INFANTS’ LEARNING FROM VIDEOS: INFLUENCE OF CHARACTER INTERACTION AND CHARACTER FAMILIARITY

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ABSTRACT

Children under age 2 are watching television (Rideout & Hamel, 2006) and the vast majority of products that are created for this audience claim to be educational (Garrison & Christakis, 2005). Evidence suggests that until children are approximately 2 years old, they tend to experience a video deficit effect, meaning they learn better from a live presentation as compared to video presentation (see Anderson & Pempek, 2005). The goal of these two studies was to determine what factors may ameliorate the video deficit in infants and toddlers. In Study 1, 15- and 18-month-old infants (N = 123) were randomly assigned to one of four experimental conditions (Parasocial-Interaction Video, Non-parasocial Interaction Video, Social Interaction Live, Non-social Interaction Live) or a Baseline Control condition. Results from Study 1 indicated that all four experimental conditions performed significantly better than the baseline control, and none of the experimental conditions differed from each other. Overall, girls performed significantly better than boys and 18-month-olds performed better than 15-month-olds. Findings suggest that both parasocial interactive cues and non-parasocial interactive cues can increase infants learning from media presentations. In Study 2, toddlers’ learning of a classic Piagetian seriation task presented on video was assessed based on how familiar they were with the character. Sixty-four 21-month-old toddlers were randomly assigned to one of 3 demonstration conditions- Adult Live, Familiar Character Video, Unfamiliar Character Video- or to a No Exposure Control group. Results from Study 2 indicated that toddlers learned the
seriation sequencing task better from a video when they were familiar rather than unfamiliar with
the character on the screen. Nearly all the toddlers in the demonstration conditions used
strategies to reach the goal-state of nesting the cups by size rather than directly imitating the
behaviors performed. The findings demonstrate that children can learn an important task from a
video presentation at very young ages when the character is familiar to them, thereby alleviating
the video deficit that typically favors live over video models.
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CHAPTER I: LITERATURE REVIEW

In 1999, the American Academy of Pediatrics (AAP) recommended that children under the age of 2 not be exposed to any screen media. However, less than 15% of families with infants follow the AAP (1999) guidelines and strongly limit their infants’ media exposure (Rideout & Hamel, 2006). Instead, reports indicate that 80% of children under age 2 view television or video programs (Rideout & Hamel, 2006) and 40% of infants are watching television or videos by 3 months of age (Zimmerman, Christakis, & Meltzoff, 2007). Children under age 2 that have watched television or videos average two hours of screen time per day (Rideout & Hamel, 2006) which is a considerable proportion of their waking hours.

Early exposure to media may be taking place, in part, because there has been an explosion in videos, television programs, and computer/video games, created for very young audiences in the past decade, many of which are marketed with exceptionally strong educational claims (Garrison & Christakis, 2005). Because of this heavy exposure to ostensibly “educational” media products, scientists are asking whether anything beneficial can be gained from media exposure at very young ages.

Efforts to determine whether very young children are capable of learning from a screen presentation yield inconsistent findings. Very young children have difficulties learning from media presentations when compared to learning from a live adult, a finding that has been labeled the video deficit (see Anderson & Pempek, 2005 for review). However, other scholars find that very young children can learn from media presentations (e.g., Meltzoff, 1988). By slightly altering factors related to the videos and how often they are presented to very young children, infants and toddlers show improved learning to levels in which the video deficit is ameliorated (e.g., Barr, Muentener, & Garcia, 2007; Barr & Wyss, 2008; Troseth, 2003a).
Neither parasocial relationships, the relationships that audience members form with media characters (Horton & Wohl, 1956), nor parasocial interactions, the interactions that occur between an audience member and a media character (Horton & Wohl, 1956), have been studied in detail with very young children. A handful of studies have shown that elementary-school aged children identify with (Hoffner, 1996) and preschool-aged children like (Calvert, Strong, Jacobs, & Conger, 2007) certain television characters. Anecdotal evidence from parents also indicates that very young children have a special connection with television characters. One parent reports about his daughter’s relationship with Elmo and states “If Emme had it her way, Elmo would wake her up in the morning, get her dressed and teach her the ABCs” (Adamick, 2008).

Experimental studies have shown that the use of familiar characters, like Elmo from Sesame Street, can influence young children’s food choices when the popular character is presented on the food label (Kotler, Schiffman, & Hanson, under review).

Although it seems clear that young children form relationships with media characters, how those relationships and interactions influence learning from media have yet to be scientifically examined during the first two years of life. Parasocial relationships or parasocial interactions may be additional factors that could alleviate the video deficit effect in very young children and help them learn from media presentations.

*Video Deficit Effect*

Despite the vast number of television and video programs that are created and marketed to very young children (Garrison & Christakis, 2005), scientists only recently began to assess whether infants can learn from screen presentations. While the research in this area is still growing, most evidence indicates that children under age 2 experience a video deficit effect (see Anderson & Pempek, 2005). Studies ranging from language learning (e.g., Krcmar, Grela, &
Lin, 2007) to object retrieval (e.g., Troseth & DeLoache, 1998) have demonstrated that infants face a video deficit effect. By contrast, other research found that certain factors, such as repetition (e.g., Barr et al., 2007), social contingency with the onscreen context (e.g., Troseth, 2003a), and increasing language cues (Barr & Wyss, 2008) can help to ameliorate the video deficit.

**Language.** Because language development is a key milestone for infants during the first two years of life (Fenson et al., 1994), researchers are particularly interested in whether infants are capable of learning language from video presentations. Krcmar and colleagues (2007) experimentally assessed whether infants and toddlers ages 15-24 months could learn novel words from the children’s television program *Teletubbies*. Results from this study support the video deficit effect. Toddlers learned more novel words when an adult presented the object to the child and labeled it than when the child was presented with a novel word via a children’s television program or when an adult labeled an object on a video (Krcmar et al., 2007).

Studies assessing infants’ abilities to discriminate phonemes from foreign languages have also found a video deficit effect (Kuhl, Tsao, & Liu, 2003). In particular, 9-month-old English speaking infants who were exposed to an adult speaking Mandarin Chinese showed phonemic learning—the ability to recognize some of the unique sounds that make up the Mandarin Chinese language. By contrast, infants that were exposed to Mandarin Chinese by watching a DVD showed no difference in performance in phonemic learning when compared to a control group. These results suggest that at 9 months of age, infants cannot learn language segmentation as well from a video presentation as they can from an adult in a live face-to-face interaction.

**Emotions.** Many educational programs successfully teach prosocial and emotional lessons to preschool-aged children (e.g., Friedrich & Stein, 1975), but only one study has assessed
infants’ emotional learning from video (Mumme & Fernald, 2003). In this study, 10- and 12-month-old infants saw an actress on a video react with either positive, negative, or neutral emotion toward a novel object. Infants were then shown two objects, one that the actress had reacted either positively, negatively, or neutrally towards as well as a novel distracter object. Experimenters counted the number of times the infants touched the target object and the distracter object to determine if the infant learned the emotions demonstrated by the actress on the screen. The number of object touches in the positive or negative emotion conditions was compared to those in the neutral emotion conditions to examine learning. If the infant touched the target object more frequently after watching the experimenter react positively, or if the child touched the distracter object more frequently after watching the experimenter react negatively towards the target object, then the infant was presumed to have learned from the demonstration. Results indicate that younger infants did not learn emotions from video, regardless of the emotion displayed. Again, this provides evidence that infants face a video deficit even when presented with emotional reactions on video. While older infants performed slightly better and were able to learn to avoid objects that the experimenter reacted negatively towards on a video presentation, even the older infants reactions did not differ when they saw the experimenter react positively towards an object.

Object retrieval tasks. Troseth and her colleagues studied the video deficit in young children in a series of object retrieval tasks (e.g., Troseth & DeLoache, 1998; Troseth, 2003b). In these studies, an experimental room is created to look like a living room with a couch, chair, and other furniture. Children then watch, either on a television screen or through a window, as a toy is hidden in the room. After watching the toy being hidden, the child enters the “living room” and searches for the toy. If the child searches for the toy in the correct hiding place(s), the child
has succeeded at the task. The number of correct searches is then compared between the children that view the hiding of the toy on the screen to those children that viewed the toy being hidden through the window to determine if children are capable of transferring what they see on a 2D screen to a real-life, 3D situation. In these studies, children are significantly more successful at finding the hidden toy when they view an adult hiding the toy through a “window” than when viewing an adult hide the toy on a screen (Deocampo & Hudson, 2005; Lauricella, Pempek, Barr, & Calvert, 2010; Schmitt & Anderson, 2002; Troseth & DeLoache, 1998; Troseth, 2003b).

