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THE INTERRELATIONSHIP BETWEEN VISUAL AND AUDITORY  
ATTENTION AND CHILDREN'S COMPREHENSION OF TELEVISION

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A Thesis  
Presented to the  
Faculty of  
California State College,  
San Bernardino

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In Partial Fulfillment  
of the Requirements for the Degree  
Master of Arts  
in  
Psychology

---

By  
Eileen F. Hartman  
November 1980



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Approved by:



Chairman

11/20/80  
Date





PARSONS  
SOUTH CO. USA

## ABSTRACT

This study explored the cognitive processes involved in young children's television viewing. In particular, the relationship between children's attention to and processing of visual versus auditory information was examined. Sixty, five-year-old children individually viewed a specially prepared 20 minute "Sesame Street" television show which contained approximately equal amounts of three types of television programs. The main information in each of the three types of programs was presented either visually, auditorily or on a combined visual-auditory channel. The children viewed the television show with either toys available to play with, a record playing in the room to listen to or with no toys or record available. A recall test and a "same-different" recognition task followed. The results showed that although visual attention to the television in the control group was nearly twice that in the toys group, there was no difference between the groups in comprehension. There was, nevertheless, a significant within-group correlation between visual attention and comprehension of visual programs. Visual attention was not strongly related to comprehension of auditory programs. These findings are discussed in terms of children's cognitive processing strategies for watching television.



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## INTRODUCTION

Watching television is the national pastime of children in the United States. Comstock, Chaffee, Katzman, McCombs and Roberts (1978) reported that children spend approximately 20% of their waking hours watching television. When one also considers that children begin purposeful systematic television viewing between two and three years of age (Anderson, Lorch, Alwitt and Levin, 1978), it can be seen that studying how children watch television and what information they retain from watching television is an important and ecologically valid task.

Research on the effects of television on children has been an area of growing interest over the past ten years. The large majority of studies in this area have examined the social impact of television on children's behavior. In particular, these studies have examined children's modeling of antisocial behavior (e.g. aggression) and prosocial behavior (e.g. helping) using the social learning theory approach (c.f. Bandura, 1965; Hoffman, 1970; Liebert, Neale and Davidson, 1973). The general finding of these studies has been that the frequency of specific behaviors can be increased by observing a model perform them.

While these findings have been both interesting and informative, they should be carefully evaluated in light of



the research on young children's cognitive processing limitations. More than 15 years ago, three pioneering researchers into the effects of television on children concluded:

...The chief part television plays in the lives of children depends at least as much on what the child brings to television as on what television brings to the child. (Schramm, Lyle and Parker, 1961, p. 74)

Despite this well known appraisal, it is only recently that attention has been given to the wide-ranging cognitive and predispositional characteristics that the child brings to the television. Noted researchers such as W. Andrew Collins (Note 1) are now considering the possibility that social lessons are not being learned by children because the lessons are not being comprehended and remembered. Understanding the cognitive skills required to comprehend television and at what age these skills develop is becoming an area of importance in television research.

Very few studies have actually examined the cognitive processing aspects of children's television viewing. Several experiments by Collins have studied young children's cognitive processing limitations in the act of television viewing. In one study, Collins, Berndt and Hess (1974) showed children an 11 minute aggressive television program and then asked them to "tell what happened in the program." They found that 67% of the kindergarteners spontaneously recalled the plot, but not the motive or the consequence of the action. The older children (2nd, 5th and 8th grade subjects) were more likely to interpret the plot in terms of the motives and consequences. In

another experiment, Collins (1973) showed children an aggressive television sequence in which both the motive and the consequence of the aggressive act were negative. Collins found that with children as old as eight the insertion of 4 minutes of commercials separating the motivation from the consequence significantly increased the amount of aggression-potential in the children, as compared to a no separation control group. The children did not remember the motivation by the time they got to the consequence and thus did not integrate this information when they interpreted the aggressive action. Consistent with these findings, Liss and Reinhardt (Note 2) reported that kindergarten children could not integrate action and rhetoric of television characters. They found that young children could understand concepts of good (heroes) and bad (villains) and identify characters as such. However, when presented with an aggressive prosocial model (hero uses violence to stop villain) they were unable to conceptually incorporate the more subtle verbal messages into their own behavioral repertoires. Young children were more influenced by the actions of the characters than by their words.

Other studies have also reported cognitive processing limitations in television viewing by young children. Collins (1970) and Leifer and Roberts (1972) found that young children often perceive a television program as a series of unrelated segments, rather than as a continuing story. It thus would appear that young children could inaccurately interpret the

plot of even simple television programs. Collins, Wellman, Kiniston and Westby (1978) reported that children in the second grade performed at the same level of recall for programs viewed in the original order as they did for programs viewed in a random order that had no sensible sequential plot. The 5th and 8th graders were substantially confused by the randomly ordered version. These studies have helped to highlight the need for further understanding of the role of developmentally changing cognitive skills in social learning from television.

