Infants' Attention and Responsiveness to Television Increases With Prior Exposure and Parental Interaction

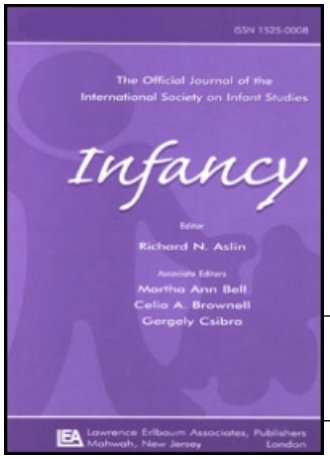
Article *in* Infancy · January 2008

DOI: 10.1080/15250000701779378

4 authors, including:

Rachel Barr
Georgetown University
98 PUBLICATIONS **2,168** CITATIONS
SEE PROFILE

Amaya Garcia
New America
8 PUBLICATIONS **263** CITATIONS
SEE PROFILE



Infancy
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t775653654

Infants' Attention and Responsiveness to Television Increases With Prior Exposure and Parental Interaction

Rachel Barr [a]; Elizabeth Zack [a]; Amaya Garcia [a]; Paul Muentener [a]
[a] Department of Psychology, Georgetown University,

Online Publication Date: 01 January 2008

To cite this Article: Barr, Rachel, Zack, Elizabeth, Garcia, Amaya and Muentener, Paul (2008) 'Infants' Attention and Responsiveness to Television Increases With Prior Exposure and Parental Interaction', Infancy, 13:1, 30 — 56

To link to this article: DOI: 10.1080/15250000701779378
URL: http://dx.doi.org/10.1080/15250000701779378

Infancy, *13*(1), 30–56, 2008

ISSN: 1525-0008 print / 1532-7078 online
DOI: 10.1080/15250000701779378

Psychology Press
Taylor & Francis Group

Infants' Attention and Responsiveness to Television Increases With Prior Exposure and Parental Interaction

Rachel Barr, Elizabeth Zack, Amaya Garcia, and Paul Muentener
Department of Psychology
Georgetown University

This study examined the relation between early television exposure and parental interaction style during infant-directed television programs on 2 outcomes: infant looking time and infant responsiveness. By quasi-experimental design half of the 12- to 18-month-old infants had prior exposure to the program content and the other half did not. Cluster analysis based on parental verbalizations revealed 3 types of parental coviewing style: high, medium, and low scaffold. Looking time was significantly higher for infants previously exposed to these videos than for those who were not. Infant looking time was also significantly higher, and infants responded more, when parents provided high levels of scaffolding in the form of questions and labels or descriptions. The results suggest that both prior exposure and parental style are associated with infant attention and responsiveness to television and have important implications for both parents and television producers.

During the 1990s, television and video programs (e.g., *Teletubbies, Baby Einstein*) started to be produced specifically for infants. Currently, parents report that many infants begin consistently viewing such programs at 6 to 9 months of age, and those exposed to television spend between 1 and 2 hrs per day doing so (Rideout & Hamel, 2006; Rideout, Vandewater, & Wartella, 2003; Zimmerman, Christakis, & Meltzoff, 2007). Many of these infant-directed programs have been explicitly or implicitly marketed as educational and include segments that encourage parents to

Correspondence should be addressed to Rachel Barr, 301H White-Gravenor Building, Georgetown University, Washington, DC 20057. E-mail: rfb5@georgetown.edu

coview with their infants to enhance the potential educational value of the viewing experience (Garrison & Christakis, 2005). There has, however, been little systematic investigation on how these programs are being used by parents and how infants are responding to them (Garrison & Christakis, 2005). We discuss two theories that have attempted to account for how children allocate attention during television viewing: the social mediation of viewing theory and the sampling model of attention theory. Whereas the social mediation theory is based on findings from parent–infant joint book-reading studies and sampling model theory was initially developed to explain children's television viewing behavior, they might be useful starting points in the exploration of infants' allocation of attention to television. Both theories suggest that (a) attention to media content follows a gradual developmental trajectory, and (b) attention is mediated. However, the theories differ in their explanations of how attention is mediated.

THEORIES OF INFORMATION PROCESSING OF TELEVISION DURING EARLY CHILDHOOD

Social Mediation of Viewing

We use Vygotskian theory to argue that parents mediate children's processing of television and scaffold children's viewing of the televised content. According to Vygotsky (1978), all cognitive functions develop through social experiences. Specifically, once a child has mastered a skill in a supportive social context, the skill will be internalized, therefore enabling the child to apply this skill in new contexts. Word learning and knowledge acquisition are acutely sensitive to social cues provided during social interactions with a joint focus of attention (for review, see Baldwin & Moses, 2001). For example, by 1 year of age infants are highly attuned to cues such as body movement, eye gaze, and emotional tone and use such cues to identify the referent in word learning situations. According to such a theoretical approach, parents can mediate looking patterns toward television stimuli during infancy by directing their child's attention to specific content during coviewing. If this is the case, a higher degree of parental scaffolding during television coviewing should positively impact attention to and learning from television (Baldwin & Moses, 2001; Britto, Brooks-Gunn, & Griffin, 2006; Haden, Reese, & Fivush, 1996).

These predictions are based on research examining parent–infant interactions in the context of joint book-reading situations. For example, DeLoache and DeMendoza (1987) reported that during book reading with their 12-, 15-, and 18-month-olds, mothers began most interactions by first providing labels for objects. Results from an infant vocabulary checklist showed that mothers tended to ask only for labels they thought their child could produce. With increasing age,

however, the overall amount of labeling decreased, as both the complexity of descriptions and the number of questions increased. Verbal participation by infants also increased with age, but nonverbal participation remained stable. When children did take turns, mothers almost always responded with confirmations and corrections. DeLoache and DeMendoza concluded that parents provided structure in book-reading situations, but increased the demands on infants as infants' productive vocabulary increased.

Individual parents display different interaction styles during book reading with infants and preschoolers, and individual parents also vary in the degree to which their interaction style matches their child's current ability (Britto et al., 2006; Haden et al., 1996; Ninio, 1980). Ninio (1980) reported three dyadic interaction styles between mothers and their 17- to 22-month-old infants. Label elicitors used *what* questions and provided confirmations following the infant's response. Gesture elicitors used *where* questions, and the infant responded using a gesture (i.e., pointing), rather than a verbal response. Labeling mothers, however, focused mainly on giving labels and did not expect the child to participate. Ninio found that vocabulary acquisition was highest for children of the label elicitors. Other studies have also demonstrated that parents adjust their interactions as a function of both child familiarity with book content (Haden et al., 1996) and as a function of the specific genre of the book (Potter & Haynes, 2000). In particular, during reading of familiar books, 4-year-olds were more likely to participate and spontaneously comment on content without direct questioning from parents (Haden et al., 1996). Taken together, these findings provide the basis for the predictions made by the social mediation theory in regard to children's attention during parent–child coviewing of television.

There has, however, been only one small descriptive study to date that has directly examined parent–child interaction during television viewing. Lemish and Rice (1986) observed 16 children, ranging between 6 months and 2.5 years, in their homes over a period of 6 to 8 months. The authors found results similar to those reported in book-reading studies. Specifically, the authors reported high levels of labeling and descriptions of content, as well as infant responsiveness in the form of pointing and imitation, during parent–child coviewing. The authors concluded that television-related talk was associated with the program content, child characteristics (including age, language, and television exposure) and parent characteristics (including parental responsiveness and talkativeness). Although these data suggest parent–child verbalizations are associated with infant television viewing, a more systematic analysis is required.

Sampling Model of Attention

The sampling model of attention claims that attention to television is influenced by prior exposure to specific content and is mediated by the formal features unique to

television (Huston & Wright, 1983). Formal features are the auditory and visual production and editing techniques that characterize television, such as action, sound effects, and pacing (the rate of scene and character changes; Calvert & Scott, 1989; Huston & Wright, 1983; Rice, Huston, & Wright, 1982; Schmitt, Anderson, & Collins, 1999). Some features, such as sound effects and rapid action, are perceptually salient and likely to elicit attention, whereas other features, such as dialogue, are not salient but are important in processing the narrative (Huston & Wright, 1983). The sampling model of attention theory suggests that attention to television is initially directed by perceptually driven processing of these salient formal features.