**Imitation tasks.** Imitation tasks are another method used to examine learning from media presentations. In imitation tasks, a demonstration is performed either on video or by an adult live in front of the child. For example, in studies by Barr and colleagues (1999, 2007) an experimenter demonstrates how to make a rattle using a ball, jar, and stick. The experimenter puts the ball in the jar, then puts the stick on the jar, and then shakes the rattle to make a sound. Learning is measured based on the number and order of behaviors that young children imitate after viewing the demonstration. Infants and toddlers under age 2, demonstrate a video deficit effect when they are required to imitate behaviors that were demonstrated on a video screen on a 3D object (Barr & Hayne, 1999; Barr, Muentener, Garcia, Fujimoto, & Chavez; Hayne, Herbert, & Simcock, 2003; McCall, Parke, & Kavanaugh, 1977), such as in the rattle task, or in a real world setting like those described in the search and retrieval tasks (Deocampo & Hudson, 2005). More specifically, 24-month-olds were less successful at finding a hidden toy in a playroom after viewing an experimenter find the hidden toy via video as compared to when they watched the experimenter find the hidden toy through a window (Deocampo & Hudson, 2005).
The video deficit has also been demonstrated when infants are required to transfer information from a 2D touch screen to a 3D object (Zack, Barr, Gerhardstein, Dickerson, & Meltzoff, 2009). In this particular study, 3D objects were created to look like a school bus, fire truck, duck, or a cow. Each 3D object had a button that when pressed made the appropriate sound (e.g. the school bus beeped and the cow mooed). A 2D photograph of these 3D objects was put onto a touch screen and pushing the button on the touch screen made the appropriate sound. An adult experimenter either demonstrated the pushing of the button on the 2D image on the touch screen or on the 3D object. Infants were either tested within-dimension, meaning they were tested on the same platform that the adult demonstrated. (e.g., demonstration on 2D touch screen, test on 2D touch screen) or between-dimension, meaning the demonstration occurred on the one platform (e.g., 3D) and the child was tested on the other platform (e.g., 2D). Even when using a touch screen to demonstrate the imitation tasks, 15-month-old infants demonstrated the video deficit when transferring information presented across dimensions- from a 2D touch screen to a 3D object and vise versa- but were quite successful at imitating the behaviors within dimensions (e.g., from 2D to 2D or from 3D to 3D). Overall, then, infants and toddlers fail to imitate information on 3D objects after watching demonstrations on any type of 2D screen, providing increasing evidence for the video deficit effect.

**Summary.** The current evidence finds that children under age 2 experience a video deficit when learning language (Kuhl et al., 2003; Krcmar et al., 2007), emotions (Mumme & Fernald, 2003), imitation tasks (Barr & Hayne, 1999; Barr et al., 2007; Deocampo & Hudson, 2005; Hayne et al., 2003; McCall et al., 1977, Zack et al., 2009) or search tasks (Schmitt & Anderson, 2002; Troseth & DeLoache, 1998; Troseth, 2003b). Overall, the evidence suggests that for very
young children, video presentations are generally not as effective tools for learning as compared to live experiences.

Learning from video. More than two decades ago, Meltzoff (1988) found that infants as young as 14-months-old were able to learn from video. In this study, 14- and 24-month-old toddlers watched an experimenter on a black and white television screen perform a demonstration on a novel toy. The demonstration was repeated three times. Toddlers were either given the toy immediately or after a 24-hour delay. Meltzoff (1988) demonstrated that 14- and 24-month old toddlers imitated more behaviors when they watched the demonstration on a television screen as compared to infants in the control conditions. These findings, however, did not compare learning from video to learning from a live adult in a face-to-face interaction.

Research that compared learning from a video to a live demonstration found that six-month-old infants did not demonstrate a video deficit, learning equally well from either type of demonstration (Barr et al., 2007). Barr and colleagues (2007) explain that very young infants may not recognize the difference that exists between 2D screen images and 3D events and thus they are able to transfer information from one dimension to another. However, during the second year of life, toddlers begin to notice the difference between 2D and 3D experiences, and have difficulty transferring information across dimensions when they are not provided with additional cues, such as repetition to help them (Barr et al., 2007).

When presentations are repeated and toddlers are tested immediately, 12- to 21-month old toddlers can learn from video (Barr et al., 2007; Barr, Muentener, Garcia, Fujimoto, & Chavez, 2007). For example, Barr, Muentener, Garcia, Fujimoto, and Chavez (2007) found that when infants were shown twice as many video demonstrations as live demonstrations (60s v. a 30s demonstration), their performance on the task was at the same level as those that viewed the
live demonstrations. Similarly, after multiple exposures to the target information toddlers 18- to 33-months of age learned the novel word “crescent” from a commercially available video (Vandewater, Barr, Park, & Lee, in press), though performance was not compared to an adult teaching condition.

Socially contingent actions between an onscreen adult and a toddler also reduce the video deficit. Troseth (2003a), for example, provided 2-year-old toddlers and their families with video cameras connected to their home television monitors for 2 weeks so that toddlers could view themselves live on the television screen. Toddlers that had contingent television experiences at home performed better on object-retrieval tasks when shown objects being hidden on video. Similarly, 2-year-old toddlers who interacted with an adult via contingent, closed-circuit television experiences prior to viewing the video demonstration in which a toy was hidden found the hidden toys better than did toddlers who only watched the toy being hidden on video (Troseth, Saylor, & Archer, 2006).

Interestingly, if a video monitor is placed so that children think they are looking at a live event through a “window”, 2-year-old children successfully performed the object retrieval tasks (Troseth & DeLoache, 1998). Thus, it is not the 2D image per se that causes the video deficit. Rather it is what the child thinks a video presentation represents. Moreover, while 30- and 36-month-old children were less successful at completing an object retrieval task after watching a video demonstration, children who were exposed to the demonstration of the hidden objects by playing an interactive computer game were as successful at the object retrieval task as those who watched the demonstration live through a window (Lauricella, et al., 2010).

Finally, language cues appear to enhance learning from video presentations. Specifically, with increased adult labeling of important television content during program pauses, children
ages 3-10 remembered more information when compared to information presented with voice-overs on a television program (Watkins, Calvert, Huston-Stein, & Wright, 1980). Even at age 2, providing video labels via video voice-overs or by the parent improved learning to levels that were significantly above baseline control participants and their scores were not significantly different from live demonstration, thus ameliorating the video deficit (Barr & Wyss, 2008). Parent-interaction, in which parents used questions and labels/descriptions while co-viewing videos with their infants resulted in increased infant looking duration to the video and infants responding more to video content (Barr, Zack, Garcia, & Muentener, 2008; Fidler, Zack, & Barr, 2010).

In sum, while it seems that infants may initially be unable to learn from video presentations, these findings suggest that there are ways in which the video deficit can be ameliorated, resulting in very young children learning from media presentations. Increasing exposure through repetition, providing verbal labels, or increasing young children’s experience using video or televised material as a source of information about children’s real world environments can help very young children learn from video. It is unlikely that these are the only factors that will successfully ameliorate the video deficit. Character related factors, like character familiarity or parasocial relationships with media characters, are options that may also ameliorate the video deficit.

**Video Deficit Theories**

Different theoretical models have been advanced to explain the video deficit; two separate but not mutually exclusive explanations are discussed here. One approach is Fisch’s (2000) Capacity Model. In this model, processing videos overloads very young children’s working memory because they have to process multiple aspects of the content simultaneously,
specifically the educational content and the narrative. In this model, prior knowledge can help to decrease the working memory demands that children encounter while learning from television presentations. An alternate approach is based on the idea that children process information better when it has social relevance to them (see Troseth et al., 2006). In this approach, very young children may not perceive the social relevance between the model’s onscreen action and real-world activities, and thus may have trouble when asked to imitate the behavior seen on a screen.

*Fisch’s Capacity Model.* According to Fisch’s (2000) Capacity Model, young children have to allocate working memory to multiple factors when watching a television program in order to comprehend both the narrative and the embedded educational content, such as a lesson about the alphabet. Toddlers may face challenges to working memory even when viewing videos that have a minimal narrative and only one educational task.

