Children's Recall of Television and Print News: A Media Comparison Study

Juliette H. Walma van der Molen and Tom H. A. van der Voort
Leiden University

An experiment was conducted (a) to compare children's recall of news information presented either audiovisually or in print, and (b) to establish whether the relative effectiveness of both media in conveying the news is dependent on children's reading proficiency and expectation of a memory test. A sample of 152 4th and 6th graders was presented with a sequence of 5 children's news stories, either in their original televised form or in a printed version. In each condition, half of the children were led to expect a memory test, whereas the other children were not. The results of a cued-recall test indicated that children who had watched the news on television remembered more than those who had received the same news in print, regardless of their reading proficiency or expectation of a memory test.

A media comparison study of the transmission of television and print news information to children was undertaken by comparing children's recall of news stories presented either audiovisually or in print. Children learn most about the news in out-of-school situations, especially via television and to a lesser extent via newspapers (Comstock & Paik, 1991). The present study, however, may have implications for the contribution of television and print to children's learning both in and outside of school. The news is an accepted topic for study in both "media studies" and "social studies" curricula (Brown, 1991). In addition, newspaper stories and news and documentary films are frequently used to update and illustrate subject matter in the curricula of several other subjects. Given that televised and printed news information is used in instruction, it is of interest to investigate from which medium children learn most. A study of the relative effectiveness of television and print to transmit news information to children may provide insight into how both media can be used to improve children's retention of other subject matter as well.

So far, media comparison experiments investigating recall of television and print news have been conducted almost exclusively with highly educated adults (college or university students). With the exception of one study in which no media difference was found (Stauffer, Frost, & Rybolt, 1981), all of the studies comparing adults' memory for television news stories with their recall of print versions containing exactly the same verbal information showed that the printed news was remembered best (DeFleur, Daven-

The goals of the present study were threefold. The main goal was to examine whether the superior recall of printed news that has been found with highly educated adults also applies to children between 10 and 12 years of age. The study's second goal was to examine whether the relative

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Juliette H. Walma van der Molen and Tom H. A. van der Voort, Center for Child and Media Studies, Leiden University, Leiden, The Netherlands.

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Correspondence concerning this article should be addressed to Juliette H. Walma van der Molen, Center for Child and Media Studies, Leiden University, P.O. Box 9555, 2300 RB Leiden, The Netherlands. Electronic mail may be sent via Internet to walma@rulfsw.leidenuniv.nl.
Differential Recall of Television and Verbal Media

To our knowledge, children's recall of television versus print news has been examined only in one quasi-experimental media comparison study, which involved children aged 10 to 12 (Beentjes, Vooijs, & van der Voort, 1993). For participants who did not expect to be tested, the authors found that viewers of children's news stories remembered more than readers of identical printed stories. Almost without exception, experimental media comparison studies have also shown that children recall fictional television stories better than text-only versions that were either read by the children (Beentjes & van der Voort, 1991a, 1991b, 1993) or read out loud to the children (Beagles-Roos & Gat, 1983; Gibbons, Anderson, Smith, Field, & Fischer, 1986; Greenfield & Beagles-Roos, 1988; Hayes, Kelly, & Mandel, 1986; Meringoff, 1980).

The finding that television stories are better remembered than text-only versions has frequently been explained in terms of Paivio’s (1969, 1971) dual-coding hypothesis. According to Paivio, audiovisual information is stored in memory in two separate but associated codes—one verbal and one visual—whereas text-only information is stored in a verbal code only. During recall, the visual memory code serves as an extra retrieval cue, which could account for the superior recall of television stories compared with stories without pictures.

However, the contribution of pictorial information to text recall may depend on the semantic overlap between the visual and verbal information. Experimental comparisons of television and radio news have shown that learning is enhanced only by the addition of redundant pictures, that is, pictures that convey the same basic propositional meaning as that conveyed by the text. When pictures and text do not overlap, both children (Nugent, 1982) and adults (e.g., Drew & Grimes, 1987; Graber, 1990; Reese, 1984) do not remember more and sometimes even remember less from an audiovisual presentation than they do from a radio presentation. Educational studies examining the effects of pictures on prose learning have also shown that children learn more from illustrated text, either orally presented or in print, only if the additional pictures are redundant with the text (e.g., Levin & Lesgold, 1978; Levin & Mayer, 1993).