With development and experience, however, children come to learn that different perceptually salient features serve to mark content for further processing, thereby increasing young children's processing of the content that immediately follows that feature (Anderson, Lorch, Field, & Sanders, 1981; Calvert, Huston, Watkins, & Wright, 1982; Huston & Wright, 1983; Rice et al., 1982). Through this process, toddlers and preschoolers learn to use features as guides to important plot-relevant content, influencing their decisions on how to allocate attention between television and toy play. Once this attention allocation decision is made, the child then becomes engaged with the television program and begins to process the information more deeply.

Huston and Wright (1983) also predicted that with repeated exposure, looking time to television programming would be maintained or possibly increase. This prediction was somewhat counterintuitive given that habituation studies using static and moving pictures typically show that looking time decreases with repeated presentations. Rather than habituate to repeated presentations of formal features, children might use their learned knowledge that formal features signal and mark specific media content as a means to reorient and maintain attention across the televised narrative (Richards & Anderson, 2004).

Consistent with the sampling model of attention theory, content predicts looking time. Studies have found that toddlers' attention to televised content increases and remains high in the presence of perceptually salient features such as children, puppets, singing, lively music, and sound effects, but decreases as the length of a segment increases, during low action, and during periods of adult narration (Anderson & Levin, 1976; Calvert et al., 1982; Huston & Wright, 1983; Schmitt et al., 1999). Developers of infant-directed programming have capitalized on these findings and have incorporated many salient features that have been shown to maintain toddlers' attention, such as sound effects and puppet characters, into their videos and DVDs.

Research has also shown that looking time and comprehension increase gradually with development and with repeated exposure to content (Anderson & Levin, 1976; Anderson et al., 1981; Crawley, Anderson, Wilder, Williams, & Santomero,

1999; Lemish, 1987; Richards & Gibson, 1997). When data are collected in a laboratory setting in the absence of parental mediation, children's looking time to a novel *Sesame Street* broadcast episode has been found to increase from 10% to 60% between the ages of 1 and 4 years (Anderson & Levin, 1976; Anderson et al., 1981; Lemish, 1987). Anderson and colleagues (1981) found that 3- and 5-year-olds attended significantly more to the correctly sequenced version of a *Sesame Street* episode than to any distorted versions, such as foreign or backward dialogue or randomly ordered shots. The authors concluded that the preschoolers comprehended the correctly sequenced version of the program and thus allocated more attention to it. Repeated presentations of the same television program also help to maintain attention, in part because comprehension increases across exposures until it finally reaches ceiling levels (e.g., Crawley et al., 1999). Crawley and colleagues (1999) showed 3-, 4-, and 5-year-olds an episode of *Blue's Clues*, once per day for 5 days. They indexed comprehension via responses to questions and also via child responsiveness. Although there were significant age-related differences in comprehension scores, comprehension at all ages increased with repeated exposure to the program. During infancy Richards and Gibson (1997) found that even after relatively short exposures to televised materials, 6-month-olds developed a familiarity preference to content. It is important to note, however, that looking time studies have not yet been conducted with newly developed infant-directed programs.

THIS STUDY

Typically, studies of social mediation theory measure infant interaction with parents and the media, and studies examining the sampling model of attention theory measure looking time. This study measured both behaviors and examined these behaviors using aspects from both theoretical perspectives. In this study, we examined how age, prior exposure, program content, and parental style are associated with infant attention as measured by both percent looking time and infant responsiveness to media content. In accord with both theories, we predicted that infants previously exposed to specific video content would have higher overall looking time to that video content relative to infants with no prior exposure. However, in accord with the sampling model of attention, we also predicted that perceptually salient features such as sound effects would result in higher looking time for all infants regardless of prior exposure to content (Huston & Wright, 1983; Richards & Anderson, 2004). We also predicted that individual parents would adopt different styles of interaction (Britto et al., 2006; Haden et al., 1996; Ninio, 1980) and that parent–infant interactions would vary as a function of the infant's age (DeLoache & DeMendoza, 1987) and familiarity with the program (Haden et al., 1996). In

accord with the social mediation theory, we predicted that higher levels of scaffolding, particularly in the form of questions and labels or descriptions, which have been shown to correlate with language outcomes in both book reading and television studies (DeLoache & DeMendoza, 1987; Lemish & Rice, 1986; Ninio, 1983), would also increase outcome variables of looking time and infant responsiveness.

To answer these questions we studied parent–infant interactions during viewing of two popular DVDs: *Baby Mozart,* from the *Baby Einstein* series, and *Kids' Favorite Songs 2* by Sesame Street Workshop. Both DVDs included formal features that had previously been found to enhance looking time in toddlers (Anderson & Levin, 1976), made implicit educational claims, encouraged coviewing, and were rated as high quality and age appropriate by parents in our sample. By quasi-experimental design, half of the participants at each age group had previously been exposed to the content of one of the two videos and half had not. We deliberately chose videos that were not narrated and did not have a story line as this reflects the content of most of the available infant-directed programming.

METHOD

Participants

One hundred and twenty 12-, 15-, and 18-month-old (57 boys) full-term healthy infants and their parents were recruited through commercially available records and by word of mouth. Forty infants (19 boys) were 12 months old (M = 12.62 months, SD = .31 months), 40 infants (21 boys) were 15 months old (M = 15.52 months, SD = .37 months), and 40 infants (17 boys) were 18 months old (M = 18.59 months, SD = .29 months). All participating caregivers were a parent of the infant (111 = mothers, 0 = fathers, and 9 = both parents or a parent and a grandparent). At the time of the study 33% of infants had one or more older siblings. Participants were African American (n = 6), Latino (n = 5), Asian (n = 6), White (n = 91), and of mixed descent (n = 12). The majority of infants were from middle- to upper-class, highly educated families. Their parents' mean educational attainment was 16.2 years (SD = 1.1) based on 99% of the sample, and their mean rank of socioeconomic status (Nakao & Treas, 1992) was 75.96 (SD = 13.13). Seventeen additional infants were excluded from the final sample due to experimenter error or interference (n = 6), equipment failure (n = 4), infant not remaining in the room for the duration of the presentation (n = 3), and an inability to transcribe the session because the parent and infant spoke in a language other than English (n = 4).

Materials

Infant-directed videos. Infant–parent dyads watched a portion of either *Baby Mozart* or *Kids' Favorite Songs 2*. The scenes were chosen because they were in the middle of the video. In *Baby Mozart,* simple toys are manipulated in time to the music of Mozart. Infants were shown from the beginning of Scene 3 to the end of Scene 6; the video presentation lasted 12 min, 57 sec. In *Kids' Favorite Songs 2, Sesame Street* puppets and children perform familiar songs such as "The Wheels on the Bus." Infants were shown from the beginning of Chapter 6 to the end of Chapter 9; the video presentation lasted 12 min, 36 sec.

Parent questionnaire. Parents were asked to provide demographic information such as occupation, ethnicity, educational attainment, and languages spoken at home. Parents were also asked to estimate their typical daily household television use and to name which television shows they viewed as high-quality programming for their infant's age group. They were asked to respond on a 4-point scale (*never/very rarely/once in a while/almost always*) how often they talked with their infant during television viewing. Finally, they were asked whether their infant had been exposed previously to the content from the *Baby Einstein* series or *Sesame Street* programming. If they answered yes, they were asked to estimate the age at which their infant first began viewing the content and the frequency with which their infant was exposed to the content on a weekly basis.

Procedure

Many of the participants in this study participated in other studies reported elsewhere (Barr, Garcia, & Muentener, 2007; Barr, Muentener, Garcia, Fujimoto, & Chavez, 2007). Infant–parent dyads were visited in their homes and tested under naturalistic conditions. The study was described to the parent and informed consent was obtained. We informed parents that we were examining how infants attended and responded to infant-directed programming and asked parents to interact with their infants during the video presentation as they typically would when viewing television. We did not inform parents that we were specifically interested in parent–infant interaction patterns. If parents asked whether or not they could speak to their infant, we answered that they should behave as they normally would while their infant viewed television, with the restriction that they remain in the room during the video presentation. Parents and infants were videotaped during the video presentation such that infants' faces and eyes were visible at all times. Siblings or other family members were also permitted to watch, as this would be representative of the infant's normal viewing environment. Following the video

presentation, an experimenter administered the parent questionnaire. Each visit lasted approximately 30 min.