In particular, working memory may be taxed if very young children are processing videos of unfamiliar people. Infants and toddlers are very attracted to faces and objects that look like faces. Older infants attend more to faces than objects when they are shown static images (von Hofsten, Dahlstrom, & Fredriksson, 2005), video images (Gredeback, Theuring, Hauf, & Kenward, 2009), or cartoon characters (Frank, Vul, & Johnson, 2009). Therefore, when watching videos with an experimenter or character on the screen, toddlers may be focusing on the characters’ face and trying to assess who the character is before they attempt to understand what the character is doing.

Prior experience with the educational content that is presented on video can help reduce working memory issues (Fisch, 2000). Traditionally, the videos that are used during experiments that assess the video deficit use a novel onscreen experimenter to model the behaviors that the child is expected to imitate after viewing, resulting in very low levels of prior knowledge of the
television character. For example, in studies by Barr and colleagues (Barr & Hayne, 1999; Barr et al., 2007; Barr, Muentener, Garcia, Fujimoto, & Chavez, 2007; Barr & Wyss, 2008) and Troseth and colleagues (1998, 2003a, 2003b), the experimenter on the screen was an adult that the child did not know. When watching these videos, the toddler has to process the novel character, the details of the demonstration, and any language or narration that accompanies the demonstration, making this a task that strains the working memory capabilities of a very young child. Thus an increase in prior knowledge of the character could likely lead to a decrease in processing demands. Some research supports this theory. Repeated exposure to a task portrayed on a video, for example, can ameliorate the video deficit (Barr, Muentener, Garcia, Fujimoto, & Chavez, 2007). Perhaps that benefit occurs, in part, because the infant is becoming more familiar with the onscreen adult performing the demonstration with each repetition. As a result of increased familiarity, the infant has to expend less working memory to process the face of the novel person which enables the infant to focus more attentional resources on processing the task portrayed on the video.

**Social Relevance.** Another approach, presented by Troseth and colleagues (2006), is that very young children may fail to process video information because it lacks social relevance to them. On typical days, young children are not expected to reenact material that they view on a television program or video in their everyday life. Therefore, video rarely has social relevance to young children. However, when the social relevance of a video program is increased, children do learn (e.g., Troseth, 2003a). Specifically, very young children can learn information from a video when exposed to closed-circuit television where they can see themselves onscreen in real time (Troseth, 2003a), or when the onscreen experimenter speaks directly to them, using their name and other personal information (Troseth et al., 2006).
Television programs and videos designed for preschool-aged children now often have characters speak to the audience and pause for a reply, potentially engaging the audience member in a communicative interaction (Calvert et al., 2007). This practice may be increasing young children’s experience that video can respond in a socially relevant manner. This outcome may be particularly strong for young children who develop emotional connections and relationships with popular television or video characters like Dora from *Dora the Explorer* or Elmo from *Sesame Street*.

Based on both of these theories, familiarity with the onscreen characters is expected to lead to improved learning from a video presentation. It is possible that children will shift attention to the task as a character becomes more familiar, which can lead to decreased demand on working memory, supporting Fisch’s (2000) capacity model. Similarly, being familiar with the character may increase the social relevance that helps children learn from video according to Troseth (2003a).

*Parasocial Relationships and Interactions*

Horton and Wohl (1956) first coined the terms “parasocial relationship” and “parasocial interaction.” A parasocial relationship is defined as a “seeming face-to-face relationship between spectator and performer” (Horton & Wohl, 1956, p. 215). In other words, people form similar kinds of relationships with characters on a television program, movie, or radio show that they would form with people in the real world. That is, people feel like they know the characters that they view regularly on a program. In an ethnographic study, for example, one woman discussed her parasocial relationship with *Good Morning America*’s co-host Joan Lunden and said, “I regard Joan Lunden as a trusted friend” (Alperstein, 1991, p.48).
Audience members can also have parasocial interactions with the media characters in which the audience member responds in some way to the actions and verbalizations made by the media character (Horton & Wohl, 1956). For example, a parasocial interaction occurs when a newscaster says to the audience, “Have a great day!” and the audience member responds out loud with, “Thanks! You do the same.” Horton and Wohl (1956) argued that, “the more the performer seems to adjust his performance to the supposed response of the audience, the more the audience tends to make the response anticipated” (p. 215).

Adult parasocial relationships and interactions. Parasocial relationships and interactions have been studied for more than 50 years (e.g., Horton & Wohl, 1956). Most of the research on parasocial relationships and interactions focused on those that adults form with media characters (Ashe & McCutcheon, 2001; Brown, Basil, & Bocarnea, 2003ab; Cohen, 2004; Giles & Maltby, 2003; Hoffner & Buchanan, 2005; Levy, 1979; Perse & Rubin, 1989; Rubin & McHugh, 1987; Rubin, Perse, & Powell, 1985; Stephens, Hill, & Bergman, 1996). Early research on parasocial relationships and interactions focused on the relationships, that audience members formed with newscasters (Levy, 1979). Focus group reports indicate that that not only do most adults (52%) feel that they have a “friend” in a newscaster, but many adults feel upset if the anchorman is on vacation and therefore not on the program that night (Levy, 1979). Some adults reported that they “talk back” to the newscaster on occasion (Levy, 1979). Other studies found that adults form parasocial relationships even with characters that do not talk directly to the audience the way newscasters do. For example, adults form parasocial relationships, as measured by involvement with the character, with celebrities like Princess Diana (Brown et al., 2003a) or favorite soap opera characters (Perse & Rubin, 1989). These relationships may form because the audience member identifies with the character or in some way wants to emulate the character.
Beyond studying the relationships that adults form with soap opera characters (Perse & Rubin, 1989), news anchors (Levy, 1979), and celebrities (Brown et al., 2003a,b), the associations between adult parasocial relationships and parasocial interactions and outcomes such as loneliness (Ashe & McCutcheon, 2001; Perse & Rubin, 1990) and attachment (Giles & Maltby, 2003) have been studied as well. Parasocial relationships even improve product sales when products are sold on home shopping television channels like QVC (Stephens et al., 1996).

The program structure itself can influence the development of parasocial interactions. Auter (1992) examined the parasocial interactions that develop when audience members watch a program in which the main character “breaks the fourth wall” by stepping out of character and addressing the audience directly as compared to a program in which the character’s interaction with the audience is edited out. Participants reported significantly higher parasocial interaction scores if they watched a television program in which the main character did “break the fourth wall” and spoke directly to the audience, suggesting that these types of television production techniques play a key role in the development of parasocial interactions.

Parasocial interactions and relationships can develop as a function of the type of program or based on the specific character and his/her qualities. Aspects related to the character’s level of attractiveness have been particularly strong predictors of the formation of parasocial relationships and interactions (Rubin & McHugh, 1987). A study of college student participants and their favorite television character by Rubin and McHugh (1987) indicated that higher levels of reported physical attraction (e.g., “I find her/him very attractive physically”) to the character significantly predicted parasocial interaction as measured by the Parasocial Interaction Scale (see Rubin et al., 1985). In addition to physical attraction, college students who reported feeling social attraction to the character (e.g., “I feel like the character could be a friend of mine”) were
more likely to form a parasocial interaction with the character. Finally, task attraction, measured by how strongly individuals reported agreeing or disagreeing with statements like, “I have confidence in his (her) ability to get the job done” was also a significant predictor of parasocial interactions.

Adults also highly value reality and want characters to act in a way that suggests that they could be real people. For example, Rubin and colleagues (1985) found that individuals who believed the news had high levels of realism had higher reported levels of parasocial interactions. Individuals who believed that it was important to view local news were also more likely to form parasocial interactions with a favorite news anchor.

