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The effects of repeated viewing on preschool children's attention to television.

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THE EFFECTS OF REPEATED VIEWING ON PRESCHOOL CHILDREN'S ATTENTION TO TELEVISION

A Thesis Presented

by

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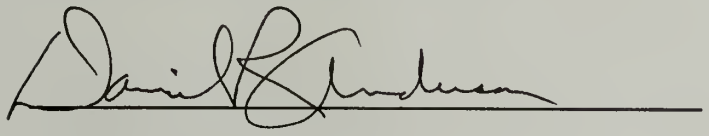

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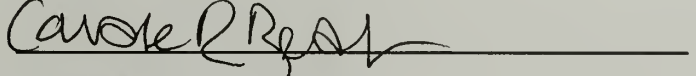

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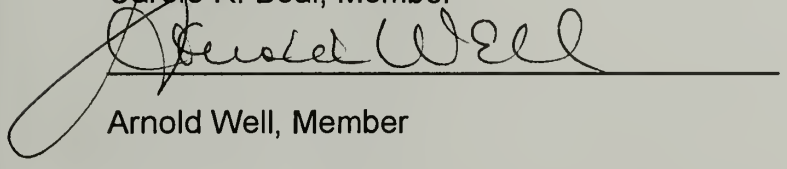

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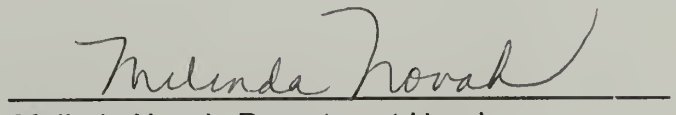

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ABSTRACT

THE EFFECTS OF REPEATED VIEWING ON PRESCHOOL CHILDREN'S ATTENTION TO TELEVISION

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Although it is a commonly known fact that preschool children crave repetition, surprisingly little research has been done on the topic. This aim of this study is to examine how preschooler's attention changes as a function of repetition in the domain of television viewing. Three, four, and five-year-olds watched the same episode of a curriculum based educational television show once a day for five consecutive days. It was found that the attention of the three and four-year-olds remained constant over the five viewings. The attention of the five-year-olds decreased over the five viewings. The show was divided into content units, and each one was classified as mainly entertainment, or mainly educational. It was found that the attention to the educational units was significantly higher than the attention to the entertainment units for the first three viewings. This difference disappeared for the final two viewings. These results are discussed in relation to current theories of attention to television.

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CHAPTER 1

PREVIOUS RESEARCH

Research concerned with preschoolers' attention to television has focused on changes in attention during a single episode of a television program or on comparing attention to different types of features. However, preschoolers seem to crave repetition of many things, including television programs. In a 1997 study conducted by the Annenberg Public Policy Center, parents of children aged two to seventeen were surveyed by telephone. They were asked how often their children repeatedly viewed the same videotape. They could answer "almost always", "once in a while", "very rarely", or "never". Sixty-nine percent of the children aged two to four "almost always" watched videos repeatedly. Less than ten percent of the children in this age group "very rarely" or "never" watched videos repeatedly. The percentage of children who "almost always" watch repeatedly decreases as age increases (Mares, in press). This study is directed at understanding how looking at the television screen changes as a young child repeatedly watches the same episode of a television program. There has been little previous research about changes in attention over repetitions of a television program. However, there have been studies done showing how comprehension changes over repetitions of storybook readings and television shows.

Literature on Storybook Repetition

Research concerning the effects of repeatedly reading the same storybook to children shows that many changes take place. Beaver (1982) read

the same book four times to her class of first-graders. She found that the more she read the book, the greater appreciation the children had for it and the more they used aspects of it (such as the language) in their everyday lives.

The effect of repeating stories has also been studied in the home environment. Martinez (1983) taped the story time of a four-year-old girl three times a week over a four-month period. When a story was initially read, the child was quiet, making few comments and asking few questions. She became more verbal as the story became more familiar. Over repeated readings, she would talk about certain parts of the story. Sometimes, she would focus on the same aspect of the story each time it was discussed. For example, the first three times her father read *The Tale of Peter Rabbit*, she had a problem with understanding that the rabbit lost his shoes. This was discussed with her father, more in depth each time. By the fourth reading, she was satisfied with her knowledge of that part of the story and did not discuss it again.

Martinez and Roser (1985) also studied the changes in children's responses during repeated book readings. They conducted two studies, one in a home environment and one in a preschool. The readings of one child in her home and one group of preschoolers were described. All children in the studies were from four to five years old. They were read six unfamiliar stories a total of three times. The sessions were audiotaped and transcribed. Children's responses were classified according to form and focus. Many changes in the quantity and quality of the children's responses were found during the repeated readings. Children in both studies did not make many responses during the first

reading. They were concentrating more on listening to the story. By the third reading, the average number of utterances about the readings doubled.

The form of the children's talk also changed. In the home study, the child initially asked questions about the story. As the book became more familiar, she started making more comments about the stories. In the preschool study, children's responses to the initial reading were mostly answers to the teacher's questions. Like the home child, they initiated more comments as the story became familiar. In both studies, the children's comments changed focus as the readings were repeated. There was not a systematic change in focus; it was different for each story. Martinez and Roser hypothesized that the change in focus occurs because, once children master certain content areas of the story, they can pay more attention to other areas. A final observation was that there was a greater depth of processing as stories were repeated. When children focused on one aspect of a story over repeated readings, their comments suggested that they were gaining insights into the story.

These findings were replicated and extended in an experimental setting by Morrow (1988). In this study, low-SES four-year-olds participated in one-to-one readings in their day care centers. The children in the different-book group had a different book read to them once a week for nine weeks. The children in the repeated-book group had three different books each read to them three times over the same time period. Responses made during the last book reading of all children were measured. The last book read was a book that the repeated-book group children were hearing for the third time, and the different-book

children were hearing for the first time. Children in the different-book group asked significantly more questions than those in the repeated-book group, and children in the repeated-book group made more comments. Further, the repeated-book group made more responses overall than the different-book group. These results replicate Martinez and Roser's (1985) finding that children tend to ask more questions during the initial reading of a book, and make more comments as the book became more familiar. They also replicate both Martinez (1983) and Martinez and Roser's (1985) finding that children tend to become more vocal as the book becomes more familiar.

Differences in the children's focus on meaning, story structure, and print and illustrations were measured. In the area of meaning, the repeated-book group made significantly more responses that were interpreting, predicting, or narrational than the different-book group. The different-book group scored significantly higher on labeling, drawing on one's experience, and detail. Children in the repeated-book group were able to make associations, judgements, and elaborative comments by the third reading, whereas the children in the different-book group made more detail-oriented responses. The repeat children also used prior knowledge for prediction.

The repeated-book group scored significantly higher than the different-book group on responses about story structure. In the area of print and illustrations, the repeated-book group made significantly more responses about print, and the different-book group made more responses about illustrations.

These two results could possibly be because the repeated-book group could focus their attention on certain parts of the story when other parts are mastered.

As books become more familiar, there are changes in the way that young children "read" and discuss books aloud with adults. Snow (1983) and Snow and Goldfield (1983) describe the storytime of a mother and her son over a period of eleven months, starting when the child was two and a half years old. The book that they read was a dictionary picture book with 880 entries. Over the 13 sessions with this book, they discussed many of the pictures repeatedly. The child's comments about these pictures changed as time went on, representing a deeper understanding of the pictures. Familiarity with the book also taught the child about the importance of text. The initial discussions focused on the pictures, with little notice given to the text by the child. However, by the time that the child reached 3 years, 4 months, he would want to hear the text. The experience with the book allowed the child to learn when the mother was just making comments about the pictures, or when she was reading from the text. Eventually, he would only discuss the pictures after the text was read.

Snow (1983) also describes the child's experience "reading" a Dr. Seuss book. When he was first exposed to this book, he was 3 years, 1 month. At this time, his "reading" of the story was mostly imitative. About a month later, he had memorized a large portion of the book.

Sulzby (1985) also studied the effects of repetition on children's "reading" of storybooks. She found changes in kindergarten children's "reading" of a favorite storybook over the course of a year. The children were interviewed

twice, once at the beginning of the year, and once at the end. Kindergartners chose a favorite storybook to bring with them to the interview. They were then asked to read the book to the interviewer. As the children got more familiar with the book, they changed from talking about discrete aspects of the book, such as the pictures, to talking about the book as a story. Thus, over repeated readings, children learned both that the book represents a story and that the text is what portrays the story. They were also able to read the story in a way that sounds similar to an adult reading that particular book.

Overall, familiarity with a certain storybook causes children to make more responses, make more comments about the book, and ask fewer questions about the book than when it was unfamiliar. Children also change the focus of what they read and discuss. But what happens to comprehension and attention over repeated viewings of a television show? Very little research has been done addressing this question.