The finding that nonredundant pictures do not facilitate the recall of audio information may be explained from limited-attentional-capacity theories (e.g., Drew & Grimes, 1987; Grimes, 1990, 1991) that posit that when verbal and visual information do not correspond, the viewer's attentional capacity is exceeded, with the result that part of the information is lost. According to the authors, in the case of nonredundant audiovisual information, viewers tend to direct their attention to the visual channel because pictures more easily and quickly provide meaning (visual dominance). The preference given to the visual information may hinder learning, because the main message in television news, as well as in instructional television programs, is usually provided in the spoken commentary.

The findings from television-audio comparisons may form a suitable basis for hypotheses concerning children's differential learning from television and print, because there are indications that children rely on the same skills to process audio and printed stories (Pezdek, Lehrer, & Simon, 1984). We therefore suspect that the outcomes of television-print studies conducted with children also depend on the degree of overlap between the television pictures and the verbal content. However, previous television-print studies have not directly examined the effect of semantic overlap between verbal and visual information, nor have they provided a description of how pictures and text were related in the television stories. Although we are not familiar with the exact nature of the stimulus materials, we suspect that the recall advantage of television found in the previous television-print comparisons conducted with children may have resulted from considerable overlap between pictorial and verbal story content in the television stories.

The present comparison of television and print news used stories from a children's news program in which an effort is made to use pictures that are redundant with the spoken commentary. It was hypothesized that children remember more from news presented on television than from the same news presented in print: first, because children may profit from the extra memory code offered by the addition of television pictures to the verbal message, and second, because children, unlike adults, may not yet be able to profit from the opportunities print offers to control the processing of information.

In the television stories used in the present study, only part of the verbally conveyed information was supplemented with redundant pictures because it is difficult to illustrate abstract information with pictures. Based on the dual-coding hypothesis, it was hypothesized that children remember more from those verbal information elements that are supported by redundant pictures. Based on limited-attentional-capacity theories, however, it was hypothesized that better recall for television compared with print news does not occur for verbal information elements that are not supported by redundant pictures. The argument presented here is supported by Levin and Berry’s (1980) study comparing children’s learning of pictured and non pictured newspaper stories, which showed that the recall advantage for the pictured stories was limited to the verbal information elements that were supported by redundant pictures.

Mental Effort and Expectation of a Memory Test

Our hypothesis that children retain television news better than print news is incompatible with Salomon’s (1981) model of children’s learning from television and print. According to Salomon, most children perceive television as an
"easy" medium and print as a "tough" one. Consequently, the amount of mental effort invested by children (that is, how hard they try to process presented information) is less for television viewing than for reading, with the result that televised information is less deeply processed than printed information. Salomon therefore assumed that inferential learning, which requires a deep level of processing, is best achieved via print, whereas learning explicit factual information, which does not require deep processing, may be accomplished equally well from television and print. However, the proposition that children learn least from television, or at best learn as much from television as from print, has been supported only by Salomon's own studies (Salomon, 1984; Salomon & Leigh, 1984) and is inconsistent with the superior recall of television found in other television-print comparisons conducted with children (Beentjes & van der Voort, 1991a, 1991b, 1993; Beentjes et al., 1993). The latter studies suggest that the additional visual memory codes offered by television pictures more than compensate for the lower mental effort invested by children when watching television. In the present study, we therefore maintained our main hypothesis that children remember television news stories better than print stories. The proposition that children invest less mental effort in watching television than in reading print has been supported both by Salomon's own studies (Salomon, 1984; Salomon & Leigh, 1984) and by other studies in which equivalent mental-effort instruments were used (Beentjes, 1989; Beentjes & van der Voort, 1993). However, relatively low levels of mental effort invested in watching television have been observed in situations in which children do not expect a memory test, as in the home situation, whereas in an instructional situation, children may also watch or read the news with the expectation that their memory for the news will be tested. Salomon and Leigh (1984) have argued that because children in a situation without test expectation tend to invest more mental effort in reading texts than in watching television, a test announcement is especially likely to raise the mental effort of viewers, a prediction that was corroborated by their study. If it is true that viewers are more likely than readers to show increased motivation following announcement of a test, then there is also reason to expect that test announcement will stimulate improved memory in viewers more than in readers. In the present study, it was therefore hypothesized that the predicted recall advantage of television compared with print news would be smaller among more proficient readers than among less proficient readers. This interaction was confirmed in a study by Beentjes and van der Voort (1993). However, the authors' classification of children as more proficient or less proficient readers was based on teachers' judgments, rather than on objective test scores.

