Effect of Visual Stimuli on Preschoolers’ Memory for Verbal Material

The authors investigated the effects of relevant and irrelevant visual stimuli on preschoolers’ memory for verbal material. Eighty-seven preschool children, ranging in age from 35 to 66 months, heard a story. The children viewed a picture relevant or irrelevant to the story or viewed no picture while listening and were tested for memory through visual and verbal recall tasks. Those children who viewed the relevant picture performed better than the irrelevant and no-picture groups on both the visual and verbal tasks. The performance of those children who viewed the irrelevant picture was task dependent. We discuss the findings in terms of visual versus verbal encoding, and practical applications in the areas of law and education are suggested.

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Encoding is the use of one or more of a variety of codes or frameworks to organize information for memory (Ornstein, 1988). Research in the area of memory has provided evidence for a variety of methods of encoding sensory stimuli as well as for developmental changes in encoding processes, particularly during the preschool years (Annett, Cook, & Leslie, 1995; Dewhurst & Conway, 1994; Hulme, 1987; Piaget, 1950).

We may encode information, for example, according to words, images, meanings, sounds, or smells (Annett et al., 1995; Dewhurst & Conway, 1994; Hulme, 1987) that are already in our memories. These methods are verbal, visual, semantic, auditory, and olfactory encoding, respectively, and their corresponding frameworks are called verbal, visual, semantic, auditory, and olfactory codes. Visual and verbal encoding are specific modes and codes that researchers have studied widely.

Verbal encoding is the use of a word or linguistic code or framework to organize information for memory. Stimuli are encoded verbally when words or sentences are drawn from memory to aid the organization of and memory for new information. We can encode verbally a variety of stimuli. For example, when presented with a picture of a barn or with the smell of hay we can say “barn” to ourselves, drawing that word from memory in an attempt to organize or make sense of the stimulus.

Hulme (1987) showed evidence for the verbal mode of encoding. Hulme tested memory for visual stimuli (i.e., pictures) that had either acoustically similar (e.g., hat, cat) or acoustically dissimilar (e.g., house, dog) names. Hulme found that memory for pictures with acoustically similar names differed significantly from memory for pictures with acoustically dissimilar names. Because the pictures were visually comparable, visual encoding alone does not account for the difference. Hulme concluded that a verbal mode of encoding is used. Although verbal codes are often used, visual encoding seems to lead to stronger memory (Dewhurst & Conway, 1994; Hulme, 1987).

Visual encoding is the use of a visual code or framework to organize information for memory. Stimuli are encoded visually when images or pictures are drawn from memory to aid in the organization of and memory for new information. We can encode visually when presented with not only visual stimuli—pictures, for example—but also stimuli such as words or sounds. That is, we can picture or imagine a sheep when we read the word “sheep” or hear “baaah.” This use of imaging for memory is visual encoding.

Dewhurst and Conway (1994) provided evidence for a visual mode of encoding by testing memory for verbal stimuli (i.e., words) of varying imageability. The words ranged from easy to difficult to visualize or imagine. The results varied across conditions.
Memory for highly imageable words differed significantly from memory for words low in imageability. Because the words were linguistically comparable, the verbal code alone did not account for this difference. Dewhurst and Conway concluded that a visual strategy or mode of encoding was used.

Dewhurst and Conway (1994) also showed that highly imageable words are remembered better than less imageable words. Easily visualized verbal stimuli are remembered better than verbal stimuli that are difficult to visualize. Imageable words, thus, may facilitate the use of a visual mode of encoding, which then may enhance memory for those words. They also found that participants remembered pictures, which likely facilitate the use of a visual code, better than words. Visual encoding seems to lead to superior memory for visual and verbal stimuli than verbal encoding alone.

Constantinidou, Neils, Bouman, Lee, and Shuren (1996) confirmed the strength of the visual code. Participants remembered objects when presented visually (i.e., line drawings) better than when presented verbally (i.e., by name). Pictures lending themselves to visual encoding were remembered better than words alone.