Literature on Television Repetition and Comprehension

Peracchio (1992) studied the effects of repetition in the acquisition of the event knowledge of a product-exchange shown aurally or audiovisually. Five and seven year old children were presented a televised version of a child returning a birthday present to the store either once or three consecutive times. In the aural presentation group, the event was depicted on the television by the narrator sitting in a rocking chair. In the audiovisual presentation group, the event was shown as it was actually happening. The children were asked three types of questions in an order designed to elicit more information as the

interview progressed. The number of events mentioned, the order in which they were mentioned, and intrusions were measured. They were combined into a score that represented the child's knowledge of the presented event. The children were first asked "How do you return something from the store?" This was the hardest category, and repetition did not facilitate any of the children's answers. The next question was less abstract, and thought of as easier for the children. They were given a broken toy and asked "What would you do if I gave you this for your birthday?" There was a significant three-way interaction of age, repetition, and presentation group. In the audiovisual presentation, the younger children did worse than the older children with one exposure, but were not different from the older children with three exposures. There was no such benefit in the aural presentation. There was also a main effect of repetition, where the children who had seen it three times exhibited more knowledge than the children who had seen it only once. The final question was thought to be the easiest for the children. They were shown a pictorial representation of a product-exchange event, and asked to tell a story about "what is happening to Jim in the picture." Again, in the audiovisual presentation, older children did better than younger children in the one-exposure condition, but there was not an age difference in the three-exposure condition. There was no interaction in the aural presentation. The conclusion was that repetition in an audiovisual format reduced age differences in learning a product-exchange event, as long as the questions were simple enough for the younger children to understand.

Mares (1997) also conducted studies designed to understand changes in children's comprehension over repeated exposures to television. She had children watch a televised story that had been misunderstood in previous research. She tested children between the ages of four-years-old and nine-years-old. She showed them a story about an old woman who was either pretty and mean, or ugly and kind. In the story, children are bored, so they go into an old woman's house. She comes in, so they hide under the table. A cat wanders inside. In the pretty-mean version, the woman is pretty, but angry at the cat. In the ugly-nice version, she is ugly, but gives the cat some cream. The video ends right as the woman is about to find the kids. She showed this video either one time or four times. The repetition group watched the story once a week for four weeks. After the video, the children were tested for a variety of things. Mares assessed comprehension by asking six multiple choice questions about actions and motives. Children were also asked to put photographs from the story in order. They were asked how the old woman felt, and were asked to make predictions about the end of the story. They were also asked if they thought the characters were nice or mean, how much they enjoyed the story, and were given a Piagetian conservation task.

The same result was found for all of the comprehension tasks. The comprehension of the younger children was worse than the comprehension of the older children for the group that only saw the story once, but there was no such difference in the comprehension scores of the repetition group. This result even held up when age group was replaced with performance on the

conservation task (whether or not the child conserved) as an index of cognitive development. Again, it was found that the non-conservers were worse than conservers after one exposure, but they were equal after four.

Children predicted the correct ending in each condition at each age (the pretty and mean lady would be mean, and the ugly-nice lady would be nice), so there were no effects of repetition for this measure. Also, children who saw the story only once enjoyed it more than those who saw it four times.

As in Perrachio's (1992) study, the performance of younger children increased to match that of older children over repetitions. They are able to understand more information from the story, and use it to answer questions about it.

Mares conducted a second study about the comprehension of the Disney film The Sword in the Stone. She had six-year-olds to nine-year-olds watch an edited version of the film, and compared children who were watching it for the first time to those who had seen it before. She measured comprehension by asking the children to serialize a set of pictures, name characters, and make inferences about the movie. She also tested the children's understanding of the moral of the movie. The characters she had the children name had gone through series of transformations in the movie. So, a picture of a fish and a squirrel could still be the same character. She found that children who had seen the film previously did better on the identity task. However, these children also had more errors in putting the pictures in the correct order (although there were very few errors in either group). As in the reading literature, children who had

seen it before were better able to make inferences about the movie than those who had seen it once.

To study the effects of repetition on the comprehension of an actual television show, Sell, Ray, and Lovelace (1995) had four-year-olds watch an edited version of a *Sesame Street* tape depicting a muppet game show (*Alphabet Treasure Hunt*) three times over a three week period. There were two types of previewing instructions. One group of children was told that they would be watching a game show and that the goal of the game show was to be the winner. They were shown a preplay of the last scene of the show, where the winner was announced, before they watched the show in its entirety. The other children were just told that they were going to watch a game show, and there was no preplay on their video. Children in all conditions were told that they should pay close attention to the show because there would be questions at the end. After each viewing, the children were asked, "How do you play *Alphabet Treasure Hunt*?" Their answers were coded as central information, peripheral information, or intrusions. Central information is made up of information about constitutive, preparatory, and sequent acts. Constitutive acts are the acts that are necessary to arrive at a goal. Preparatory acts are the acts that make it possible for the constitutive acts to happen. Sequent acts are the acts that happen after the goal has already been achieved. Goal acts were also included as central information. Peripheral information is information that describes things that happen during the show but is not related to goal achievement. Intrusions are irrelevant comments.

Regardless of gender or instruction condition, after their second and third viewing, children recalled significantly more central and peripheral information, and made fewer intrusive comments than after their first. However, there were no significant differences between the second and third viewings for any type of responses. Considering the specific categories of central information, it was found that children recalled significantly more information about constitutive acts after their third viewing than either their first or second. There was no difference between their first and second viewings. They recalled significantly more information about preparatory acts in both their second and third viewing than their first, but there was no difference between their second and third viewing. There were no significant differences in the recall of sequent acts over viewing periods. They recalled more goal acts in their second viewing than in both the first and the third. However, the difference between the first and third viewing was not significant.

Thus, the children were able to increase their knowledge of the game show script, focusing more on relevant details, as repetition increased. Sell, Ray, and Lovelace (1995) hypothesize that the children are able to form script knowledge for this episode.

This research shows that differences in the comprehension of televised stories between older children and younger children can be reduced with multiple exposures to that story. Also, preschool children are better able to form scripts for television shows with repetition. Overall comprehension seems to increase with repetition. How does attention change with repetition?

Literature on Repetition and Attention

Research about how attention changes over repetition of the same television stimulus is minimal. Anderson and Levin (1976) measured the visual attention of children aged 1-4 to an episode of *Sesame Street* where three bits (short segments) were repeated. They found that attention to these bits did not change as a function of repetition. Wright, Kotler, Hughes, and Donley (1997) studied the effect of repetition of brief messages on preschool children. Children came in once a week for four weeks, and were shown an edited program from PBS's Ready to Learn series. They were then shown a 30-second interstitial segment that conveyed an educational message. The relevance and repetition of the interstitials were the manipulations. One group of children saw the same interstitial paired with a show that had a message that was relevant to the show. One group saw different interstitials paired with a show that was not relevant to the interstitial. One group saw the same interstitial paired with a show that was not relevant, and one group saw different interstitials that were not relevant. Free recall of the interstitial was measured. No significant main effect of repetition or interaction of repetition and relevance was found. However, when the message was relevant, there was a marginal positive effect of repetition. There was also a significant interaction of repetition by week, where the repetition groups increased in free recall faster than the non-repetition groups, although there was no overall effect of repetition. They also measured visual attention, and found no main effects of condition or week on percent attention. They concluded that repetition was an effective way to convey messages in

interstitial bits but only if they are relevant to the message of the preceding program.

There seems to be no effect of repetition on small segments of television shows. However, this does not indicate what would happen to attention over repetitions of an entire episode of a television show. The research on repeated reading and television viewing suggests that children's attention might change focus over repeated episodes. For example, children's comments during storytime indicate that the focus changes from information about details to a more elaborate understanding of the story as a whole. Also, children's script knowledge of a particular video over repeated viewings changes focus from the irrelevant to goal-directed behavior. Therefore, over repetitions of an entire television show, children's attention might indicate that they are focusing on different parts of the show during each repetition. Other predictions can be made using existing theories of attention to the television.

Predictions Using Theories of Attention to Television

Theories of children's attention to television do not directly address the issue of repetition. Nevertheless, predictions about how attention may change over repeated exposures to a television program can be made based on the theories of Singer (1980), Anderson and Lorch (1983), and Huston and Wright (1989).

Singer's Theory

Singer (1980) notes that any new, unexpected stimulus in the environment triggers the orienting reflex. This is how attention is directed toward

a sudden, possibly dangerous, stimulus. Once we see that it is a familiar stimulus, or at least not a dangerous one, we are able to habituate, or stop orienting to this stimulus. This concept is related to television in that some aspects of television can elicit this reflex. For example, he argues that the magazine format of *Sesame Street* (a format where the show consists of short, unrelated bits) utilizes this mechanism to keep the attention of the audience. If learning material is to be processed, Singer suggests that it must be specifically attended to while in short term memory. But if television has already gone on to the next novel segment and has elicited another orienting reflex, there is no time to reflect on the previous stimulus, and it is not processed. It is hard to habituate to the television because there are so many new and different features appearing all the time.

Singer also states that people have good recognition memory (memory for recognizing images we have seen before among those we have not). But in normal decision making, we rely on strategy to retrieve information. Thus, mere exposure to material is not enough for retrieval. Information presented passively (such as material from the television) will activate recognition memory, but it will not necessarily be encoded or available for use. Young children cannot anticipate what will be shown, and thus cannot process the new material. They especially cannot process rapid content changes. Singer suggests that the material needs to be presented slowly and repetitively for the child to be able to process it.

Thus, Singer might predict that for all preschoolers, regardless of age, attention would decline with repetition. Since the children will know what is going to happen over repeated exposures, the features will not be novel, and the children will habituate. The orienting reflex would not be elicited during each viewing, and attention would steadily decrease. Also, since the child will be able to anticipate what will be shown, they can process the new material and they should have higher comprehension scores with repetition. Although Singer did not recommend repeating an entire show as a strategy for letting children process information, he did recommend repetition of material.