Coding

Segment analysis. We did a scene-by-scene analysis analogous to the page-by-page episodes used as a unit of analysis in book-reading studies (e.g., DeLoache & DeMendoza, 1987). The segments were determined by the inherent structure of the DVDs. The *Baby Mozart* DVD was a series of brief clips accompanied by sound effects and longer clips timed to Mozart music. For example, a metronome, accompanied by the sound of ticking was followed by a segment showing toy seals moving around a mechanized staircase in time to Mozart music. Comparisons were made between the sound effects segments and the music segments. There were 13 segments, with an average length of 60 sec (*SD* = 50 sec) ranging in duration from 13 sec to 140 sec. The *Kids' Favorite Songs 2* DVD was divided by periods of dialogue and periods of singing. Throughout the video a song would be introduced by Elmo, followed by puppets or children singing the song. The songs were interspersed with conversation between puppets and children. The content was first broken into periods of singing and talking and then further broken into segments that included music, puppets, children, and animation. Because there were more categories, the *Kids' Favorite Songs 2* video was broken into 22 segments with an average length of 33 sec (*SD* = 29 sec) ranging in length from 9 sec to 115 sec. We coded looking time for each of the segments and the combined looking time across segments to obtain overall looking time for the following four categories: Baby Mozart sound effects, Baby Mozart music, Kids Favorites Children and Kids Favorites Puppets. A Pearson product–moment correlation yielded an interobserver reliability coefficient for the duration of the segment types of 1.0 for *Baby Mozart* and .99 for *Kids' Favorite Songs 2*.

Infant Behaviors

Looking time. Percent looking time, measured from the videotaped sessions, was defined as the percentage of time the infant spent looking at the television screen across all segments (Anderson & Levin, 1976). Due to some variations in in-home recording, this was calculated by dividing the infant's total looking time by the total time recorded. Percent looking time was used as the primary outcome measure. We also calculated mean length of a look, the number of looks, length of maximum look, and the proportion of looks greater than 15 sec (sustained attention). Pearson product–moment correlations were high and ranged between .88 and .98 based on 33% of the sessions.

Infant responsiveness to video content. Studies of attention should include other measures in addition to looking time (e.g., Rolandelli, Wright, Huston, & Eakins, 1991) because online verbal and nonverbal imitative behavior, pointing, and verbalizations have been associated with increased comprehension (Anderson et al., 2000; Barr & Hayne, 1999; Crawley et al., 1999). In particular, pointing is an important indicator of emerging joint attention in 12- to 18-month-olds (Butterworth, 2001). Pointing is most commonly used by 12- to 18-month-olds for the following reasons: (a) to indicate that the infant is requesting an object or a label for an object, (b) to indicate that the infant wants the parent to share the directed object of interest, and (c) to nonverbally respond to a parent question about a recognized object. In all cases, pointing to the television indicates active engagement with the media content. Infant responsiveness to video was defined as the total frequency of four behaviors: vocalizations toward video, verbal responses to the video or in answer to parent questions about the video, pointing, and infant play. Pointing was defined as the number of times the infant pointed toward the screen during the presentation. Infant play was defined as dancing and clapping in response to the video. We also recorded the frequency of vocalizations, verbalizations, pointing, and infant play not made in response to the video. The proportion of infant responses to video content divided by total infant responses (responses to video + responses not in relation to video content) was defined as the measure of infant responsiveness to video. This proportion measure was used in all analyses. Two observers coded videotapes of 29 infants and agreement on total infant responsiveness frequency was 95.9%.

Parent Verbalizations

A detailed coding scheme based on book-reading studies was developed (DeLoache & DeMendoza, 1987; Haden et al., 1996; Lemish & Rice, 1986; Potter & Haynes, 2000; Reese, Cox, Harte, & McAnally, 2003) and an additional interactive verbalizations category specific to television viewing was added to the coding scheme. The following categories were coded.

Questions. Questions were defined as *wh-* questions, questions beginning with what, who, when, or how such as "Where is the dog?" or "What does a duck say?", yes–no questions such as "Do you see the lights?" or "Is that a walrus?", tag questions such as "He's the biggest, isn't he?", and directives or requests such as "Is that Elmo or Zoe?" or "Show me the flower."

Labels or descriptions. Labels were defined as single referents provided for the infant, such as "Dog, cat" or "That's green." Descriptions were defined as utterances longer than single words or labels, such as "The train is going around the track" or "The seals are going up and down the ramp."

Abstractions. Abstractions were defined as information provided by the caregiver that extended beyond the immediate video context. Abstractions included requesting or providing information about a connection between the infants' experiences and the video; for example, "We have a toy just like that."

Attentional vocatives. Attentional vocatives were defined as a caregiver's attempts to obtain the infants' attention verbally by using an utterance, such as "Look" or "Look at that," or by repeating information.

Confirmations and corrections. Confirmations and corrections were defined as either positive or negative feedback provided by the caregiver related to the infant's previous utterance or behavior, such as "Yes, that's right, that's a ball."

Evaluations. Evaluations were defined as requests or judgments provided by the caregiver about the video; for example, "This is really funny."

Interactive verbalizations. Interactive verbalizations were defined as comments by the caregiver about the way the child is interacting with the media or suggestions about how the child should interact with the media; for example, "You're dancing" or "Let's clap."

Singing. Singing was only calculated for *Kids' Favorite Song*s *2*. It was coded as present or absent during 22 separate singing segments. Parents were given 1 point during each segment in which they sang.

Verbalizations unrelated to media content. These were defined as verbalizations that were unrelated to media content or verbalizations that were ambiguous in terms of whether the parent was discussing video content or an object in the home.

Placeholders. These were defined as responses that did not provide any new information to the infant, such as "I don't know."

Uncodable verbalizations. We were unable to transcribe 4.3% of what caregivers said and an additional 0.48% of the data did not fall into any of the other categories.

The total frequencies of each of these categories of verbalizations were calculated across the entire viewing period. Then for each category, a proportion measure as a function of the total adult verbalizations was calculated. Proportions were used in all analyses because of large individual differences in verbal scaffolding and overall talkativeness during the video presentations (see also Haden et al., 1996). It is important to note that 7.5% of parents of infants at each age made no

video-related verbalizations at all. Categories were mutually exclusive and overall percentage reliability calculated for 38 of the 120 transcripts was 89% (κ = .87).

RESULTS

Descriptive Statistics

The average television usage per household was 3.67 hr per day (*SD* = 2.46; range = 0–12 hr). There was no difference in average hours of television usage for children who had prior exposure to *Baby Mozart* or *Kids' Favorite Songs 2* (*M* = 3.86, *SD* = 2.28) or had no prior exposure (*M* = 3.48, *SD* = 2.62), $t(118) < 1$, as measured by parental report of estimated hours of television usage per day (6% of parents typically did not allow their infants to view television at all). Furthermore, 80% of parents reported that they often or almost always talk with their infant during television viewing.

For those infants previously exposed to the videos used in this study, age of first exposure to *Baby Mozart* was 4.8 months (*SD* = 4.4) and to *Kids' Favorite Songs 2* was 10.3 months (*SD* = 4.5). Table 1 shows the average age and frequency with which infants were exposed to the program content.