It is also important in studying the cognitive processes involved in television viewing to look at the cognitive consequences of watching television on children. Does watching television make children dull, passive processors of information or does watching television foster the development of alert critical thinkers? The few articles and studies that have looked at these issues have reported mixed findings. Speculative critiques by T. Berry Brazelton (1972) and more recently M. Winn (1977) have concluded that television viewing in young children is simply a mesmerising passively receptive activity. Brazelton even goes so far as to say that children are hooked or locked to the television screen and thus forced to absorb the message of a violent, consumption-oriented society.

Brazelton and Winn's position postulates that there is little or no interaction between the child and the television. Therefore, as a result, television viewing plays no role in facilitating cognitive development in children.

On the other hand, there are those who contend that watching television involves relatively advanced cognitive skills. They argue that as an active cognitive process, watching television plays a positive role in cognitive development. The effect of television on children is a consequence of the interaction between the child and the child's interpretation of the television. Research by Anderson has supported this active television processing view. Anderson, Lorch, Alwitt and Levin (1978) watched five-year-old children view television with toys available to play with. They reported that contrary to Brazelton and Winn's assumption, the children actually visually attended to the television screen only 47% of the time with 54% of all looks less than three seconds in length. Further, Lorch, Anderson and Levin (1979) reported that children's comprehension of television content was not affected by the percent of time they spent looking at the television. They concluded that by age five, children have developed relatively sophisticated cognitive strategies for viewing television that allow them to divide their attention between watching television and other activities. Anderson (Note 3) stated:

Our conception of young children's television viewing is of a cognitively active learned behavior sensibly intermeshed with relatively passive unlearned cognitive processes. We see television viewing as a cyclic transactional information processing activity. (pgs. 8-9)

The controversy over whether children's television viewing involves passively absorbing information on the one hand, versus



actively and selectively processing information on the other hand, can only be resolved by additional research on cognitive aspects of children's television viewing.

#### Visual and Auditory Attention

As it has been pointed out, it is important to investigate what information young children process and remember from watching television. Specifically, the present study focused on the relationship between children's processing of information presented visually on television versus processing the simultaneously presented auditory-verbal information. In particular, this study was designed to examine the interrelationship between children's attention to visual versus auditory information while watching television. Some specific questions of interest are the following: (1) Are children listening to television when they are not watching it? (2) Are children able to simultaneously process a visual information channel and an auditory information channel? Anecdotal information indicates that some adult television viewers typically "watch" television by following the action auditorily (often while performing a household task such as ironing) and looking at the screen intermittently simply to confirm their comprehension. This method of watching television assumes a fairly sophisticated cognitive processing ability. It assumes that a person can (1) follow the plot from the auditory channel while participating in some other activity, (2) develop

hypotheses as to what is likely to happen next, so that they can (3) look at the television when it is necessary to catch a particularly interesting or important visual event. Current research on children's attention has indicated that children are generally inefficient at selective, divided and maintained attention (Gale and Lynn, 1972; Lipps Birch, 1976; Strutt, Anderson and Well, 1975). If, as the data suggests, children can not or do not choose to simultaneously process a visual information channel and an auditory information channel, the question becomes: What kind of relationship exists between children's attention to and processing of visual versus auditory information?

Research in the area of the role of attention to visual versus auditory information in children's comprehension of television has been very sparse. Anderson, Lorch, Alwitt and Levin (1978) found that auditory attributes play a major role in determining visual attention. Their results were supported by Wartella and Ettema (1974) who also reported that "auditory complexity" appeared to be most strongly related to continued visual attention to television commercials. Consistent with these findings, Liss (Note 4) reported that deaf children performed more poorly than hearing children on central information items due to their auditory modality deficits. All of these analyses strongly implicated auditory attributes as most importantly related to visual attention. Anderson and his colleagues claimed that although it was clear



that auditory attributes were highly effective determinants of looking at television, they knew almost nothing about the determinants of listening to television. They concluded their discussion of watching children watch television with the conviction that in order to understand attention to television, auditory attention must be better understood. Lyle (1972) discussed the need to explore auditory attention to television in his review of the research on attention to television. He noted that studies of visual attention to the television screen leave unanswered "... the question of whether or not 'attention time' is restricted to 'eye contact' time." (pg.26)

Television programming has often been described as "radio with pictures" (Anderson, Lorch, Alwitt and Levin, 1978), since most intended messages are presented via the auditory track. If visual attention is strongly related to auditory attention, one might expect to find a positive relationship between visual attention and comprehension of a television program.

In testing this relationship, research has suggested somewhat inconclusive and contradictory results. Lorch, Anderson and Levin (1979) had five-year-old children watch television with either a variety of toys available to play with or no toys. In the no toys group visual attention to the television averaged 87%, whereas visual attention for the group with toys averaged only 44%. The interesting findings were that despite the visual attention differences, the two groups did not differ in comprehension of the program. However, in the toys group there was

a significant and substantial positive correlation between visual attention and comprehension on all questions, including those based on information only presented auditorily. Lorch, Anderson and Levin concluded that auditory attention to television is positively correlated with visual attention. They further suggested that children who are engaged in a symbolic play activity during television viewing superficially monitor the sound track to detect cues for the need to return full attention to the television.

