JOURNAL OF APPLIED DEVELOPMENTAL PSYCHOLOGY 8, 329–342 (1987)

Effects of Television Preplay Formats on Children's Attention and Story Comprehension

SANDRA L. CALVERT
Georgetown University

ALETHA C. HUSTON
JOHN C. WRIGHT
University of Kansas

Children's visual attention to, and comprehension of, a television program was measured as a function of inserts called *preplays* that varied on two orthogonal dimensions: (1) Presence or absence of visual excerpts from the program, and (2) concrete or inferential story narration. Visual fixation was coded continuously for 64 pairs of same-sex children, in 1st through 4th grades, while they viewed the television program with one of four types of preplays. After viewing, each child answered items assessing his or her comprehension of the visually and verbally presented content. Children who viewed visual preplays attended longer than did children who viewed nonvisual preplays. Visual presentation predicted comprehension of content presented in a visual mode, whereas inferential narration predicted comprehension of implicit content presented in a verbal mode. The results suggest that information processing is modality specific: Visual presentation affects visual processing and abstract language affects verbal processing. The results do not support the hypothesis that visual presentations interfere with linguistic processing.

INTRODUCTION

A growing debate about children's comprehension of television content involves the role of visually presented information, particularly in relation to verbal program content. On the one hand, visual presentations are said to increase children's comprehension of television content, particularly auditorily presented

This research was supported by grants to the Center for Research on the Influences of Television on Children (CRITC) from the Spencer Foundation and by a National Institute of Child Health and Human Development training grant (1T32HD07173-01) to the University of Kansas. We thank the staffs and students of Deerfield, Pinckney, and Schwegler Grade Schools of the USD #497 School District; the staff of CRITC; the Department of Radio, TV, and Film at the University of Kansas; Dr. David Thissen; Ms. Suzanne Bryant; and Columbia Broadcasting System for their assistance.

Correspondence and requests for reprints should be sent to Sandra L. Calvert, Department of Psychology, Georgetown University, 37th and O Street, N.W., Washington, DC 20057.

verbal content (Calvert, Huston, Watkins, & Wright, 1982; Gibbons, Anderson, Smith, Field, & Fischer, 1986). On the other hand, some investigators have found that televised visual presentations appear to interfere with processing linguistic program content (Hayes & Birnbaum, 1980; Hayes, Chemelski, & Birnbaum, 1981; Meringoff, 1980).

The present study was designed to examine developmental differences in children's visual attention and comprehension of television content as a function of both visual action and verbal narration. Comparisons of visual and verbal information have been carried out by using naturally occurring program content (e.g., Anderson, Lorch, Field, & Sanders, 1981; Calvert et al., 1982); by comparing presentations in one modality, either visual or auditory, with two-modality stimuli (e.g., Gibbons et al., 1986; Meringoff, 1980); or by mixing auditory and visual materials from different programs (e.g., Hayes et al., 1981). Verbal and visual stimuli, however, have not been experimentally varied simultaneously within one television program.

Visual Presentations and Comprehension of Language

Visual presentations may be interesting and memorable to children because of salient perceptual properties such as the movement of characters (Huston & Wright, 1983; Pezdek & Stevens, 1984). Young children remember the incidental, irrelevant details of a program better than the central plot, perhaps because incidental content is often visually presented (Watkins, Calvert, Huston-Stein, & Wright, 1980). Visually presented action may be effective because it lends itself to iconic modes of representation that are used readily by young children (Calvert et al., 1982). Gibbons et al. (1986) found that children remembered character actions better than utterances, even when information about actions was presented verbally. They also found that utterances were recalled better when accompanied by visual presentations than when presented only in the auditory mode. These studies suggest that visually presented content, particularly character action, is especially likely to be processed and stored by young children, and that it enhances processing of accompanying verbal content.