Because this study was conducted under naturalistic conditions and infants were free to move around their own living rooms during the video presentation, we wanted to report the context in which these videos were being viewed. We coded where the infants were positioned (mostly on the floor, mostly on furniture, both), whether the television was at eye level or not, how much time infants allocated to toy play (low, moderate, high), and how active they were (low, moderate, high). Reliability was 100% for all categories based on 10% of the data. Most infants were on the floor and not at eye level with the television during the video presenta-

TABLE 1
Mean Age (in Months) at Which Infants First Viewed the Two Programs and Mean Frequency of Viewing per Week (*SE*) as a Function of Infant Age (in Months) at Time of Study and Program Content

	12		*15*		*18*		*Total*	
	BM	*KF*	*BM*	*KF*	*BM*	*KF*	*BM*	*KF*
Age first viewed								
M	4.35	6.17	3.15	11.00	7.22	13.72	4.83	10.3
SE	3.09	4.15	3.22	3.04	5.91	2.31	4.39	4.46
Frequency per week								
M	3.17	3.38	2.18	4.00	3.50	3.06	2.90	3.50
SE	1.68	1.41	1.37	2.18	3.51	2.54	2.27	2.05

Note. BM = *Baby Mozart;* KF = *Kids' Favorite Songs 2*.

tion (71% and 72%, respectively). There was large variability in the amount of time infants allocated to toy play and their levels of motor activity during the video presentation (see Table 2). Table 3 provides descriptive statistics for the parent verbalizations and child interactions. One surprising finding was that singing occurred very little. The overall mean was 1.95 (SD = 2.8, min = 0, max = 11) and 70% of parents sang 2 or less of the maximum 22 possible times.

Preliminary Analyses

Preliminary analyses indicated that gender, sibling status (dummy coded as having siblings or not), and socioeconomic status did not significantly enter into any model predicting any of the outcome measures. These variables were therefore collapsed across all subsequent analyses.

What Predicts Infant Looking or Infant Responsiveness?

The study was designed to examine whether age, program type, prior exposure to content, and parent verbalizations during television viewing predicted infant behavior. To assess these factors, we conducted two linear regressions, simultaneously entering hours of household TV per day, program type, prior exposure to program type, age, and the proportion of parent verbalizations (questions, labels or descriptions, abstractions, attention-getting behaviors, evaluations, interactive verbalizations, and confirmations and corrections) with percentage looking time and infant responsiveness as outcome variables. Initial collinearity diagnostics indicated that all Variance Inflation Factors were < 2. Table 4 displays the zero order correlations between all variables. Preliminary analyses indicated that there were

TABLE 2
Toy Play (%) and Activity Level (%) During Coviewing as a Function of Infant Age (in Months) and Program Type

		Toy Play			*Activity Level*		
Age	*Program Type*	*None*	*Moderate*	*High*	*Low*	*Moderate*	*High*
12	BM	25	45	30	35	30	35
	KF	15	55	30	10	45	45
15	BM	70	25	5	60	35	5
	KF	25	45	30	30	50	20
18	BM	55	35	5	45	45	5
	KF	25	55	20	30	30	40
	Total	35.83	43.33	20.00	35.00	39.17	25.00

Note. BM = *Baby Mozart;* KF = *Kids' Favorite Songs 2.*

TABLE 3
Range, Mean, Standard Error, and Standard Deviation for the Adult Verbalizations and Child Behaviors

	Min	*Max*	*M*	*SE*	*SD*
Adult verbalizations					
Questions	0.00%	46.00%	13.55%	0.97%	10.62%
Labels or descriptions	0.00%	59.00%	14.70%	1.17%	12.79%
Abstractions	0.00%	50.00%	5.67%	0.58%	6.40%
Attention getting	0.00%	100.00%	12.96%	1.19%	13.07%
Confirmations and corrections	0.00%	57.00%	3.82%	0.62%	6.81%
Evaluations	0.00%	33.00%	4.51%	0.50%	5.49%
Interactive verbalizations	0.00%	35.00%	3.74%	0.62%	6.75%
Singing	0.00%	31.00%	2.09%	0.43%	4.72%
Unrelated to media content	0.00%	100.00%	30.30%	2.51%	27.46%
Placeholders	0.00%	16.00%	1.39%	0.23%	2.48%
Uncodable behavior	0.00%	100.00%	4.78%	1.00%	10.98%
Child behaviors					
% looking time	11.67%	99.44%	64.95%	1.99%	21.84%
Total looking time (sec)	84.00	720.00	453.50	13.55	148.44
Mean look length (sec)	2.75	143.67	18.73	1.67	18.34
Number of looks	3.00	76.00	33.80	1.41	15.47
Maximum look	16.00	378.35	87.09	5.85	64.08
% sustained attention (looks > 15 sec)	1.32%	83.33%	29.66%	1.70%	18.57%
Infant responsiveness to video %	0.00%	100.00%	84.41%	2.30%	25.14%
Pointing %	0.00%	64.00%	6.42%	1.16%	12.68%

Note. There were 3 mothers who said nothing (3/120 = .025).

no significant interactions between age, program type, and prior exposure to content, therefore interaction terms were not entered into the regression model.

Table 5 presents the results of the regression analysis on infants' percentage looking time and infants' responsiveness. The overall model for percentage looking time was significant, $F(11, 119) = 6.90$, $p < .001$, $R = .64$, $R^2 = .41$. We found that program type, prior exposure, and age predicted percentage looking time. Furthermore, household television usage negatively predicted percentage looking time—the higher the household television usage, the lower the infant's looking time. Percentage looking time was predicted by the proportion of parent questions, parent labels or descriptions, and parent abstractions. Attention-getting verbalizations, evaluations, interactive verbalizations, and confirmations and corrections did not predict percentage looking time.

The overall model for infant responsiveness was also significant, $F(11, 119) = 4.93$, $p < .001$, $R = .58$, $R^2 = .33$, but a different pattern emerged. Infant responsiveness was predicted by program type, questions, labels or descriptions, and confirmations and corrections. Age, household television exposure, prior exposure to

TABLE 4
First-Order Correlations Between Predictor and Outcome Variables

	Age	*Program*	*Exposure*	*Hr TV*	*Questions*	*Labels*	*Abstractions*	*Attention Getting*	*Confirm*	*Evaluations*	*Play*	*% Looking*
Program type	.00	—										
Prior exposure	.00	.00	—									
Household hr TV	.08	.09	.08	—								
Questions	.41**	.04	–.05	.02	—							
Labels	.08	.35**	.11	–.06	.22**	—						
Abstractions	.16	.10	.03	–.04	.07	.12	—					
Attention getting	–.18	.38**	.11	–.04	–.03	.23*	–.07	—				
Confirmations	.33**	.15	.04	–.13	.28**	.05	.12	–.03	—			
Evaluations	–.11	–.17	–.01	–.03	.06	.02	.10	.04	–.12	—		
Media-related play	–.13	–.52**	.09	–.04	.03	–.12	.04	.17	–.06	.25*	—	
% looking time	.27**	.24**	.23**	–.13	.36**	.42**	.28**	.10	.13	.14	–.06	—
Infant responsiveness	.23**	.24**	.08	.07	.37**	.39**	.01	–.02	.29**	.02	–.01	.43**

Note. Categorical variables of exposure (0 = no exposure, 1 = exposure) and program type (0 = *Kids' Favorite Songs 2*, 1 = *Baby Mozart*) were dummy coded, and age was entered as an ordinal variable.

*$p < .05$ (two-tailed). **$p < .01$ (two-tailed).

TABLE 5
Factors that Predict Percentage Looking Time and Infant Responsiveness

	Percentage Looking Time			*Infant Responsiveness*		
	Unstandardized Coefficients		*Standardized Coefficients*	*Unstandardized Coefficients*		*Standardized Coefficients*
Predictors	*B*	*SE*	*Beta*	*B*	*SE*	*Beta*
Program type	.092	.044	.211*	.151	.069	.238*
Prior exposure	.100	.033	.229**	.034	.051	.053
Household TV	–.016	.007	–.175*	.008	.011	.062
Age	.017	.008	.189*	.009	.012	.073
Proportion video-related information						
Questions	.481	.176	.234**	.615	.274	.204*
Labels or descriptions	.400	.142	.234**	.773	.222	.309**
Abstractions	.540	.264	.158*	–.602	.412	–.121
Attention getting	–.032	.140	–.019	–.380	.218	–.155†
Confirmations and corrections	–.234	.266	–.073	.856	.415	.182*
Evaluations	.567	.313	.142	.321	.487	.055
Interactive verbalizations	.111	.296	.034	.576	.462	.122

†$p < .10$. *$p < .05$. **$p < .01$.

content, parent abstractions, attention-getting verbalizations, evaluations, and interactive verbalizations were not related to infant responsiveness.