Researchers have examined the outcomes and behavior changes that occur as a result of having a parasocial relationship with media characters. Specifically, parasocial relationships can have positive and negative influences on audience members and their behavior. People who reported parasocial relationships with the professional basketball player “Magic” Johnson, who is HIV positive, were more concerned about AIDS and more likely to report a reduction in high risk sexual behavior (Brown & Basil, 1995). Professional baseball player Mark McGuire broke the homerun record in 1998; leading to a substantial increase in the amount of media attention he received (Brown, et al., 2003b). Not only was Mark McGuire well known for his homerun hitting, his interest in preventing child abuse became a popular topic for media coverage as well. As a result, those who formed parasocial relationships with Mark McGuire were more likely to become concerned with preventing child abuse (Brown et al., 2003b). However, people who formed parasocial relationships with Mark McGuire were also more likely to consider taking the muscle-enhancing drug that McGuire had used while playing baseball (Brown et al., 2003b).
While there is considerable overlap in how parasocial relationships and parasocial interactions have been studied in much of the adult literature, these two phenomena can exist separately. One may lead to the development of the other, but the direction is still not entirely clear. Rubin and McHugh (1987) developed a path model to predict parasocial relationship development based on a combination of television exposure, three types of attraction (social, task, and physical), and parasocial interaction. Parasocial interaction was measured using an adapted version of the Parasocial Interaction Scale by Rubin and colleagues (1985). The three attraction variables were measured using a 15-item scale that was originally developed by McCroskey and McCain (1974). Social attraction was measured by the level of similarity between the media character’s attitudes and the audience members’ attitudes. Task attraction was measured based on the viewer’s opinion of how well the character is able to complete their job. Physical attraction was measured based on how physically attractive the audience member finds the media character. Findings indicated that a significant path exists between social and task attraction and relationship importance when the two attraction variables are mediated by parasocial interaction (see Figure 1). According to these authors, parasocial interaction is strongly associated with both social attraction and task attraction and plays a key role in the development of parasocial relationships.

However, there are a few limitations of this study. The measure of parasocial relationship used in this study examined how important the participant felt developing a relationship with a favorite television character is, which focused on questions that measured the participant’s dedication to the program the character was on. Additionally, parasocial interaction was measured by an adapted version of the Parasocial Interaction Scale developed by Rubin and colleagues (1985). While their adapted version did include a question asking if the participant
makes remarks to their favorite television character, the other questions were primarily addressing the parasocial relationship rather than the parasocial interaction that the audience member had with the media character. Therefore, this study does not clearly indicate the direction in which parasocial relationships develop.

Blurring the boundaries between parasocial relationship and parasocial interaction, is a flaw in studies as well. Many studies examine parasocial relationships and parasocial interactions as one concept rather than explicitly differentiating these terms in the way that Horton and Wohl (1956) initially distinguished them. For instance, many studies use the Parasocial Interaction Scale that was developed by Rubin and colleagues (1985) to examine audience members’ parasocial interactions with media characters (e.g., Rubin & McHugh, 1987; Perse & Rubin, 1989). However, the questions that are asked on the Parasocial Interaction Scale address factors that are more associated with parasocial relationships than parasocial interactions. For example, the questions on the Parasocial Interaction Scale include: “I feel sorry for my favorite newscaster when he or she makes a mistake”, “I like hearing the voice of my favorite newscaster in my home”, “My favorite newscaster keeps me company when the news is on television” (see Rubin et al., 1985). As a result, the adult literature on parasocial relationships and interactions rarely disassociates these two different terms into distinct separate concepts, making it very challenging to understand the direction in which the development of parasocial relationships and interactions occur.

Nevertheless, there is reason to suspect that parasocial interaction may not occur until an audience member has a parasocial relationship with the character and truly trusts them. The research that examines audience parasocial interaction with media character often asks the participant to discuss their parasocial interaction with a “favorite” television character (e.g.,
Cohen, 2004; Perse & Rubin, 1987; Perse & Rubin, 1988; Perse & Rubin, 1989), suggesting that without the familiarity and emotional connection to a character, adults are unlikely to engage in parasocial interactions. The connections between parasocial relationships and parasocial interactions may be of particular importance when considering very young children.

Children’s parasocial relationships and interactions. Neither psychologists nor those in the field of communications have deeply investigated the parasocial relationships and interactions that young children form with media characters. Given the number of children’s programs that now rely on character’s interacting with the audience, either by looking directly out of the screen at the audience or stopping and pausing to let the child respond to a question, it is important to understand how parasocial interactions and relationships develop in young audiences and how they may influence their learning from media.

Many programs created for the preschool audience have shifted towards using interactive techniques in which the characters look directly out at the audience and use language that invites the audience to participate with the characters (e.g. Blue’s Clues, Dora the Explorer, Super Why). Children’s programs such as Mister Roger’s Neighborhood, Dora the Explorer, and Blues Clues are popular programs that “break this fourth wall” and have the characters “interact” with the child audience members. Programs like Blues’ Clues, that utilize interactive techniques, have a positive impact on children’s cognitive development, including performance on pattern perception, creative thinking, and general problem solving skills (Anderson & et al., 2000). These studies indicate that factors related to the production of television programs that might lead to parasocial interaction can also play a role in how well children learn from them. Though not framed as parasocial interaction, children who interact with media characters demonstrate favorable outcomes. For instance, child audience interactions to character prompts became more
frequent over repeated viewings of an episode of Blue’s Clues (Crawley, Anderson, Wilder, Williams, & Santomero, 1999). Consistent with these findings, Calvert and colleagues (2007) found that the more preschool-aged children responded to character prompts from Dora the Explorer, the better they understood the central, plot-relevant story content.

In addition to program characteristics, characters’ behaviors and character traits are extremely important for children to develop parasocial relationships and interactions with the character. For children ages 7-12, wishful identification and parasocial interaction was higher for characters regarded as kinder, more helpful, more caring, less mean, and less selfish (Hoffner, 1996). For girls only, the attractiveness of the character was the sole predictor of parasocial interactions with female characters (Hoffner, 1996).

Increased exposure to the television characters may also be related to an increase in how much children like the character. Children reported that they liked the main characters Blue and Steve from the television program Blue’s Clues more after the second season of viewing than the first (Anderson et al., 2000). Also, children may be more likely to identify with characters that are similar to them. Hoffner (1996) asked 7- to 11-year-olds about their favorite television characters and found that children’s favorite TV characters were predominately of the same sex as the child, but more so for boys (91%) than for girls (53%). Similarly, research on Dora, the main character from the children’s educational show Dora the Explorer, found that girls perceived themselves as being like Dora and wanting to be like Dora more than boys did (Calvert et al., 2007). These results suggest that girls tend to identify with the main character Dora in this program and see her as a possible role model whereas boys do not have these same types of connections with this particular media character. Overall, exposure and similarities between the
child audience member and the media character appear to be important factors that likely lead to the development of parasocial relationships.

Similar to adults, it appears that relationships that children have with media characters can influence behavior. Character familiarity and branded characters have been extremely successful at marketing various food products to very young children. Specifically, using pictures of familiar characters, such as Elmo from *Sesame Street*, when marketing certain food products increased young children’s selection of that food when given a food choice (Kotler et al., under review). Associations with popular television characters also lead to creative, divergent learning after viewing preschool educational programs. For example, preschoolers who reported that they were more similar to the character Dora from *Dora the Explorer*, who models creative, divergent responses to problems, made more divergent responses after viewing an episode of the program than those who perceived themselves as less similar to Dora (Calvert et al., 2007). It may be that the emotional connection that young children have towards these media characters is playing a role in their learning from them.

In summary, the literature provides evidence that familiarity with characters can influence young children’s food choice when the specific character is on the packaging (Kotler et al., under review) and that the techniques used to increase audience interaction with programs like *Blue’s Clues* and *Dora the Explorer* does improve learning (Anderson et al., 2000; Calvert et al., 2007). However, it is still unclear how parasocial relationships and parasocial interactions increase learning from media presentations. Did young children learn more from *Blue’s Clues* as a function of the interactive cues alone? Or did these children develop a parasocial relationship with the main characters, the animated dog Blue and the adult male character Steve that led to increased learning when interactive techniques were used? It is important that future research,
especially with young children, examine parasocial relationships and parasocial interactions as
two separate but related concepts in order to better understand the role they both play in young
children’s learning from media. It may not be that interactivity alone drives improved
performance, but that having a parasocial relationship with the character and adding interactivity
may result in increased learning.

*Seriation Skills and Strategies*

Piaget (1952) created classic tasks that assessed children’s conceptual understanding in
which objects are ordered in a logical-mathematical sequence, such as by size. The ability to
seriate is a cognitive task that is associated with later mathematical, sequencing, and ordering
skills (Arlin, 1981; Clements, 1984; Piaget, 1952). If children can learn to seriate after viewing a
character perform that kind of task on video, then they will be exhibiting learning of a
meaningful complex cognitive task, thereby meeting one criticism about whether infants can
learn a truly educational task from a video (Anderson & Pempek, 2005). No one, however, has
yet examined if infants or toddlers can learn from a video demonstrating this kind of complex
task.