Although visual encoding seems a powerful strategy for remembering information, it is not flawless. Irrelevant visual stimuli can actually interfere with visual encoding. Quinn and McConnell (1996) tested memory to determine if the presentation of irrelevant visual stimuli would interfere with the visual encoding of verbal material. Participants used either a visual or verbal mnemonic device to encode word lists. Both conditions were exposed to the irrelevant visual stimuli, but only the visual condition was affected. The participants using the visual mnemonic device did not remember the word lists as well as the participants in the verbal condition (i.e., using a verbal mnemonic device; Quinn & McConnell, 1996). Irrelevant visual stimuli appeared to weaken memory by interfering with visual encoding. Irrelevant visual stimuli, however, did not appear to affect verbal encoding.

Researchers have found parallel results for verbal encoding. The presentation of irrelevant verbal material diminished individuals’ memory for information encoded via a verbal strategy, but not for the same information encoded via a visual strategy (Logie, 1986). Also, Korni-Nouri, Nilsson, and Bäckman (1994) found that a verbal attentional demand task interfered with subsequent recall of the verbal features (e.g., name) more than with subsequent recall of the visual features (e.g., color) of objects. Irrelevant verbal stimuli appear to interfere with verbal encoding but not with visual encoding.

These findings suggest that the visual and verbal modes of encoding are distinct from each other. Of some interest, then, are the specific conditions under which, or populations in which, one mode is used or preferred over the other. This question is of particular interest in preschool age children because they are at the beginning of their development of verbal skills and, therefore, are just beginning to develop a verbal framework for encoding.

According to Piaget (1950), as children move from the preoperational stage to the concrete-operational stage, they begin to encode symbolically versus primarily imaginatively. Freund and Johnson’s (1972) evidence supports Piaget’s theory. They tested 6-year-olds’ memory for visually similar versus visually dissimilar words and found that their memory for the visually similar words was poorer than their memory for the visually dissimilar words. Visual similarity interfered with the 6-year-olds’ use of visual encoding but had no effect on the memory performance of third graders who had already developed symbolic encoding strategies. Six-year-olds appear to use a visual code even when use of a verbal code could benefit memory performance.

Hayes and Rosner (1975) however, have shown preschoolers’ ability to encode verbally. When preschoolers were instructed to rehearse verbally and overtly, their memory performance showed a phonetic effect or acoustic similarity effect. That is, preschoolers remembered phonetically dissimilar pictures better than phonetically similar pictures (e.g., hat, cat), implying the use of a verbal code.

The spontaneous use of verbal encoding appears to increase with age (Hulme, 1987). Hulme (1987) showed that verbal encoding is used by 4- to 10-year-olds for memory of pictures and that the verbal code interfered with memory for pictures with acoustically similar names. Children did not remember pictures with acoustically similar names as well as pictures with acoustically dissimilar names. Hulme found that this acoustic similarity effect increased with age and implies, then, that the use of verbal encoding increases with age.

Research in the area of autobiographical memory also suggests an increase in verbal encoding with age. Autobiographical memory or memory for personally experienced events in narrative or verbal form does not usually develop before age 4 (Papalia, Olds, & Feldman, 1998). Fivush, Haden, and Adam (1995) explored preschoolers’ autobiographical memories longitudinally. The children’s narratives or verbal expressions of the events increased in complexity with age. Together, this evidence suggests that narrative or verbal codes for memory develop with language and that children may be unable to hold the memories in mind until they can put them into words (Papalia et al., 1998), that is, not until they can verbally encode them. Aschermann, Dannenberg, and...
Schulz (1998) and Priestley and Pipe (1997), however, offer evidence to the contrary.

Research has shown that preschool-age children have accurate memory for experienced events. Although less able to remember information about an experienced event when interviewed verbally, preschoolers remembered significantly more information when interviewed with visual cues (i.e., pictures or props; Aschermann et al., 1998; Priestley & Pipe, 1997). The pictures and props may cue visually encoded information about the event, thus facilitating memory for the event.

Davis and Hathaway (1986) showed that visual stimuli enhanced preschoolers’ memory also when they are presented at encoding. They found that preschoolers who heard a story and watched an experimenter manipulate props to match events in the story remembered more about the story than preschoolers who only heard the story.

Newton (1994) confirmed these findings with a study that tested the effect of a matching (i.e., relevant) picture on children’s memory for discourse. He presented a story with or without a relevant picture and then tested memory for the events in the story. The children remembered the verbal stimulus (story) better when presented with a relevant visual stimulus (picture) than when presented alone (Newton, 1994). The picture may have facilitated visual encoding of the story, enhancing memory.