The present study was conducted with children from two age groups: Grades 4 and 6. Because reading proficiency is more developed in Grade 6 than it is in Grade 4, sixth graders are likely to remember more printed news than are fourth graders. Hence, relative to sixth graders, fourth graders may benefit more from televised information. A similar interaction effect was indeed found in a comparison study conducted by Beentjes and van der Voort (1991a). Therefore, in the present study, it was hypothesized that the predicted recall advantage of television compared with print news would be smaller among children in Grade 6 than among children in Grade 4.

**Method**

**Participants**

The study was conducted with a sample of 73 girls and 79 boys from Grades 4 (n = 72; M age = 9 years 3 months) and 6 (n = 80; M age = 11 years 2 months) from five primary schools in the urban district of Leiden, The Netherlands. The children came from both lower- and middle-class families and did not have any learning, visual, speech, or hearing disorders. Children whose score on a standardized test of reading comprehension (National Institute for Education and Measurement, 1981, 1991) was more than two standard deviations below the group mean were not included in the sample. The assumption was that participation of this subgroup of very poor readers would obstruct procedures in the print condition and could lead to a disproportionate reduction of performance in the print condition.

**Design**

A 2 (Grade 4 vs. Grade 6) X 2 (less vs. more proficient readers) X 2 (television vs. print) X 2 (with vs. without expectation of a memory test) design was used. To reduce error variance, a randomized block factorial design (Kirk, 1968) was chosen. Reading proficiency was used as the blocking variable. Within each grade, children were matched in blocks of four children with identical or almost equal scores on the reading comprehension test. Subsequently, within each block, children were randomly assigned to one of the 2 (television vs. print) X 2 (with vs. without expectation of a memory test) experimental conditions. Because the children were placed in blocks of four participants with a comparable level of reading proficiency, the factors medium and test expectation were used in the analyses as within-subjects, or rather, "within-blocks" factors; the two other factors were between-subjects factors. The distinction between less proficient and more proficient readers was made within each grade, using the median of scores on the reading comprehension test as the cutoff score. Hence, half of the children in the experiment belonged to the category of less proficient readers; the other children were more proficient readers. To control for possible experimenter effects, the participation of three experimenters was systematically varied across grades and
across the four experimental conditions. The main dependent variables were: the amount of mental effort children invested in reading or watching the news stories (as reflected by responses to a four-item “mental effort” questionnaire) and the proportion of correct answers on a memory test about the news stories.

**Stimulus Materials**

Each child was presented with five news stories. Half of the children saw the news on television; the other half read print versions of the same items.

The five news stories had been taken from the *Jeugdjournaal* (Children’s News), a daily news program in The Netherlands designed specifically to make the news comprehensible to children of about 10 to 12 years of age. In order to minimize children’s advance knowledge of the news stories, stories were selected that had been broadcast at least one year prior to the experiment. For the same reason, stories were selected that involved isolated news events that had not attracted repeated media attention. The spoken commentary in the five television news stories was comprehensible without the accompanying pictures. Hence, a literal transcript of the television narrative was used in the print condition, without additions or deletions.

The five news stories were representative of the issues typically covered by the Dutch Children’s News program, including topics of special interest to children as well as “adult” topics. The stories selected covered the following events: “Bear set free in sanctuary after years of captivity,” “Bullied Japanese pupils play hooky,” “Queen Beatrix opens new railway tunnel,” “Rhinoceros wrongfully sold to circus,” and “New U.S. law restricts purchase of firearms.” Each television news story began with a short summary delivered by an anchorperson and continued with film footage accompanied by spoken commentary. For the television condition, the five news items were combined into the format of a regular children’s newscast, including the Children’s News leader and credit titles. The total duration of the newscast was 11 minutes, about the same as that of a regular Children’s News broadcast.

The print versions of the five news stories were presented in a newspaper format. The television titles that served to announce each television news story were used as headlines for the printed stories. The introductory commentary, delivered by an anchorperson in the early part of each of the television stories, was transformed into a bold printed lead in the print versions. The remaining text of the television stories was printed in two columns. Thus, an attempt was made to approximate the natural format of newspapers as closely as possible, while keeping the verbal information conveyed by the print and television stories constant.