Previous research has compared young children’s success at seriating plastic cups either
with no prior demonstration or after watching an adult seriate the cups (DeLoache, Sugarman, &
Brown, 1985; Fragaszy, Galloway, Johnson-Pynn, & Brakke, 2002; Greenfield, Nelson, &
Saltzman 1972). This kind of sequencing task requires children to nest cups together in the
correct order so that all of the smaller cups are placed within the largest cup.

Research by Greenfield and colleagues (1972) examined the strategies that very young
children used to nest cups after seeing a live adult demonstrate how to seriate five cups. In this
study, the adult demonstrated the *subassembly method*, a complex strategy in which she nested
the cups together by putting two already combined cups into a larger cup. After exposure to the model, children sometimes nested only two cups together, known as the pair method. Rather than imitating the model’s subassembly method, children who were successful at this task typically used a simpler approach, known as the pot method, in which children moved one cup into an existing cup structure. In other words, children who were successful in nesting all five cups worked to achieve the goal of nesting a full stack of five cups by using a simpler, and different, strategy rather than directly copying the behaviors demonstrated.

The seriation task, then, is unique because it is a meaningful cognitive task that allows for variation in how toddlers can reach the goal state. Many studies assessed learning based on the infant or toddlers ability to imitate the behaviors that were demonstrated (e.g., Barr & Hayne, 1999; Barr et al., 2007; Troseth & DeLoache, 1998; Troseth, 2003b). However, imitation is more than just mimicking the behaviors seen (Bandura, 1986; Carpenter, Call, & Tomasello, 2002). Children may mimic a person’s behavior without fully understanding the reason behind the actions or they may emulate the end result and not necessarily attend or copy the exact behaviors demonstrated (Carpenter et al., 2002). Research indicates that infants will mimic an experimenter’s actions directly if the goal of the task is unknown, but will emulate the experimenter and achieve the end-state of the task, without copying unnecessary behaviors when the goal is clear (Carpenter, Call, & Tomasello, 2005). Similarly, Meltzoff (1995) showed that infants will seek to achieve the goal-state even when the goal state action is never demonstrated directly for them. More specifically, if an experimenter attempts but fails to reach the goal-state, 18-month-old infants will successfully perform the actions that the experimenter had meant to perform, rather than mimicking his mistakes.
Seriation is a logical mathematical task that allows assessment of whether or not young children are imitating an act verbatim, or whether they are seeking to achieve the overall goal of seriation by adopting a variety of methods to perform the task. Seriation tasks can provide evidence of conceptual learning from television, a problem that was reported with previous research in this area (Anderson & Pempek, 2005).

Summary

Despite the AAP (1999) recommendation that infants under age 2 should not be exposed to any screen media, the majority of infants and toddlers have watched television (Rideout & Hamel, 2006) and many products have been created for this very young audience with strong educational claims (Garrison & Christakis, 2005). Recent research has discovered ways in which factors related to the production or viewing of the video demonstration can be altered to help children under 2 learn from video presentations (Barr & Wyss, 2008; Barr et al., 2007; Barr, Muentener, Garcia, Fujimoto, & Chavez, 2007; Lauricella et al., 2010; Troseth, 2003a).

Research with older children has indicated that the use of interactive cues, like those used in popular television programs Blue’s Clues and Dora the Explorer are associated with increased learning (Anderson et al., 2000; Calvert et al., 2007), but to date research has not examined the impact of similar interactive cues on infant and toddler learning from media presentations. Very young children form emotional connections with media characters (Adamick, 2008) and certain characters that are highly popular with very young children, such as Elmo, can actually influence behavior changes (Kotler et al, under review). Therefore, parasocial relationships and the use of interaction styles may be additional tools that are capable of ameliorating the video deficit effect for very young children.
In this dissertation, two studies assessed what factors influence infant and toddler learning from video presentations. In Study 1, an imitation task was used to assess whether a model’s use of parasocial or non-parasocial cues influence how infants and toddlers learn from video when compared to social and non-social cues used in a live demonstration. In Study 2, plastic nesting cups were used to examine whether toddlers could learn a classic Piagetian seriation task from video when demonstrated by a familiar versus an unfamiliar on-screen character, thereby assessing the role of parasocial relationships
CHAPTER II: STUDY 1: PARASOCIAL INTERACTION AND TODDLERS’ LEARNING FROM VIDEO

Research demonstrates that toddlers often face a video deficit until they are approximately 2 years old (Anderson & Pempek, 2005). However, when the social relevance of the video presentation is increased, the video deficit can be ameliorated (Troseth, 2003b). The purpose of this study was to determine if factors related to the child or the way in which a demonstration was presented on video could also ameliorate the video deficit in children under age 2. Fifteen- and 18-month-old children were randomly assigned to one of four treatment conditions: Parasocial, Non-Parasocial, Social, or Non-Social, or to a no exposure Baseline control group, and learning was measured based on their success at imitating the steps necessary to create a toy rattle.

Given that infants are capable of following eye gaze (for review see Meltzoff & Brooks, 2007) and that interactive techniques can teach preschool-aged audiences (Calvert et al., 2007), we hypothesized that infants who viewed demonstrations in which the character looked out at the audience (Social and Parasocial conditions) would imitate more behaviors than infants that viewed demonstrations in which the experimenter focused her attention only on the object (Non-Social and Non-Parasocial conditions). Additionally, we predicted that the use of parasocial interaction cues in a video would increase the social relevance of the media experience and infants and toddlers would learn better from a video presentation in which parasocial cues were used as compared to a video in which non-parasocial cues were used. Finally, because infant girls are better at following eye gaze (Bayliss, di Pellegrino, & Tipper, 2005) and prefer attending to faces than boys (Connellan, Baron-Cohen, Wheelwright, Batki, & Ahluwalia, 2000), girls were predicted to perform better than boys on this specific imitation task.
Method

Participants

One hundred and twenty-three infants participated in this study. Sixty-one 18-month-olds (31 male) and 62 15-month olds (32 male) were randomly assigned by age and sex into one of five conditions. Two conditions were video demonstration conditions: Parasocial and Non-Parasocial; two were live demonstration conditions: Social and Non-Social; and one was a no-demonstration Baseline Control. Overall the sample was relatively homogeneous in ethnicity and socioeconomic status. Eighty percent of the infants were Caucasian, 8% were mixed ethnicities, 5% African American, 6% Asian, and less than 1% Hispanic. Socioeconomic status was indexed by parental education. Most parents (87%) had a graduate degree, 12% had a college degree, and less than 2% had only a high school degree.

Materials and Experimental Conditions

The stimuli used involved construction of a red rattle, identical to the one used by Simcock and DeLoache (2006), which consisted of a red wooden stick (the stick) (12.5 cm long) with a plug on the end which fit into a blue plastic ball with a hole cut in the top (the jar) (4 cm in diameter), and a red wooden bead (the ball) (1.5 cm in diameter). Two videos in which the same female experimenter performed the demonstration were created. In the Non-parasocial condition, during one continuous shot, the televised adult looked at the pieces of the rattle and narrated her behavior. The televised adult said, “I’m making a rattle. I put the ball in the jar. Now I put the stick on the jar. See a rattle. Shake. Shake. Shake.” The televised adult looked down at the objects while performing the demonstration except when it was time to shake the rattle. At this point the televised adult looked sideways and shook the rattle up high near her head as she looked at it (see Figure 2). The televised adult did not make eye-contact with the audience at any
point during the demonstration. To start the second demonstration, the televised adult said, “I’ll do that again.” There was a brief 1 second fade to black and then the first demonstration was repeated.

In the Parasocial condition, the televised adult put together the same rattle as in the Non-parasocial condition. However, the televised adult looked straight ahead (at the audience) and said, “Let’s make a rattle. You put the ball in the jar. Now, you put the stick on the jar. See a rattle. Shake. Shake. Shake.” The televised adult looked down at the object while performing each specific action (e.g., putting the ball in the jar) but looked at the audience after each action and looked at the audience when she shook the rattle (see Figure 2). To start the second demonstration, the televised adult said, “Let’s do that again!” Once again, there was a brief 1 second fade to black and then the first demonstration was repeated.

The live demonstration conditions (Social and Non-Social) were identical to the video conditions (Parasocial and Non-Parasocial, respectively) except that the demonstration was performed live in front of the infant rather than on a video. After the first demonstration, the experimenter took the rattle apart behind her back and placed the three pieces in front of her and repeated the demonstration. The demonstration was repeated twice for all infants. There was also a Baseline Control condition that did not view a demonstration.