Friedlander and his associates have come the closest to directly examining children's auditory attention to television (Bohannon and Friedlander, 1973). Their findings are consistent with Anderson's report that children pay little attention at a semantic level to the auditory channel alone on television. In Friedlanders's procedure, children were presented with a television program in which a degraded sound track was sometimes present. The children were instructed that they could receive a normal soundtrack by operating a switch. Friedlander found that five to eight-year-old children had only a minimal preference for the normal soundtrack whereas the older children showed a consistent preference. The younger children actually preferred a meaningless soundtrack with "lively intonation" to a monotonous semantically sensible sound track. Levin, Petros and Petrella (Note 5) found that for children's commercials, significantly more central information was remembered from the visual track while significantly more irrelevant information

was remembered from the auditory track. These findings also agree with the work of Anderson (1979) and Friedlander (1973) cited earlier which suggest that the auditory track may not be attended to at a semantic level. Together, the results of Anderson, Friedlander and Levin seem to suggest that when children are not looking at television, they are monitoring the auditory track for a lively intonation pattern or a change in the auditory signal to redirect visual attention back to the television, to resume semantic processing of the program.

While these studies seem to indicate a positive relationship between children's attention to visual versus auditory information, other researchers have suggested a less clear relationship. In a recent study by Zuckerman, Ziegler and Stevenson (1978) children viewed 15 minutes of television with 8 commercials interspersed throughout. A recognition test followed in which the children were presented several two to three-second auditory or visual segments from the commercials. The overall recognition sensitivity for auditory segments was lower ( $d'=.52$ ) than for visual segments ( $d'=.72$ ). Further, the correlation between auditory recognition and visual attention was very low ( $r=.203$ ), suggesting a weak relationship between visual attention and recognition of auditorily presented information. Similarly, Friedrich and Stein (1973) reported that visual attention was not a good predictor of comprehension of television by children. They suggested that auditory attention alone probably was sufficient for following the flow



of events because of familiarity with program characters and format.

Additional research is clearly necessary to discover the role of attention to visual versus auditory information in children's comprehension of television. Specifically the question of concern in this study was: "What kind of information (visual or auditory) do young children attend to, process and remember from watching television?" This experiment attempted to manipulate the amount of visual and auditory attention to television by children and then measured the effect on memory for auditorily and visually presented information. The experiment utilized Anderson's basic paradigm (Lorch, Anderson and Levin, 1979) but also included an additional independent variable and a more extensive battery of memory tests designed to specifically compare memory for auditory versus visual information.

Five-year-old children were randomly assigned to one of three possible television viewing conditions. The children all individually viewed a specially prepared 20 minute "Sesame Street" television program. The amount of visual attention to the television was manipulated by having toys or no toys available to play with during viewing. The amount of auditory attention was manipulated by having a children's record playing in the room or no record available to listen to during viewing. There were thus three experimental conditions, defined by the conditions of viewing--toys available, record playing or neither

the toys or the record available (control). Subjects' degree of visual attention to the television throughout viewing was recorded by two observers to determine the extent to which visual attention differed between the groups.

The effect of the independent manipulations of visual attention and auditory attention were measured on several memory tests. In the first memory test, questions were asked to determine the subjects' comprehension of specific aspects of the program that had been presented visually, auditorily or on a combined visual-auditory channel. In the second memory test an old-new recognition task was conducted. This test allowed a comparison of recognition memory for auditory as compared with visual segments in each of the three viewing conditions. Through these two measures this experiment tested if children listen to and comprehend auditory information from television when they are not watching it (i.e. when toys are available to play with) and if they watch and comprehend visual information from television when they are not listening to it (i.e. when a record is available to listen to).

Research addressing these and similar issues may have practical implications for making children's television programs more comprehensible. If children's comprehension is found to be highly correlated with visual, but not auditory attention, the most effective production strategies for such children's television shows as "Sesame Street" would be those aimed at capturing children's visual attention during the most important

program segments. On the other hand, if children's comprehension is found to be highly correlated with auditory, and not visual attention, then the most effective production strategies would be those geared at capturing children's auditory attention during the most important program segments.

The use of five-year-old subjects in this study was based on relevant findings by Anderson, Lorch, Alwitt and Levin (1978). They reported that children do not deliberately "watch" television until at least the age of four. Prior to this age, children appear to have their attention "captured" by television, rather than deliberately processing it. To insure that the subjects tested were experienced at systematically monitoring television five-year-old children were used.



## METHOD

### Subjects

Sixty, five-year-old children from the San Bernardino, California metropolitan area participated in this study. The children were individually brought to the California State College, San Bernardino by a parent.

### Setting, Apparatus and Stimulus Materials

Children individually viewed a "Sesame Street" taped television program in a comfortably furnished viewing room. In the toys condition a variety of toys were available in the room for the child to play with. In the record playing condition a children's record was playing on a small record player in the back of the room. Videotape equipment in an adjacent room was connected through the wall to a television monitor in the viewing room. In the observation room there was a Foringer 1699 RP-904/231-18 and a 4 LVE 411-20 counter panel for recording the child's visual attention to the television through a one-way mirror. A small video screen was also placed in the observation room for the viewing of the program by the observers.

