions.

There are a number of explanations for the memory enhancement associated with story illustrations. One of the most commonly cited reasons for picture facilitation effects is the dual coding hypothesis proposed by Paivio (1970, 1986). According to this model, exposure to information both verbally and pictorially results in the construction of separate verbal and pictorial representations that are connected in memory. Verbally and pictorially presented material should be easier to recall than information presented in only one modality because the two representations provide redundant retrieval routes. It has also been suggested that pictures increase motivation and attention to the material, make the material more concrete and comprehensible, and serve to organize verbal information—all of which may lead to the establishment of stronger, more elaborated, and more organized memory traces (Digdon, Pressley, & Levin, 1985; Levin & Mayer, 1993; Peeck, 1993; Pressley, Pigott, & Bryant, 1982; Ruch & Levin, 1977).

Some of the literature on picture enhancement effects suggests that the facilitative effects of illustrations may increase with age. For example, some studies have suggested that for recall of auditory stimuli to be facilitated by the addition of visual stimuli, younger children require greater redundancy between the visual and auditory information than do older children (Furnham, De Siena, & Gunter, 2002; Guttman, Levin, & Pressley, 1977). In one such study, Guttman and colleagues (1977) presented kindergartners, second graders, and third graders with stories on tape with no pictures, complete pictures illustrating the content of each sentence, or partial pictures depicting the same information as the complete pictures except that the object to be asked about in the recall test was omitted. For example, in the complete picture condition, children heard the sentence, “One evening
Sue’s family sat down to eat a big turkey for dinner,” while looking at a picture of a family seated around a table holding a turkey, whereas in the partial picture condition, children heard the same sentence and saw the same picture except that the turkey was not visible. The children later were asked to remember what food had been served at Sue’s house. Relative to the no-picture control condition, third graders benefited from both the partial and complete picture conditions, but kindergartners and second graders benefited only from complete pictures.

Only a handful of studies have evaluated the use of illustrations to enhance prose learning in preschoolers (e.g., Digdon et al., 1985; Pressley et al., 1982). These investigations show that illustrations enhance preschoolers’ memories of auditory prose under highly supportive conditions. In two sets of experiments conducted by Pressley and colleagues (Digdon et al., 1985; Pressley et al., 1982), 3- and 4-year-olds listened to simple sentences (e.g., “The skunk sat on the bed”) accompanied by different types of pictures and were explicitly instructed to look at the pictures and to listen to and remember the sentences. Children had superior recall of the objects of the sentences when they were presented with illustrations of the entire sentences or separate pictures of the subjects and objects than when shown illustrations of only the objects or of sentence content other than the objects.

The conditions under which picture enhancement effects have been demonstrated in preschoolers, however, differ in several ways from the conditions under which preschoolers are exposed to stories outside the laboratory. First, the to-be-remembered stimuli in these studies consisted of individual sentences (e.g., Pressley et al., 1982) or 10-sentence stories (e.g., Digdon et al., 1985), with one illustration or set of illustrations corresponding to each sentence. Many books developed for preschoolers, however, are more complex than these to-be-remembered stimuli, with longer narratives and illustrations that depict only a small portion of the story action. Second, the assessments of preschoolers’ memories in previous research were highly structured and did not require the children to recall the overall meaning (or “gist”) of the sentences; rather, the preschoolers were asked to provide the object of each sentence in response to probes containing the subject and action, and both the memory cue (i.e., the subject) and the to-be-remembered item (i.e., the object) were explicitly portrayed in each picture. Thus, it is not known whether illustrations enhance children’s abilities to understand and remember more complex narratives that require the integration of ideas across sentences, particularly when the illustrations do not convey all of the information being probed. Finally, in previous studies, children were explicitly warned about the memory test and instructed to attend to both the verbal and visual stimuli. Therefore, whether illustrations enhance preschoolers’ incidental story recall, particularly when they are not informed of the relevance of the illustrations, is unclear.

There are several reasons to believe that under more typically occurring exposure conditions, story illustrations might not produce the same mnemonic benefits for preschoolers as have been observed for older children. Picture facilitation effects presumably require that individuals attend to and encode both verbal and pictorial details and then combine or connect those details in memory. The ability to encode and combine auditory and visual details is likely to be dependent, at least in part, on the availability of working memory resources (Mayer & Moreno, 1998). Consistent with this argument, research with adults indicates that learning tasks that overload working memory reduce the degree to which visual stimuli facilitate recall of verbal information (Mayer & Moreno, 1998). Given that young children have very limited attentional and working memory resources (e.g., Cowan,
Saults, & Elliot, 2002; Dempster, 1981; Kail, 2003), they might not be able to attend to and encode both visual and auditory information to the same degree as are older children, particularly when the stimuli are complex.