A contrasting view, the visual superiority hypothesis, suggests that interesting visual stimuli may detract from the comprehension of verbally presented messages. For example, when visual and auditory tracks from two different television programs were combined, young children remembered the visually presented content better than the auditorily presented content (Hayes & Birnbaum, 1980; Pezdek & Stevens, 1984). Children also recalled dialogue better from an auditory presentation of a story book than from a televised version of the same story (Meringoff, 1980). The visual superiority effect appeared to diminish with development because effects were found for young children, and not for adults (Hayes & Birnbaum, 1980).

Effects of Language Comprehensibility

One source of these discrepant views may be variations in the comprehensibility of the verbal and visual content. With visual content held constant, preschoolers attend longer when understandable language is presented on the auditory track than when difficult or incomprehensible language is presented (Anderson et al., 1981). Several theorists have proposed that language at moderate levels of difficulty is more worthy of attention than language that is either too easy or too difficult (Anderson et al., 1981; Rice, Huston, & Wright, 1982). Young children, therefore, should attend more to language that is concrete and easy to understand, whereas older children should attend more to language that is comparatively abstract and that offers new information beyond that which is obvious from other aspects of the program content.

For accurate comprehension of a televised story, attention is necessary, but not sufficient. (Huston & Wright, 1983; Lorch, Anderson, & Levin, 1979). Comprehension requires viewers to integrate explicitly presented central events and to infer implicity presented content about character motives and feelings (Collins, 1983). Therefore, comprehensible language that emphasizes central story themes should be especially likely to promote comprehension as well as attention.

Effects of Linguistic Aids on Comprehension

The effects of linguistic aids on comprehension have been demonstrated in studies of *verbal rehearsal,* in which adults summarize significant story content for children (Friedrich & Stein, 1975; Watkins et al., 1980). It has been found that verbal cues are particularly helpful because they present content that is implicit in the story (Collins, Sobol, & Westby, 1981). Typically, adults view a television program with children and verbally label the important content after it is presented. Verbal rehearsal is most influential for comprehension in the verbal mode (Collins et al., 1981; Stein & Friedrich, 1975).

An analogous effect might be realized by *prehearsal*, that is, by active forward processing that anticipates, rather than recapitulates, story content. Children with mature attentional systems may process specific information efficiently if they know beforehand that certain information will be presented (Flavell, 1977). Important events are anticipated through schemas, pre-existing cognitive structures that guide the comprehension process (Mandler, 1979). If forward prehearsal can guide children's initial selection and encoding of information by providing a story scheme, then the probability is increased that children will attend to and remember that particular visual and auditory content.

Modality-Specific Processing

The impact of visual and verbal television presentations may be modality-specific; in other words, visual presentations may improve comprehension of visual

content, and verbal presentations may influence linguistic or symbolic comprehension (Meringoff, Vibbert, Char, Fernie, Banker, & Gardner, 1983). Visually presented character actions are related to improvements in picture sequencing (Beagles-Roos & Gat, 1983), recognition of visually presented events (Calvert et al., 1982; Hayes & Birnbaum, 1980), and visually-based inferences (Beagles-Roos & Gat, 1983; Meringoff, 1980). Verbally presented content is related to recognition of expressive language and inferences drawn upon from the child's broader, personal knowledge base (Beagles-Roos & Gat, 1983; Meringoff, 1980).

The purpose of this study was to examine developmental differences in children's visual attention and comprehension as a function of varying visual and verbal attributes in story *preplays*. Preplays were made with or without visual portrayals of character actions and with concrete or abstract verbal narration. To test for modality-specific learning, comprehension tasks were either visual (i.e., picture sequencing and incidental recognition), or verbal (i.e., recognition of explicit and implicit story content). Children from 1st through 4th grades were included because earlier findings suggest that that age period is one in which the ability to comprehend implicit content is acquired (Collins, 1983).

It was expected that (1) visual presentation would enhance visual attention and comprehension of visually presented content; (2) effects of visual presentation would be more pronounced at younger than at older age levels; (3) verbal presentation would enhance comprehension of verbally presented content; and (4) concrete narration would enhance attention and comprehension at younger ages, but abstract narration would enhance attention and comprehension at older ages.