Each child viewed a "Sesame Street" program that had been edited by the experimenters for this specific research study. The program was approximately 20 minutes in length and consisted

of 11 randomly ordered individual color segments. Of these 11 segments, 3 contained largely auditory information and comprised 6 minutes 30 seconds of the total television program, 5 contained largely visual information and comprised 6 minutes 45 seconds of the television program and 3 contained equal amounts of both auditory and visual information and comprised 7 minutes of the total television program. The 11 segments were previously rated by three adult viewers as containing largely auditory, visual or both auditory and visual information based on the following criteria: (1) a segment was labeled as "auditory" when the central information was presented via the auditory channel and the segment could be clearly understood with the visual channel turned off, (2) a segment was labeled as "visual" when the central information was presented via the visual channel and the segment could be clearly understood with the auditory channel turned off and (3) a segment was labeled as "combined" when the central information was presented on both the auditory and visual channels and the segment could only be understood with the auditory and visual channels turned on.

#### Design

This experiment utilized a 2 (sex) x 3 (television viewing condition) x 3 (type of program) mixed factorial design. All subjects viewed a "Sesame Street" television program which contained approximately equal amounts of three types of television programs. The main information in each of the three types of

programs was presented either visually, auditorily or on both the visual and auditory channels. Equal numbers of subjects were randomly assigned to view the television show with either toys available to play with, a record playing in the room to listen to or with no toys or record available (control).

The effect of the television viewing condition and the type of television program was measured in several ways. The dependent variables included the amount of visual attention measured by observers (duration and frequency of eye gazes), recall accuracy and recognition accuracy. A 2 x 3 x 3 Analysis of Variance was carried out on each of these three dependent variables.

#### Procedure

The parent and child were brought into the viewing room where the study was briefly explained. Each child was tested individually. The children were instructed to watch television just like they would if they were in their own home. They were told that they could play with the toys (if present) or listen to the record (if playing) if they wanted to. All of the children were told that they would be asked a few questions about the television program when it was finished.

After the study was explained the child was left alone in the viewing room. The parent was taken to another room during the session and instructed to fill out a questionnaire on the television viewing habits of the child. After approximately



five minutes the television program began. Two observers behind a one-way mirror recorded and measured the child's visual attention to the television. (Of the two observers, one was blind to the predictions of the experiment). Each observer depressed a pushbutton attached to a timer every time the subject looked at the television and released it when the child looked away. The duration of attention in seconds and the cumulative frequency of glances was recorded for each of the 11 individual segments of the television show. Observers noted the beginning and ending of each program segment on a small video screen located inside the observation room. At the conclusion of each segment the data was recorded and the counter was cleared and reset. Pearson  $r$  correlations showed interobserver reliability above .98.

Immediately following the show, the experimenter entered the viewing room for memory testing. Two memory tests were used. First, the subject was questioned on specific aspects of the show. Then the child was given an old-new recognition test. In the first memory test, questions were asked to determine the subjects' comprehension of specific aspects of the three types of programs. Recall questions on the auditory segments were based only upon information spoken by the characters while recall questions on visual segments were based only upon information shown on the screen. Test questions on the programs that included both auditory and visual information were specifically coded as to whether the

answer relied on visually or auditorily presented material. Such questions included the following: "What was the name of Billy Joe's partner?" "When Billy Joe and Sunset were going down the steps into the basement, what did they fall into?" Questions followed the order in which the segments had been presented. Most questions were scored on the following three point scale: 2 points if the child answered correctly, 1 point if a prompt was necessary before the child answered and 0 points if the child answered incorrectly with the help of the prompt. Exceptions to this scoring occurred when the child was asked for multiple responses to a single question. For example, the child was asked the following question: "Name some of the things Billy Joe had in his office." In this case the following scoring system was used: 2 points if the child gave at least 2 correct responses, 1 point if the child gave at least 2 correct responses with the help of a prompt, 0 points if the child gave only 1 correct response with prompting. Prompts were essentially restatements of the original questions but with an additional piece of information given. For example, if the original question "What was Ernie afraid of?" was answered incorrectly, a prompt followed. In the prompted question the experimenter asked, "What kinds of spooky things was Ernie afraid of?" If the child did not answer correctly when prompted, the experimenter gave the correct response before proceeding. There were 35 questions (16 Auditory and 19 Visual) from the 11 taped program segments.

In the recognition memory test the child was presented twelve, ten-second program segments in an old-new recognition task. These twelve segments consisted of two, ten-second visual segments from each of the three types of programs plus six new distractor program segments. Children were asked to state if they had seen the segment before. Testing took about 20 minutes.



## RESULTS

The data were scored in several ways. The dependent variables were amount of visual attention, recall accuracy and recognition accuracy. Separate analyses on these measures were carried out. The rejection region for all of the analyses was  $p < .05$ . It should be noted that no sex differences were observed with any of the three dependent variables and thus the reported data has been collapsed across sex.