Rolle-Maloney and Simonds (1998) conducted an extension of Newton’s (1994) design as a pilot study. Thirty-three children of preschool age were randomly assigned to three independent groups. All of the children heard an identical story. During the story, the control group was presented with no visual stimulus, the relevant group was presented with a picture relevant to the story, and the irrelevant group was presented with a picture irrelevant to the story. The children’s memory for the story was then tested through visual and verbal recall tasks. The children who saw the irrelevant picture scored significantly lower (remembered less) on the visual task than the children who saw the relevant or no picture. Although the differences were not statistically significant, the relevant- and irrelevant-picture groups both remembered more than the no-picture group when tested verbally.

The pilot study was extended for the current study. Modifications were made in the design to increase the likelihood of detecting statistically significant effects. The sample size was increased, and the dependent measures were modified to increase the range of scores on both tasks.

According to MacDonald and Hayne (1996) and Ricci, Beal, and Dekle (1996), children recall and verbalize information more readily for a researcher who is familiar than for a researcher who is unfamiliar. Also, according to Naremore (1997), children are more willing to verbalize what they know when the verbalization or communication is purposeful (e.g., to inform someone who does not already have the information). Because scores on the pilot’s verbal task ranged only from 0 to 3 out of 12, modifications were made to account for a potential floor effect. The current study included procedures to increase the preschoolers’ familiarity with the researchers before testing and also procedures to increase the amount of purpose apparent in the task. With the scores on the pilot’s visual task the opposite was true; there was a potential ceiling effect (i.e., almost all of the children scored high on the task). To address this possibility, we added an additional visual measure.

Consistent with Newton’s (1994) study, relevant visual stimuli should enhance preschooler’s performance on the verbal and visual recall tasks in comparison to the control group’s performance. Consistent with the pilot study, the irrelevant visual stimuli should enhance preschooler’s performance on the verbal recall task but interfere with performance on the visual recall tasks in comparison again to the control group’s performance.

Method

Participants

Eighty-seven preschoolers ranging in age from 35–66 months ($M = 53.7$ months) participated in the study while at their preschool facilities in Anchorage, Alaska. The children were randomly assigned to one of three interview conditions: the no-picture (control) group (16 girls and 13 boys), the relevant-picture group (12 girls and 17 boys), or the irrelevant-picture group (14 girls and 15 boys). They were treated in accordance with the ethical principles of the American Psychological Association (Canter, Bennett, Jones, & Nagy, 1994).

Materials

A story was written and recorded on audiocassette for the study. The main character of the story was Mikey Moose, and the setting was Playground Park. The plot consisted of Mikey visiting his favorite bush and finding it being eaten by another moose. Mikey walked away from the bush sad and hungry until he was lost. Then Mikey saw a bush like his favorite one, ate, and took a nap. The story concluded with Mikey’s realization that he was not lost and his decision to share his favorite bush with all the animals in the park. The recorded story was 1.5 min in length (see Appendix).
Three color picture pages were prepared for the study. The relevant page depicted a moose facing a bush. The other two pages were irrelevant to the story. One page depicted a fish eating sea grass, and the second page depicted a dog barking at a tree. Each page measured 12 × 16 cm and could be slid into a white, single-page album with the same measurements.

Nine picture blocks were also prepared for the study. Three blocks were relevant to the story. They depicted scenes from the story (e.g., a moose sleeping) that could be sequenced according to the plot. The remaining six blocks were irrelevant to the story; three depicted scenes revolving around a fish (e.g., a fish blowing bubbles), and three depicted scenes revolving around a dog (e.g., a dog playing with a ball). The blocks were wooden, each with a different picture affixed to the top. Each block measured 10 × 10 × 4 cm.

Data collection sheets were also prepared for the study. The sheets included spaces to record the experimental condition, the sex and age of each child, and each child’s response to the question, “Which picture page (of the three) tells about the story?” Each sheet also contained a list of 12 distinct story descriptors, that is, words or phrases descriptive of the story’s main character, setting, or plot. For example, “moose,” “Mikey,” “park,” “bush,” “getting lost,” “eating,” and “deciding to share” were descriptors. Spaces were left next to each descriptor for recording applicable data. Spaces were also included to record the number of correct picture blocks chosen (zero to three) and number sequenced correctly (also zero to three).