**Procedure**

At each school, the television and print conditions of the experiment were conducted simultaneously in two vacant rooms in the school building. The children participated in small groups of three or four. The decision was made to subject the children to experimental treatments in small groups, rather than individually, to increase the comparability between the experimental condition given no expectation of a memory test and the home situation. In the home situation, children usually watch television in the presence of others as well (Bower, 1985), and most coviewing occurs with other children within the same age range (e.g., McDonald, 1986). Furthermore, the assumption was that it would be difficult to let the children watch or read the news in an informal way if they were left alone with a strange experimenter.

Children were called from their classroom in groups of six or eight. The children who had been assigned to the television condition were taken to the “viewing room” by an experimenter; the other children were brought to the “reading room” by a different experimenter. In both rooms, children were seated at tables placed at a distance of about four feet from each other. In the viewing room, the children sat at a distance of about seven feet from a 16-inch color television placed at eye level.

To reduce the possibility of classroom effects, each classroom contributed to each of the four experimental conditions. A maximum of 16 children from each class participated in the experiment. To prevent children from telling each other what was expected of them in the experiment, the experimental treatments of children from the same class were completed in one morning or one afternoon. The children from one class who were assigned to the television or print condition without expectation of a memory test participated in the first session. The other children, who were assigned to the television or print condition with expectation of a memory test, were tested in a second session immediately following the first. Therefore, there is a possibility of order and time of day effects being confounded with test expectancy. Each session lasted about 50 min.

In the conditions without expectation of a memory test, the children were told, “We are going to do something special and different today. However, I still have some things to complete for you, which I can only do now, because I have just learned all your names.” In the television condition the experimenter then said, “In the meantime, you can watch some television. I have here a videotape of an episode of the Children’s News. You can watch that while I’m busy working.” In the print condition the experimenter said, “In the meantime, you can read something. I have here some stories from a children’s newspaper. You can read those while I’m busy working.” The children were also asked not to talk to each other. They were told that talking would make it difficult for the experimenter to concentrate.

In the conditions with expectation of a memory test, the children were told, “Today we are going to have a test.” In the television condition the experimenter said, “I have here a videotape of an episode of the Children’s News that we are going to watch.” In the print condition the experimenter said, “I have here some stories from a children’s newspaper that I want you to read.” Subsequently, the children were instructed, “You will have to pay close attention to what you are going to watch (read), because afterwards you will be questioned about it.”

The children in the television condition were exposed to the news for 11 minutes. The children in the print condition were allowed to read the news stories at their own rate. The decision was made not to hold exposure time constant across the television and print conditions, because a pilot study had shown that most children needed more than 11 minutes to read the stories. Constant exposure times would therefore put children in the print condition at a disadvantage and prevent a meaningful media comparison.1 The average reading time was 12.59 minutes.

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1 To increase the comparability of exposure times for children in the television and print conditions, we could have allowed the TV children to look at parts of the program a second time. In our view, however, this would not improve the study because (a) it is difficult to decide which parts of the program would have to be repeated, (b) repeated viewing of television news items does not usually occur, so that the ecological validity might be decreased, (c) equalization of the mean exposure times for the television and print conditions would create pseudo-comparability, because most children in the print condition needed less or more than the average
Immediately after presentation of the five news items, the children in the television condition were presented with the first dependent measure. The children in the print condition had been asked to raise their hands when they were finished reading, at which time they were presented with the first dependent measure. The first measure concerned the amount of mental effort the children had invested while watching or reading the news stories. Subsequently, a cued recall test was administered to measure the children's memory for the stories. Both measures were preceded by written instructions. The children's reading proficiency had been established three weeks prior to the experiment.

Measures

Reading proficiency. Reading proficiency was assessed by means of standardized reading comprehension tests developed by the National Institute for Education and Measurement (1981, 1991). Two different test versions were used to measure reading comprehension in the fourth graders and sixth graders. Each test contained five texts with a total of 25 corresponding multiple-choice questions. The questions asked children to identify the central theme of a text, to link different parts of a text, and to draw inferences from the information provided in the texts. Cronbach's alpha (K-R 20) was .85 (Grade 4) and .80 (Grade 6).