Parent Interaction Style

Following Haden and colleagues (1996), we conducted a cluster analysis to examine different parent–infant interaction styles (see also Britto et al., 2006; Ninio, 1980). Given that the proportions of different parent verbalizations were significantly associated with both percentage looking time and infant responsiveness, we used K-means cluster analysis to examine whether parents were relying on particular combinations of these strategies. We chose K-means cluster analysis because it is a useful statistical method to classify cases into subgroups based on a set of specific attributes. We collapsed the data across program type.

We decided to enter the proportion of questions and labels or descriptions into our cluster analysis for the following reasons. First, these were the two largest categories of video-related verbalizations as well as the two categories that significantly predicted both outcomes. Second, they were the categories most frequently used by parents in book reading with 12- to 18-month-olds (DeLoache & DeMendoza, 1987). Third, these factors had previously been used to determine types of

reading styles: labelers, gesture elicitors and label elicitors (Ninio, 1980). Ninio found that some parents used mainly *wh-* questions such as who, what, how, and why (label elicitors), and other parents used questions such as yes–no questions and direct requests to elicit pointing to objects (gesture elicitors). For this reason, we entered the following types of questions: *wh-* questions, yes–no questions, direct requests, and tag questions and labels or descriptions into the analyses. Reliability was recalculated for coding of different question types. Categories were mutually exclusive and reliability to different question types was 97% ($\kappa = .95$) based on 38 of 120 transcripts.

Because we were interested in how parents were using this situation as an opportunity to engage in joint attention to the media content with their infants, and because verbalizations unrelated to media content constituted 30% of parent verbalizations, we also entered the proportion of this class of verbalizations into the analyses. Verbalizations unrelated to media content are somewhat unique to television viewing. Such a category does not occur during book reading because parents whose infants cannot read necessarily treat book reading as a joint attention situation. In the case of television, parents might infer that because television is an audiovisual format that infants understand the medium without assistance. Alternatively, they might not want to increase their infants' attention to television because they believe television viewing will have a negative impact on development. Other parents might follow the infant and in some cases the infant might not attend to the video, in which case their verbalizations would also be unrelated to media content. In all cases, the result would be the same: a higher level of non-media-related verbalizations.

We entered the proportion of the different question types (*wh-* questions, yes–no questions, direct requests, and tag questions), labels or descriptions, and verbalizations unrelated to video content into the cluster analyses. Recall that proportions were calculated as a function of overall parental verbalizations. We conducted cluster analyses and compared the models with number of clusters at two, three, and four. The two-cluster model yielded very uneven groups. The four-cluster model yielded nonsensical groups with one subgroup having only a few cases. The cluster analysis set at three yielded a normal distribution with most parents falling in the middle and the high and low groups at either end of the distribution. We named Cluster 1 ($n = 34$), with a low proportion of different questions types and labels or descriptions and a high proportion of verbalizations unrelated to media content as low scaffold; Cluster 2 ($n = 53$), with a higher proportion of different question types and labels or descriptions as medium scaffold; and Cluster 3 ($n = 33$), with the highest proportion of different question types and labels or descriptions and the lowest proportion of verbalizations unrelated to video content as high scaffold. Table 6 shows the proportion of types of questions, labels or descriptions, and verbalizations unrelated to video content as a function of the cluster.

TABLE 6
Percentage of Utterances as a Function of Parent–Infant Interaction Style

	Parent Interaction Style							
	Low Scaffold[a]		*Medium Scaffold*[b]		*High Scaffold*[c]		*Total*	
	%	*± 1SE*	*%*	*± 1SE*	*%*	*± 1SE*	*%*	*± 1SE*
Adult verbalizations								
What questions	3.72%	0.76	5.05%	0.76	8.71%	1.01	5.68%	0.52
Yes–no questions	3.17%	0.87	7.43%	0.98	8.73%	1.19	6.58%	0.63
Tag questions	0.47%	0.34	0.71%	0.18	0.61%	0.20	0.62%	0.14
Direct requests	0.77%	0.36	0.48%	0.17	0.89%	0.26	0.67%	0.14
Labels or descriptions	4.48%	0.93	11.21%	1.06	30.85%	1.57	14.70%	1.17
Abstractions	2.22%	0.80	6.86%	1.05	7.29%	0.74	5.67%	0.58
Attention getting	6.37%	1.01	14.90%	2.33	16.64%	1.41	12.96%	1.19
Unrelated to media	67.34%	2.95	20.38%	1.96	8.06%	1.03	30.30%	2.51
Child outcomes								
Percentage looking time	45.86%	3.19	68.30%	2.62	79.22%	2.53	64.95%	1.99
Infant responsiveness	44.17%	4.29	64.26%	4.69	74.69%	4.76	61.43%	2.92

[a]$n = 34$. [b]$n = 53$. [c]$n = 33$.

We then examined whether parental style, program type, prior exposure to content, and age were associated with percentage looking time and infant responsiveness. We conducted a 3 (parental style) × 2 (program type) × 3 (age) × 2 (exposure) multivariate analysis of variance (MANOVA) on percentage looking and infant responsiveness.

Percentage looking. The MANOVA yielded a main effect of parental style, $F(2, 86) = 19.9$, $p < .01$, partial $\eta^2 = .32$. Post-hoc Student–Newman–Kuels tests ($p < .05$) indicated that infants in the low-scaffold group had significantly lower percentage looking time ($M = 46.8\%$, $SE = 3.3$) than infants in the medium-scaffold group ($M = 68.1\%$, $SE = 2.5$), who had significantly lower percentage looking time than the high-scaffold group ($M = 79.2\%$, $SE = 3.5$). There was a trend for a main effect of program type, $F(1, 86) = 3.07$, $p < .09$, partial $\eta^2 = .03$ in the direction of increased percentage looking time toward the *Baby Mozart* DVD ($M = 67.4\%$, $SE = 2.4$ and $M = 59.9\%$, $SE = 2.6$ for *Baby Mozart* and *Kids Favorite,* respectively). There was also a trend for a main effect of exposure to content, $F(1, 86) = 2.95$, $p < .09$, partial $\eta^2 = .03$ with percentage looking time slightly higher in the exposure

group (M = 67.9%, SE = 2.6) than the no exposure group (M = 59.4%, SE = 2.4). There was no main effect of age.

The main effect of parental style was qualified by an Age × Parental Style interaction, $F(4, 86) = 2.54$, $p < .05$, partial $\eta^2 = .11$ (see Figure 1). To assess the interaction, three separate one-way analyses of variance (ANOVAs) were conducted at each age. At 12 months there was a trend for a significant effect of parental style, $F(3, 37) = 3.09$, $p < .06$, partial $\eta^2 = .14$. A post-hoc Student–Newman–Keuls test ($p < .05$) indicated that there was a significant difference between the high- and low-scaffold groups, and the medium scaffold was intermediate between the two. At 15 months there was a significant effect of parental style, $F(3, 37) = 14.78$, $p < .01$, partial $\eta^2 = .44$. A post-hoc Student–Newman–Keuls test ($p < .05$) indicated that looking time was significantly higher for the medium- and high-scaffold groups than the low-scaffold group. Finally, at 18 months, there was a significant effect of parental style, $F(3, 37) = 16.41$, $p < .01$, partial $\eta^2 = .47$. A post-hoc Student–Newman–Keuls test ($p < .05$) indicated that looking time was significantly higher for the medium- and high-scaffold group than the low-scaffold group.

Infant responsiveness. The MANOVA yielded a main effect of program type, $F(1, 86) = 8.50$, $p < .01$, partial $\eta^2 = .09$. Infants had higher levels of responsiveness during *Baby Mozart* (M = 67.4%, SE = 4.4) than during *Kids' Favorite Songs 2* (M = 51.7%, SE = 4.8). There was a main effect of age, $F(2, 86) = 3.29$, $p < .05$, partial $\eta^2 = .07$. There were no main effects of exposure or parental style.