Even if preschoolers do encode details from both modalities, it is not clear whether they will actually link these two types of information in memory and use these links during retrieval. For example, the literature on symbolic development suggests that the ability to maintain and connect two representations of the same thing increases gradually between 2 and 5 years of age (e.g., DeLoache, 2000; Gopnik & Astington, 1988). There is also considerable evidence that the ability to integrate across stimuli to extract an overall meaning (or gist) improves significantly across childhood (e.g., Bjorklund & Muir, 1988; Brainerd & Reyna, 2004; Brainerd, Reyna, & Forrest, 2002). Consistent with these broad developmental patterns, research on children’s use of visual imagery strategies suggests that very young children do not spontaneously combine verbal and pictorial information in memory. In one study examining young children’s use of experimenter-provided elaborative associations, Pressley and MacFayden (1983) looked at whether preschoolers’ and kindergartners’ memories for verbally presented paired associates were enhanced by providing interactive pictures of the paired items. Preschoolers benefited from the mnemonic pictures only when they were instructed at testing to think about the pictures, whereas kindergartners did not require the cue. Thus, the younger children appeared to be unlikely to use the pictures to retrieve the target words unless they were explicitly instructed to do so.

If preschoolers have difficulty in encoding both verbal and pictorial information or connecting the pictorial information to the verbal information in memory, illustrations might not enhance their memories for the stories they are meant to depict. On the other hand, it seems possible that even if young children do not encode both pictorial and verbal stimuli or are unable to combine them in memory, they might still benefit from pictures if the pictures make the stories more interesting and, thus, serve to maintain young children’s attention to the listening task. In other words, illustrations could potentially facilitate story recall even when children do not learn from their content.

The primary goals of this experiment were to determine whether illustrations help preschoolers to remember a series of events described in a story and to examine the extent to which picture facilitation effects might change across the preschool years. We compared the story recall of preschoolers who were presented with a verbal story narrative and illustrations with that of preschoolers who were presented with only the verbal narrative. Children were asked to recall the story both immediately and after a 1-week delay. A third condition in which children were presented with the verbal narrative and shown uninformative illustrations was included to determine whether pictures might serve simply to hold children’s attention to the listening task. Finally, to evaluate the possibility that children might attend to and remember only the information presented in the pictures alone, we also included a picture-only condition. We examined group differences in children’s recall performance and the degree to which group differences might be moderated by age (in months). Recall performance was measured by the number of story events recalled accurately and inaccurately as well as by the proportions of story details reported about each event. With respect to children’s recollections of story details, we were particularly interested in the extent to which the information recalled by the children was conveyed by the story narrative, the illustrations, or both. Between-group comparisons of the production of these details were designed to provide information about the extent to which (a) illus-
trations enhanced recall of narrative information that was either redundant or nonredundant with pictorial details, (b) narrative details could be generated by exposure to the pictures alone, and (c) pictorial details might be produced by exposure to the story narrative alone.

**Method**

**Participants**

A total of 60 preschoolers were recruited from six preschools in a small midwestern city in the United States. Of this sample, 2 children were absent from the follow-up session and so were excluded from the analyses, reducing the final sample size to 58. The mean age of the children was 56 months ($SD = 4.6$, range = 46–63), and 57% of the children were female. The children came from a variety of ethnic origins; fully 67% were Caucasian, 10% were African American, 5% were Asian American, 3% were Native American, 2% were Hispanic, and 12% were of mixed ethnicity or unspecified ethnicity (i.e., parents did not specify their children’s ethnicity). The mean level of education of the participants’ parents was 15.5 years for mothers and 15.1 years for fathers, indicating that the children were generally from middle-class families.

**Procedure**

The participants met individually with the experimenter for two sessions. Each session was videotaped for subsequent analysis. In Session 1, the children were presented with one of two prerecorded stories about a fictional animal character. Each child was randomly assigned to one of four story presentation conditions. In the Verbal and Picture condition, the children listened to the story on an audiotape while looking at pictures illustrating the main events in the story. In the Verbal and Irrelevant Picture group, the children listened to the story while looking at illustrations that were not relevant to the main ideas in the story. In the Verbal Only group, the children listened to the story but did not look at any corresponding pictures. Finally, in the Picture Only condition, the children looked at illustrations of the events in the story but did not hear the verbal story.