Mental effort. The amount of mental effort invested in watching or reading the news stories was measured by means of an expanded version of Salomon's (1984) four-item scale, developed by Beenjtes, Voojis, and van der Voort (1993). In Salomon's study, four questions were asked: "How easy was it to understand the film (story)?," "How much did you concentrate while watching (reading)?," "How hard did you try to understand the film (story)?," and "How hard do you think your friends in your class will try to understand the film (story)?" Salomon's mental effort scale is not very reliable, due to the small number of items. Therefore, it was expanded by Beenjtes et al. (1993). The expanded questionnaire contains 18 statements concerning the extent to which the child had made an effort to process the news stories. For example: "When I was watching (reading), I wanted to understand everything," or "When I was watching (reading), I did not notice what was going on around me." Children responded to the statements on a four-point scale running from "quite true" to "not true." A child's scale score was the mean item score averaged across the 18 items. Cronbach's alpha was .79 for children who watched the news and .81 for children who read the news.

Recall. Memory for the five news stories was measured by means of a paper-and-pencil test containing 56 open-ended questions. The decision was made to elicit the children's recall of the information with cued recall questions, because free recall tests without retrieval cues may underestimate children's actual knowledge of information to which they have been exposed (Berry, 1983; Levin & Lesgold, 1978; Woodall, Davis, & Sahlin, 1983). The idea of using a multiple-choice test was abandoned because we were interested in measuring children's recall of the news information rather than their recognition.

For each of the five news stories, open-ended questions were generated about each of the five components of which most news stories are composed: event, place, principal(s), cause, and consequence (Findahl & Hőjer, 1985). In addition, questions about story details were generated. The memory test contained only questions about information that was present in the printed news stories—and thus in the television narrative. Hence, the test did not include questions on visual information that was not conveyed verbally. A number of questions were rephrased on the basis of insights gained from a pilot study conducted with children from Grades 4 and 6 in four schools that did not take part in the actual experiment (n = 148). The children's answers were scored without knowledge of the experimental condition to which each child had been assigned. Cronbach's alpha (K-R 20) for the final test was .93.

To enable an analysis of the contribution of redundant pictorial information to children's story recall, the questions in the memory test were classified into two types: (a) questions about information that was conveyed only verbally, in print or in the television narrative, and (b) questions about verbal information that, either partly or completely, had also been presented visually on television. The 56 questions were assigned to the categories "verbal only" and "visual" information by two independent judges. Interrater agreement as measured by Cohen's kappa was .96. Thirty-five questions were categorized as "verbal only" (Cronbach's alpha = .89), and 21 questions as "visual" (Cronbach's alpha = .84).

Results

Initial data checks showed that the distributions of mental effort and recall scores satisfied the assumptions underlying analysis of variance. Main effects of gender and interactions involving gender were not statistically significant for any measure. Therefore, gender was not included in the analyses. In the analyses of variance, the children included in each block of four, who had been matched on reading ability, were treated as if they were one person who had been treated with repeated measures (Kirk, 1968; Tabachnick & Fidell, 1989). All effects were assessed at the .05 level.

Mental Effort

A 2 (television vs. print) x 2 (with vs. without expectation of a memory test) x 2 (Grade 4 vs. Grade 6) x 2 (less vs. more proficient readers) analysis of variance was performed on the mental effort scores, with medium and test expectation as within-subjects factors and grade and level of reading proficiency as between-subjects factors. Within Grade 4, there were 18 blocks of four children; within Grade 6, there were 20 blocks. Table 1 presents the mean mental effort scores for the television and print conditions as a function of grade and expectation of a memory test. The main effect of test expectation was statistically significant, $F(1, 34) = 18.98, MSE = 0.122, p < .001$; the proportion of variance accounted for was $\eta^2 = .36$, using $\eta^2 = SS_{effect}/(SS_{effect} + SS_{error})$ (Cohen, 1973, 1988; Tabachnick & Fidell, 1989). Children who expected to be tested reportedly invested more mental effort than did children who did not expect to be questioned. The analysis yielded no statistically significant main effects for medium, grade, and level of reading proficiency, all $p > .06$. The announcement of a memory test appeared to increase mental effort in viewers more strongly than in readers. However, this interaction
Table 1

Mean Mental Effort for Television and Print as a Function of Grade and Expectation of a Memory Test

<table>
<thead>
<tr>
<th>Expectation of a memory test</th>
<th>TV</th>
<th>Print</th>
<th>TV</th>
<th>Print</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>4</td>
<td>2.94</td>
<td>0.50</td>
<td>2.85</td>
<td>0.34</td>
</tr>
<tr>
<td>6</td>
<td>2.97</td>
<td>0.32</td>
<td>3.07</td>
<td>0.27</td>
</tr>
<tr>
<td>M</td>
<td>2.96</td>
<td>0.41</td>
<td>2.96</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Note. Minimum score is 1 (low mental effort) and maximum score is 4 (high mental effort).