METHOD

Participants

Subjects were 64 pairs of children who attended one of three schools in a moderate-sized Midwestern city. The program was shown to pairs of children to approximate the natural viewing situation in which children usually watch with another person rather than alone. Within sex and grade groupings, children were randomly assigned to pairs with the stipulation that teachers could substitute a child if it was inconvenient for a particular student to leave the classroom, although teachers rarely made substitutions. All pairs of children knew one another since they were in the same classroom, but friendship was not a criterion for the selection of pairs. Pairs of children were equally distributed by sex and by 1st, 2nd, 3rd and 4th grades.

Stimulus Program

Previous research conducted by CBS (1974) about the "Fat Albert and the Cosby Kids" program series revealed that children often did not understand the

intended program message for a specific episode about divorce, titled "Mom or Pop". Consequently, this color-animated episode was selected for this study.

In the story, Flora, a new child in the school, was unfriendly and aloof. Fat Albert's friends teased her and made her cry. When the boys found out about her parents' divorce, they made her a present and put on a special show to make amends. After Flora became friends with the boys, her parents' conflict continued. Flora ran away from home, and the boys helped find her. The plot was resolved when her parents realized that their arguments made Flora unhappy.

Treatment Conditions

The story was retained from the original program, but commercials and verbal summaries by Bill Cosby were deleted. The verbal summaries were deleted because previous research on a different episode of the series revealed that kindergartners who did not attend when Bill Cosby was narrating understood the important story content better than kindergartners who did attend when Bill Cosby was narrating (Calvert et al., 1982). The complexity of the language that Cosby used was considered a potential reason why young children did not understand the narration. Therefore, the type of narration became one dimension that was manipulated in the experimental inserts.

Preplays, which summarized central plot events, were inserted before three story sections. Preplays previewed story content with either verbal narration alone or verbal narration supplemented with visual exerpts from the cartoon. The four preplay conditions were (a) nonvisual, concrete narration; (b) nonvisual, inferential narration; (c) visual, concrete narration; and (d) visual, inferential narration. The total time of the program, plus preplays, ranged from 17 minutes, 47 seconds to 19 minutes, 49 seconds.

All preplays were presented on the television screen by a female narrator in a gypsy costume who could foresee future cartoon events in her crystal ball. In nonvisual conditions, only the narrator was shown as she described future story events. In visual conditions, excerpts from the story were shown inside a bubble insert which appeared beside the narrator. As she described the content, the narrator pointed to the visual sequences inside the bubble (e.g., Flora's parents are shown rushing out the door). Dialogue, music, and sound effects from the program were not present in any of the preplays. In concrete narration conditions, central character actions were described in simple, concrete language (e.g., "Flora's parents go out and look for Flora"). In inferential narration conditions, thematic content was embellished and integrated by stating implicit relations among the story events (e.g., "Flora's parents go out and look for Flora because they are worried about her").

Procedure

Same-sex pairs of children were taken from their classrooms to a mobile laboratory where they were seated opposite one another at a table. Across the room

from them was a television monitor below a one-way mirror. On the table were small toys, comic books, and drawing materials. An experimenter told the children to play and watch television as they would at home. She then went to an adjacent observation room and activated a videotape recorder that played the edited version of the program to which the pair had been randomly assigned.

Visual Attention

Visual attention was scored *on* when a child looked at the television screen and *off* when a child looked away. Two observers, seated behind the one-way mirror, continuously scored attention with a Datamyte electronic recorder. Each observer recorded one child's visual orientation.

Interobserver reliability was examined by having a third observer score one of the two children. The third observer was physically separated from the other two observers so they could not see or hear each other. Although the observers knew that reliability was being scored, they did not know which child was being scored for reliability. Based on the scorings of several children, interobserver reliability was 97%, using the formula of 2 times the number of looks divided by the total number of scores. Agreement occurred when both observers coded an onset or offset of attention within ± 2.4 seconds of one another. Previous research has demonstrated comparable levels of reliability when observers scored attention from videotapes (Wright et al., 1984).