Procedure

All participants were tested in their homes at a time that the parent reported the child was alert and active. All parents completed an informed consent and a short parent questionnaire while the experimenters played with the infant until the infant was comfortable with them.

Infants in the treatment conditions sat in their parent’s lap and were exposed either to a live or a video demonstration. Infants were tested immediately after viewing. For infants in the
four experimental conditions, the experimenter put the three pieces of the rattle in front of the infant and said, “You just saw how to make a rattle. Can you show me how to make a rattle?” To assess the spontaneous production of the target actions, the experimenter put the three pieces of the rattle in front of the infant in the Baseline Control condition and said, “These are the things you use to make a rattle. Can you show me how to make a rattle?” All infants were given 60 seconds to make the rattle.

Although parents remained in the room for the entire procedure and were told to interact with their infant, they were told not to direct the infant to the target actions. The demonstration and test were videotaped for later coding.

**Coding and Reliability**

*Imitation Scores.* Scoring began as soon as the infant touched any of the pieces of the rattle. Three possible target actions were coded and awarded 1 point each: putting the ball in the jar, the stick on the jar, and shaking the rattle. An imitation score was calculated by summing the total number of target actions that each infant imitated during the videotaped test session (range 0–3). Twenty-one percent of tests were coded by 2 observers, yielding 92% agreement and a kappa of .84.

*Looking Time.* Looking time was coded from the videotaped sessions using a computer timer. The coder pressed a key to mark the beginning and end of the demonstration and pressed another key when toddlers looked at or away from the demonstration. The overall percent looking was subsequently calculated (e.g., Wright et al., 1984). Data were not recorded for six toddlers due to technical errors with the videotaping equipment. Twenty percent of videotapes were coded by two observers, yielding an intraclass reliability correlation above .95.
Results

Imitation Scores

Imitation is operationally defined as group performance that is significantly above baseline (see Barr & Hayne, 2000). A 5 Condition (Parasocial, Social, Non-Parasocial, Non-Social, Baseline Control) x 2 Age (18 months, 15 months) x 2 sex (male, female) analysis of variance (ANOVA) was conducted with total imitation score as the dependent variable. The overall ANOVA yielded a significant main effect of condition, $F(4, 103) = 10.75, p < .01$, partial $\eta^2 = .30$, and sex, $F(1, 103) = 8.44, p < .01$, partial $\eta^2 = .08$. Tukeys post hoc t-tests ($p < .05$) indicated that children in the four experimental conditions (Social ($M = 2.1, SD = .83$); Non-Social ($M = 2.00, SD = .82$); Parasocial ($M = 1.92, SD = .83$); Non-Parasocial ($M = 1.96, SD = .89$) scored significantly higher than those in the Baseline Control condition ($M = .83, SD = .76$). Girls ($M = 1.98, SD = .95$) scored significantly higher than boys ($M = 1.57, SD = .89$). There were no significant differences in imitation scores as a function of age.

Since imitation scores for toddlers in all four experimental conditions were significantly higher than those for toddlers in the Baseline Control condition, we dropped the baseline condition out of further analyses to examine how interactive and non-interactive conditions differed as well as how the video and live conditions differed.

Because imitations scores did not significantly differ for two interactive conditions (Parasocial and Social) these two conditions were collapsed into an Interactive condition. Similarly, the two non-interactive conditions (Non-Parasocial and Non-Social) were collapsed in a single Non-Interactive condition. A 2 Condition (Interactive, Non-Interactive) x 2 Age (18 months, 15 months) x 2 sex (male, female) ANOVA was conducted with total imitation score as the dependent variable. The overall ANOVA yielded a significant main effect of age, $F(1, 91) =$
5.53, $p = .02$, partial $\eta^2 = .06$, and sex, $F(1, 91) = 7.98, p < .01$, partial $\eta^2 = .08$. Eighteen-month-olds ($M = 2.18, SD = .78$) scored significantly higher than 15-month-olds ($M = 1.80, SD = .88$) and girls ($M = 2.23, SD = .81$) scored significantly higher than boys ($M = 1.76, SD = .84$). There were no significant differences in imitation score as a function of condition.

Because imitations scores did not significantly differ for two video conditions (Parasocial and Non-Parasocial), these two conditions were then collapsed into a Video condition. Similarly, the two live conditions (Social and Non-Social) were collapsed in a single Live condition. A 2 Condition (Video, Live) x 2 Age (18 months, 15 months) x 2 sex (male, female) ANOVA was conducted with total imitation score as the dependent variable. The overall ANOVA yielded a significant main effect of age, $F(1, 91) = 5.37, p = .02$, partial $\eta^2 = .06$, and sex, $F(1, 91) = 7.85, p < .01$, partial $\eta^2 = .08$. Eighteen-month-olds ($M = 2.18, SD = .78$) scored significantly higher than 15-month-olds ($M = 1.80, SD = .88$), and girls ($M = 2.23, SD = .81$) scored significantly higher than boys ($M = 1.76, SD = .84$). There were no significant differences in imitation score as a function of the Live or Video conditions.

**Looking time**

A 4 Condition (Social, Non-Social, Parasocial, Non-Parasocial) x 2 Age (18 months, 15 months) x 2 Sex (male, female) ANOVA conducted with percent looking time as the dependent variable yielded a sex by condition interaction, $F(3, 77) = 4.95, p < .01$ partial $\eta^2 = .16$. To analyze the interaction between sex and condition, separate one way ANOVAs were conducted with looking time as the dependent variable and condition as the independent variable for each sex. When the ANOVA was conducted only for the boys, there was a significant main effect of condition, $F(3, 38) = 5.81, p < .01$ partial $\eta^2 = .31$. Tukeys Post hoc t-tests ($p < .05$) indicated that boys looked significantly less during Parasocial ($M = 85.97, SD = 13.73$) than to any of the
other three demonstrations (Social ($M = 89.12, SD = 6.01$), Non-social Interaction Live ($M = 97.24, SD = 2.86$), Non-parasocial ($M = 97.75, SD = 2.48$). When the ANOVA was conducted with only the girls, looking time did not differ by condition.

An Analysis of Covariance (ANCOVA) controlling for looking time was conducted with imitation scores as the dependent variable and age, sex, and condition as the independent variables. The overall ANCOVA yielded a significant main effect of age, $F(1, 76) = 5.29, p = .02$, partial $\eta^2 = .07$ and sex, $F(1, 76) = 5.92, p = .02$, partial $\eta^2 = .08$. Even when controlling for looking time, girls ($M = 2.21, SD = .81$) and older children ($M = 2.09, SD = .83$) still performed better than boys ($M = 1.77, SD = .81$) and younger children ($M = 1.79, SD = .85$). Once again, there were no differences across the four experimental conditions on imitation scores, $F(3, 76) = .38, p = .77$.

Discussion

The purpose of this study was to assess how interactive features, such as eye gaze and simple interactive language cues, and characteristics of the toddler, such as age and sex, influence young children’s imitation. In support of our first prediction, toddlers performed equally well on the imitation task when they viewed the live demonstrations as when they viewed the video presentations, thus providing evidence that the video deficit can be ameliorated. However, contrary to our second hypothesis, imitation performance did not differ as a function of the interactive cues used. Although toddlers in both the Parasocial and Non-Parasocial conditions successfully learned from video, performing significantly above those toddlers in the Baseline Control condition, they did not significantly differ from each other. Finally, girls and 18-month-olds performed the imitation task better than boys and 15-month-
olds, regardless of whether the demonstration was presented live or on video and regardless of whether interactive cues were used or not.

Both Parasocial and Non-Parasocial conditions were successful techniques to teach young children, but they may do so in different ways. Parasocial interaction cues on video may increase audience motivation to learn the task or simply increase their trust in the character. By contrast, non-parasocial interaction cues may help very young children focus on the task being demonstrated. That is, the eye-gaze of the experimenter remained focused on the pieces of the rattle throughout the entire demonstration which may have helped toddlers focus their attention on the pieces used to create the rattle thereby assisting their learning of the task.

While toddlers’ learning was not impacted by factors related to the presentation of the demonstration, aspects of the children, specifically age and sex, were related to their success. Previous research examining the video deficit effect frequently demonstrates that learning performance improves with the age of the child (e.g., Barr et al., 2007; Troseth & DeLoache, 1998). Additionally, girls outperformed boys on this task, regardless of condition. This finding is consistent with a study by Goldenberg and colleagues (2009) that found sex differences, with girls learning more words from a video than boys. In our study, girls were also more attentive than boys to the Parasocial video presentation.