Recall

The analysis performed on children's total scores on the memory test was identical to that applied to the mental effort scores. Table 2 presents the mean proportions of correct answers for viewers and readers as a function of grade and expectation of a memory test. As predicted, the children who were shown the television news stories exhibited statistically higher recall ($M = .51$, $SD = .19$) than the children who read the printed versions ($M = .42$, $SD = .21$), $F(1, 34) = 10.62, MSE = 0.026, p < .004, \eta^2 = .24$. Sixth graders ($M = .56$, $SD = .18$) remembered more of the news stories than fourth graders ($M = .36$, $SD = .18$), $F(1, 34) = 61.07, MSE = 0.025, p < .001, \eta^2 = .64$. Children who expected to be tested tended to perform better than children who did not expect a retention test. However, this effect was not statistically significant, $F(1, 34) = 2.87, MSE = 0.014, p < .10$, and did not apply to the children in the print condition. The announcement of a test enhanced the memory of the viewers more than that of the readers, but this interaction was not statistically significant, $F(1, 34) = 2.07, MSE = 0.026, p < .17$. Contrary to our prediction, relative recall for television and print news was not dependent on grade level, interaction $F < 1$. There were no statistically significant higher order interaction effects.

Table 3 presents the mean proportions of correct answers for viewers and readers as a function of reading proficiency. More proficient readers remembered the news stories better than less proficient readers, $F(1, 34) = 50.11, MSE = 0.025, p < .001, \eta^2 = .59$. The recall advantage of television compared with print news was more pronounced among the less proficient readers than it was among the more proficient readers, but contrary to our expectations, this interaction between medium and reading proficiency was not statistically significant, $F(1, 34) = 3.35, MSE = 0.026, p < .08$. (Note, however, that a one-tailed test of this hypothesis would be statistically significant, $p < .04$.)

To check whether television's superiority over print in conveying news information applied to all five news stories used in the study, an analysis of variance was conducted with medium and test expectation as within-subjects factors and recall of each of the five news items as an additional within-subjects factor. There was no statistically significant interaction effect between news items and medium, $F(4, 148) = 1.19, MSE = 0.022, p > .30$, indicating that the tendency for television news to be better retained than print news applied about equally to each of the five news items.

To establish whether the redundant visual information in the television items contributed to children's news recall, an analysis of variance was conducted with medium and test expectation as within-subjects factors and recall of verbal only and visual information as an additional within-subjects factor. As indicated by a statistically significant interaction between medium and information type (see Figure 1), $F(1, 37) = 27.21, MSE = 0.006, p < .001, \eta^2 = .42$, the superior recall of television compared with print news was especially pronounced when the news information had been depicted visually on television. On questions about information that was conveyed only verbally, viewers ($M = .46, SD = .20$) performed slightly but not statistically better than readers ($M = .41, SD = .22$), $F(1, 37) = 3.18, MSE = 0.030, p < .09$. However, when information elements were conveyed both verbally and visually in the television items, viewers ($M = .60, SD = .20$) remembered considerably more than readers ($M = .45, SD = .22$), $F(1, 37) = 26.71, MSE = 0.028, p < .001$.