After presentation of the story, the children completed a puzzle as a distracter task for approximately 5 min and were then given a memory interview in which they were asked to recall the story. Approximately 1 week later ($M = 7$ days, range = 6–9), a second memory interview was administered to elicit the children’s delayed recall of the story.

**Materials**

**Stories**

To ensure that any illustration or age effects were not specific to a particular set of stimuli, we developed two stories corresponding to two fictional animal characters: “Basil the Bobbin” and “Wilbur the Woozle.” Within each story presentation group, participants were randomly assigned to either the Bobbin set or the Woozle set. Thus, the two stories were distributed evenly across the four story presentation groups. Each story began with a brief description of the characteristics of the fictional animal (e.g., bobbins have very long
tongues, bounce on their tails, and live in holes in the ground) and then described a series of 18 events involving the animal character. Each event description had two main components. The first component described the setting for the event and the initiating actions (e.g., Basil the Bobbin reaches a river, is not sure how he will cross it, and then notices a long branch hanging over the river). The second component described response actions and the conclusion or resolution of the event (e.g., Basil extends his tongue across the river, wraps it around the branch, and swings himself across). The event narratives in the Bobbin story averaged 6.7 sentences and 64.7 words, whereas those in the Woozle story averaged 6.6 sentences and 61.9 words.

For groups that were presented with illustrations, there were two illustrated pages corresponding to each event, that is, one for each event component (i.e., the setting/initiating actions and the resolution). In the Verbal and Picture condition, the pictures illustrated the gist of each event component. For example, for the river event in the Bobbin story, the first illustration depicted Basil on one side of a river and a tree on the other side of the river. The second illustration showed Basil in the air over the river with his long tongue extending to a branch on the tree. In the Verbal and Irrelevant Picture condition, the pictures provided no information about the main idea of each event. Each irrelevant illustration had the same number of objects (e.g., bush, tree, river) on each page as the corresponding illustration for that event in the Verbal and Picture condition, but the illustrated items did not convey information critical to understanding the event. For example, for the river event in the bobbin story, the first picture showed Basil next to a dirt path with a patch of flowers in the background, whereas the second illustration depicted Basil standing on the path holding flowers in his paw. The illustrations used in the Picture Only condition were identical to those used in the Verbal and Picture condition.

Children in both the Verbal and Picture condition and Verbal and Irrelevant Picture condition heard the story on a prerecorded audiotape; after the verbal presentation of each event component, a tone cued the children to turn the page. The description of each event component lasted 15 to 17 s, and the tones were timed such that they occurred every 20 s. Children in the Verbal Only condition heard the same audiotape of the story with the tones sounding between event components. Children in the Picture Only condition listened to a tape consisting of only a series of tones, 20 s apart, cuing them to turn the page. Thus, children in the Verbal and Picture, Verbal and Irrelevant Picture, and Picture Only conditions were exposed to each illustration for the same amount of time (20 s). Although it is unlikely that participants in this study were able to read the text of the stories, there were no written words on any of the pages to ensure that the story was presented only aurally for children in the verbal conditions.

**Memory interview**

The memory interview consisted of a series of open-ended questions about the story at two levels of specificity. The interview began with a very general question (e.g., “What happened in that story about Basil the Bobbin’s journey to visit his cousin Hilda?”) to which the children were encouraged to provide as much information as possible. This general probe was followed by more focused open-ended questions about each story event not already recalled by the children (e.g., “What happened when Basil got to the river?”). Children were prompted to elaborate on each event with “Can you tell me more about that?” or “How did that happen?” Children always were questioned by a “naive” experimenter,
that is, an individual who had not been involved in the story presentation task. All children were interviewed by the same experimenter at both sessions.

Coding

Event-level coding

The coding of the memory interviews first involved an assessment of the accuracy of children’s reports of each event in the story. Each story event reported was assigned one of five accuracy codes. If children recalled the gist of what was stated in the text about an event, the response was coded as accurate complete recall (e.g., “Basil swung himself over the river with his tongue”). If children recalled only part of an event (i.e., if they did not report the event resolution) but were otherwise accurate, the event was assigned a partial recall code (e.g., “Basil didn’t know how to cross the river”). An answer that added to or elaborated on what was actually stated in the story was coded as an elaboration (e.g., “Basil swung himself over the river with his tongue, and his tongue got really tired”). A distortion was coded when children distorted a story event in recall (e.g., “Basil swam across the river”), whereas an intrusion was coded when children reported an event that was not described in the text at all (e.g., “Basil rode a bicycle”). One research assistant scored all interview transcripts for accuracy, and a reliability coder coded approximately 20% of the other coder’s work. Interrater reliability for the accuracy codes was quite good ($\kappa = .85$).

