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Television Production Feature Effects on Children's Comprehension of Time

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Children's temporal comprehension was assessed after viewing a television program containing a flashback that shifted the events to a much earlier time. The flashback was marked or not marked with sound effects, and time relations were visually represented with either dreamy camera dissolves or abrupt camera cuts. Sixty-four children, equally distributed by grades kindergarten and first versus fourth and fifth, participated in individual viewing sessions. After viewing, children answered questions to assess comprehension of the flashback. Older children understood the flashback better than did the younger children. Children who saw dreamy visual dissolves understood temporal concepts presented in the flashback better than those who saw camera cuts, particularly at young ages. The results suggest that formal production features affect children's comprehension of complex temporal concepts presented via television.

Television allows a unique perceptual experience that is not possible in real life. Not subject to the limitations of real-life experiences, characters are able to travel in condensed time and space dimensions. Sleeping eight hours, for example, may be represented by a two second fade to black. Flashbacks even allow viewers to see a character's thoughts about events that happened in another time and place.

As children's real-world understanding of temporal concepts is gradually developing (Harner, 1982), how do they come to understand media conventions like flashbacks which distort the logical temporal flow of events? Do formal features, the audiovisual production techniques that are used to present, segment, and represent television content (Huston & Wright, 1983), affect children's comprehension of time? The purpose of this study was to examine developmental differences in children's comprehension of a flashback as a function of certain television production features.

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Children's Comprehension of Television Programs

Collins (1979) theorized that temporal integration of the plot line is a key viewer activity for mature comprehension of a televised story. Specifically, viewers must select and then link key story events over time. For example, Collins, Wellman, Keniston, and Westby (1978) showed second, fifth, and eighth graders an action-adventure program which varied on two dimensions, (a) organization of the scenes (temporal vs. random presentation), and (b) plot complexity (simple vs. complex). Children who viewed the program scenes in the original temporal order recognized more inferential, implied content than did children who viewed the scenes in random order. Second-grade boys, the one exception, were not adversely affected by scrambling the scenes, supposedly because they did not temporally integrate the program content, even when the scenes were presented in the correct sequence. The authors concluded that comprehension of inferential content required viewers to organize and order plot events into a temporal scheme and that the ability to do so increased with age.

Although Collins et al. (1978) demonstrated that temporal disruption decreased older children's comprehension of plot-essential content, the temporal manipulations used in the study lacked ecological validity. Because the scenes were randomly ordered, the end of the program may have been shown before the beginning. Such presentations are rarely, if ever, seen on television. In contrast, comprehension of flashbacks should increase with age because children see them in television programs. More specifically, as sensitivity to the temporal order of events increases with age, so should comprehension of flashbacks. An analysis of children's comprehension of flashbacks would extend the current research base about children's temporal organization of the plot line to television programming that they are likely to view in real life.

The Relation of Visual Attention and TV Story Comprehension

Collins (1983) hypothesized that the primary reason that young children retained essential television content so poorly was because they selected and encoded program information inadequately as they viewed. This hypothesis implies that children may understand essential content better if they attend selectively to key televised events during viewing.

Anderson and Lorch (1983) theorized that children actively process television content through schemata, learned expectations about what is likely to happen in a story. Young children are less likely to watch television with their eyes glued to the TV screen than to look back and forth from play activities to the television content. When children are not looking at the television screen, they may monitor auditory features for cues that signal the presence of content that is meaningful to the current schema (Anderson, Lorch, Field, & Sanders, 1981). Because sound effects typically indicate a change in the program, a good comprehension strategy may be to attend at these program points. Sound effects do, in fact, reliably recruit attention from children who are not looking and maintain

attention from children who *are* looking at the television screen (Alwitt, Anderson, Lorch, & Levin, 1980; Anderson & Levin, 1976). That is, sound effects reliably get children to look at targeted televised content.

Visual attention at specific program points has been linked to comprehension of essential program content. For example, Lorch, Anderson, and Levin (1979) found that preschoolers' visual attention at specific program points was related to their comprehension of content presented on *Sesame Street,* perhaps because the creators of *Sesame Street* reserved attention-getting formal features for program points when important information was presented (Bryant, Hezel, & Zillman, 1979). These findings imply that young children may initially understand essential content partly because of production decisions about the ways in which formal features are paired with the content (Calvert, Huston, Watkins, & Wright, 1982).