### Visual Attention

The amount of visual attention was the first dependent variable observed. An analysis of variance was performed on the percent of time that each child visually attended to television as a function of the sex of subject, television viewing condition and type of program. This data is presented in ~~Tabl~~ Table 1.

The effect of the television viewing condition on visual attention was significant,  $F(2,54)=72.62$ ,  $MS_e=.048$ . As shown in Table 2, post hoc comparisons indicated that subjects' visual attention to the television program was significantly higher in the control group (88%) than in the toys group (44%) and higher in the record group (82%) than in the toys group. No significant difference in visual attention was found between the record group and the control group. These findings showed

Table 1  
 Mean Percentage of Visual Attention for Each  
 Television Viewing Condition as a Function  
 of the Type of Program

Television Viewing Condition	Type of Program			$\bar{X}$
	Auditory	Visual	Combined (A&V)	
Control	.81430	.89425	.93305	.88053
Toys	.37390	.43855	.50275	.43840
Record	<u>.74105</u>	<u>.87105</u>	<u>.85535</u>	.82248
$\bar{X}$	.64308	.73462	.76372	

Table 2  
 Tukey's Honestly Significant Difference Among  
 Means for the Percentage of Visual Attention  
 in Each Television Viewing Condition

	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_3$
$\bar{X}_1 = .88053$	-----	.44213*	.05805
$\bar{X}_2 = .43840$	-----	-----	.38408*
$\bar{X}_3 = .82248$	-----	-----	-----

\*HSD  $.05, 108 = .06720$

$\bar{X}_1 =$  Control Condition

$\bar{X}_2 =$  Toys Condition

$\bar{X}_3 =$  Record Condition

that presenting toys effectively reduced visual attention to the television relative to the other two viewing conditions.

A significant effect for type of television program was also observed,  $F(2,108)=30.52$ ,  $MS_e=.008$ . As can be seen in Table 3, post hoc comparisons revealed that subjects' visual attention to the television was significantly higher in the program segments which contained largely visual information (73%) than in those which contained largely auditory information (64%). Subjects' visual attention was also significantly higher in the program segments which contained equal amounts of both visual and auditory information (76%) than in those which contained largely auditory information. The effect of the television viewing condition did not interact with the type of television program.

#### Recall Accuracy

The second dependent variable examined was recall accuracy. An analysis of variance was performed on the coded recall scores (0-2 code with 0=no recall, 1=recall with assistance and 2=recall without assistance). The factors were sex of subject, television viewing condition and type of program. It should be noted that test questions were classified into four categories. There were visual questions on the visual segments, auditory questions on the auditory segments and both visual questions and auditory questions on the segments containing equal amounts of visual and auditory information. There were no questions

Table 3  
 Tukey's Honestly Significant Difference Among  
 Means for the Percentage of Visual  
 Attention in Each Program Type

	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_3$
$\bar{X}_1 = .64308$	-----	.09154*	.12064*
$\bar{X}_2 = .73462$	-----	-----	.02910
$\bar{X}_3 = .76372$	-----	-----	-----

\*HSD  $.05, 108 = .06720$

$\bar{X}_1 =$  Auditory Program

$\bar{X}_2 =$  Visual Program

$\bar{X}_3 =$  Combined Auditory and Visual Program



asked based on visual information from auditory segments and no questions asked based on auditory information from visual segments. Mean recall scores are presented in Table 4.

Recall did not significantly vary as a function of the television viewing condition, despite differences in visual attention to the television program. However, a significant effect for type of program was observed,  $F(3,162)=7.94$ ,  $MS_e=.081$ . As indicated in Table 5, recall was lower on auditory questions from program segments containing both visual and auditory information than in the other three conditions. The more interesting effect, however, was the significant interaction of Television Viewing Condition x Type of Program,  $F(6,162)=2.99$ ,  $MS_e=.081$ . As can be seen in Table 4, Dunnett's post hoc contrasts were conducted to compare the control condition with each of the other viewing conditions for each type of program. Contrasts revealed that with auditory program segments recall was significantly greater in the control condition (recall score=1.31) than in the record condition (1.09). However, there was no significant difference between the condition with toys (1.17) and the control condition. With visual program segments, recall was significantly greater in the control condition (1.31) than in the condition with toys (.92). The record condition (1.20) did not significantly differ from the control condition. With questions based on auditory information from programs containing both visual and auditory information, recall was significantly greater in the control condition (1.06)

Table 4  
 Mean Coded Recall Scores for Each Television  
 Viewing Condition as a Function of  
 the Type of Program (0-2 code)

Television Viewing Condition	Type of Program				$\bar{X}$
	Auditory	Visual	Combined/A	Combined/V	
Control	1.31100	1.31100	1.06350	1.16700	1.21313
Toys	1.16650	0.91600* <sub>2</sub>	0.97950	1.08350	1.03638
Record	<u>1.08850</u> * <sub>1</sub>	<u>1.19950</u>	<u>0.82100</u> * <sub>3</sub>	<u>1.16700</u>	1.06900
$\bar{X}$	1.18867	1.14217	0.95467	1.13917	