Comprehension

Picture Sequence Scores. After viewing, children were taken to separate rooms for comprehension testing. Each child was asked to sequence 4 sets of 6 photographs taken from the television program. Three sets represented each of the 3 program segments summarized by the 3 preplays. These sets included 4 pictures shown and 2 not shown in the visual preplays to determine if children could integrate additional story information into the structure created by the preplays. The 4th set represented central visual events from the whole program with 2 pictures from scenes shown in each of the 3 visual preplays.

For each picture set, an experimenter randomly arranged the 6 photographs in 2 rows and said, "Here are some pictures of things that happened in the story. I'd like you to put these pictures in order from the first thing that happened in the story to the last in a line right in front of you." After the child ordered the photographs, the experimenter said, "Now tell me what happened in the story."

Following procedures developed by Wright et al. (1984), picture sequence scores were calculated by comparing the child's picture order to its correct, absolute position and to the number of correctly sequenced adjacent pictures. To do so, the pictures had been correctly numbered from 1 to 6. For each picture, one point was awarded for every picture with a lower-numbered picture to its left. In addition, one point was awarded for each correct adjacent pair of pic-

tures. Picture sequence scores were calculated by adding the two parts, resulting in a maximum score of 20.

Multiple-Choice Recognition Scores. The multiple-choice test was designed to measure children's comprehension of program content while controlling for possible age differences in verbal abilities. Following procedures adapted from Collins (1983), three adults identified and placed central and incidental story events in an open-ended questionnaire. Next, 18 adults viewed the program, rated the questions as central or incidental to the plot, and answered the questions. Central content was defined as plot-essential information, and incidental content was defined as information peripheral to the plot. Items with a minimum centrality rating of 70% were retained. Central questions were classified as either explicitly presented facts or as implicitly presented inferences about character feelings and motives. Incidental questions contained visual information and a few verbal jokes.

To construct multiple-choice alternatives, one incorrect verbal response was taken from answers to the open-ended questionnaires. A visual referent was supplied for each question by including a photograph taken at a relevant program point. There were 13 implicit, 8 explicit, and 21 incidental items. An example of an implicit item was, "What happened to Flora's parents? (A) They decided to be friends; or (B) They decided to get married again." An explicit item was, "Why did Flora cry on her birthday? (A) Because her parents were arguing; or (B) Because the gang was teasing her." An incidental item was, "Why did Rudy laugh when Flora was reading? (A) The story was funny; or (B) She tickled his foot."

The 42 recognition items each of which consisted of a picture, a question, and two response options, were arranged in two books. The order of book presentation was counterbalanced across children.

RESULTS

Visual Attention

Duration of visual attention was defined as the percent of time that a pair of children looked at the television screen during the preplays or the program. Duration of attention to the preplays and to the program were submitted, in turn, to analysis of variance of grade (4) × sex (2) × visual-nonvisual presentation (2) × narration complexity (2). The unit of analysis was pairs of children because children who view together influence one another's attentional patterns. For instance, one child may ask another to look at her picture or to look at the television program. Because of the dependency of attention scores, pairs have typically been used as the unit of analyses for visual attention (e.g., Calvert et al., 1982; Wright et al., 1984).

TABLE 1
Percent of Visual Attention and Mean Comprehension Scores for Significant Treatment Effects

	Visual Treatment		Verbal Narration	
	Visual	Nonvisual	Concrete	Inferential
Attention to Preplays	60%	43%		
Segment Sequencing	15.32	14.37		
Whole Program Sequencing				
Girls	17.53	17.94	17.44	18.03
Boys	17.69	15.53	17.38	15.85
Implicit Content			10.92	11.50

All effects are based on 64 pairs of subjects.

As predicted, children who viewed visual preplays attended longer than did children who viewed nonvisual preplays, $F(1,32) = 11.08, p < .01$. The means appear in Table 1. Fourth graders ($M = 64\%$) attended longer to preplays than did third ($M = 47\%$), second ($M = 45\%$), or first graders ($M = 49\%$), $F(3,32) = 2.99, p < .05$. There were no significant main effects or interactions for visual attention to the program.