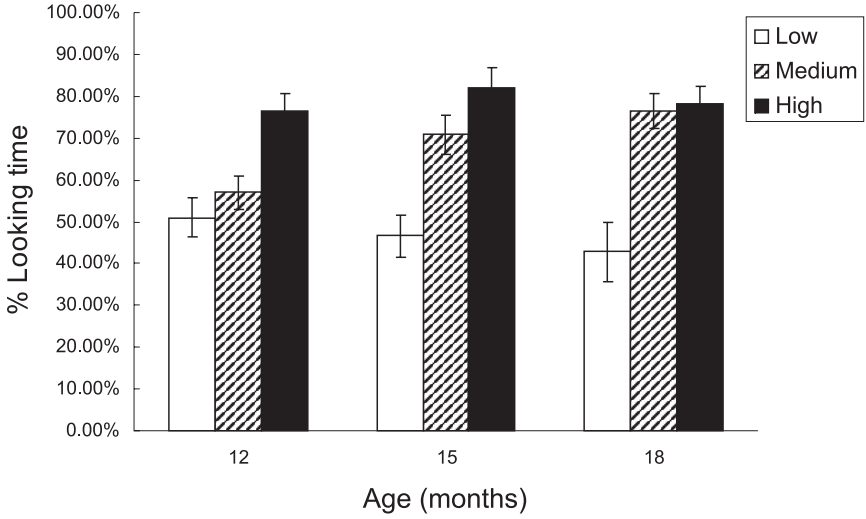


FIGURE 1 Looking time as a function of age and parent–infant interaction style.

Main effects were qualified by the following interactions. There was a significant Program Type × Parental Style interaction, $F(2, 86) = 4.68$, $p < .02$, partial $\eta^2 = .10$. We conducted separate *t* tests for each parental style and found that there was a significant effect of program type. There was no difference for the low-scaffold group, $t(32) < 1$ (*Kids' Favorite Songs 2, M* = 67%, *SD* = 30%; *Baby Mozart*, *M* = 60%, *SD* = 20%). For the medium- and high-scaffold groups, infants responded less during *Kids' Favorite Songs 2* (medium scaffold *M* = 49%, *SD* = 33%; high scaffold, *M* = 39%, *SD* = 37%) than during *Baby Mozart* (medium scaffold *M* = 67%, *SD* = 31%; high scaffold, *M* = 76%, *SD* = 29%), $t(51) = -2.01$, $p = .05$ and $t(31) = -2.92$, $p < .01$ for the medium- and high-scaffold groups, respectively. For *Kids' Favorite Songs 2*, the medium and high scaffolds were associated with less infant responding than for *Baby Mozart*.

There was a significant Age × Program Type interaction, $F(2, 86) = 3.18$, $p < .05$, partial $\eta^2 = .07$. We conducted separate *t* tests at each age and found that there was a significant effect of program type only for 18-month-olds, $t(38) = -3.11$, $p < .01$. The 18-month-olds viewing *Baby Mozart* (*M* = 83%, *SD* = 33%) were significantly more responsive than 18-month-olds viewing *Kids' Favorite Songs 2* (*M* = 58%, *SD* = 14%).

How Is Parent Interaction Style Related to Age, Prior Exposure, and Program Type?

We conducted chi-square analyses to determine how parental styles were related to infant age, prior exposure to program content, and program type. No cells had a cell count less than the five required for chi-square power to be sufficient. A 3(age) × 3 (parental style) chi-square indicated no significant effect of age, $\chi^2 (4, N = 120) = 6.94$, *ns.* A 2 (exposure) × 3 (parental style) chi-square indicated no effect of exposure, $\chi^2 (2, N = 120) = 4.17$, *ns*. Parental styles were not dependent on their infant's prior exposure to program content or their infant's age. A 2 (program type) × 3 (parental style) chi-square did indicate a significant effect of program type, $\chi^2 (2, N = 120) = 12.10$, $p < .01$. Parents were significantly more likely to use the low-scaffold style when coviewing *Kids' Favorite Songs 2* than *Baby Mozart*. Parents adopted higher scaffolding styles during *Baby Mozart* than they did during the *Sesame Street* video. It is possible that because the music on *Baby Mozart* is instrumental rather than vocal, it was less likely to interfere with parents' presentation of, and infants' processing of, verbal information, making it easier for parents to ask questions and provide labels or descriptions. It is also important to note that although parental style was related to program type, the infant's behavior might have had a direct effect on parental behavior. That is, infant responsiveness to program content might influence parents and change the parent–infant interaction style. The current data set does not allow for further analysis of this pattern of results but such findings warrant further empirical investigation.

Do Specific Program Features Also Predict Looking?

According to the sampling model theory of attention, the content that toddlers attend to will differ as a function of familiarity with specific media content. We predicted that prior exposure to program content would either maintain or increase looking time. For these analyses only percentage looking was examined because prior exposure was not related to infant responsiveness (see Tables 3 and 4). Repeated measures analyses were conducted across program feature segments to assess the effect of prior exposure on looking time (see Table 7).

Baby Mozart. We predicted that looking time during perceptually salient sound effects would not be associated with prior exposure but looking time to the remaining music segments would be higher for the prior exposure group. To assess this we calculated the mean percentage looking time to sound effects and the mean percentage looking time to the music segments. A 2 (exposure) × 2(program features: sound effects, music) ANOVA with repeated measures across program features yielded a main effect of program features, $F(1, 58) = 26.72$, $p < .01$, and a trend for exposure, $F(1, 58) = 3.86$, $p < .06$, which was qualified by a significant interaction, $F(1, 58) = 5.02$, $p < .03$. That is, there was no significant difference in percentage looking time during the sound effects segments but there was a significant difference in percentage looking time during the segments accompanied by Mozart music. The prior exposure group had significantly higher looking time than the no exposure group during music segments.

Kids' Favorite Songs 2. We predicted that because the *Sesame Street* characters are unique to *Sesame Street* programming, familiarity with *Sesame Street* is more likely to increase looking time to *Sesame Street* characters for infants in the

TABLE 7
Mean Percentage Looking Time as a Function of Program Type, Segment, and Prior Exposure to Prior Content

	Segments			
	Baby Mozart		*Kids' Favorite Songs 2*	
Prior Exposure	*Sound Effects*	*Mozart Music*	*Children*	*Puppets*
No exposure				
M	74.3	59.9	59.6	54.0
SE	4.0	4.2	4.8	5.1
Exposure				
M	80.3	74.1	63.3	71.2
SE	2.9	3.2	4.3	4.1

Note. Estimated marginal means are reported.

prior exposure condition, but that both groups would attend to children on screen. A 2 (exposure) × 2(program features: children and puppets) ANOVA with repeated measures across program features yielded no main effect of program features, $F(1, 58) < 1$, and a trend for exposure, $F(1, 58) = 2.97$, $p < .09$. However, the interaction was significant, $F(1, 58) = 7.60$, $p < .01$. Those with prior exposure to *Sesame Street* had significantly higher percentage looking time during the puppet segments than infants with no prior exposure, but percentage looking times did not differ for segments featuring children.

GENERAL DISCUSSION

The findings reported here suggest that infant attention allocation to television is associated with four factors: age, formal features of television, prior exposure to televised content, and parent–infant interaction style. Prior exposure to specific media content, age, and parental style during coviewing significantly predicted looking time, whereas program type, parental style, and infant age predicted infant responsiveness to the video content. The findings are consistent with aspects of both the social mediation theory and the sampling model of attention theory.

Consistent with social mediation theory, parents used the same types of statements during television viewing that are common in parent–child book reading, and infant looking patterns were associated with both parent–infant interaction style and the age of the infant (DeLoache & DeMendoza, 1987; Haden et al., 1996; Lemish & Rice, 1986; Reese et al., 2003). Higher proportions of video-relevant information, and in particular questions and labels or descriptions provided by parents, were associated with higher percentage looking time and infant responsiveness. These findings are consistent with a more general theory that infants learn in the context of joint attention with a more sophisticated social partner (e.g., Baldwin & Moses, 2001). There were large individual differences in how parents interacted with their infants during the television coviewing situation. High-scaffold parents almost exclusively discussed the content of the video with their infants, whereas low-scaffold parents spent little time orienting infants to the video at all. Presumably high-scaffold parents indicated to the infant that the programming was the current source of joint attention. Finally, the relation between the type of scaffold and infant looking was also associated with the infant's age; older toddlers looked more with both a medium and high scaffold and 12-month-olds only looked longer during high scaffolding. Bidirectional processes are also likely to be involved. That is, the parent might be following the infant's level of active responsiveness and looking patterns, and respond more when the infant's responsiveness increases. We are currently examining this relation further in a new study.