Dunnett's  $d'_{.05,162} = .20160$

\*<sub>1</sub> Comparisons = .22250 (Control & Record)

\*<sub>2</sub> Comparisons = .39500 (Control & Toys)

\*<sub>3</sub> Comparisons = .24250 (Control & Record)

Table 5  
 Tukey's Honestly Significant Difference Among  
 Means for the Coded Recall Scores  
 in Each Program Type

	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_3$	$\bar{X}_4$
$\bar{X}_1=1.18867$	-----	.04650	.23400*	.04950
$\bar{X}_2=1.14217$	-----	-----	.18750	.00300
$\bar{X}_3=0.95467$	-----	-----	-----	.18450
$\bar{X}_4=1.13917$	-----	-----	-----	-----

\*HSD  $.05, 162 = .23101$

$\bar{X}_1 =$  Auditory Program

$\bar{X}_2 =$  Visual Program

$\bar{X}_3 =$  Combined Auditory & Visual Program/A. Question

$\bar{X}_4 =$  Combined Auditory & Visual Program/V. Question

than in the record condition (.82). There was no significant difference between the toys condition (.98) and the control condition. No significant differences resulted with the visual questions from program segments containing both visual and auditory information.

#### Recognition Accuracy

The signal detection measure of  $d'$  scores was computed on the recognition accuracy data. The  $d'$  measure is the ratio of the hit rate, that is,  $P$  ("old"/old) relative to the false alarm rate,  $P$  ("old"/new). The values of  $d'$  reflect subjects' recognition sensitivity in distinguishing the original (i.e. old) items from the changed (i.e. new) test items. The  $d'$  values were computed for each subjects' response to each of the three types of programs (visual, auditory and combined visual-auditory). The procedure suggested by Hochhaus (1972) was followed for calculating  $d'$  values. This data is presented in Table 6.

An analysis of variance was performed on the  $d'$  data. The only significant effect observed was the main effect of type of program,  $F(2,108)=33.97$ ,  $MS_e=2.67$ . The direction of this effect can be seen in Table 7. This effect is not particularly interesting because different questions were used for each program and the effect may be due to the differences in the test items. Further, a closer analysis of this data showed that the entire effect was accounted for by a uniformly low performance on the recognition test item

Table 6  
 Mean d' Data for Each Television Viewing Condition  
 as a Function of the Type of Program

Television Viewing Condition	Type of Program			$\bar{X}$
	Auditory	Visual	Combined (A&V)	
Control	4.54825	3.11880	5.06805	4.24503
Toys	4.97410	2.33910	4.67820	3.99713
Record	<u>5.06805</u>	<u>2.85890</u>	<u>5.06805</u>	<u>4.33167</u>
$\bar{X}$	4.86347	2.77227	4.93810	



Table 7  
 Tukey's Honestly Significant Difference Among  
 Means for the  $d'$  Data in Each Program Type

	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_3$
$\bar{X}_1=4.86347$	-----	2.09120*	0.07463
$\bar{X}_2=2.77227$	-----	-----	2.16583*
$\bar{X}_3=4.93810$	-----	-----	-----

\*HSD  $.05, 108 = 1.22767$

$\bar{X}_1 =$  Auditory Program

$\bar{X}_2 =$  Visual Program

$\bar{X}_3 =$  Combined Auditory and Visual Program

from one specific visual segment. This suggests that the effect might be due to the difficulty of this particular item, rather than to the experimental condition. With this one segment removed, the recognition accuracy in the visual condition was not significantly lower than the recognition accuracy in the auditory and combined conditions. Recognition accuracy was generally very high ( $d'=4.19$ ) suggesting that the absence of significant effects may be due to a ceiling effect.

#### Correlation Data

One of the major issues of this study was to determine whether within-program variations in visual attention were correlated with comprehension. In order to specifically examine this issue, correlations were calculated between the average percent of visual attention to each of the 11 program segments and the average coded recall scores for each of the program segments. The overall correlation was found to be low, but significant ( $r=.295$ ,  $t(60)=2.35$ ).

To more closely observe the relationship between visual attention and comprehension correlations were computed for each television viewing condition as a function of the type of program. Only auditory programs and visual programs were examined since it was not possible to determine for combined auditory-visual shows at what particular part of the show the child was visually attending. This data is presented in Table 8. As can be seen in Table 8, significant correlations

Table 8  
 Correlations Between Average Percent Visual  
 Attention and Average Coded Recall Scores

Television Viewing Condition	Type of Program	
	Auditory	Visual
Control	-.065	+.430*
Toys	+.117	+.611*
Record	<u>+.203</u>	<u>+.360*</u>
$\bar{X}$	+.085	+.467

\*p < .05



between visual attention and comprehension were found for visual programs in all three television viewing conditions. No significant correlations were observed for auditory programs in any of the television viewing conditions.