Comprehension

Picture Sequencing. Two measures were obtained for picture sequencing: Segment sequencing and whole program sequencing. The three segment sequence scores were treated as a repeated measures factor in a grade (4) × sex (2) × visual-nonvisual presentation (2) × narration complexity (2) × segment sequence scores (3) analysis of variance. Pairs were used as the unit of analysis for all comprehension scores.[1]

As expected, children who viewed visual preplays performed better on the

[1]Because of our interest in the attention-comprehension relationship, a somewhat controversial issue became the unit of analysis for comprehension scores. That is, if attention scores affect comprehension scores, then the dependency of attention scores for children viewing together might lead to dependency between their comprehension scores. In previous research, pairs were used as the unit of analysis for attention scores, and individuals were used as the unit of analysis for comprehension scores. In that data set, the attention scores of children viewing together were significantly correlated, but the comprehension scores were not (Calvert et al., 1982).

Following that precedent, picture sequencing and multiple choice comprehension scores were analyzed initially with individuals as the unit of analysis. However, the comprehension scores of children viewing together were significantly correlated in this data set. That is, the comprehension scores of pairs were dependent.

Because of the dependency issue, our statistician recommended that the most conservative and correct statistical procedure was to reanalyze all the comprehension data with pairs as the unit of analysis. The results were the same, regardless of the unit of analysis.

segment sequencing tasks than children who viewed nonvisual preplays, F (1,32) = 4.86, $p < .05$. The means appear in Table 1. Fourth graders (M = 15.79) performed better than first graders (M = 13.56), F (3,32) = 4.82, $p < .01$. Narration complexity had no effect on segment sequencing.

Whole program sequencing was submitted to analysis of variance of grade (4) × sex (2) × visual-nonvisual presentation (2) × narration complexity (2). Duncan's text was used for all follow-up tests.

For whole program sequencing, preplay treatment effects were qualified by gender. There was a significant sex × visual-nonvisual interaction, F (1,32) = 4.64, $p < .05$. As seen in Table 1, boys who had seen visual preplays performed better than those who had seen nonvisual preplays; there was little difference for girls in visual and nonvisual conditions.

There was also an interaction of sex × narration complexity, F (1,32) = 4.39, $p < .05$. Boys performed better after concrete preplays than after inferential preplays; again, there was little difference for girls in concrete and inferential conditions. The means appear in Table 1.

Main effects of grade and sex occurred for whole program sequencing. Fourth (M = 18.10), 3rd (M = 17.50), and second graders (M = 17.53) performed better than 1st graders (M = 14.85), F (3,32) = 6.78, $p < .001$. Girls (M = 17.74) performed better than boys (M = 16.52), F (1,32) = 4.39, $p < .05$.

Multiple-Choice Recognition Scores. The recognition scores for implicit, explicit, and incidental responses were submitted, in turn, to analysis of variance of grade (4) × sex (2) × visual-nonvisual presentation (2) × narration complexity (2).

Visual preplays had no effect on any of the multiple-choice scores. There were no significant main effects or interactions of visual-nonvisual presentation.

As expected, children who heard inferential narration recognized more implicit content than those who heard concrete narration, F (1,32) = 4.88, $p < .05$, see Table 1. Narration complexity had no effect on recognition of explicit or incidental content.

Main effects of grade occurred for all three recognition scores: Implicit content, F (3,32) = 7.26, $p < .001$; explicit content, F (3,32) = 3.99, $p < .05$; and incidental content, F (3,32) = 13.71, $p < .0001$. Fourth (M = 12.10) and third graders (M = 11.50) recognized more implicit content than 1st graders (M = 10.28). Second graders (M = 7.38) recognized more explicit content than 1st graders (M = 6.70). Fourth graders (M = 18.13) recognized more incidental content than did 3rd (M = 16.40), 2nd (M = 16.38), and 1st graders (M = 14.98).

For implicit content, the interaction of sex × grade was significant, F (3,32) = 2.82, $p < .05$. At the first grade level, girls (M = 11.13) recognized more implicit content than boys (M = 9.50). Girls (M = 7.49) also recognized more explicit content than boys (M = 7.19), F (1,32) = 4.57, $p < .05$.