Proposition-level coding

A second level of coding was designed to provide information about the amount of details the children reported about the story events and the extent to which these details were provided by the story narrative versus the illustrations. To this end, the story narrative and relevant illustrations were parsed into propositions or idea units conveying the core actions and objects involved in each event. For example, in the river event of the Bobbin story, the sentence “Basil swung himself over the river to the other side” could be parsed into three propositions: Basil swung himself, he swung over the river, and he got to the other side. For the Bobbin story, 144 propositions were conveyed only by the verbal narrative (verbal-only details), 62 propositions were redundant units provided by both the narrative and the illustrations (verbal and pictorial details), and 57 units were conveyed uniquely by the pictures (pictorial-only details). For the Woozle story, there were 107 verbal-only details, 64 verbal and pictorial details, and 45 pictorial-only details. The units of information provided by the irrelevant pictures for a particular event all were unique to the illustrations. The irrelevant pictures for the Bobbin story conveyed 91 idea units, and those for the Woozle story conveyed 99 idea units. Children’s recall at each interview was similarly parsed into propositions or idea units, and each unique (i.e., nonrepetitive) proposition was then classified according to whether it was consistent with the verbal-only, verbal and pictorial, or pictorial-only details. Propositions that did not match any details provided by the verbal narrative or pictures were classified as constructed details. The recall of children in the Verbal and Irrelevant Picture condition was also compared with the idea units provided by the irrelevant illustrations. Two research assistants each coded half of the transcripts and coded 20% of each other’s work for reliability purposes. Inter-
rater reliability was high ($\kappa = .92$). Because of the slight differences in the number of idea units provided by the two story sets, all recall scores were calculated as proportions.

## Results

The overall goals of the analyses were to examine group differences in recall performance and to determine the degree to which these differences were moderated by the children’s age. The analyses were carried out in two stages. The first stage focused on the amount and accuracy of children’s recall at the level of the story event, whereas the second stage involved parsing the story events into verbal and pictorial propositions to examine the amount and source (i.e., narrative vs. illustrations) of the details reported by the children. Preliminary analyses indicated no differences in recall performance as a function of interviewer, preschool, gender, ethnicity, or story set (Bobbin or Woozle). Consequently, for further analyses, the data were collapsed across these variables.

For both sets of analyses, repeated measures general linear models (GLMs) were used to examine differences among the four story presentation groups in selected measures of recall performance at the two memory assessments (within-subjects or repeated measure). To determine whether group differences were moderated by the children’s age, we included age (in months) and an interaction between age and group in each model. We used a continuous measure of age (in months) because it was sampled as a continuous variable and there is a considerable methodological literature that recommends against the dichotomization of continuous explanatory variables (e.g., Altman & Royston, 2006; McCallum, Zhang, Preacher, & Rucker, 2002; Owen & Froman, 2005). Age was standardized to have a mean of 0 and a standard deviation of 1 to facilitate interpretation of age by group interactions. Significant age by group interactions indicated that age moderated group differences in recall. These interactions were explored by estimating separate regression lines, representing the change in recall performance with age, for each experimental group and then carrying out simple effects tests of the group differences at different values of age (for a summary of contemporary methods for testing moderation, see Dearing & Hamilton, 2006).

### Recall accuracy

The analyses of recall accuracy involved calculation of the number of story events reported accurately and inaccurately. Preliminary analyses indicated that the frequency of elaborations was quite low. Because these responses were accurate in terms of the gist, the number of events coded as elaborations was combined with the number of events coded as accurate complete recall to form an accurate recall score. A recall error score was calculated as the number of reported events coded as distortions or intrusions. Table 1 displays the mean accurate recall and recall error scores for the four presentation groups at the first and second memory interviews. Note that because the total number of events was 18, the maximum possible score for accurate recall was 18, but the number of recall errors could, theoretically, exceed 18 due to the possibility of intrusions.
As indicated by the accurate recall scores in Table 1, the children in all groups accurately reported much less than half of the 18 story events. The repeated measures GLM revealed a main effect of time, $F(1,50) = 12.03, p < .002$, partial $\eta^2 = .19$, such that the number of correct responses decreased over time. There was no main effect of age, but there was a main effect of group, $F(3,50) = 7.72, p = .0002$, partial $\eta^2 = .32$, and an interaction between age and group across time, $F(3,50) = 3.89, p < .05$, partial $\eta^2 = .19$, indicating that the differences among the experimental groups were moderated by the children’s age. To explore the interaction between age and group, we used the parameter estimates generated by the GLM to calculate simple slopes and intercepts and to plot separate regression lines, representing age regressed on accurate recall, for each group (Fig. 1). Because there were no interactions involving time, we collapsed across the first and second interviews. To avoid extrapolation beyond the current data, we limited the plot to age values at which the sample was reasonably dense, that is, from 1 standard deviation below the mean to 1 standard deviation above the mean (51–61 months). As can be seen from Fig. 1, at the youngest ages there were no differences among the three verbal groups, but with increasing age the Verbal and Picture group increasingly outperformed the other two verbal groups. In fact, at 61 months (1 standard deviation above the mean), the Verbal and Picture group significantly outperformed the other verbal groups, $F$s(1,50) $\geq 7.09$, $p$s $\leq .02$, partial $\eta^2$s $\geq .12$. Thus, the illustrations combined with the narrative enhanced story recall only for the oldest children in the sample. It is also apparent in Fig. 1 that at all ages children in all three verbal groups outperformed those in the Picture Only group, $F$s(1,50) $\geq 8.45$, $p$s $< .006$, partial $\eta^2$s $\geq .14$.