#### Television Viewing Questionnaire

Parents were asked to fill out a questionnaire on the television viewing habits of their child. Results showed that, on the average, children watched approximately  $2\frac{3}{4}$  hours of television a day. These results were consistent with Comstock, Chaffee, Katzman, McCombs and Roberts' report (1978) that children spend approximately 20% of their waking hours watching television. The amount of time watched per day ranged from less than 1 hour to 7 hours. The questionnaire revealed that 38% of the children predominantly asked to watch television while 32% watched the television just because it was already on. Of the remaining 30%, 10% both asked to watch and/or watched because the television was on, depending upon what particular show was scheduled to be broadcast and 20% independently turned the television on without asking. With regard to predominant behavior during a television program it was found that 66% of the children played with toys or other children while watching television. Only 11% watched intently without engaging in some other activity. The remaining 23% either played and/or watched intently, depending upon the particular show being broadcast.



## DISCUSSION

This study explored the cognitive processes involved in young children's television viewing. In particular, the relationship between children's attention to and processing of visual versus auditory information was examined. Lorch, Anderson and Levin (1979) and Bohannon and Friedlander (1973) reported a positive relationship between the processing of auditory information from television and visual attention to the television. On the other hand, research from the laboratories of Zuckerman, Ziegler and Stevenson (1978) and Friedrich and Stein (1973) suggested a weak relationship between visual attention and children's knowledge of program content. Because of these contradictory findings, it was believed that additional research was needed to discover the role of attention to visual versus auditory information in children's comprehension of television. Both recall accuracy and recognition accuracy were examined as measures of comprehension in this study. However, because a ceiling effect was observed with the recognition data, comprehension will be discussed only in terms of recall accuracy.

Looking first at visual attention, the results of this experiment showed that the amount of visual attention was successfully manipulated. As shown in Table 2, subjects'

visual attention to the television program was significantly higher in the control condition than in the toys condition. Visual attention was not reduced in the record condition relative to the control condition, but it was anticipated that records reduced auditory attention, which could not be directly observed. These findings showed that the presentation of toys effectively reduced visual attention to the television program relative to the other two viewing conditions.

Consistent with the results of Lorch, Anderson and Levin's research (1979), this study showed that although visual attention to the television in the control group was nearly twice that in the toys group, there was no difference between the groups in comprehension. This finding is seen in the absence of a significant main effect with recall accuracy. Visual attention was, nevertheless, positively related to comprehension of visual programs. As can be seen in Table 4, with visual program segments recall was significantly greater in the control condition than in the toys condition. This suggests that as visual attention is increased, comprehension of visual information is also increased. Consistent with this finding, the data presented in Table 8 showed a significant correlation in the toys condition between visual attention and comprehension of visual programs.

On the other hand, the results of this study indicated that visual attention was not strongly related to comprehension of auditory programs. This result is contrary to findings by



Lorch, Anderson and Levin (1979) that auditory comprehension was positively correlated with visual attention. As can be seen in Table 4, with auditory program segments and with questions based on auditory information from programs containing both visual and auditory information recall was not significantly greater in the control condition than in the toys condition. This suggests that as visual attention is increased, comprehension of auditory information is not necessarily increased. Consistent with this finding, the data presented in Table 8 showed no significant correlation between visual attention and comprehension of auditory programs in the toys condition.

With regard to auditory attention no real evidence exists showing that the children's record was successful in manipulating the amount of auditory attention. Auditory attention was not directly measured and thus no statements can be made regarding the effectiveness of the record in the manipulation of auditory attention. While it may be argued that the record simply interfered with the auditory track of the television, research by Doyle (1973) makes this assumption appear unreasonable. Doyle found that eight-year-old children performed better than chance on a selective attention task in the auditory modality. This suggests that the children in the present study could have selectively attended to either the television or the record without having these two sources simply interfere with each other. The results of the study showed that differences in recall scores

were observed in the record condition as a function of the type of program. As shown in Table 4, with auditory program segments and with questions based on auditory information from programs containing both visual and auditory information recall was significantly greater in the control condition than in the record condition. This suggests that as auditory attention is increased, comprehension of auditory information is also increased.

The present study strongly suggests that young children process auditory information from television when they are not visually attending to the television (i.e. when they are playing with toys). The results indicated that the presentation of toys decreased visual information without decreasing memory for auditory information. The findings also suggest that young children's memory for visual information is unaffected when a record is playing. The data showed that the presentation of a record did not significantly decrease visual information comprehension relative to the control condition.

These results indicate that young children utilize a fairly sophisticated cognitive processing strategy for watching television. Contrary to the current research on children's attention which has indicated that children are generally inefficient at selective, divided and maintained attention (Gale and Lynn, 1972; Lipps Birch, 1976; Strutt, Anderson and Well, 1975), the findings of this experiment suggest that young children have relatively complex cognitive strategies for



watching television which allow them to divide their visual and auditory attention between watching television and other activities, such as toy play and record listening.