Scene changes, in which story events shift to another place, are program points where it seems advantageous to keep children's attention in order to maximize temporal integration of program content. Calvert and Gersh (1987) demonstrated that sound effects increased children's story comprehension by enhancing visual attention at key scene changes. Kindergartners who heard sound effects were more likely to look at targeted scene transitions and to understand plot-essential content than were kindergartners who did not hear sound effects. Fourth graders, however, did not need such markers, probably because they did not need assistance in selecting significant story content.

Taken together, these studies suggest that one approach to assisting children's comprehension of flashbacks is to mark them with sound effects, thereby enhancing visual attention so that information is available for further processing. Sound effects can highlight content just as a spotlight calls attention to a specific actor in a play (Wright & Huston, 1983).

Features as Representational Codes

Although sound effects can enhance the probability that children will see flashback scene transitions, they must still understand that a major change in time and place has occurred. One characteristic that affects children's ability to understand temporal concepts is cognitive development. As children age, they better understand abstract concepts about time (Fraisse, 1982). Therefore, developmental differences should occur in children's comprehension of flashbacks.

Children's comprehension of flashbacks may also be affected by their familiarity and understanding of media codes. One organizational function of formal features is that they represent shifts in time (Wright & Huston, 1983). Cuts and dissolves are visual features that compress time and convey changes in place. When a camera cuts from one scene to the next, the visual scene shifts perspectives rather suddenly. By contrast, camera dissolves shift scenes by laying pictures of one scene on top of pictures from the next scene. Both types of visual features require viewers to infer the meaning of the feature. However, because

dreamy camera dissolves are much more often used to represent major changes in time and place than are camera cuts, dissolves should be an easier feature for media-literate children to understand (Wright & Huston, 1981). Flashbacks, which convey major changes in time and place, are typically introduced and terminated with dissolves (Reisz & Millar, 1968).

By violating typical media conventions, avant-garde film techniques challenge viewers to make different inferences about the meaning of production features (Salomon, 1979). For example, camera cuts were used sometimes in the films *Julia* and *The French Lieutenant's Woman* to convey flashbacks in time. As cuts are less frequently used to represent flashbacks, viewers may be required to invest more mental effort (Salomon, 1983) to understand the story than if dreamy dissolves represented those changes. Because of their greater media experience and cognitive flexibility, older viewers should have more skill at understanding violations of media codes than do younger viewers.

Visual formal features have been used to convey sex-typed messages (Calvert & Huston, 1987). For example, dreamy camera dissolves are more often used to present commercials directed at girls, whereas camera cuts are more often used to present commercials directed at boys (Welch, Huston-Stein, Wright, & Plehal, 1979). Therefore, boys and girls may be differentially responsive to features like cuts and dissolves, due to previous learning histories.

The Present Study

The purpose of this study was to examine developmental differences in children's understanding of a television program that varied the presentation of a flashback sequence. The televised flashback was marked or not marked with sound effects, and time relations were represented with either dreamy camera dissolves or camera cuts. Sound effects were expected to guide young children's attention to the visual formal features that represented the time shift. All children were expected to understand that dissolves represented major time shifts more so than did cuts and accordingly, to understand the flashback better after seeing dissolves than after seeing cuts. Younger children were expected to rely more on dissolves for accurate comprehension than were older children. Regardless of condition, older children were expected to understand the flashback better than younger children. Sex differences were assessed to compare boys' and girls' comprehension of the flashback, particularly in the cut versus dissolve conditions.

METHOD

Television Program

A 21-minute color, animated episode of "Tarzan: Lord of the Jungle," portrayed a cruel huntress who learned that all animals have a right to be free. This program was selected because a flashback sequence shifted the scenes to events

that occurred at earlier times. The 35 second flashback showed Tarzan meeting a golden lion many years before, when the lion was a baby cub.

Treatment Conditions

In all four treatment conditions, the program plot was retained. By editing the program, visual features either strongly or weakly marked the transitions to other time periods before and after the flashback. A dreamy visual dissolve was the strong visual marker; this effect made the edges of the picture look like they were slowly spinning. A camera cut was the weak visual marker. These visual features were either preceded or not preceded by the 1 second sound effects of a slide whistle. The four experimental conditions were (1) cut and no sound effects; (2) cut and sound effects; (3) dreamy dissolve and no sound effects; and (4) dreamy dissolve and sound effects.

Subjects

Subjects were 64 children, equally distributed by sex and by grades kindergarten and first (M = 6 years, 8 months) versus fourth and fifth (M = 10 years, 6 months), who attended one of three schools in a moderate size Southeastern city. Within grades, children were randomly assigned to one of the four treatment conditions.