Supplementary Analyses

In the preceding analyses, the scores of each individual child were used as the units of analysis. This approach may be criticized because the children in the experiment were tested in small groups of three or four, rather than individually, suggesting that the small groups are the independent units that should be used in the analyses (e.g., Levin, 1992). We believe that the analyses based on children's individual scores are defensible because the children in each small

Table 2

Mean Recall Scores for Television and Print as a Function of Grade and Expectation of a Memory Test

<table>
<thead>
<tr>
<th>Expectation of a memory test</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td>TV</td>
<td>Print</td>
</tr>
<tr>
<td>M</td>
<td>SD</td>
<td>SD</td>
</tr>
<tr>
<td>4</td>
<td>.44</td>
<td>.19</td>
</tr>
<tr>
<td>6</td>
<td>.64</td>
<td>.12</td>
</tr>
<tr>
<td>M</td>
<td>.55</td>
<td>.19</td>
</tr>
</tbody>
</table>

Note. Scores represent mean proportions of correct answers.
Table 3
Mean Recall Scores for Television and Print as a Function of Reading Proficiency

<table>
<thead>
<tr>
<th>Reading proficiency</th>
<th>TV</th>
<th>Print</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>More proficient readers</td>
<td>.58</td>
<td>.13</td>
<td>.54</td>
</tr>
<tr>
<td>Less proficient readers</td>
<td>.44</td>
<td>.15</td>
<td>.31</td>
</tr>
</tbody>
</table>

Note. Scores represent mean proportions of correct answers.

Discussion
Whereas previous experimental media comparison studies have shown that adults remember more from print news than from television news, the reverse was found in the present study conducted with children. In accordance with our main hypothesis, children remembered televised news stories better than comparable printed versions. The printed

The effects found for recall of the news were all identical to those found in the original analyses. Again, statistically significant main effects were found for medium, $F(1, 32) = 5.20, MSE = 0.023, p < .03, \eta^2 = .14$; for grade, $F(1, 32) = 41.99, MSE = 0.023, p < .001, \eta^2 = .57$; and for level of reading proficiency, $F(1, 32) = 11.72, MSE = 0.017, p < .003, \eta^2 = .27$. In addition, as was found before, the interactions between medium and test expectation, $F(1, 32) = 1.99, MSE = 0.023, p > .16$, and between medium and level of reading proficiency, $F(1, 32) = 1.28, MSE = 0.017, p > .26$, were not statistically significant, and there were no other significant interaction effects, all $p > .20$. An analysis of recall for verbal only and visual information again resulted in a statistically significant interaction between medium and information type, $F(1, 38) = 20.68, MSE = 0.002, p < .001, \eta^2 = .38$. Again, on questions about information that was conveyed only verbally, no statistical difference was found between viewers and readers, $t(38) = 1.05, p > .29$, whereas on questions about visual information, viewers scored statistically better than readers, $t(38) = 2.93, p < .007$.
news was less well remembered, despite the fact that the print condition offered two advantages. First, the readers were exposed to the stimulus materials an average of two min longer than the viewers. In addition, the very poorest readers were not included in the experiment because it was expected that these children would reduce recall in the print condition for reasons that were of no theoretical interest to us.

In the present study, recall from television and print news was examined with authentic stimuli, as in previous media comparison studies conducted with adults. An important advantage of the use of authentic stimuli is improved ecological validity. A disadvantage, however, is that theoretical interpretation of experimental results obtained with authentic stimulus materials may be complicated by the possibility of confounded factors. In theory, the superior recall of television compared with print news that was found in the present study could be interpreted in two ways: (a) children benefit from the extra memory code offered by the addition of television pictures to the verbal message, provided that the pictures overlap with the verbal information, or (b) children are insufficiently able to process printed information effectively. A third possible reason could be that the potential advantages of print news were underutilized, an argument that will be discussed later. Previous television-print comparisons (e.g., Beentjes et al., 1993) have provided little empirical basis for choosing between the explanations mentioned under (a) and (b). However, because the present study distinguished between: (a) recall of verbal television information supplemented with pictures and verbal-only television information; and (b) more proficient and less proficient readers, it may shed light on this issue.

Because this study showed better recall of television compared with print news only in the case of verbal information supplemented with redundant pictures, the explanation in terms of the advantage of dual memory codes offered by redundant audiovisual information seems most plausible. At the same time, however, there was no evidence that the observed superior recall of television compared with print news could be attributed to differential capacities for processing information from print. The recall advantage of television did not depend on children’s level of reading proficiency or grade level. It should be noted, however, that this finding may not be generalized to the small subgroup of very poor readers who were not included in the experiment. In addition, the study involved narratives that were designed to be well understandable to children between 10 and 12 years of age. It could be that children’s reading proficiency does affect the relative effectiveness of television and print news when the verbal information is less easy to understand. Finally, not a very wide age range was employed in the study.