Visual Attention as a Predictor of Comprehension

The final analysis assessed the relation of visual attention to comprehension. Regressions were performed on picture sequencing and recognition scores. If a grouping factor (i.e., grade or sex) had been significant in the analysis of variance, it was allowed to enter the regression equation first. Then visual presentation, verbal presentation, and visual attention to the preplays were allowed to enter the regression equations. Attention to each preplay was used to predict its corresponding segment sequencing score.

Visual attention to preplays consistently predicted comprehension of picture sequencing measures, that is, comprehension in the visual modality. For each of the three segment sequence scores, attention to the immediately preceding preplay was a significant predictor of performance. Whole program sequencing was predicted by attention to all the preplays. The results of the analyses are summarized in Table 2. Because visual presentation did not enter these equations, its

TABLE 2
Children's Visual Attention to Preplays as Predictors of Comprehension Scores

Dependent Variable	Variable Entered Into Regression Equation[a]	Beta	Multiple *R*	Multiple *RSQ*	Increase in *RSQ*
Segment sequencing (Picture set one)	1. Grade***	.37	.42	.18	.18
	2. Sex***	.21	.48	.23	.05
	3. Attention to preplay one***	.23	.53	.28	.05
Segment sequencing (Picture set two)	1. Attention to preplay two*	.30	.30	.09	.09
Segment sequencing (Picture set three)	1. Grade*	.20	.27	.08	.08
	2. Attention to preplay three****	.45	.52	.27	.09
Whole program sequencing	1. Grade****	.37	.42	.18	.18
	2. Sex***	.21	.48	.23	.05
	3. Attention to preplays***	.23	.53	.28	.05
Incidental recognition	1. Grade****	.51	.57	.33	.33
	2. Attention to preplays****	.26	.62	.39	.06
Implicit Recognition	1. Grade****	.50	.50	.25	.25
	2. Verbal****	.24	.55	.30	.05
Explicit Recognition	1. Grade**	.35	.35	.12	.12
	2. Sex**	.25	.43	.18	.06

[a]The direction of effects was positive for all variables entering the regression equations. Variables were coded as follows: Grade (First=1; Second=2; Third=3; Fourth=4); Sex (Male=1; Female=2); Visual (Absence=1; Presence=2); Verbal (Absence=1; Presence=2); Visual attention to preplays was coded as percentages.

Codes for significance are as follows: *$p<.05$ **$p<.01$ ***$p<.001$ ****$p<.0001$

effects on comprehension appear to be mediated by visual attention to the visual preplays.

Visual attention to preplays was not a good predictor of multiple-choice recognition scores, that is, measures presented in the verbal mode. The only case in which visual attention was a significant predictor was for incidental content. As expected, verbal presentation was a significant predictor of inferential content.

DISCUSSION

The primary purpose of this study was to test the effects of visual and verbal television presentation on modality-specific learning. Visual attention was expected to serve as a mediator for comprehension of visually presented content. Experimental inserts (i.e., preplays) allowed the program to remain constant for all children while examining visual versus auditory comprehension. In visual preplays, action sequences from the story were presented beside a narrator. In nonvisual preplays, only the narrator was shown. The narration was either concrete or inferential.

As expected, children who viewed visual preplays attended longer than children who viewed nonvisual preplays. Because attention to the program did not differ, but attention to the preplays did, visual and verbal effects on comprehension could be linked to the experimental manipulations. Children who viewed visual preplays performed better on the segment sequencing task, a visual comprehension task, than did children who viewed nonvisual preplays. Boys who viewed visual preplays sequenced events from the whole program better than did boys who viewed nonvisual preplays. Finally, attention to visual preplays predicted comprehension of both the segment sequencing and whole program sequencing tasks, that is, comprehension in the visual modality.

In contrast, verbal presentation affected comprehension of information presented in the verbal mode. Specifically, children who heard inferential narration recognized more implicit content than those who heard concrete narration. Verbal presentation also predicted comprehension of implicit content. Visual attention did not predict comprehension of either the explicit or the implicit recognition scores.