Procedure

Children participated individually in 1 hour sessions in a vacant room in their school. Each child was seated next to an experimenter at a table that had small toys and comic books on it. The experimenter said, "We're going to watch a television program together called, 'Tarzan.' You should read, play with toys, and talk just like you do at home. After the program, I'm going to ask you some questions about the story. Are you ready to see the program?" With remote control buttons, the experimenter then activated a hidden camera, which videotaped the viewing session, and a videotape recorder, which played one of the four edited program versions.

Visual Attention

Later, one observer, who was blind to the experimental hypotheses, scored videotapes of children's visual attention to the television program. Visual attention was scored *on* when children looked at the television screen and *off* when they looked away.

Two attention scores were computed. Baseline attention scores measured the percentage of children who were looking at the program immediately before the onset of treatment to determine if the different treatment groups were initially comparable. Treatment attention scores measured the percentage of children who were looking at the television program within 5 seconds after the onset of the flashbacks.

Interobserver reliability for attention scores, based on ten randomly selected viewing sessions, was computed between the primary observer and a second observer. Interobserver reliability was 93%, calculated as 2 × the number of agreements divided by the total number of scores for both observers. Agreement occurred when both observers scored an onset or offset of attention within 5 seconds after a sound effect occurred or during that same program time frame in no-sound-effect conditions. The primary observer's attention scorings were used in the analyses.

Flashback Comprehension: Free Recall Task

After viewing, the experimenter asked the child, "Do you ever think about things that happened to you when you were little? Tell me one thing that happened to you when you were little." After the child responded, the experimenter said, "That was something that happened to you in the *past*. In this story, did Tarzan ever think about something that happened in the past?" If the child said "yes," the experimenter asked "What happened in the past?" The experimenter wrote the child's responses on an answer sheet.

Both questions composed the free recall measure. Children were credited with a correct response only if they decided that an event happened in the past and then described the event from the flashback. In the description, children had to mention the golden lion and refer to at least one of the following: (a) events specific to the flashback (e.g., Tarzan found the baby lion); (b) the lion's age or changes in size (e.g., baby cub; little then big); or (c) the internal state of characters (e.g., Tarzan remembered finding the baby cub). Saying "yes" to the first half of the measure was necessary but not sufficient to receive credit for a correct response on the free recall task. Some children said "yes" but didn't know what happened in the past or gave incorrect confusion responses such as "He remembered that he should let the huntress be free."

One observer, who was unfamiliar with the experimental hypotheses or treatment conditions, scored all responses. Correct responses were scored as 1; incorrect responses were scored as 0. Interobserver reliability for free recall scores, based on the data from all 64 subjects, was computed between the primary observer and a second observer. Agreement occurred when both observers scored a 0 or a 1 for each subject. Interobserver reliability was 98%, calculated as 2 × the number of agreements divided by the total number of scores for both observers. The primary observer's scorings were used in the analyses.

RESULTS

Effects of Sound on Visual Attention

The first hypothesis was that children who heard sound effects would be more likely to see the visual features that represented the first flashback than would those who did not hear sound effects. Contrary to prediction, children who did

not hear sound effects were just as likely to see the visual features at the onset of the first flashback as were children who did hear sound effects (88% vs. 91%). The sound treatment was not differentially effective primarily because of baseline differences in attention. As seen in Table 1, children in the no-sound-effect condition were more likely to be looking at the television program immediately before the onset of treatment than were the children in the sound effect treatment (91% vs. 63%), $\chi^2(1) = 7.06$, $p < .01$. Sound effects, then, essentially made the two groups equivalent in attention when the first flashback began, but the sound treatment did not make the groups different. Therefore, hypothesis one was not supported.

Flashback Comprehension: Free Recall Task

Effects of Features on Comprehension. The second hypothesis was that children who saw dreamy dissolves would understand flashbacks better than would those who saw camera cuts. On the free recall task, children who saw dissolves did understand the flashbacks better than did those who saw cuts (63% vs. 38%), $\chi^2(1) = 4.00$, $p < .05$. All children who answered the question correctly referred to the flashback as an event that happened in the past. Hypothesis two was supported.

The third hypothesis was that young children would be more reliant on dissolves for comprehension of the flashbacks than would be the older children. As seen in Table 2, younger children performed significantly better on the free recall task after they saw dissolves rather than cuts (50% vs. 13%), $\chi^2(1) = 5.24$, $p < .025$, but this difference was not statistically significant for older children (75% vs. 63%). Hypothesis three was supported.