Anderson and Lorch's Theory

In contrast to Singer, Anderson and Lorch (1983) offer a different explanation for what happens when a child watches television. They note that the "ongoing cognitive processing of television is to a great extent schema driven." Through experience with both life and television, a viewer develops a schema for a normal television program, and attention to television is partly controlled by this schema. Fluctuations in attention are a reflection of a combination of factors.

First, visual attention to the television depends on what other alternative activities are available. It has been demonstrated experimentally that if television is the only activity available, attention is higher than if there are other possible activities.

A second factor is that the program must be comprehensible to the viewer, but not overly predictable. Attention will terminate if there are absolutely

no gaps left in the understanding of a program, such as an adult watching a rerun. Attention will also terminate if the content is too difficult to process, such as a child watching the news. This can be delineated in an inverse-U shaped function with comprehension level on the X-axis and attention on the Y-axis. The maximum amount of attention is given to the stimulus when comprehension is at the optimal level.

Another factor that contributes to fluctuations of attention deals with periods of visual inattention to the television. During this time, a viewer usually uses auditory cues to monitor the television. An experienced viewer does not necessarily process the audio semantically, but relies on their schema to decide when to attend. For example, part of an experienced child's schema could be that children's voices mean the show is directed toward children, is comprehensible to children, and would hold a child's interest, so the child looks at the television screen when s/he hears children's voices.

The last factor deals with the idea of attentional inertia, which is the idea that the longer a look has been in progress, the greater probability the look has of continuing. It has been hypothesized that this "cognitive glue" maintains attention over complex information, so that there is a better chance for it to get comprehended. According to the previous discussion, attention would usually terminate if the information got too complex. Attentional inertia allows attention to stay on the television for some extra time, and possibly allows for more of the content to be comprehended.

According to this theory, looks are elicited and maintained by a combination of comprehensibility, attentional inertia, and cues of significant content. Looks are terminated by incomprehensibility, predictability, distraction, and paying attention to an alternate activity. Children also learn cues to content which is not of interest to them (e.g., adult male voices), and use these cues to terminate attention.

As for what happens when a show is repeated, this theory would most likely predict an interaction with age and exposure number. The older children will have a better-developed schema, and will have few gaps in understanding after the first or second exposure. Parts of the show that were comprehensible during the first exposure will become predictable. For the older children, more of the show will initially be comprehensible. Thus, attention would decline over the sessions for the older children. However, the younger children will probably be less attentive in the first few sessions, as the show will be more cognitively demanding for them, and they will not comprehend it all initially. There will be some lack of understanding that will be alleviated by watching the show again. They will comprehend more each time they watch. Their attention would increase through repetition. However, some of the parts that had started out as initially incomprehensible, and had become comprehensible, might end up becoming boring. Thus, another possibility is that the attention of the younger children will increase, and then decrease.

Huston and Wright's Theory

Huston and Wright (1989) offer a theory that suggests children process television both passively and actively. Huston and Wright are concerned with the moment-to-moment and show-to-show changes in cognitive processing.

As children develop, there is a change in cognitive functioning from perceptual exploration to perceptual search. A child who uses perceptual exploration will respond to immediate, salient, and discrete parts of a stimulus. With increased exposure, and familiarization, the child's method of information finding becomes perceptual search. Perceptual search is guided by internal goals, and thus allows the child to select things that are interesting and informative. The change from perceptual exploration to perceptual search is reflected in television as a change from passive to active viewing. Inexperienced viewers are guided by the formal features that are perceptually salient to young children, such as novelty, change, and movement. More experienced viewers have enough experience with the television to use the formal features to actively guide their attention.

As a model for attention, Huston and Wright add more detail to the inverse-U shaped function described previously. Not only is the right amount of comprehension needed for maximum attention, the stimulus also has to be moderately novel, surprising, recognizable, ordered (not repetitive or totally unpredictable), regular (not redundant or inconsistent), and integratable (not wholistic or incongruous). With familiarization, the function shifts. That is, things that are originally comprehensible and novel become simple and familiar.

Thus, according to this model, attention is a function of form (e.g., novelty), content (e.g., comprehensibility), and viewer characteristics (e.g., the ability to comprehend).

To explain moment-to-moment attention decisions, Huston and Wright offer the stimulus sampling model. At certain points in a television-watching session, children make a decision about whether to attend, keep attending, stop attending, or remain inattentive to the television. This model implies a connection between levels of cognitive processing, the role played by formal features, and motivational involvement. At the most superficial level of cognitive processing, attention is elicited and maintained by the salience of formal features, such as Singer suggests. However, at the next level of processing, the child decides if the program is recognizable and comprehensible - if it is on the right point of the inverse-U shaped function described earlier. At this level of processing, the formal features are not controlling the child's attention. In this case, the formal features give the child clues as to the content type and difficulty level. Children will watch if they feel it will be appealing.

At the deepest level of cognitive processing, the child decides if it is worthwhile to watch - if it is encodable and understandable. Now formal features are "representations of cognitive operations" and they "segment and structure the flow of content." The motivation to watch is to share, remember, and see how the show turns out.

Implications for subsequent viewing is another part of this model. The child cognitively processes the features that are indicators of a particular show

or series. Formal features, such as the program logo, tell the child which program it is, and the child will watch if s/he has enjoyed the program before. As for what happens when a show is repeated, this theory would also predict an interaction between age and exposure number. The younger children will be less experienced to begin with, and will not be as good at using formal features to guide their active processing. Thus, the younger children will habituate to using the formal features as perceptually salient events. However, with the familiarity of watching the same program each time, they might start processing more deeply. This theory would predict an increase in attention as the child changes from showing orienting responses to the formal features to comprehension guided attention. With the added experience with the particular show, the attention of the younger children may then decrease as the show becomes more familiar. Because of their general experience, the older children are already using the formal features to actively guide their attention. Their attention will probably decrease since the show will be becoming more familiar, simple, wholistic, redundant, repetitive, and expected. In addition, the motivation to watch it will decrease since it is obvious what will happen.

Predictions

Since there is no previous research on how attention in preschool children changes over the course of repeated viewings of a whole television show, predictions about what will happen must be made based on theory and by extending related research. Singer's (1980) theory predicts generally decreasing attention. Anderson and Lorch (1983) and Huston and Wright

(1989) predict increasing attention in younger viewers and an inverted-U function or decreasing attention in older viewers. According to the repeated reading literature, children's attention changes focus as the stories become more familiar. The child's attention should change focus as the show becomes more familiar. This suggests that there should be systematic changes in attention to different parts of the program with repetition. This study will look at how attention changes over repetition.

The Experiment

This study will examine changes in looking at the television screen as three to five year olds repeatedly watch the same episode of *Blue's Clues*, a curriculum-based show for preschoolers, once a day for five consecutive days. *Blue's Clues* is designed for two to five year old children, with the modal age being four, and is intended to teach thinking skills to preschoolers. In discussing the analyses, I will assume that the show was successful at obtaining this goal of being optimally designed to teach four-year-olds. In the program, Steve, the human host, encourages viewers to help him solve problems and play games with his animated puppy, Blue. The program is designed to encourage high levels of interaction from viewers.

This study is part of a larger project that concerns the effects of repeatedly watching the same episode of *Blue's Clues*. The larger study examines attention, interaction, and comprehension. The present study focuses only on visual attention in a group that watched the episode for five consecutive days.

The analysis tests theoretically based predictions about changes in the overall level of attention. A more detailed analysis will breaks the episode into content defined segments.

Singer (1980) would predict a steady decrease in the overall amount of attention for all ages, regardless of the content. Anderson and Lorch (1983) and Huston and Wright (1989) would predict an age by exposure interaction for both overall attention and attention to certain content segments. Assuming that the modal age is four, they would predict that the attention of the three-year-olds would increase as the content became more comprehensible. The attention of the four-year-olds would follow an inverse-U shaped function, as the content becomes more comprehensible, and then too comprehensible with increased familiarity. The attention of the five-year-olds would steadily decrease as the initially comprehensible material becomes boring.

CHAPTER 2

METHOD

Design

The aim of this study is to examine preschoolers' viewing behavior and comprehension as a function of repeated exposure to an episode of a curriculum-based television show. Three, four, and five-year-olds participated in this study. The television program was *Blue's Clues*, a preschool show designed to elicit interaction and improve cognitive skills. A repeated-exposure group watched the program once a day for five consecutive days. This is the only group that will be studied in this paper. A one-exposure group watched the program once. A control group watched an episode of *The Busy World of Richard Scarry*, a preschool television program that does not emphasize cognitive skills or interactivity. The overall design was 3(age) X 2(sex) X 3(viewing condition) between-subjects. In addition, the study allows for separate 3(age) X 2(sex) X 5(viewing session) mixed design comparisons of videotaped viewing behaviors in the repeated-exposure group. In this paper, only the 3(age) X 2 (sex) X 5 (viewing session) mixed design comparisons of looking behavior will be analyzed.