The superiority of television as a news medium for children proved to be of a more general nature than we had expected. The finding that children remember more from television news than from print news was not restricted to certain subgroups of children. Moreover, the superiority of television was not confined to the school situation in which children may consume the news knowing that they will be questioned about the information, but applied equally to the home situation in which the news is consumed without the expectation of a memory test. The results of this study are “good news” for children, because in the home situation they rely primarily on the medium that can serve them most effectively. For instructional settings, the study suggests that television news that is adapted to children’s level of understanding may be an effective aid to the teacher.

Unlike Salomon and Leigh's (1984) hypothesis, the additional mental effort elicited by the announcement of a test was only slightly and not statistically greater for viewers than it was for readers. One possible reason is that viewers exhibited an above-average level of mental effort even when they were not led to expect a test (without test expectation viewers’ mean mental effort score was 2.61 on a scale from 1 to 4). Despite our efforts to make the condition without expectation of a memory test as comparable as possible to the home situation, viewers’ mental effort nevertheless may have been higher in this condition than it would have been at home. The children’s mental effort may have been raised because they were called from their classroom, not knowing what would be expected of them.

The prediction that the recall advantage of television compared to print news would be most pronounced among children who knew that they would be tested was based on Salomon and Leigh’s (1984) assumption that a test announcement would be especially likely to stimulate mental effort in viewers. Because this assumption was not borne out by our findings, it is understandable that the recall advantage of television compared with print news was not statistically larger in the condition with test expectation than it was in the condition without test expectation.

The present study compared television news stories with bare text versions, rather than with texts supplemented with an illustration or photo. The decision was made not to add illustrations to the print stories for four reasons. First, only a small minority of the news stories in both “adult” and children’s newspapers are supplemented with a photo or some other form of illustration. Second, the omission of illustrations enhances the comparability of the present study with previous news media comparison studies, none of which used print stories supplemented with pictures. Third, the same news story may be illustrated in numerous ways, and there is no objective way of selecting one illustration for a given story. Finally, it seems likely that the addition of one illustration to each print story would do little to enhance children’s recall, because a newspaper illustration usually depicts only one of the many informational elements in a news story. The latter argument seems to be in conflict with Levin and Berry’s (1980) finding that the addition of one picture to a newspaper story can enhance children’s recall. However, the pictures used in Levin and Berry’s study were line drawings depicting each story’s main idea. Therefore, these pictures may not be representative of the photos used in newspapers, which are generally meant to attract the reader’s attention rather than to convey the story’s main idea.

Whereas television’s capacity to supplement verbal information with pictures was effectively utilized in the news
stories of the present study, the pictures shown in "adult" television news programs are often unrelated to the spoken commentary (Robinson & Levy, 1986). It therefore remains to be seen whether children's superior recall for television news also applies to their memory for "adult" news. On the other hand, it is equally questionable whether the superior recall for print news that has been found with adults would also be found if their memory for television and print versions of the Children's News were compared. Despite their better developed reading skills, adults might remember as much from the children's television news stories as from comparable print versions; they might even remember more from the television versions. In another experiment in progress, we are exploring these questions by subjecting both children and adults to television and print stories in both children's and "adult" news formats.

Whereas the children's television news stories in the present experiment effectively used the aids that television has to offer to the transfer of information, the potential advantages of newspapers may have been underutilized. To ensure comparability between the two experimental conditions, the printed texts were identical to the television narratives. Although the printed stories were perfectly understandable as texts without the accompanying visuals, recall of the print versions may to some degree have been disadvantaged in our study because the stories were not originally written as newspaper stories. A similar problem arose in the media comparison studies conducted with adults. In the studies conducted with adults, however, there was no reason to assume that the medium effect reported resulted from underutilization of the print medium, because it was the printed news that was remembered best. Because the children in our study, in contrast, remembered more of the television news, it needs to be further examined whether the superior recall of television news might have resulted in part from a less than optimal utilization of the printed word in our print news conditions. In another experiment we will therefore examine whether television is also the most effective news medium for children when children's television news stories are compared not only with literal transcripts of the television narratives, but also with "real" newspaper coverage of the same topics in a children's newspaper. We suspect, however, that television will again emerge as the more effective news medium for children.

References
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CHILDREN'S RECALL OF TV AND PRINT NEWS