Given that eye gaze was a crucial part of all four experimental conditions, it is likely that the ability to follow eye gaze played a role in infant’s success on this task. Prior research has demonstrated that females are generally better than males at following eye gaze (Bayliss et al., 2005). This ability to follow eye-gaze may partly explain why attention was lower for boys in the Parasocial condition compared to the other experimental conditions. Boys may have had difficulty following the eye-gaze of the on-screen experimenter and looked away from the
screen, resulting in lower levels of attention to the Parasocial video, than when she only looked at the objects, a simpler task for a child to track.

In previous research in which a video deficit effect was found, the demonstrations were performed with minimal verbal description (e.g., Barr & Hayne, 1999; Barr & Wyss, 2008; Barr et al., 2007; Barr, Muentener, Garcia, Fujimoto, & Chavez, 2007; Hayne et al., 2003). However, Hayne and Herbert (2004) found that a verbal prompt at the time of test enhanced retrieval by 18- to 30-month-olds. When rich language cues were added to the demonstration in the present study, infants were able to imitate from television after only 2 demonstrations and exhibited no video deficit. This finding may reflect enhanced information processing due to stimuli changes in both the character’s and experimenter’s eye gaze and language cues. Additionally, the increased language cues provided in the demonstrations may have been particularly helpful to the girls in our study since girls tend to have higher levels of vocabulary at 15-18 months of age (Fenson et al., 2000). Moreover, the increased language provided in the demonstrations may have taxed boys’ working memory more than the girls’ working memory. If boys have yet to develop language as well as the girls, it may be that processing the additional language cues resulted in less working memory dedicated to the demonstration and thus worse performance on the task.

There are two main limitations of this study. First, the cues used to differentiate the Parasocial and Non-Parasocial conditions were not as evident as we had anticipated. In both video conditions, the rattle pieces were at the center bottom of the screen. Children may have focused their attention only on the rattle pieces and not noticed that the experimenter was using interactive cues. Eye-tracking studies are needed to address this possible interpretation of the data. Second, the experimenters that performed the demonstrations were not familiar to the child. It may be that parasocial interaction can influence learning if the child has a parasocial
relationship with the character. Thus our use of parasocial interactive cues may have been less effective given that children had no prior exposure or relationship with the character. Finally, we did not have a prior measure of language skills for children.

In conclusion, this study provides evidence that factors related to both the onscreen character and characteristics of the child may play a role in infant’s successful imitation from a video presentation. However, this study leaves questions unanswered regarding the effects of parasocial interaction cues when the character is someone that the child is familiar with or has a parasocial relationship with. That topic is the focus of the second study.
CHAPTER III: ROLE OF FAMILIARITY

In Study 1, we found that both parasocial and non-parasocial interaction cues were effective in helping children learn from media presentations and toddlers learned equally well from video demonstrations as from live presentations. Contrary to prediction, however, toddlers did not learn better from the parasocial interaction video than the non-parasocial interaction video. These findings suggest that utilizing parasocial interaction techniques does not in itself increase infant or toddler learning from video. Since the onscreen adult in our video conditions was novel, it is unlikely that the participants had any sort of parasocial relationship with the character. Research with adults indicates that parasocial interactions are unlikely to occur without a parasocial relationship with the media character (Horton & Wohl, 1956). Therefore, in order for parasocial interaction cues to be effective for very young children, a parasocial relationship, or at least familiarity with the character, may be required.

Most research on parasocial interactions and relationships have focused on those that adults have with media characters. Like adults, young children do form parasocial relationships with media characters (Hoffner, 1996), but to date little is known about the specifics of these relationships. Research shows that preschool-aged girls perceived themselves as being like Dora and wanted to be like Dora from *Dora the Explorer* (Calvert et al., 2007) and anecdotal evidence from parents suggest that Elmo is a favorite of many infants and toddlers (Adamick, 2008).

While no research has directly tested the impact of parasocial relationships on young children’s learning from video, there is evidence that increased familiarity with the program or television character is associated with improved learning. Specifically experienced preschool-aged viewers participate more during the television program *Blue’s Clues* than inexperienced viewers (Crawley et al., 2002) and viewers’ interactions with the program increased with
repetition of the program (Crawley et al., 1999). Similarly, the video deficit is ameliorated with children under 2, when the video demonstration is repeated (Barr, Muentener, Garcia, Fujimoto, & Chavez, 2007) or when the child has increased exposure to the experimenter on the screen as a result of contingent interactions (Troseth, 2003b). Overall, then, there is evidence that increasing familiarity, which may be a first step in building a parasocial relationship with a media character, can improve learning from video.

Popular children’s television characters, like Elmo from *Sesame Street*, who is highly regarded and easily recognized by preschool-aged children, can also influence behavior change. Kotler and colleagues (under review), gave preschool-aged children food choices and measured how their food selection was impacted when stickers of different children’s television characters were placed on the food package. Kotler and colleagues (under review) found that by placing a sticker of the popular *Sesame Street* character Elmo on the food packaging, they could alter children’s food selection from unhealthy to healthy food products. This study provides evidence that character familiarity can influence behavior changes in young children, and suggests that the use of a familiar character on a video program may also impact how young children learn.

Given that preschool-aged children interact more with a program when they are more familiar with it (Crawley et al., 1999) and that the video deficit is ameliorated with increased exposure (Barr et al., 2007), we hypothesized that it may be the parasocial relationship with the character that drives successful learning from video. Since it is very difficult to determine if preverbal toddlers have a parasocial relationship with a television character, we first examined whether familiarity with a very popular television character would ameliorate the video deficit.
CHAPTER IV: STUDY 2:

FAMILIAR CHARACTERS AND TODDLERS’ LEARNING FROM VIDEO

The Present Study

Our purpose in Study 2 was to examine whether toddlers could learn a classic Piagetian seriation sequencing task from a video presentation and whether toddlers would learn better from an onscreen character that was familiar as compared to an onscreen character that was unfamiliar. Toddlers were randomly assigned to one of three treatment conditions: Familiar Character, Unfamiliar Character, or Adult Live, or a baseline No Exposure Control group. The familiar character used in the current study was the popular puppet Elmo from Sesame Street, while the unfamiliar character was the puppet DoDo, a character popular in Taiwan but unknown to children in the US. Our target task involved seriating cups by size, an important logical-mathematical skill that has not yet been examined in the video deficit literature.

Based on the video deficit findings (see Anderson & Pempek, 2005 for review), we predicted that toddlers would perform the seriation task significantly better after viewing the adult perform the demonstration live than the No Exposure control. Given that young children form strong social and emotional connections and relationships with television characters (Hoffner, 1996) and that processing demands may be decreased when there is prior knowledge of a television character (Fisch, 2000), we predicted that toddlers in the Familiar Character condition would seriate more cups correctly than those in the Unfamiliar Character condition or in the No Exposure Control condition. Finally, because toddlers use simpler seriation strategies than those shown by a live adult (Greenfield et al., 1972) and because toddlers often seek to achieve the goal, rather than directly mimicking the behaviors demonstrated (Carpenter et al., 2002), we predicted that toddlers in all conditions would use simpler strategies than those
demonstrated by either a live adult or a video character model. Put another way, we predicted that toddlers would learn the intent of the task, and not just imitate the model’s behavior.

Method

Participants

Participants were 64 (32 males) 21-month-old toddlers (M = 651.88 days, SD = 17.31) who were recruited from the Washington, DC area. Toddlers were recruited from a database of infants that had participated in previous studies, advertisements in newspapers, flyers in local businesses, and word-of-mouth communication with other parents. Parents’ years of education ranged from 12 to 25 years (M = 18.02, SD = 1.92); 27% of parents had a college degree and 62% of parents had a Masters Degree or higher. Toddlers were Caucasian (79%), African American (4.5%), Asian (4.5%), and of other or mixed ethnicities (11%).

Materials

Plastic nesting cups. Five colorful plastic nesting cups were used in a seriation task (see Figure 3). The cups varied in size. The smallest cup measured 3.65 cm in diameter and 6.19 cm in height, and the largest cup measured 11.75 cm in diameter and 10.32 cm in height. The cups also varied in color from smallest to largest: (1) green, (2) purple, (3) orange, (4) pink, and (5) yellow. The same set of 5 nesting cups was used for all demonstrations and subsequent testing of seriation skills.