Participants

Participants were recruited from three day-care-centers in New York and Connecticut. Permission slips were sent home with the children, and the sample was selected from the returned permission slips. The 108 participants included 36 three-year-olds (range 2 years, 11 months to 3 years, 11 months; mean age

was 3 years, 7 months; 13 females), 38 four-year-olds (range 4 years, 0 months to 4 years, 11 months; mean age was 4 years, 6 months; 18 females), and 34 five-year-olds, (range 5 years, 0 months to 5 years, 10 months; mean age was 5 years, 3 months; 16 females). 40.7% of the participants were African-American, 36.1% were Caucasian, 21.3% were Hispanic, and the rest (1.9%) were Asian-American. The participants were assigned to one of the three experimental or control groups based on their age, sex, and ethnicity. For example, three children of the same age, sex, and ethnicity would be put in three different experimental groups. Unfortunately, there were not enough participants to match perfectly by these criteria, so six of the children were assigned randomly. They were put in triads where the other two participants were the same age, sex, and ethnicity, but the randomly assigned child differed in one or more of the variables. In the control group, there were 12 three-year-olds (4 females), 12 four-year-olds (6 females), and 12 five-year-olds (6 females). In the one-exposure group, there were 12 three-year-olds (5 females), 14 four-year-olds (8 females), and 10 five-year-olds (4 females). The repeated-exposure group, which provides the data for this thesis, had 11 three-year-olds (mean age 3 years, 7 months, range 3 years, one month to 3 years 11 months; 3 females), 13 four-year-olds (mean age 4 years, 5 months, range 4 years 0 months to 4 years 9 months; 6 females), and 12 five-year-olds (mean age 5 years, 3 months, range 5 years 0 months to 5 years 6 months; 6 females).

In order for there to be enough participants in the repeated-exposure group, more children were recruited for this group than were actually needed.

Of the 52 participants who watched on the first day, there were 36 who watched all five days and were tested. Fourteen were dropped because of absence, and 2 were not tested although they did watch from the first to the fourth day and were present on the fifth. In addition, there were 13 children who were in the control or one-exposure group who completed the session but were not used in the final sample. One child was dropped because of equipment failure.

Setting

Participants were recruited from three different day care centers. One, in Stamford, Connecticut, provided 60 participants (19 in the repeated-exposure group). Another, in Queens, New York City, provided 20 participants (7 in the repeated-exposure group). The third provided 28 participants (10 in the repeated-exposure group) from Harlem, New York City. In every school the children were taken to a room in the day care center that was quiet and away from most distractions. In the Connecticut school, two rooms were used. One room was a conference room, and the other was an unused computer room. In the Queens school, different classrooms that happened to be empty that day were used. In the Harlem school, three different rooms were used. One was an office, one was the teacher's lounge, and the other was the nurse's office. In the Connecticut school, the repeated-exposure participants watched in the same room all five days. However, because of lack of availability of empty rooms in the other two schools, some repeated-exposure children watched in different rooms on different days.

Video Setup

The television was set up near an electrical outlet, and the video camera was on a tripod next to the television. The participant was seated on the floor directly in front of the television, with crayons, paper, and blocks in front of the child. The experimenter sat behind or next to the camera, in order to move it if the child moved out of camera range. Video recording equipment was used to record the children's watching of the television shows and interviews. The television and VCR were provided by the schools.

Materials

Blocks, crayons, and paper were provided by the schools. The experimental tape was episode 101 of *Blue's Clues*, with a running time of 24 minutes 30 seconds. In this show, a human host (Steve) guides children through his animated world solving problems left by his puppy Blue. In this episode, Blue gives Steve and the viewers three clues to try to figure out what Blue wants to drink with her snack. On the way, Steve and Blue invite viewers to help elephants paint their family (using color knowledge), help characters put food of different shapes away (using shape recognition), and help chicks find their friends with matching hats (using matching skills). The series had not yet been telecast at the time of the study.

Procedure

Children were brought to the viewing room individually. The child was seated on the floor in front of the television, approximately 1 meter from the screen, with paper, crayons, and blocks within reaching distance. The

experimenter talked to the child for a few minutes and then played the videotape. During the program, interaction with the child was kept to a minimum. If the child asked a question or directed a comment to the experimenter, she would indicate that she was doing work and that the child should go back to playing or watching television. While the program was in progress, the experimenter recorded any interaction the child directed toward the television. After the video ended, children in the repeated-exposure group were taken back to class. They were told that they would be able to come back and watch the next day. On the fifth day, they were tested after viewing. The children of the control and one-exposure groups were tested after their first viewing session. Following the last viewing session, each child was given a comprehension test. The data from this test are not part of this thesis.

Coding

The Super-8 or Hi-8 tapes that were used to record the children were dubbed onto standard VHS videotapes to which standard vertical interval and longitudinal time code was added. The time code allows for frame accurate computer-assisted coding.

Visual attention was coded on a continuous basis. Coders advanced the tape to the exact frame where the participant began a look to the television. The coder then pressed a button on the computer and held it until the look ended. The computer recorded the video frame numbers concurrent with the button push and release. A look is defined as visual orientation toward the television. Because of the clarity of these tapes, there was little difficulty in deciding where

the participant is looking. However, there were some parts of the session where the coder was uncertain about where the participant was looking, as in when the participant moved out of camera view. Here, the coder pressed a button on the computer at the exact frame that the uncertainty began, and released it at the exact frame where it ends.

CHAPTER 3

RESULTS

Interobserver Reliability

Prior research with this methodology (e.g. Anderson & Levin, 1976) has found high levels of interobserver reliability for assessing looking at TV. Nevertheless, interobserver reliability for the present research was assessed by having each of the four coders code a tape in common. Interobserver reliability was estimated as the phi correlation. The phi correlation ranged from .97 to .99, which is in accordance with previous research.

Uncertainty

The percent of coder uncertainty for each session was measured. The mean percent uncertainty was .57%, with a range from 0% to 15.17%. A 3 (age) X 2 (sex) X 5 (exposure number) ANOVA revealed no significant effects of uncertainty. Because uncertainty appeared to be randomly distributed across conditions, it was handled in the following manner: Episodes of uncertainty that were preceded and followed by looks were treated as a look. That is, if the child was looking the moment before the uncertainty began, and was still looking the moment it ended, it was treated as one uninterrupted look. Episodes of uncertainty that were preceded and followed by pauses (periods between looks at the television) were treated as an uninterrupted pause. The first half of episodes of uncertainty that were preceded by a look and followed by a pause were coded as a look, and the second half were coded as a pause. Likewise, the first half of episodes of uncertainty that were preceded by a pause and

followed by a look were coded as a pause, and the second half were coded as a look.

Missing Session

There was one session that was missing due to a lost tape. The fourth session of a three-year-old, Hispanic male was lost. The missing data point was estimated using the following formula: $X_{pq} = (nT_p + aT_q - T..) / ((n-1)(a-1))$, where X_{pq} is the estimated score, n is the number of subjects (36), T_p is the sum of the scores the subject provided, a is the number of sessions (5), T_q is the sum of the scores provided by all the other subjects in the fourth session, and T.. is the total number of scores provided by all the other subjects in all of the sessions. This formula allows for using the scores of all the participants during the fourth session, as well as the missing participant's other scores, in estimating the missing score. Using this formula, scores were estimated for the missing participant's percent attention, average look length, number of looks, and average pause length. Because this score was estimated, in the testing of any analysis that involves this score, the degrees of freedom of the error term were reduced by one.

Looking Measures

All statistics that are reported are significant at $p < .05$ unless otherwise noted. Percent looking was measured as the number of frames looking at the screen divided by the total number of frames in the program times 100. Overall looking was tested using a 3(age) X 2(sex) X 5(exposure number) ANOVA on percent look. The Mauchly sphericity test showed that the sphericity assumption

was violated ($W = .35457$, $p < .001$). Thus, the degrees of freedom were corrected using the Greenhouse-Geisser Epsilon ($\varepsilon = .66466$). As shown in Figure 1, a significant age x exposure effect was found, $F [5.32, 79.09] = 2.78$. Additional one-way ANOVAs were done for each age group to determine the nature of this effect. There were no significant effects for the three-year-olds or the four-year-olds. However, there was a significant decrease in the looking of the five-year-olds over the five sessions, $F [4, 44] = 3.98$. Note that the main effect of exposure number was not significant. Only the older children had significantly decreasing attention over the five exposures.

The 3 (age) X 2 (sex) X 5 (exposure number) ANOVA on percent attention showed that there was a significant interaction of age and exposure number. According to some of the theories, this might be because of a linear decrease in the attention of the older children, while the younger children's attention showed a linear increase or a quadratic trend. Thus, trend analyses on percent attention were also done. There were no linear or quadratic trends in the overall data. Further, the slope of the line showing the effect of exposure on percent attention did not differ significantly from 0 (slope = -1.39, $t = -1.538$, 95% confidence interval = [-3.17, .39]). Thus, there were no overall trends or effects of exposure, which was expected since there was no main effect of exposure in the original ANOVA. However, a linear trend significantly varied as a function of age ($F [2, 30] = 4.26$). Separate analyses for each age showed no linear effect for the three-year-olds or the four-year-olds. Also, the slope for the effect of exposure on percent attention of the three-year-olds was found to be 1.87, which is not

significantly different from 0 (t = 1.746, 95% confidence interval = [-1.54, 5.27]). The slope for the four-year-olds was –2.06, which was also not significantly different from 0 (t = -2.277, 95% confidence interval = [-4.93, .818]). This indicates that there is no effect of exposure number on percent attention for the three-year-olds and the four-year-olds. However, there was a significant linear effect found for the five-year-olds (F [1, 11] = 15.06), as expected by theory. Also, the slope for the five-year-olds was negative and significantly different from 0 (slope = -3.27, t = -5.047, 95% confidence interval = [-5.33, -1.2]), indicating decreasing attention. Although some of the theories predicted an interaction of age and quadratic trend, none was found.