The results support the hypothesis that information processing is modality-specific (Meringoff et al., 1983). That is, information presented in a visual mode affected comprehension of visually presented material, and information presented in a verbal mode affected comprehension of verbally presented material. Because effects of visual presentation occurred across middle childhood, a visual superiority effect (Hayes & Birnbaum, 1980) was not found. There were no age differences for visual over nonvisual presentation, nor did visual presentation interfere with verbal comprehension. Instead, implicit and explicit comprehension were unrelated to either visual presentation or visual attention.

Perhaps children need to listen, but not necessarily look, when comprehension of verbal material is required. Alternatively, it may be when children look, not how much they look, that affects comprehension of verbal material (Lorch et al., 1979; Pezdek & Hartman, 1983). Measures of auditory attention are needed to clarify the relation between attentional processes and comprehension of verbally presented material.

Effects of inferential narration occurred across the middle childhood age range. Specifically, all age groups who heard inferential narration performed better on the implicit recognition test than did children who heard concrete narration, but concrete narration did not affect comprehension of explicit content. Collins et al. (1981) found that children benefited from narration only when implicit information was provided that children did not spontaneously produce themselves. Because inferential narration seemed comprehensible to children across the 6-to-10-year-old age range, producers of children's television programs might try using inferential narration to help children understand content they might otherwise fail to comprehend.

Sex differences occurred on comprehension measures that had some verbal components, which is a finding consistent with those reported by Friedrich and Stein (1975). Girls understood explicit and implicit program content better than boys. On whole program sequencing, boys performed poorly in inferential, as compared to concrete, narration conditions. Both temporal integration of the plot line and comprehension of explicit content have been linked to comprehension of implicitly presented content (Collins, 1983). The results suggest that verbal processes are used to integrate, sequence, and infer implicit relations among central events, and that girls are somewhat better than boys in utilizing verbal information for this purpose during middle childhood.

Although the findings were consistent with predictions that visual components of media produce differences in recall of visually presented material (Beagles-Roos & Gat, 1983; Meringoff, 1980), this type of comprehension is not merely visual recognition. The picture sequencing task required reproduction of the temporal relations among pictures (Wright et al., 1984). Visual preplays provided a visual, structural overview in which children could integrate story content. Thus, the visual component of preplays appeared to affect processing of the program material at an abstract, schematic level, especially when children had to sequence events from the whole program.

Because children in nonvisual conditions saw a narrator on the television screen, character action, rather than visual stimuli per se, seemed to be the feature that was attention-getting and memorable for children (Calvert et al., 1982; Gibbons et al., 1986). This study provides further support that visual superiority may actually be action superiority (Gibbons et al., 1986).

Although the present findings shed light on how the modality of the presentation affects children's learning from televised narratives, preplays might not enhance children's comprehension of ordinary television programs. Without an

adequate control, the intervention procedures could conceivably even interfere with children's sequencing and recognition skills.

A second limitation is the use of only a single television program, which limits the generalizability of the findings. Another problem was that the production quality of the preplay inserts was not comparable to the original broadcast material, nor were we able to use the original narrator of the program series. Ideally, several programs of broadcast quality, which vary the presence versus absence of preplays, should be tested, especially with the use of original narrators like Bill Cosby. Such an analysis would answer questions regarding whether there are any practical benefits of preplays for children's comprehension of television programs.

The implications of this research are that children's television programs should use character actions and inferential language to emphasize key program points. Action is both attention-getting and memorable for children. Verbal narration can be used to integrate content and provide information that children do not spontaneously produce. Visual and auditory tracks do not interfere with one another when they are not in competition. Instead, character action affects comprehension of visually presented content whereas language affects comprehension of verbally presented content. Under typical viewing circumstances, visual presentation is more likely to complement than to disrupt children's comprehension of televised messages.

REFERENCES

Anderson, D.R., Lorch, E.P., Field, D.E., & Sanders, J. (1981). The effects of tv program comprehensibility on children's visual attention and story comprehension. *Child Development, 52,* 151–157.