The repeated measures GLM of recall errors indicated that the frequency of recall errors increased over the 1-week delay, $F(1,50) = 6.91, p < .02$, partial $\eta^2 = .12$. There was also a main effect of group $F(3,50) = 9.68, p < .0001$, partial $\eta^2 = .37$. Pairwise comparisons between groups indicated that the Picture Only group produced significantly more recall errors than did all other groups, $F$s(1,50) $\geq 15.33$, $p$s $\leq .0004$, partial $\eta^2$s $\geq .24$, but there were no significant differences among the verbal groups, $F$s(1,50) $\leq 0.89$, $p$s $\geq .35$, partial $\eta^2$s $\leq .01$. The main effect of age was not significant, and none of the interaction effects was significant.

To summarize, the event-level analyses of recall accuracy indicate that the mnemonic benefits of the relevant illustrations increased across the preschool years. Moreover, the poor performance in the Picture Only condition suggests that any memory enhancement associated with the Verbal and Picture condition did not simply reflect recall of the illustrations alone.

Table 1

<table>
<thead>
<tr>
<th>Recall measure</th>
<th>Story presentation group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Verbal and Picture</td>
</tr>
<tr>
<td><strong>Accurate recall</strong></td>
<td></td>
</tr>
<tr>
<td>Interview 1</td>
<td>7.4 (4.8)</td>
</tr>
<tr>
<td>Interview 2</td>
<td>6.1 (4.3)</td>
</tr>
<tr>
<td><strong>Recall errors</strong></td>
<td></td>
</tr>
<tr>
<td>Interview 1</td>
<td>2.0 (1.7)</td>
</tr>
<tr>
<td>Interview 2</td>
<td>2.3 (2.4)</td>
</tr>
</tbody>
</table>

Note. Standard deviations are in parentheses.
Recall of verbal and pictorial propositions

The event-level analyses focused on children’s recall of the gist of each story event, which was conveyed by both the verbal narrative and the illustrations. But each event was composed of multiple propositions that were provided by the verbal narrative (verbal-only details), the illustrations (pictorial-only details), or both (verbal and pictorial details). The second analysis phase examined how much of the detail provided by these sources was recalled by children in the different presentation groups. Because the number of propositions differed across these three categories and across stories, these analyses were conducted on the proportions of all possible verbal-only, pictorial-only, or verbal and pictorial propositions reported by children in the memory interviews.

It should be noted that although not all groups were exposed to all three types of details, it was possible that children might generate nonpresented details through inference or other constructive processes. Between-group comparisons on these variables provided information about how reports of these details were influenced by exposure to the story narrative versus the illustrations. Specifically, we compared the Verbal and Picture group’s recall of verbal-only propositions and verbal and pictorial propositions with reports of those same details in the Verbal Only and Verbal and Irrelevant Picture groups to determine whether illustrations enhanced recall of narrative propositions that were either redundant or nonredundant with illustrations. We also contrasted recall of verbal-only details in the verbal groups with the production of the same details in the Picture Only group to assess the degree to which verbal details could be constructed on the basis of the illustrations alone. Finally, to explore whether the information conveyed by the pictures could be produced by exposure to the story narrative alone, recall of pictorial-only propositions in the Picture Only group was compared with that among groups not actually shown the illustrations (i.e., the Verbal Only and Verbal and Irrelevant Picture groups).