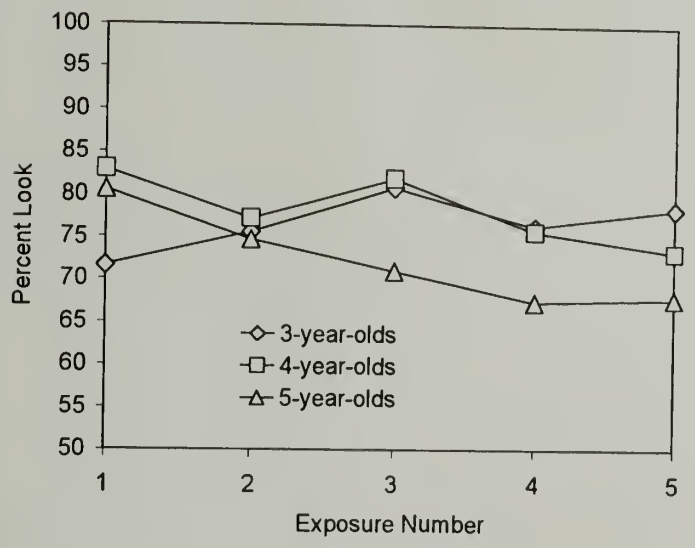

Figure 1. Percent Looking as a Function of Exposure Number and Age

Number of looks was defined as the total number of looks during the entire episode of *Blue's Clues*. A 3(age) X 2(sex) X 5(exposure number) ANOVA on number of looks violated the sphericity assumption ($W = .45029$, $p < .007$, $\varepsilon = .72967$). There was an overall exposure number main effect for number of looks, $F [2.92, 86.83] = 4.27$ (see figure 2). The test also revealed a marginally significant age X exposure interaction ($F [5.84, 86.83] = 2.05$, $p = .0693$). Separate one way ANOVAs for each age group indicated that the five-year-olds had a significant change in number of looks over the five sessions, $F [4, 44] = 9.23$, as shown in Figure 3 on the next page. There were no significant effects for the three-year-olds or the four-year-olds.

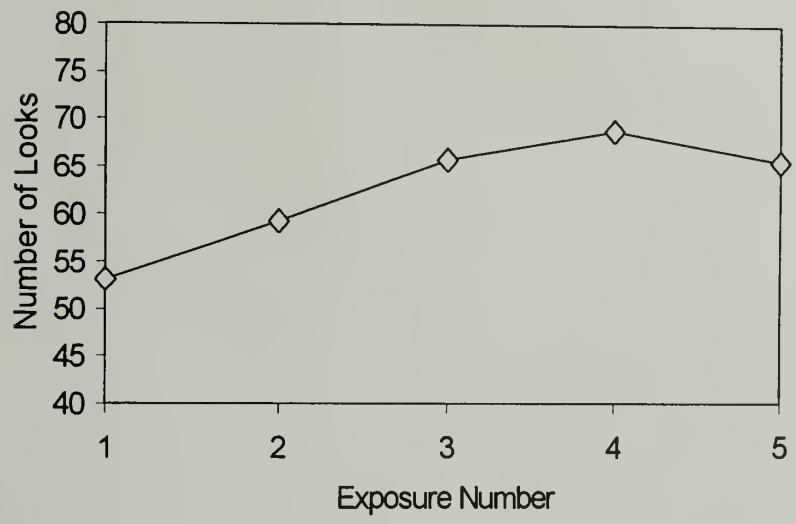

Figure 2. Number of Looks as a Function of Exposure Number

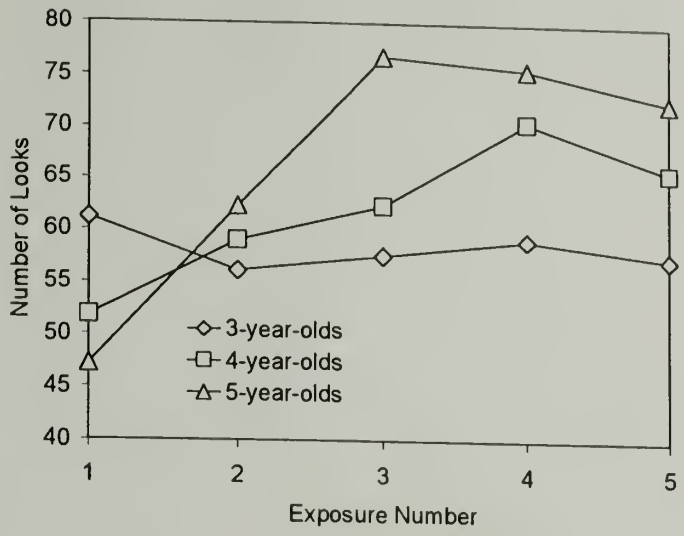

Figure 3. Number of Looks as a Function of Exposure Number and Age

3(age) X 2(sex) X 5(exposure number) ANOVAs were also run on average look length and average pause length. Although there were no significant effects, the average look length did decrease over the five exposures (see Table 1 on next page).

Education vs. Entertainment

The show was broken down into content units, and each content unit was determined to be either educational or entertainment (see Appendix A, page 45). Because some of the content units were very short, uncertainty was ignored for the rest of the analyses. That is, periods of uncertainty were deleted from each content unit, and the total length of the content unit was determined by subtracting the uncertainty.

Table 1. Average Look Length (in seconds) as a Function of Exposure Number and Age

	Exposure Number				
Age	1	2	3	4	5
3	23.59	37.06	34.44	29.21	29.29
4	35.99	30.09	30.83	24.38	23.78
5	41.84	38.38	24.96	27.73	18.78
Total	34.15	34.99	29.98	27.19	23.80

For example, if a content unit was originally 30 seconds long, and there was 5 seconds of uncertainty for a given child, the total length of the unit was considered 25 seconds long for that child. If the child was looking at the television for 15 seconds of the content unit and looking away for 10 seconds, the percent attention would be (15/25)*100 = 60%. Because the periods of uncertainty interrupt looks and pauses, average look length and number of looks were not analyzed for these data.

A 3(age) X 2(sex) X 2(content type: educational vs. entertainment) X 5(exposure number) ANOVA on percent attention was done. In tests involving

the exposure within-subject effect, the sphericity assumption was violated (W = .34545, p = .000, ε = .67990). The interaction of age X exposure was significant (F [5.45, 80.91] = 2.88), which was expected considering the significant age by exposure effect on the overall percent attention. There was a significant main effect of content type (F [1, 30] = 5.42) due to greater attention to the educational units than the entertainment units (mean educational = 78.58%, mean entertainment = 74.88%). This is mediated by a significant exposure by content type interaction (F [4, 119] = 3.78), where more attention was paid to the educational units than the entertainment units for the first three exposures. Bonferroni tests revealed that the differences between attention to the two content types were significantly different for the first (t (35) = 3.61, p = .001) and third (t (35) = 3.03, p = .005) exposure. The difference was nearly significant for the second exposure (t (35) = 2.64, p = .012). Attention to the two content types was not significantly different for the fourth and fifth exposure (see Figure 4).

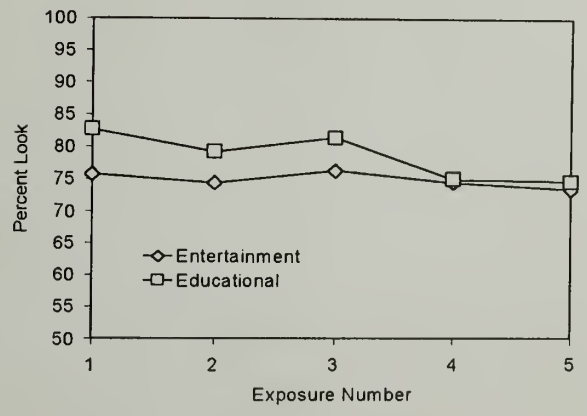

Figure 4. Percent Looking as a Function of Exposure Number and Content Type

Content Units

Separate 3(age) X 2(sex) X 5(exposure number) ANOVAs were also run on each content unit to determine if certain content units elicited any systematic changes in attention over the five days. There were no meaningful effects across the content units, although the results of some of the ANOVAs were significant. These results are shown in Appendix B (page 46).

As can be seen in Figure 5, the pattern of visual attention to each content unit is similar for the first and the fifth exposure. Recall, however, that the visual attention of the five-year-olds dropped significantly over exposures. Figure 6 on the next page shows that this was not due to decreases in attention in specific content units. Rather, this drop is due to general decreases in overall attention to the show.