Consistent with the sampling model of attention, looking patterns changed as a function of specific media content. Sound effects were able to generate an orient-

ing response from all infants viewing *Baby Mozart,* but, with prior exposure to content, infants increased overall looking time, attending during segments that did not include perceptually salient sound effects. Similarly, prior exposure to the puppet characters on the *Kids' Favorite Songs 2* video increased looking time. We infer that the perceptually salient features such as sound effects and unique puppet characters combined with repeated exposure led to increases in overall percentage looking. This finding is consistent with the claim that with experience infants' attention allocation will shift from an orienting reflex to an active use of formal features as predictors of content (see also Calvert et al., 1982; Huston & Wright, 1983). Systematic empirical investigation of formal features during infancy is, however, urgently required to assess how infants are processing formal features. In our laboratory, for example, we are investigating the effects of different formal features on infants' imitation from television.

Although the pattern of results obtained in this study is consistent with findings from prior studies of attention to television conducted with toddlers and preschoolers, there is one major difference: Percentage looking time by infants in this study was very high, averaging between 60% and 70%. This is in contrast to a report by Anderson and Levin (1976) of 5% to 10% looking time for 12- and 18-month-olds. There are a number of important differences between the original Anderson and Levin study and this study, which have important implications regarding the generalizability of this study. First, the Anderson and Levin study was conducted in a lab setting, whereas in this study, infants and their parents viewed the videos together in their homes. Second, when the Anderson and Levin study was conducted infants were typically not being exposed to television on a regular basis until 2.5 years, but now infants are beginning to be exposed to television on a regular basis around 6 to 9 months (Rideout & Hamel, 2006). Third, Anderson and Levin showed infants a 1-hr episode of *Sesame Street* that was being developed for preschoolers. The videos in this study were designed for infants and toddlers and a shorter 12-min portion of the video was shown. Furthermore, producers have incorporated, either intentionally or inadvertently, a large number of features into infant-directed programming that are known to increase looking time. Finally, and probably most important, the parents in the Anderson and Levin study were instructed not to interact with their infants during the televised presentation.

A second surprising but not unpredicted finding was that infants who had prior exposure to the media content had increased percentage looking time. Consistent with studies of infant attention during television viewing (Richards & Gibson, 1997), we conclude that infants with prior exposure to the content in this study had developed a familiarity preference.

A major caveat to this study is that infants' looking time and responsiveness to video content are only indirect measures of comprehension. Given that higher looking time and responsiveness are good indicators of comprehension in preschoolers (Anderson & Lorch, 1983), the high overall levels of percentage looking

time and increased looking time as a function of prior exposure could be interpreted to reflect infant comprehension of the content. Alternatively, because it is difficult for children to represent and focus on the symbolic role of an object if their attention is captured by the object itself, children typically do not relate television to the real world (Troseth, Pierroutsakos, & DeLoache, 2004). Thus, children's high levels of looking to television could be attributed to their fascination with the colorful, exciting object, as opposed to the comprehensible message it shows.

In fact, researchers have repeatedly found a video deficit effect in learning from television relative to learning from live interactions, implying that learning from television provides a cognitive challenge during early childhood (for review see, Anderson & Pempek, 2005; Barr, in press). For example, 12- to 30-month-old infants imitate significantly fewer actions from television than from a live demonstration (Barr & Hayne, 1999; Hayne, Herbert, & Simcock, 2003). Although infants are highly attentive and responsive to infant-directed programming, it is still very likely that they would exhibit a video deficit in learning from such media relative to what they would learn from live interactions (Anderson & Pempek, 2005; Barr, in press).

Recent data from imitation studies suggest that the video deficit effect can be ameliorated by repeated exposure (Barr et al., 2007; Barr et al., 2007). Repeated exposure and recognition of the formal features of specific program content, resulting in increased looking time, might allow for the additional cognitive processing necessary to enable infants to learn from television. For this reason, repetition of material might be particularly helpful during the infancy period when processing of information from television is cognitively challenging. Furthermore, the effect of parental style on overall percentage looking time and infant responsiveness in this study suggests that scaffolding by parents might be particularly helpful during infancy as it can enable the infant to link televised information to the real world.

Although these findings provide some support for the sampling model of attention and the social mediation theory, neither theory accounts for all the available data. Rather, the findings reported here suggest that an integration of the theories might be warranted. How infants attend to television is dependent on prior exposure to specific content and whether or not parents orient infants to media content. We contend that infants learn about media content via parental interaction and repetition of content such that the content becomes increasingly comprehendible, leading to increases in infant looking time and responsiveness.

There are still many unanswered questions. Currently we do not know what the long-term effects of such early media exposure will be on cognitive and social development (Anderson & Pempek, 2005; Barr, in press). It is not known whether early parent–infant interaction styles will predict later styles of media comprehension or school readiness. Recent epidemiological findings have suggested that

early exposure to heavy levels of television disrupts later attention and sleep regulation (Christakis, Zimmerman, DiGiuseppe, & McCarty, 2004; Thompson & Christakis, 2005). However, these results were based on data collected before the production of infant-directed videos and DVDs when infant attention, as measured by time-lapsed in-home cameras, ranged between 5% and 10% (Anderson, Lorch, Field, Collins, & Nathan, 1986). Results obtained from data collected more recently have failed to replicate these findings (e.g., Stevens & Muslow, 2006). It is interesting to note that in this study one of the few factors to negatively predict percentage looking time and infant responsiveness was household television usage—higher household television usage levels predicted lower percentage looking time to infant-directed programming. The current finding of average looking time to more recent infant-directed videos ranging from 60% to 70% suggests that today's media environment might produce quite different, albeit unknown, consequences.

Although not possible to assess in this study, it is possible that increases in looking time and responsiveness during infant-directed programming could have direct positive benefits on infant learning. For preschoolers, exposure to high-quality children's educational programs (e.g., *Sesame Street*, *Blue's Clues*, and *Mister Rogers' Neighborhood*) that are aimed at viewers between the ages of 3 and 6 have enhanced preschoolers' cognitive (Ball & Bogatz, 1970, 1972; Wright et al., 2001), language (Rice, Huston, Truglio, & Wright, 1990), and prosocial skills (Friedrich & Stein, 1975) and have had a long-lasting positive impact on school performance (Anderson, Huston, Schmitt, Linebarger, & Wright, 2001; Wright et al., 2001). Given that parent mediation during book reading has a direct relationship to current vocabulary levels (DeLoache & DeMendoza, 1987; Ninio, 1980, 1983), that television can facilitate vocabulary acquisition in preschoolers (Rice et al., 1990), and that parent–infant interaction styles are similar during book reading and television viewing, it is possible that the parent–infant interaction styles used during television viewing might also be directly related to vocabulary levels.

Taken together, these findings already have a number of practical implications for caregivers and parents. Many parents and child-care centers (Christakis, Garrison, & Zimmerman, 2006; Jordan, 2005; Rideout et al., 2003) are using media on a daily basis. How these media are used might be as important as the fact that they are being used at all.

ACKNOWLEDGMENTS

This research was supported by grant number HD043047-01 from the National Institute Child Health and Development to Rachel Barr and an NSF grant to Children's Digital Media Center (# NSF 0126014) to Sandra Calvert and the Georgetown University Graduate School of Arts and Sciences. We thank Jennifer Ruskis, Dina Spagnola, and Lorena Valencia for assisting with the data collection

and collation. We would like to thank the infants and their parents who made this research possible.

REFERENCES

Anderson, D. R., Bryant, J., Wilder, A., Santomero, A., Williams, M. E., & Crawley, A. M. (2000). Researching *Blue's Clues*: Viewing behavior and impact. *Media Psychology, 2,* 179–194.

Anderson, D. R., Huston, A. C., Schmitt, K. L., Linebarger, D. L., & Wright, J. C. (2001). Early childhood television viewing and adolescent behavior: The recontact study. *Monographs of the Society for Research in Child Development, 66*.

Anderson, D. R., & Levin, S. R. (1976). Young children's attention to "Sesame Street." *Child Development, 47,* 806–811.