Table 2 shows the proportions of verbal-only, pictorial-only, and verbal and pictorial details recalled at the first and second interviews for each story presentation condition. The low proportions of these details recalled should not be surprising given that the propositions refer to all possible details provided by the narrative and the illustrations and that
the children tended to report the overall gist of each story event. A series of t-tests, with α = .0083 according to the Bonferroni adjustment for multiple comparisons, indicated that across all groups at both interviews, the proportion of verbal and pictorial details recalled was higher than the proportion of verbal-only details recalled, ts(56) ≥ 7.92, ps ≤ .0001, which was higher than the proportion of pictorial-only details reported, ts(56) ≥ 6.61, ps ≤ .0001.

To examine the effects of group, age, and the group by age interaction on recall of each type of detail, three separate repeated measures GLMs, with interview as the repeated measure, were conducted. The repeated measures GLM of verbal-only details revealed that recall of these details decreased over time, F(1, 49) = 4.99, p = .03, partial η² = .09, and that there was a main effect of group, F(3, 49) = 7.43, p = .0003, partial η² = .31, but that there were no main effects or interactions involving age. Follow-up contrasts indicated that, not surprisingly, the three verbal groups recalled more verbal-only details than did the Picture Only group, Fs(1, 49) ≥ 10.93, ps ≤ .002, partial η²s ≥ .18, indicating that without the verbal narrative the preschoolers were not able to construct these details on their own.

The repeated measures GLM of recall of verbal and pictorial details revealed patterns somewhat similar to those observed in the event-level analyses of accurate recall. First, performance declined significantly over time, F(1, 49) = 6.09, p = .017, partial η² = .11. There was also a main effect of group, F(3, 49) = 4.82, p = .005, partial η² = .23, which was qualified by a significant group by age interaction, F(3, 49) = 3.01, p < .05, partial η² = .16. To explore more precisely how group differences were moderated by age, we calculated simple slope and intercept estimates for each group and plotted the predicted verbal and pictorial detail scores, averaged across interview, for each experimental condition as a function of age (Fig. 2). As illustrated by the four regression lines in Fig. 2, the recall advantage of the Verbal and Picture group increased with age relative to the other groups. Indeed, at 1 standard deviation below the mean for age, there were no significant differences in production of verbal and pictorial details among the verbal groups and only the Verbal Only group significantly outperformed the Picture Only group, F(1, 49) = 6.27, p = .016, partial η² = .11. In contrast, at the older end of the age range (i.e., 1 standard deviation above the mean), the Verbal and Picture group produced significantly more verbal and pictorial details than did any of the other groups, Fs(1, 49) ≥ 4.94,

Table 2
Proportions of verbal-only, verbal and pictorial, and pictorial-only propositions recalled as a function of story presentation group

<table>
<thead>
<tr>
<th>Recall measure</th>
<th>Story presentation group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Verbal and Picture</td>
</tr>
<tr>
<td><strong>Interview 1</strong></td>
<td></td>
</tr>
<tr>
<td>Verbal only</td>
<td>.07 (.04)</td>
</tr>
<tr>
<td>Verbal and pictorial</td>
<td>.18 (.10)</td>
</tr>
<tr>
<td>Pictorial only</td>
<td>.01 (.01)</td>
</tr>
<tr>
<td><strong>Interview 2</strong></td>
<td></td>
</tr>
<tr>
<td>Verbal only</td>
<td>.05 (.03)</td>
</tr>
<tr>
<td>Verbal and pictorial</td>
<td>.15 (.08)</td>
</tr>
<tr>
<td>Pictorial only</td>
<td>.00 (.01)</td>
</tr>
</tbody>
</table>

*Note.* Standard deviations are in parentheses.
ps ≤ .03, partial η²'s ≥ .09. Thus, when narrative information was also presented pictorially, it was remembered better by older children but not by younger children. Combined with the results of the analyses of verbal-only details, these findings suggest that the facilitative effects of the illustrations, when observed, were limited to recall of information that was conveyed by both the narrative and the illustrations rather than recall of the entire narrative.

The data in Table 2 also show that children recalled very few of the picture-only details. The GLM analysis of picture-only details produced no significant main effects or interactions. Thus, children in all four groups reported similar numbers of propositions that happened to be consistent with details conveyed by the relevant illustrations in spite of the fact that only two of the groups were actually shown these illustrations. These patterns suggest that the children who were exposed to story illustrations gleaned very little unique information from them.