Developmental Differences. The fourth hypothesis was that older children would understand flashbacks better than would the younger children. As predicted, older children understood the flashback in the free recall task better than did the younger children (69% vs. 31%), $\chi^2(1) = 9.00$, $p < .005$. Therefore, hypothesis four received strong support.

TABLE 1
Frequency of Children Looking at the Television Screen by Sound Effect Treatment during Baseline and Treatment Phases

	Baseline Phase		Treatment Phase	
	Not Looking	Looking	Not Looking	Looking
No sound	3	29	4	28
Sound	12	20	3	29

$N = 64$.

TABLE 2
Frequencies of Children's Flashback Comprehension Responses as a Function of Visual Formal Features and Grade

	Kindergarten and First Grades		Fourth and Fifth Grades	
	Incorrect	Correct	Incorrect	Correct
Cut	14	2	6	10
Dissolve	8	8	4	12
Both conditions	22	10	10	22

$N = 64$.

Sex Differences. The fifth hypothesis examined overall sex differences in children's comprehension of the flashback as well as in cut versus dissolve conditions. Boys and girls understood the flashback equally well.

DISCUSSION

The purpose of this study was to examine the effects of television production features on children's comprehension of a flashback where the program scenes shifted to a much earlier time and place. Sound effects were expected to enhance attention to the visual features that represented the time transition.

As found in previous studies (Alwitt et al., 1980; Calvert & Gersh, 1987), children who heard sound effects at the onset of the flashback were likely to reorient their attention back to the television program. Children who were not looking prior to a sound effect typically did look immediately after they heard it. However, because children in no-sound-effect conditions tended to be looking immediately before treatment, there were no attentional differences between the two groups at the onset of the flashback. Therefore, sound effects did not increase children's selective attention to the flashback segment. Put simply, most children attended to the flashback transitions, regardless of the sound treatment.

The major question concerned whether children would understand flashbacks represented by dissolves better than flashbacks represented by camera cuts. Children who saw dreamy dissolves rather than cuts performed better on the free recall task which assessed children's comprehension of past events. Similarly, Rice, Huston, and Wright (1986) demonstrated that children as young as age six understood instant replays of events that were marked with the typical wipe pattern used in televised baseball games. These findings suggest that as early as age six, children are becoming media-literate about the ways in which visual formal features are used to represent changes in time.

As expected, younger children were more reliant on dissolves for comprehension of the flashbacks than were the older children. The results suggest that older children can understand a violation of a typical media convention better than can

younger children (Wright & Huston, 1981). Nonetheless, the generality of the findings are limited by the use of only one television program.

Not surprisingly, developmental differences occurred in children's comprehension of the flashback. Sixty-nine % of fourth and fifth graders versus 31% of kindergarten and first graders recalled that a change in time had occurred. Sex differences in comprehension, however, were not found. The present findings are consistent with developmental differences in children's comprehension of television programming (Collins, 1983), in their comprehension of time (Fraisse, 1982), and in their media literacy (Wright & Huston, 1983).

Although Collins et al. (1978) demonstrated that children are sensitive to the temporal order of televised events, the present study demonstrates that temporal sensitivity develops much earlier than previously documented. Contrary to the findings of Collins et al. (1978), fifth graders were not confused by temporal disruption. Although scrambling the order of scenes led to decreased comprehension for fifth-grade children (Collins et al., 1978), comprehension of temporal disruptions like flashbacks were understood by a majority of fifth graders. Half of the kindergarten and first graders, who were younger than the second-grade boys who demonstrated no sensitivity to temporal disruption (Collins et al., 1978), understood that changes in time were occurring when they viewed flashbacks represented by dissolves.

The probable reason for the discrepant findings in these two studies is the nature of, and children's familiarity with, the type of experimental stimuli used. Flashback sequences are a familiar, ecologically valid temporal disruption whereas randomly ordered scenes are not. The results suggest that temporal disruptions can be understood by young children when the disruptions are familiar media conventions, particularly when time transitions are represented in conventional ways (Reisz & Millar, 1968).

CONCLUSION

In conclusion, age-related improvements in children's comprehension of time may reflect both their growing knowledge about how formal features are used to represent time and their ability to use features to guide their comprehension. Dreamy camera dissolves that indicated a time shift increased children's understanding that a past event had been shown, particularly at young ages. While processing of television content is often perceived as a lazy cognitive activity, children exert mental effort to comprehend complex tasks when they are challenged to do so.

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