Beagles-Roos, J., & Gat, I. (1983). Specific impact of radio and television on children's story comprehension. *Journal of Educational Psychology, 75,* 128–137.

Calvert, S.L., Huston, A.C., Watkins, B.A., & Wright, J.C. (1982). The relation between selective attention to television forms and children's comprehension of content. *Child Development, 53,* 601–610.

CBS Broadcast Group (1974). *A study of messages received by children who viewed an episode of "Fat Albert and the Cosby Kids."* Office of Social Research, Department of Economics and Research, Columbia Broadcasting System, New York.

Collins, W.A. (1983). Interpretation and inference in children's television viewing. In J. Bryant & D.R. Anderson (Eds.), *Children's understanding of television: Research on attention and comprehension* (pp. 125–150). New York: Academic.

Collins, W.A., Sobol, B.L., & Westby, S. (1981). Effects of adult commentary on children's comprehension and inferences about a televised aggressive portrayal. *Child Development, 52,* 158–163.

Flavell, J. (1977). *Cognitive Development.* Englewood Cliffs, NJ: Prentice Hall.

Friedrich, L.K., & Stein, A.H. (1975). Prosocial television and young children: The effects of verbal labeling and role playing on learning and behavior. *Child Development, 46,* 27–38.

Gibbons, J., Anderson, D.R., Smith, R., Field, D., & Fischer, C. (1986). Young children's recall and reconstruction of audio and audiovisual narratives. *Child Development, 57,* 1014–1023.

Hayes, D., & Birnbaum, D. (1980). Preschoolers' retention of televised events: Is a picture worth a thousand words? *Developmental Psychology, 16,* 410–416.

Hayes, D., Chemelski, B., & Birnbaum, D. (1981). Young children's incidental and intentional retention of televised events. *Developmental Psychology, 17,* 230–232.

Huston, A.C., & Wright, J.C. (1983). Children's processing of television: The informative functions of formal features. In J. Bryant & D.R. Anderson (Eds.), *Children's understanding of television: Research on attention and comprehension* (pp. 35–68). New York: Academic.

Lorch, E.P., Anderson, D.R., & Levin, S.R. (1979). The relationship of visual attention and children's comprehension of television. *Child Development, 26,* 126–135.

Mandler, J. (1979). Categorical and schematic organization in memory. In C.R. Puff (Ed.), *Memory, organization, and structure.* New York: Academic.

Meringoff, L.K. (1980). A story: Influence of the medium on children's story apprehension. *Journal of Educational Psychology, 72,* 240–249

Meringoff, L., Vibbert, M., Char, C., Fernie, D., Banker, G., & Gardner, H. (1983). How is children's learning from television distinctive? Exploiting the medium methodologically. In J. Bryant & D.R. Anderson (Eds.), *Children's understanding of television: Research on attention and comprehension.* New York: Academic.

Pezdek, K., & Hartman, E. (1983). Children's television viewing: Attention and comprehension of auditory versus visual information. *Child Development, 54,* 1015–1023.

Pezdek, K., & Stevens, E. (1984). Children's memory for auditory and visual information on television. *Developmental Psychology, 20,* 212–218.

Rice, M.L., Huston, A.C., & Wright, J.C. (1982). The forms and codes of television: Effects on children's attention, comprehension, and social behavior. In D. Pearl, L. Bouthilet, & J.B. Lazar (Eds.), *Television and behavior: Ten years of scientific progress and implications for the 80's* (Vol. 2). Washington, DC: Government Printing Office.

Watkins, B.A., Calvert, S.L., Huston-Stein, A.C., & Wright, J.C. (1980). Children's recall of television material: Effects of presentation mode and adult labeling. *Developmental Psychology, 16,* 672–674.

Wright, J.C., Huston, A.C., Ross, R.P., Calvert, S.L., Rolandelli, D., Weeks, L.A., Raessi, P., & Potts, R. (1984). Pace and continuity of television programs: Effects on children's attention and comprehension. *Developmental Psychology, 20,* 653–666.