**Discussion**

Illustrations are ubiquitous in storybooks for young children, yet the few studies of picture facilitation effects in preschoolers have focused only on performance in highly structured, deliberate memory tasks (Digdon et al., 1985; Pressley et al., 1982). The current investigation is the first to examine the impact of illustrations on preschoolers’ comprehension and retention of story narratives. Our findings indicate that the degree to which illustrations enhance memory for stories increases across the preschool years. The event-level analyses of story recall showed that children in the Verbal and Picture group performed no differently from those in the other verbal groups at the low end of the age range, but as age increased, children in this group showed a growing recall advantage. The proposition-level analyses revealed that these patterns were limited to story details conveyed by both the narrative and the illustrations rather than information provided by either the narrative alone or the pictures alone. It is also worth noting that overall patterns of long-term retention across story presentation conditions were generally consistent with the literature on memory development. The children accurately recalled much less of the 18 events...
depicted in the stories, and this level of retention fits well with research on recall versus recognition performance in this age group (e.g., Baker-Ward, Ornstein, Gordon, Larus, & Clubb, 1993). Recall performance also declined from the immediate interview to the 1-week interview, as evidenced by decreases in accurate recall, verbal details, and verbal and pictorial details as well as increases in recall errors. These patterns suggest that, consistent with research on constructive memory processes, the children made inferences and guesses about the story content as their memories faded (e.g., Greenhoot, 2000; Paris & Lindauer, 1977).

The fact that the Verbal and Irrelevant Picture condition had no facilitative effects on story recall, regardless of age, suggests that the beneficial effects of illustrations could not be attributed to increased motivation and attention to the listening task. The children must have attended to the content of the pictures given that it determined their efficacy in enhancing recall. It was not the case, however, that the children relied solely on the illustrations in reporting the stories given that the Picture Only group accurately recalled fewer story events than did all other groups. Admittedly, the Picture Only group was exposed to fewer total propositions than were all other groups, yet even when the analyses were limited to recall of information represented in both modalities (i.e., the verbal and pictorial propositions), the Verbal and Picture group outperformed the Picture Only group. Taken together, these findings suggest that exposure to the combination of verbal and visual information enabled the older preschoolers to establish more elaborate and easily retrieved memory traces than did exposure to verbal information alone or visual information alone. These patterns are consistent with Paivio’s (1970, 1986) dual coding hypothesis, which states that stimuli that activate two codes (i.e., verbal and visual) are more easily remembered than stimuli that activate one code, as well as with the argument that pictures make stories more concrete, comprehensible, and coherent (Levin & Mayer, 1993).

The finding that illustrations enhanced memory only for details presented in both modalities is compatible with previous studies suggesting that redundancy between verbal and visual information might be necessary for visual stimuli to enhance verbal memory in young children (Digdon et al., 1985; Furnham et al., 2002; Guttman et al., 1977; Pressley et al., 1982). The most common explanation is that, consistent with the literature on the development of imagery as a memory strategy (e.g., Pressley, 1977, 1982; Schneider & Pressley, 1997), younger children are less able to generate mental images of the nonpicted items. On the other hand, the illustrations in this study were designed to convey the central propositions or gist of each event; thus, this pattern could have more to do with the centrality of the verbal and pictorial details than with two-modality presentation. Indeed, across age and group, children recalled a higher proportion of these details than of verbal-only or pictorial-only details. Additional research in which the centrality of illustrated story details is manipulated would permit stronger conclusions about the role of verbal–visual redundancy in young children’s recall of illustrated stories.

Why were the beneficial effects of illustrations minimized in younger preschoolers? One possibility is that very young children do not understand the relevance of illustrations and, therefore, fail to encode the illustrations or use them as retrieval cues. In fact, in previous studies that have found picture facilitation effects in very young children, children were explicitly prompted to attend to the pictures while listening to the verbal stimuli (Digdon et al., 1985; Pressley et al., 1982). Thus, very young children may require prompts to encode illustrations and/or to retrieve the resulting images during recall. Consistent with the argument that young children do not recognize the utility of pictorial accompaniments

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to verbal stimuli, Pressley and MacFayden (1983) found that preschoolers’ paired associates recall was enhanced by interactive pictures of the paired items only when the children were instructed at testing to retrieve the pictures.

Additional explanations are offered by the broader literature on memory and cognitive development. Fuzzy trace theory, for example, might suggest that picture facilitation effects depend on the integration of information across modalities into an overall gist, and there is considerable evidence that younger children have more difficulty in integrating across stimuli and extracting the gist than do older children (e.g., Bjorklund & Muir, 1988; Brainerd & Reyna, 2004). Research on areas of symbolic development, such as the appearance–reality distinction and the use of scale models as symbols, shows that the ability to represent and link two ways of thinking about one entity emerges gradually across early childhood (e.g., DeLoache, 2000; Flavell, Green, & Flavell, 1986). This work also suggests that young children may have difficulty in maintaining and connecting the visual and verbal representations of the story in memory.