It was hoped that the present research would have some practical implications for making children's television programs more comprehensible. The results indicated that young children's comprehension was positively correlated with visual attention to visual programs but not significantly related to comprehension of auditory programs. These findings therefore suggest that production strategies which emphasize the enhancement of visual attention or auditory attention may not by themselves benefit comprehension. This finding contradicts the present production principles used by the Children's Television Workshop producers who try to ensure moderately high levels of visual attention in the belief that comprehension of the program will thereby be increased (Lesser, 1974). Further research is needed in the production of children's educational television before the most effective programming strategies can be developed.

In conclusion, this study suggests that the television viewing situation of the young child involves an active transaction between the child, the television and the television viewing environment. Contrary to the views of such writers as T. Berry Brazelton (1972) and M. Winn (1977), the findings of this research suggest that the young child is not mesmerized or controlled by the television. The combined results of the

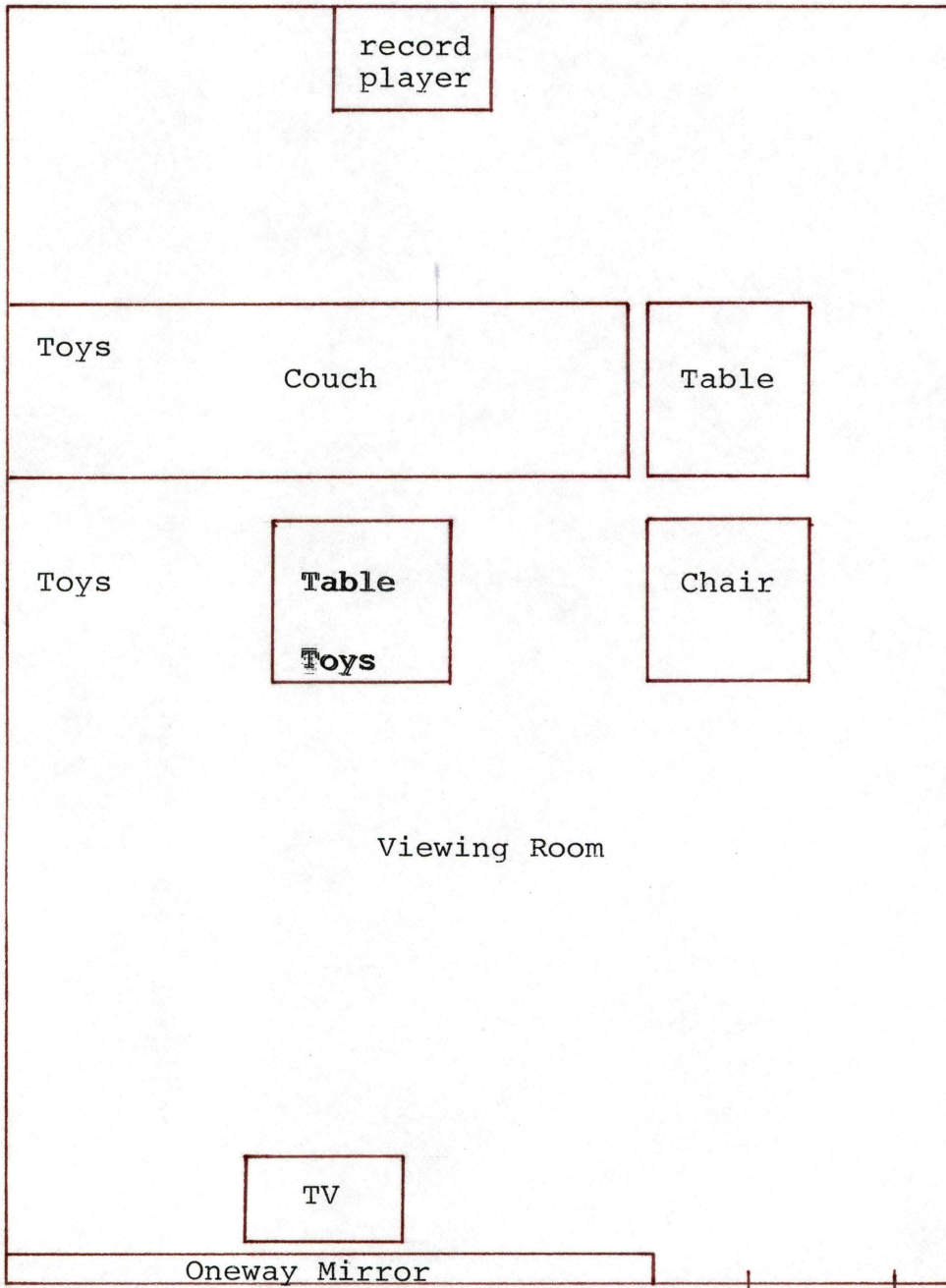
experiment and the parent questionnaire indicate that young children are far more interested in playing with toys and interacting with other children while watching television than intently staring at the television screen. Watching television for young children involves a fairly sophisticated cognitive processing ability that allows them to divide their visual and auditory attention between watching television and other activities.



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APPENDIX

DIAGRAM OF VIEWING ROOM



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