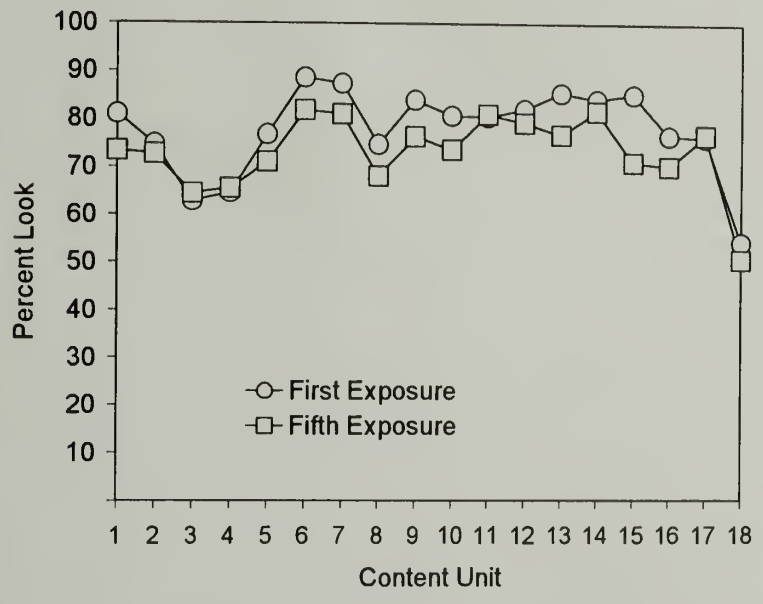

Figure 5. Percent Looking to Each Content Unit for the First and Fifth Exposure

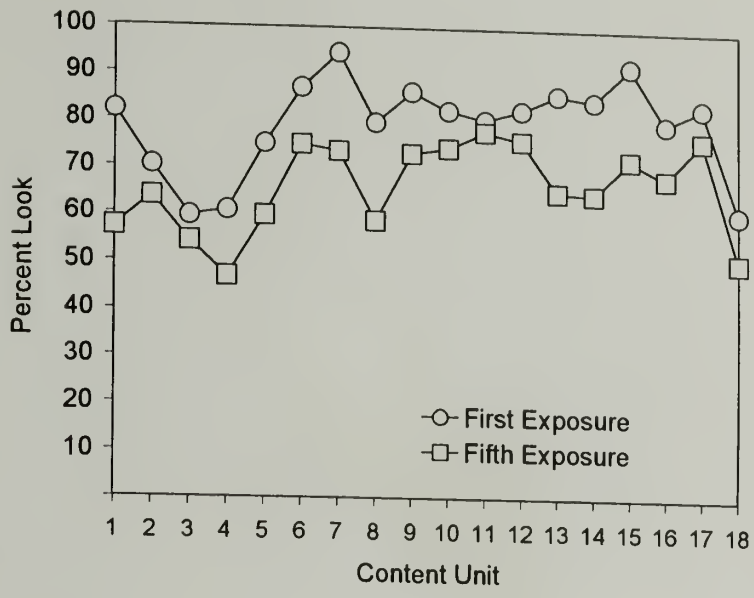

Figure 6. Percent Looking by the 5-year-olds to Each Content Unit for the First and Fifth Exposure

CHAPTER 4

DISCUSSION

The goal of this thesis was to describe what happens to preschoolers' visual attention over repeated viewings of a television show. Preschoolers watched the same episode of *Blue's Clues* once a day for five days, and their visual attention to the show was measured. Overall, looking at the show remained constant over the five days. The number of looks increased over the first four exposures.

These overall results were qualified by significant age by exposure effects. As repetition number increased, the number of looks by the five-year-olds increased, while their percent looking decreased. Their looks became shorter and more frequent. (Although there were no significant effects of average look length, Table 1 shows that the average look length of the five-year-olds did decrease over the repetitions.)

The show was divided into content units, and each was designated as an entertainment or an educational unit. Percent looking at the educational units was compared to looking at the entertainment units. More attention was paid to the educational units than the entertainment units overall. However, the significant content type by exposure interaction showed that more attention was paid to the educational units for only the first three exposures. Attention was equal to the two content types for the fourth and fifth exposure.

Summarizing, when younger preschoolers repeatedly watch the same episode of a television show designed for four-year-olds, their attention remains

relatively constant. The attention of older preschoolers drops. More attention is initially paid to educational units, which then drops to the level of that for entertainment units.

Recall that Singer's theory would predict steadily decreasing attention over repetitions, regardless of the age of the child. The orienting reflex would not be elicited because the stimuli would not be novel. In the present study, however, the attention of the younger children remained constant over the repetitions. Only the five-year-olds had steadily decreasing attention over repetitions.

Singer's theory would not predict any differences between looking at entertainment units and looking at educational units, as there should not be any differences in the number of formal features that elicit the orienting response in the two types of units. There was a difference in looking at the two types of units in this study, suggesting either that this theory can not account for the result, or that there are more features that elicit the orienting response in the educational units. However, percent looking to the educational units decreased to the level of looking at the entertainment units over the five repetitions. Singer's theory would explain this by suggesting that the children are habituating to the features in the educational units. However, the percent looking to the entertainment units remained relatively constant. It is unlikely that there were no formal features for the children to habituate to in the entertainment units. It is just as unlikely that the children did not habituate to the formal features that were present in the

entertainment units. Thus, this theory can not account for the findings of this study.

The prediction for what happens over repetition using Anderson and Lorch's theory was that the attention of the younger children would increase, while the attention of the older children would decrease. Younger children would comprehend more over the repetitions, resulting in greater attention, while the show would become more predictable for older children, resulting in less attention. The attention of the five-year-olds did decrease, which is what the theory would predict. However, the attention of the younger children remained constant. Although not predicted using this theory, the constant attention of the younger children could still be explained by this theory. If this theory is correct, then the results would indicate that the comprehension of the children did not increase over the five exposures. Intuitively, this seems unlikely. Thus, this theory also can not account for these results.

This theory would predict differential looking at the entertainment and educational units over the five days. Assuming that the educational units are initially less comprehensible than the entertainment units, this theory would predict that the children would initially look more at the entertainment units than the educational units. As repetition number increased, and children became more familiar with the show, the educational units would become more comprehensible, and looking would increase. The entertainment units would become more predictable, and looking would decrease. This study showed that initially, there was more looking at the educational units than the entertainment

units. Over repetitions, looking at the educational units decreases, while looking at the entertainment units remains steady. The only way that this theory could account for these results would be if the educational units were initially more comprehensible than the entertainment units, and the comprehensibility of the entertainment units did not change over the repetitions. It is unlikely that repeated exposure would not increase comprehensibility. It is also unlikely that the educational units were more comprehensible than the entertainment units. Thus, this theory also can not account for the results found in this study.

According to Huston and Wright's theory, formal features guide the attention by eliciting the orienting response in the younger viewers, while older children guide their own attention using formal features as cues. This theory would predict that over repetitions, younger children's attention would increase as they learn to guide their own attention to the episode. Further, the attention of the older children would decrease as the show became more predictable. The decreasing attention of the five-year-olds does fit this theory's predictions. However, the attention of the younger children remained constant, which is not what would be predicted by this theory. The way this theory could explain that discrepant result is that initially, attention was high because the orienting reflex was triggered. However, after habituation, the attention did not decrease. This is because the children were now cognitively guiding their own attention to the television. They had enough information about this particular show to comprehend it, so attention did not decrease.

This theory would predict age differences in attention to the educational and entertainment units of the show. Since formal features guide younger childrens' attention, and it is assumed that there are no differences in formal features in the two types of units, there should be no differences between looking at entertainment and educational units for younger children. Since older children are cognitively guiding their own attention, partly using comprehension as a factor, they should have the differing attention to the two types of units that was discussed previously in the section on Anderson and Lorch's theory. However, there were no age differences in looking at the entertainment and educational units in this study. This could be explained by this theory in that the orienting responses of all the children are being elicited. However, then the prediction for what would happen follows the predictions of Singer's theory, and Singer's theory could not account for these results. Thus, this theory can not account for the differential looking to the educational and entertainment units. For the overall results, though, this theory seems to be the one that can best account for the results after the fact. The theory's complexity, however, prevents confident a priori testable predictions.

The reading literature suggested that over repetitions of stimuli, children might focus on different aspects of the show. Some parts would become more comprehensible, and some would become more predictable. This does not seem to be the case here. However, looking did change in relation to type of content. More attention was initially paid to the educational content than entertainment content, but by the fourth exposure, there was no difference in the

attention to the two types of content units. However, there is an overlap in that both types of units were designed to elicit the most attention possible, insofar as educational units also contained significant entertainment for the children. For example, in the shape game, as soon as the child voiceover indicated which food was which shape, Blue would bound over to the refrigerator, holding that food in her mouth, while singing/barking a little tune. Although part of an educational segment, Blue's action was put in for entertainment purposes. Nonetheless, there was still a difference between the two content types for the first exposures, favoring the educational content.

These results are not fully explained by theory or previous literature. There are some possible reasons. First, *Blue's Clues* is a highly interactive television program. Breaks in attention may result from behavioral interactions. According to the reading literature, children are more verbal over repetitions of a storybook. If children are more verbal over repetitions of a television show, that could account for the greater numbers of looks at the television as repetition number increased. The only other person in the room for the child to make comments to was the experimenter, and when the child was talking to the experimenter, s/he would usually break the gaze at the television.

Another explanation for why the number of looks of the five-year-olds increased so much is addressed in the Anderson and Lorch and Huston and Wright theories. Older children can use auditory cues to decide whether or not to watch a particular part of the television. The five-year-olds were making short, frequent looks at the television as they became familiar with the content.

They may have been monitoring the television for the most interesting parts of the show. Younger children may have had to watch more of the show to understand it even when it became familiar.