Procedure

A team of two female experimenters conducted the research. Parental consent was obtained prior to the interviews with participants. The experimenters visited each classroom for 20 min in order to become familiar to the children. The interviews were conducted during a second visit in a quiet room or area of the preschool. A written script was followed throughout each interview.

Each child was interviewed individually. The children were seated at a table, and after introductions were made, were asked to play with LEGO®-type blocks with the two experimenters. After playing for 3 min, one experimenter left the room to observe from a place out of the child’s sight. The child was then introduced to a “story on a tape” and encouraged “let’s listen carefully” to the taped story. In the relevant- and irrelevant-picture conditions only, pictures were presented to “look at while listening to the story.”

In the relevant-picture condition, the picture page of the moose facing a bush was placed in the album and given to the child to hold like a book for the duration of the story. The picture page depicting the fish eating sea grass was shown in the irrelevant-picture condition in the same manner. A blank white page was shown in the no-picture condition. The taped story was then played, and as it ended the album was collected.

After the story ended, the children in all conditions were treated the same. They were asked three distracter questions (e.g., “How old are you?”). Experimenter responses were limited to, “Okay.” The children then completed a multiple-choice visual recall task. They were presented with a binder containing all three picture pages (i.e., the moose facing a bush, the fish eating sea grass, and the dog barking at a tree). Order of the pictures inside the binder was counterbalanced. The children were asked by the second experimenter, who had just reentered the room and been informed that the children had heard the story, to identify which picture “tells” about the story. The children’s responses were recorded on the data collection sheets.

After responding, the children were presented with a verbal recall task. They were asked by the second experimenter to “tell” what the story was about. Experimenter probes were limited to, “Anything else?” Check marks were made on the data collection sheets in the appropriate rows for responses matching or approximately matching any of the 12 story descriptors. The children were then asked four direct questions including, for example, “What happened at the end of the story?” Direct questions that had been answered in free recall were excluded. Responses matching or approximately matching any of the 12 descriptors were recorded, again, with a check mark in the appropriate row. For each participant, check marks were summed to determine the total number of descriptors remembered.

A second visual task was then presented to the children. The nine picture blocks were placed on the table to “help” the child “remember the story.” The children were asked to choose “which blocks go with the story you heard on the tape,” and to arrange the picture blocks “in a line” from the beginning to the end of the story. One point was scored for each correct picture block chosen and one for each correct sequential placement.

Results

Scores (i.e., picture pages chosen) on the first visual task were coded as either correct or incorrect and analyzed using a Pearson chi-square test. There were statistically significant differences between the groups, χ²(2, N = 85) = 23.47, p < .001. The preschoolers in the relevant-picture group all chose the correct picture page. The preschoolers in the no-picture group chose correctly significantly more often than they chose incorrectly; however, the preschoolers...
in the irrelevant-picture group chose incorrectly about as often as they chose correctly. When the preschoolers in the irrelevant group chose incorrectly, they almost always chose the irrelevant picture they had seen. Table 1 shows the relevant-, irrelevant-, and no-picture groups’ actual counts for correct and incorrect picture choices.

On the verbal task, overall scores ranged from 0–9 story descriptors remembered out of a possible 12 (M = 2.8, SD = 2.5). The mean scores (SD) were 4.17 (2.89) for the relevant-, 2.69 (2.56) for the irrelevant-, and 1.55 (1.22) for the no-picture group. These mean differences were statistically significant, F(2, 86) = 8.85, p = <.001. According to the Student-Newman-Keuls post hoc test, the preschoolers in the relevant-picture group remembered more descriptors than the preschoolers in both the irrelevant- and no-picture groups. Although not statistically significant, the direction of the difference between the mean number of descriptors remembered in the no-picture (M = 1.55, SD = 1.22) and irrelevant-picture (M = 2.69, SD = 2.56) groups partly supports the hypothesis. The irrelevant-picture group did not remember more descriptors than the no-picture group.

Mean scores (i.e., mean number of blocks chosen and sequenced correctly) on the second visual task also were compared using a one-way analysis of variance (ANOVA). Although the means were in the predicted direction, there were no statistically significant differences between groups, F(2, 86) = 1.16, p = .32. Mean scores (SD) for the relevant-, irrelevant-, and no-picture groups were 3.45 (1.57), 2.66 (2.34), and 3.14 (1.91), respectively.