Anderson, D. R., & Lorch, E. P. (1983). Looking at television: Action or reaction? In J. Bryant & D. R. Anderson (Eds.), *Children's understanding of television: Research on attention and comprehension* (pp. 1–33). New York: Academic.

Anderson, D. R., Lorch, E. P., Field, D. E., Collins, P. A., & Nathan, J. G. (1986). Television viewing at home—Age trends in visual attention and time with TV. *Child Development, 57,* 1024–1033.

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

Anderson, D. R., & Pempek, T. (2005). Television and very young children. *American Behavioral Scientist, 48,* 505–522.

Baldwin, D. A., & Moses, L. J. (2001). Links between social understanding and early word learning: Challenges to current accounts. *Social Development, 10,* 309–329.

Ball, S., & Bogatz, G. A. (1970). *The first year of Sesame Street: An evaluation. A report to the Children's Television Workshop*. Princeton, NJ: Educational Testing Services.

Ball, S., & Bogatz, G. A. (1972). Summative research on *Sesame Street*: Implications in the study of preschool children. In A. D. Pick (Ed.), *Minnesota symposia on child psychology* (Vol. 6, pp. ix–170). Minneapolis: University of Minnesota.

Barr, R. (in press). Attention to and learning from media during infancy and early childhood. In S. L. Calvert & B. J. Wilson (Eds.), *Blackwell handbook of child development and the media.*

Barr, R., Muentener, P., & Garcia, A. (2007) Age-related changes in deferred imitation from television by 6- to 18-month-olds. *Developmental Science, 10,* 910–921.

Barr, R., & Hayne, H. (1999). Developmental changes in imitation from television during infancy. *Child Development, 70,* 1067–1081.

Barr, R., Muentener, P., Garcia, A., Fujimoto, M., & Chavez, V. (2007). The effect of repetition on imitation from television during infancy. *Developmental Psychobiology, 49,* 196–207.

Britto, P. R., Brooks-Gunn, J., & Griffin, T. M. (2006). Maternal reading and teaching patterns: Associations with school readiness in low-income African American families. *Reading Research Quarterly, 41,* 68–89.

Butterworth, G. (2001). Joint visual attention in infancy. In G. Bremner & A. Fogel (Eds.), *Blackwell handbook of infant development* (pp. 213–240). Malden, MA: Blackwell.

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

Calvert, S. L., & Scott, M. C. (1989). Sound effects for children's temporal integration of fast-paced television content. *Journal of Broadcasting and Electronic Media, 33,* 233–246.

Christakis, D. A., Garrison, M. M., & Zimmerman, F. J. (2006). Television viewing in child care programs. *Communication Reports, 19,* 111–120.

Christakis, D. A., Zimmerman, F. J., DiGiuseppe, D. L., & McCarty, C. A. (2004). Early television exposure and subsequent attentional problems in children. *Pediatrics, 113,* 708–713.

Crawley, A. M., Anderson, D. R., Wilder, A., Williams, M., & Santomero, A. (1999). Effects of repeated exposures to a single episode of the television program *Blue's Clues* on the viewing behaviors and comprehension of preschool children. *Journal of Educational Psychology, 91,* 630–637.

DeLoache, J. S., & DeMendoza, O. A. P. (1987). Joint picturebook interactions of mothers and 1-year-old children. *British Journal of Developmental Psychology, 5,* 111–123.

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

Garrison, M., & Christakis, D. A. (2005). *A teacher in the living room: Educational media for babies, toddlers, and preschoolers.* Menlo Park, CA: The Henry J. Kaiser Family Foundation.

Haden, C. A., Reese, E., & Fivush, R. (1996). Mothers' extratextual comments during storybook reading: Stylistic differences over time and across texts. *Discourse Processes, 21,* 135–169.

Hayne, H., Herbert, J., & Simcock, G. (2003). Imitation from television by 24- and 30-month-olds. *Developmental Science, 6,* 254–261.

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

Jordan, A. B. (2005). Learning to use books and television: An exploratory study in the ecological perspective. *American Behavioral Scientist, 48,* 523–538.

Lemish, D. (1987). Viewers in diapers: The early development of television viewing. In T. R. Lindlof (Ed.), *Natural audiences: Qualitative research of media uses and its effects* (pp. 33–57). Norwood, NJ: Ablex.

Lemish, D., & Rice, M. L. (1986). Television as a talking picture book: A prop for language acquisition. *Journal of Child Language, 13,* 251–274.

Nakao, K., & Treas, J. (1992). *The 1989 socioeconomic index of occupations: Construction from the 1989 Occupational Prestige Scores*. Chicago: National Opinion Research Center**.**

Ninio, A. (1980). Picture-book reading in mother–infant dyads belonging to two subgroups in Israel. *Child Development, 51,* 587–590.

Ninio, A. (1983). Joint book reading as a multiple vocabulary acquisition device. *Developmental Psychology, 19,* 445–451.

Potter, C. A., & Haynes, W. O. (2000). The effects of genre on mother–toddler interaction during joint book reading. *Infant Toddler Intervention, 10,* 97–105.

Reese, E., Cox, A., Harte, D., & McAnally, H. (2003). Diversity in adults' styles of reading books to children. In S. A. van Kleeck, & E. B. Bauer (Eds.), *On reading books to children: Parents and teachers* (pp. 37–57). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Rice, M. L., Huston, A. C., Truglio, R., & Wright, J. C. (1990). Words from "Sesame Street": Learning vocabulary while viewing. *Developmental Psychology, 26,* 421–428.

Rice, M. L., Huston, A. C., & Wright, J. C. (1982). The forms of television: Effects on children's attention, comprehension, and social behavior. In L. B. D. Pearl & J. Lazar (Eds.), *Television and behavior: Ten years of scientific progress and implications for the eighties* (pp. 24–38). Washington, DC: U.S. Government Printing Office.

Richards, J. E., & Anderson, D. R. (2004). Attentional inertia in children's extended looking at television. In R. V. Kail (Ed.), *Advances in child development and behavior* (Vol. 32, pp. 163–212). San Diego, CA: Academic.

Richards, J. E., & Gibson, T. L. (1997). Extended visual fixation in young infants: Look distributions, heart rate changes, and attention. *Child Development, 68,* 1041–1056.

Rideout, V., & Hamel, E. (2006). *The media family: Electronic media in the lives of infants, toddlers, preschoolers and their parents*. Menlo Park, CA: Kaiser Family Foundation.

Rideout, V., Vandewater, E., & Wartella, E. (2003). *Zero to six: Electronic media in the lives of infants, toddlers, and preschoolers*. Menlo Park, CA: Kaiser Family Foundation.

Rolandelli, D. R., Wright, J. C., Huston, A. C., & Eakins, D. (1991). Children's auditory and visual processing of narrated and nonnarrated television programming. *Journal of Experimental Child Psychology, 51,* 90–122.

Schmitt, K. L., Anderson, D. R., & Collins, P. A. (1999). Form and content: Looking at visual features of television. *Developmental Psychology, 35,* 1156–1167.

Stevens, T., & Muslow, M. (2006). There is no meaningful relationship between television exposure and symptoms of attention-deficit/hyperactivity disorder. *Pediatrics, 117,* 665–672.

Thompson, D. A., & Christakis, D. A. (2005). The association between television viewing and irregular sleep schedules among children less than 3 years of age. *Pediatrics, 116,* 851–856.

Troseth, G. L., Pierroutsakos, S. L., & DeLoache, J. S. (2004). From the innocent to the intelligent eye: The early development of pictorial competence. In R. V. Kail (Ed.), *Advances in child development and behavior* (Vol. 32, pp. 1–35). San Diego, CA: Academic.

Vygotsky, L. S. (1978). *Mind and society: The development of higher mental processes*. Cambridge, MA: Harvard University Press.

Wright, J. C., Huston, A. C., Murphy, K. C., St. Peters, M., Pinon, M., Scantlin, R., et al. (2001). The relations of early television viewing to school readiness and vocabulary of children from low-income families: The early window project. *Child Development, 72,* 1347–1366.

Zimmerman, F. J., Christakis, D. A., & Meltzoff, A. N. (2007). Television and DVD/video viewing by children 2 years and younger. *Archives of Pediatric and Adolescent Medicine, 161,* 437–479.