This study shows that younger preschoolers can watch the same episode of a television program over and over without losing interest. They also do not necessarily change the focus of what they are watching. Older children do lose interest, although they may frequently monitor the show for the parts that would be interesting to them.

In order to more fully understand the benefits and costs of repetition, more experimental work needs to be done. An important experiment would be to see what happens if a child watches five different episodes of *Blue's Clues* over five days. If comprehension of each show is the same as the comprehension of watching one show over the five days, then there is no benefit to repetition. Another manipulation would be to study what happens with a regular preschool show over repetitions. *Blue's Clues* is unique in that it is designed to elicit interaction. It is important to see what happens over repetition with a standard preschool show that is not designed to elicit interaction.

Common sense would dictate that even a preschooler's attention would drop over five repetitions of a preschool television show. However, this study shows that with a television show that is cognitively engaging like *Blue's Clues*, attention remains steady over five days. In an innovative programming strategy, the same episode of *Blue's Clues* is broadcast on Nickelodeon five times a week. The ratings do not generally decline during the week as the same

episode is repeated (M. Williams, personal communication, May 1997). This study, along with the rating information, shows that children seem to be able to get enough information out of each viewing to remain interested in watching the same episode throughout the week.

The fact that three and four-year-old children can watch a twenty-four minute program five times without having a decrease in attention raises some interesting questions about the psychology of children that age. What is it about early cognitive development that allows young children to keep their attention constant to the same stimulus? Both theory and common sense would predict that their attention would drop by the fifth repetition, but it did not. This study suggests that younger children seem to process information differently than older children and adults. The word "again" is learned early in a child's life, and this seems to serve a very important purpose. Young children are constantly asking to be re-read the same story, to re-play the same games, and to re-watch the same videos. This greatly aids their learning process, by helping them to encode and integrate information that was lost after the first exposure to the stimulus. Thus, repetition is an important tool for the enrichment of preschoolers, and has been underestimated in the theories of early cognitive development.

APPENDIX A

CONTENT UNITS FOR EPISODE 101 OF BLUE'S CLUES

Unit	Begin frame (h:mm:ss.ff)	End frame (h:mm:ss.ff)	#frames (#secs)	Description	Entertainment vs Educational
1	0:00:00.01	0:00:30.16	916(30)	Standard Open	Entertainment
2	0:00:30.17	0:02:18.02	3226 (107)	Setting up clue game	Entertainment
3	0:02:18.03	0:02:38.25	623 (20)	Notebook	Entertainment
4	0:02:38.26	0:03:32.18	1613 (54)	Song	Entertainment
5	0:03:32.19	0:05:03.09	2721 (90)	First clue	Educational
6	0:05:03.10	0:05:53.11	1502 (50)	Blue hiding under bed	Entertainment
7	0:05:53.12	0:07:57.20	3729 (124)	Color game	Educational
8	0:07:57.21	0:08:38.02	1212 (40)	Telephone ring/Steve fall down	Entertainment
9	0:08:38.03	0:11:21.24	4912(163)	Shape game	Educational
10	0:11:21.25	0:13:43.13	4249(141)	Finding second clue	Educational
11	0:13:43.14	0:15:13.24	2711(90)	Getting mail	Entertainment
12	0:15:13.25	0:16:07.23	1619(54)	Going into picture	Entertainment
13	0:16:07.24	0:18:31.27	4324(144)	Matching game	Educational
14	0:18:31.28	0:18:48.22	505(16)	Blue hiding on Steve's head	Entertainment
15	0:18:48.23	0:20:26.22	2940(98)	Finding third clue	Educational
16	0:20:26.23	0:22:15.20	3268(109)	Thinking chair	Educational
17	0:22:15.21	0:23:11:21	1681(56)	Eating snack/recap	Entertainment
18	0:23:11.22	0:23:49.21	1140(38)	Goodbye song	Entertainment
19	0:23:49.22	0:24:30.00	1209(40)	Credits	

APPENDIX B

ANALYSIS OF CONTENT UNITS

Separate 3(age) X 2(sex) X 5(exposure number) ANOVAs were run on each content unit. Significant effects were found in the following content units.

Unit 6

In this unit, Blue is hiding from Steve under the bed. This unit was designated an entertainment unit (see Appendix A, page 45). The sphericity assumption was violated in this analysis ($W = .26394$, $p = .000$, $\varepsilon = .59187$). There was a significant age by exposure effect on this content unit ($F [4.73, 70.43] = 2.64$, see Figure 7 on the next page). Separate ANOVAs were run for each age group to determine how attention changed to this unit at each age. No significant results were found for three-year-olds or five-year-olds. However, there was a marginally significant result for the four-year-olds. Sphericity was again violated ($W = .03285$, $p = .000$, $\varepsilon = .46964$) in this analysis. There was a marginally significant effect of exposure for the four-year-olds ($F [1.88, 22.07] = 3.14$, $p = .0658$).

Unit 7

In this unit, the Blue is helping elephants paint their family. This is an educational unit involving color knowledge. Sphericity was violated ($W = .46162$, $p = .009$, $\varepsilon = .75994$). There was a marginally significant age by sex by exposure interaction ($F [6.08, 90.43] = 1.90$, $p = .0884$). As shown in

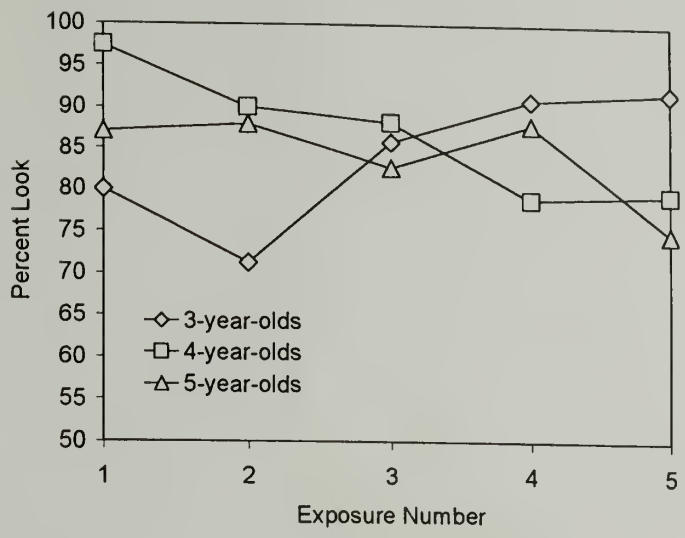

Figure 7. Percent Looking to Unit 6 as a Function of Exposure Number and Age

Figure 8 (see next page), there was a significant age by exposure interaction (F [6.08, 90.43] = 2.34). Additional 2(sex) X 5(exposure number) ANOVAs at each age revealed no significant effects for the three-year-olds. There was also a significant effect of exposure for the five-year-olds (F [4, 40] = 3.46). There was a significant sex by exposure effect for the four-year-olds (F [4, 44] = 3.48). Further analysis of this effect revealed that the girls had a marginally significant effect of exposure, where their attention decreased over the five sessions (F [2.28, 13.70] = 3.38, p = .0596), but the boy's attention remained constant. (There was a violation of the sphericity assumption, W = .0072, p = .01, ε = .57068).

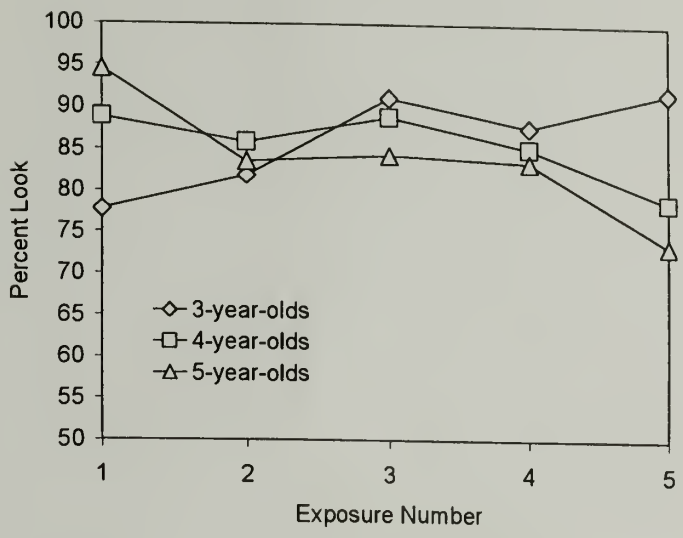

Figure 8. Percent Looking to Unit 7 as a Function of Exposure Number and Age

Unit 9

In this educational unit, shape knowledge is used in a food game. A 3 (age) X 2 (sex) X 5 (exposure number) ANOVA revealed a significant three-way interaction (See Figures 9 and 10 on the next page). 2 (sex) X 5 (exposure number) ANOVAs were run to find the nature of the three-way interaction. There were no significant results for the three-year-olds. There was a significant sex by exposure interaction for the four-year-olds, $F [4, 43] = 4.75$. There was a significant sex main effect for the four-year-olds, $F [1, 11] = 4.93$. The mean percent attention for the four-year-old girls was 77.14%, while the mean for the four-year-old boys was 92.53%). There was also a significant exposure main effect, $F [4, 43] = 2.64$. There was also an exposure main effect for the five-year-olds ($F [4, 40] = 4.13$).