**Discussion**

Consistent with the hypothesis and with the research done by Newton (1994) and Davis and Hathaway (1986), the preschoolers who viewed a relevant visual stimulus with the verbal material performed better on both the visual and verbal recall tasks than the preschoolers in the control group. The use of visual and verbal encoding together enhances preschoolers’ memory for verbal material.

Also, as hypothesized the preschoolers who viewed an irrelevant visual stimulus with the verbal material performed worse on the first visual task, but as well as the preschoolers in the control (no-picture) group on the verbal task. Although there was no statistical significance, the direction of the difference showed the irrelevant picture actually enhanced their performance on the verbal task. These findings were consistent with the data of Quinn and McConnell (1996) with adult participants. Irrelevant visual stimuli, here, interfered with preschoolers’ visual encoding but not with their verbal encoding.

Not surprisingly, when the children in the irrelevant-picture group chose the incorrect picture, they tended to choose the same irrelevant picture they had seen while listening to the story. Consistent with the Constantinidou et al. (1996) research with adult participants, visual encoding seems to lead to stronger memory than verbal encoding.

The second visual task, the identifying and sequencing of the picture blocks, did not show a significant difference between the groups, as did the first visual task. The picture blocks depicting fish were less similar to the irrelevant (fish) picture page than the picture blocks depicting moose were to the relevant (moose) picture page. This inconsistency may have affected the results. Also, the second part of this task, the sequencing of the blocks, may have measured a construct other than visual encoding, perhaps the ability to recode visually encoded information into verbal or narrative form.

A question, then, is raised concerning how visually and verbally encoded information affect one another in the retrieval and expression of our memories. Future research may identify the process by which information is translated from the verbal code to the visual code and vice versa in order to meet the specific task or demand.

**TABLE 1**

<table>
<thead>
<tr>
<th>Group</th>
<th>Correct</th>
<th>Incorrect</th>
</tr>
</thead>
<tbody>
<tr>
<td>No picture</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td>Relevant</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>Irrelevant</td>
<td>13</td>
<td>15</td>
</tr>
</tbody>
</table>

Practical implications of the findings fall into the area of education and law. Educational implications include the enhancement of preschoolers’ learning and the publication of suitable preschool literature. Preschoolers are best able to recall information from a story that has pictures. Moreover, if the pictures coincide with the story, the preschoolers will be able to utilize both visual and verbal encoding to assist them in their learning and understanding of the information. Preschoolers’ books should be illustrated, and the illustrations should be, but are not always, relevant to the adjacent information.

The findings also should be viewed in relation to teaching and educational testing procedures. When
and realized he had not been lost at all. He was still at home in Playground Park. Eating he was so tired that he lay down and took a nap. When Mikey awoke he saw his family and friends.

Mikey did not know what to do, so he just kept walking. Soon he realized he was lost. Then suddenly, he saw Mikey arrived for his breakfast, he noticed another moose eating the yummy leaves of his favorite bush.

Sad and hungry, Mikey wandered away from his Playground Park bush. He had never felt so hungry. Each morning Mikey went on a walk to his favorite bush that he liked to eat for breakfast. One day when Mikey arrived for his breakfast, he noticed another moose eating the yummy leaves of his favorite bush.

Once upon a time lived Mikey the Moose. Mikey lived near a city in Playground Park. Mikey lived with his family and friends.

References


APPENDIX

Once upon a time lived Mikey the Moose. Mikey lived near a city in Playground Park. Mikey lived with his family and friends.

Each morning Mikey went on a walk to his favorite bush that he liked to eat for breakfast. One day when Mikey arrived for his breakfast, he noticed another moose eating the yummy leaves of his favorite bush.

Sad and hungry, Mikey wandered away from his Playground Park bush. He had never felt so hungry. Mikey did not know what to do, so he just kept walking. Soon he realized he was lost. Then suddenly, he saw a bush just like his favorite bush in Playground Park.

Mikey was surprised and very happy. He ran over to the bush and ate until he could eat no more. After eating he was so tired that he lay down and took a nap. When Mikey awoke he saw his family and friends and realized he had not been lost at all. He was still at home in Playground Park.

Mikey was so happy that he decided to share his favorite bush with all the animals in the park.