A final possibility is that very young children simply lack the processing capacity necessary to attend to and encode both the narrative and the illustrations and to connect the resulting representations in memory. Mayer and Moreno (1998) showed that adults’ processing resources affect their abilities to attend to and integrate information presented both visually and auditorily. It is well established that working memory abilities improve dramatically across childhood (e.g., Case, 1974; Cowan et al., 2002; Dempster, 1981), and this improvement might contribute to change in children’s ability to benefit from story illustrations. In support of this explanation, previous investigations that have revealed picture facilitation for recall of verbal information in young preschoolers used much simpler stimuli that would place fewer demands on working memory (e.g., single words, paired associates, simple sentences with one picture corresponding to each sentence) than those used in the current study (Digdon et al., 1985; Jones, 1973; Kau & Winer, 1987; Pressley et al., 1982). Additional research involving manipulations of story and illustration complexity, or direct assessments of working memory, would help to clarify the role of processing resources in picture facilitation effects.

Interestingly, the current findings are quite consistent with recent experiments illustrating a pattern of privileged processing of auditory information over visual information during both infancy and early childhood (Lewkowicz, 1994; Napolitano & Sloutsky, 2004; Robinson & Sloutsky, 2004). For instance, Napolitano and Sloutsky (2004) showed that when 4-year-olds were presented with unfamiliar auditory and visual stimuli simultaneously, they encoded and remembered the auditory stimuli more readily. In the current study, the lack of picture facilitation effects in younger preschoolers could be interpreted as a dominance of the auditory modality over the visual modality, perhaps due to the high processing demands of the cross-modal task.

Regardless of age, children who heard the verbal narrative remembered more story events than did those who only viewed the illustrations. Thus, children in the Picture Only group did not spontaneously construct the story narrative on the basis of the pictures alone, even though the pictures were intended to depict the gist of the story events. Of course, children in the Picture Only group were not explicitly told to generate a narrative while viewing the pictures. But these results also fit well with evidence that preschoolers often fail to grasp the interconnections between pictures that tell a story (Berman, 1988; Bornens, 1990; Trabasso & Nickels, 1992). Indeed, compared with older children, pre-
schoolers have difficulty in constructing coherent stories from picture books even when asked to do so (Berman, 1988; Trabasso & Nickels, 1992).

A very interesting finding revealed by the propositional analyses was that across all ages the children remembered very few of the pictorial-only details, and that children in the Picture Only group remembered similar numbers of these details as did children in the verbal groups. In other words, the Verbal Only and Verbal and Irrelevant Picture groups’ scores on pictorial-only details did not differ from those of the Verbal and Picture and Picture Only groups, even though the former groups did not actually see the pictures. Thus, the children seemed to recall very little unique information from the illustrations, and what they did recollect could be generated without exposure to the pictures at all. In addition, comparisons between the Verbal Only and Picture Only groups on verbal and pictorial propositions (the only details to which all groups were exposed in some form) showed that children remembered these details better when they were presented verbally than when they were presented visually. This pattern suggests that young children might have difficulty in translating visual information into verbal information (Kee, Bell, & Davis, 1981). Of course, although the illustrations were intended to represent the gist of each story event, it also is possible that children simply did not understand the pictorial representations without the verbal narrative.

Although additional research is needed to explore contextual variables and child characteristics that determine the way in which young children respond to story illustrations, our findings have several implications for the design and presentation of stories to preschoolers. For example, it might not be appropriate to expect preschoolers to obtain unique information about a story from the illustrations, at least not without adult guidance. In addition, very young children might be more likely to benefit from illustrations if they are simple and if the children are prompted to attend to them. Indeed, illustrations might serve different functions in interactive story-reading sessions between young children and adults. We used an audiotaped story presentation format in this study to standardize exposure time across conditions, and children do sometimes listen to prerecorded stories while looking at books. When a person reads a story to a child, however, both the child and the reader may ask questions and make comments about the pictures and text, and these behaviors are associated with children’s vocabulary and story comprehension skills (e.g., Haden, Reese, & Fivush, 1996; Reese & Cox, 1999). In this type of story presentation context, illustrations might elicit more discussion than would narrative alone, and this in turn might enhance children’s comprehension and recall of the story. Future research should examine the specific role of illustrations in eliciting parent and child extratextual comments and the effects of such comments on young children’s story comprehension and recall.

Uncited references


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