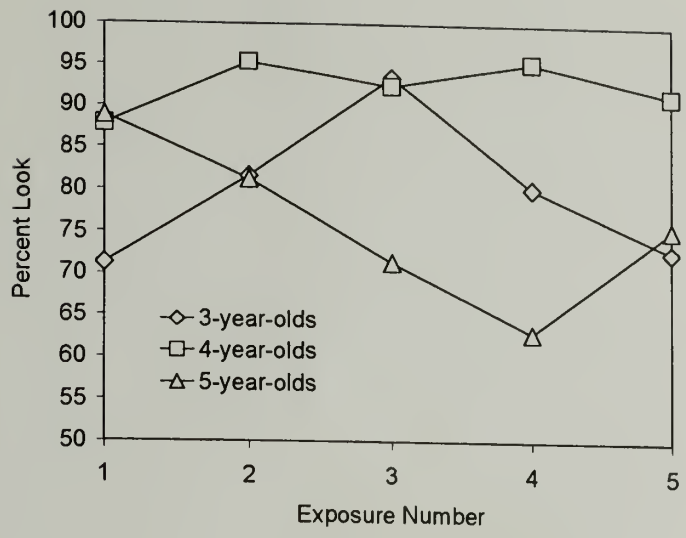

Figure 9. Boys' Percent Looking to Unit 9 as a Function of Exposure Number and Age

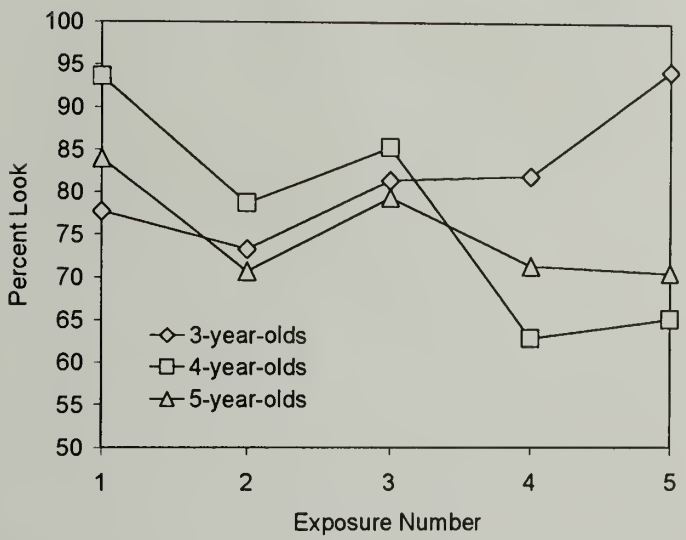

Figure 10. Girls' Percent Looking to Unit 9 as a Function of Exposure Number and Age

Unit 10

In this educational unit, Steve finds and processes the second clue. Sphericity was violated (W = .53038, p = .035, ε = .73105). There was an age by exposure effect (F [5.85, 86.99] = 2.54, see Figure 11). Further ANOVAs on each age showed a significant exposure effect for the five-year-olds, (F [4, 44] = 4.51). There were no significant results for the three-year-olds or the four-year-olds.

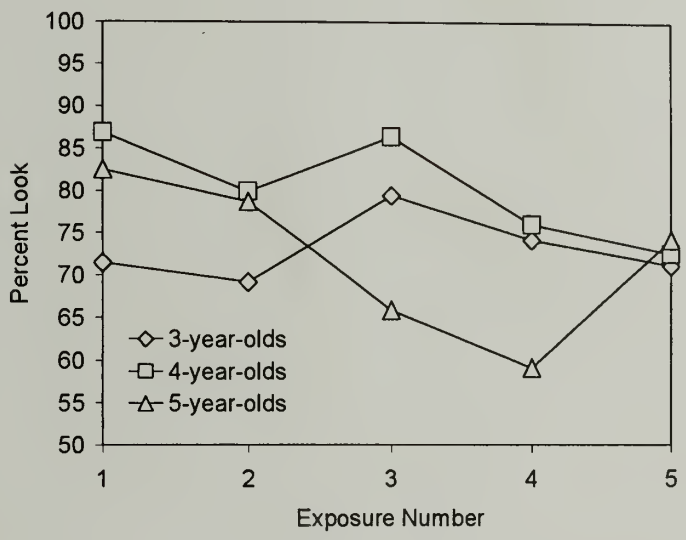

Figure 11. Percent Looking to Unit 10 as a Function of Exposure Number and Age

Unit 13

In this educational unit, matching knowledge is used in a game where chicks need to find their friends who are wearing the same hats. The 3 (age) X 2 (sex) X 5 (exposure number) ANOVA on this content unit violated sphericity (W = .35304, p = .001, ε = .64539). There was a marginally significant age by exposure interaction (F [5.16, 76.80] = 1.97, p = .0916, see Figure 12 on page 51). Separate one-way ANOVAs at each age showed no significant effects for the three-year-olds or four-year-olds. The analysis for the five-year-olds violated the sphericity assumption (W = .10832, p = .013, ε = .60032). There was a significant main effect of exposure for the five-year-olds (F [2.4,26.42] = 3.86).

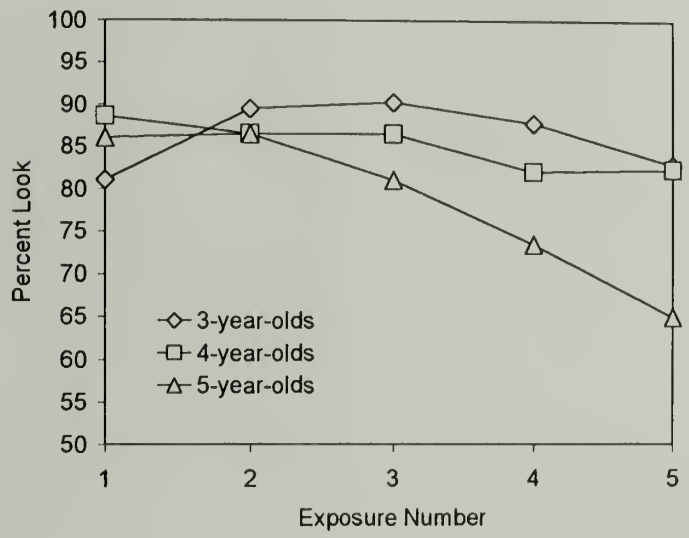

Figure 12. Percent Looking to Unit 13 as a Function of Exposure Number and Age

Unit 15

In this educational unit, Steve finds and processes the third clue. There was a main effect of exposure (F [4, 119] = 2.80, see Figure 13 on next page).

Unit 18

In this entertainment unit, Steve and Blue are singing the goodbye song. There is a significant between-subjects effect of age by sex (F [2, 30] = 4.03, see Figure 14 on next page). There was also a main effect of sex, where the boys watched this unit significantly more than the girls (mean boys = 56.31, mean girls = 44.57).

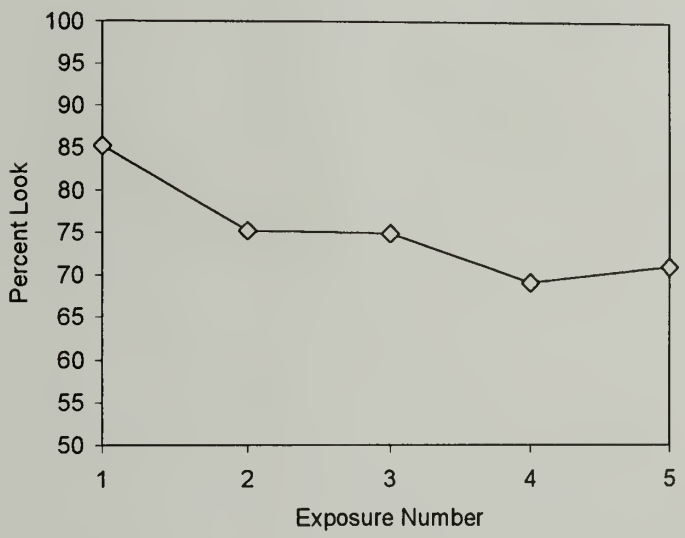

Figure 13. Percent Looking to Unit 15 as a Function of Exposure Number

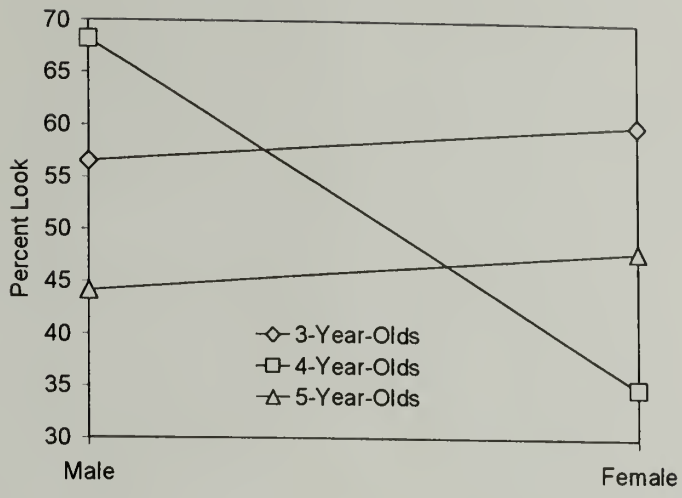

Figure 14. Percent Looking to Unit 18 as a Function of Sex and Age

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