Treatment Conditions

Toddlers were randomly assigned to one of four conditions: Familiar Character, Unfamiliar Character, Adult Live, and No Exposure Control. See Figure 4. Three toddlers (1 male) randomly assigned to the Familiar Character condition were not familiar with the Elmo
character. These three toddlers were dropped from the sample and were randomly replaced with 3 toddlers who were familiar with Elmo.

The three treatment conditions demonstrated how to seriate five plastic nesting cups. In the Adult Live condition, the toddler sat in the parent’s lap and faced the experimenter who sat approximately three feet away as she demonstrated how to nest the five plastic cups together. In the Familiar Character and Unfamiliar Character conditions, the child sat on the parent’s lap and watched a novel video of a puppet demonstrating how to nest the five cups together on a laptop computer. First the adult or character showed the child all 5 cups nested inside each other (goal state) and said. “Look we are going to put the cups together like this, see?” Next the child watched as the adult or character put the cups in a line from smallest to biggest. The adult or character said, “First we take the teeny tiny cup and put it here; then we put this one here; next we put this one here; then we put this cup here; and last we take the really big cup and put it here.” See Figure 5.

The child then watched as the adult or character placed each cup inside the other, using Greenfield and colleagues (1972) more complex subassembly method. That is, first the smallest cup (1) was placed in cup 2; then those two cups were placed in cup 3; then those three cups were placed in cup 4; and finally, all cups were placed into the largest cup (5). The adult or character performing this part of the demonstration said, “Now we are going to put the cups together. We take the teeny tiny cup and put it in this one; then we take this cup and put it in this one; then we take this cup and put it in this one; and last, we take all the cups and put them in the really big cup.” The child was shown all 5 cups nested inside each other again (goal state) and the adult or character said, “See we put the cups together.”
The complete demonstration was repeated a second time for all treatment groups. The live demonstration lasted approximately 1 minute and 30 seconds, and both video treatments lasted approximately 4 minutes because it took longer to manipulate the cups with a puppet.

The videos were nearly identical for both the Familiar Character and the Unfamiliar Character conditions. Toddlers in the Familiar Character condition viewed a video that featured the puppet Elmo, a popular Sesame Street character. Toddlers in the Unfamiliar Character condition viewed a video that featured the puppet DoDo, a popular Taiwanese character that is unfamiliar to US audiences. The characters in both videos used the same voice and actions to demonstrate the task. To keep the language consistent across the video conditions, both the familiar and unfamiliar characters spoke in the third person and used language that is typical of Elmo. For example, in both videos, the characters interacted with the audience using parasocial interaction cues by introducing themselves (e.g., “Hi, my name is Elmo/DoDo!”), asking the audience questions (e.g., “Will you play with Elmo/DoDo?”), making eye contact with the audience, and giving the audience positive feedback (e.g., “Thank you! You good helper!”). The Adult Live condition did not use this kind of language, and the adult was introduced when she first entered the toddler’s home. In the No Exposure Control condition, the toddlers were not given any demonstration or exposure to the cups prior to the seriation test.

Procedure

Toddlers were visited in their homes at a time chosen by their parents. Parents read and signed an informed consent form while the experimenters played with the toddler. Next parents completed a brief questionnaire about their toddlers’ media use, favorite television characters, experience playing with nesting cups, general family demographic information, and the short form of the MacArthur Communicative Development Inventory Checklist (CDI) Level II. The
MacArthur CDI measured toddler’s productive language skills by asking the parent to check all words that her child currently produced (Fenson, et al., 2000). Once the parent completed the paperwork and the child appeared to be comfortable with the experimenters, the study began. The parent remained in the room with the toddler.

Toddlers in the *Adult Live, Familiar Character*, and *Unfamiliar Character* experimental conditions viewed the demonstration in their parent’s lap. Based on prior research (e.g., Greenfield et al., 1972), the toddler was then given the five separated cups in a random spatial array. Then the experimenter said, “Now it’s your turn to play with the cups.” Toddlers in the *No Exposure Control* group did not see the demonstrations and were only provided with the 5 cups. The experimenter said, “These are cups for you to play with.” All toddlers were given a total of 2 minutes to play with the cups. Sessions were videotaped for later coding.

**Coding**

*Seriation scores.* Coders watched the video of the test session and recorded the order of each complete set of seriated cups. A complete set was defined as the final set of cups nested together before the child disassembled it. For example, if the child put cup 1 in cup 2 (order 1-2) and then put cup 3 on top of these cups (order 3-1-2), before removing cup 3 from the stack, the completed stack was recorded as 3-1-2. If a child turned a cup upside down and began stacking rather than nesting the cups, these behaviors were not coded.

All complete sets were then scored for seriation performance based on a two-part system developed by Wright and colleagues (1984). For part 1 of the scoring system, one point was awarded for each smaller cup that was placed inside a larger cup. For example: cup 1 in cup 4 (1-4) = 1pt; cup 1 in cup 2 in cup 3 (1-2-3) = 1 pt + 2 pt = 3 pts. For part 2 of the scoring system, one additional point was awarded for each cup that was in the exact correct sequential order. For
example: cup 1 in cup 2 (1-2) = 1 pt; cup 3 in cup 4 and both in cup 5 (3-4-5) = 2 pts; cup 1 in
cup 3 (1-3) = 0 pts. If a larger cup was placed on top of a smaller cup, for example cup 2 on cup
1 (2-1), no points were awarded for the order score. The total points were summed to create a
seriation score. For example, the sequence 12345 = 10 + 4 = 14, yields the highest possible score.
The score from each child’s best seriated set during a 2 minute time frame was later analyzed.
Twenty percent of the sample was double coded for reliability. Intraclass correlations for
reliability were \( r = .99 \), well within the acceptable range of 0.7 to 1.0.

*Strategies.* Given that there were multiple ways in which the goal state (5 correctly nested
cups) could be reached, we coded the strategies that children used during the test. First, we
assessed whether or not the toddlers copied the demonstration of lining up the cups from smallest
to largest. Only toddlers who lined up three or more cups, regardless of order, were coded as
lining up the cups.

To determine whether toddlers imitated the demonstrator’s nesting strategy, we then
coded the seriation strategy that each child utilized based on the coding system developed by
Greenfield and colleagues (1972). For each move, toddler’s use of the pair method, the pot
method, or the subassembly method was assessed. The pair method occurred when the toddler
combined only 2 cups together, whereas the pot and subassembly method occurred when the
child nested 3 or more cups together. For example, if the toddler put cup 2 into cup 3, this was
coded as the *pair method*. The method was coded as *pot method* when the child took a larger cup
and use it as a “pot” in which he or she placed smaller cups. In other words, if a toddler put cup
3 into cup 4 and then put cup 2 inside (3-4; then 2 into 3-4 combined) this move was coded as
the pot method. The method was coded as *subassembly method* when a child moved a
previously constructed set of two or more cups as a *unit* into a larger cup. For example, if a
toddler put cup 2 into cup 3 (2-3) and then moved cups 2 and 3 (2-3) as a unit into cup 4 (2-3 into 4), this was coded as the subassembly method. For each toddler, we calculated the percentage of pair, pot, and subassembly moves out of the total number of moves made during the allotted two minutes. Twenty percent of the sample was double coded for reliability. Cohen’s kappa was .98.

Visual attention. Visual attention was coded from the videotapes as each toddler viewed the demonstrations. Visual attention was measured as the total amount of time the toddler’s attention was “on task.” Attention was defined as being “on task” if the toddler was looking at the screen (for video conditions) or at the experimenter or the cups (for live condition). The toddler’s attention was coded as “off task” if the toddler was looking elsewhere. Percent visual attention was calculated by dividing total “on task” attention time by the total length of the presentation. Thirty-one percent of the sample was double-coded for reliability. Intraclass correlations for reliability were \( r = .84 \), well within the acceptable range of 0.7 to 1.0.

Toddler behaviors. Child behaviors were coded from the videotapes as each toddler viewed the demonstration. Coders used Noldus Observer software to score for the number of times that the child smiled and said the character’s name. Twenty percent of the sample was double coded for reliability. Intraclass correlations for reliability were \( r = .87 \) for smiling and \( r = .95 \) for naming the character, which were well within the acceptable range of 0.7 to 1.0.

Results

Descriptive Statistics

Reports from the parent questionnaire indicated that 84% of toddlers in the sample were familiar with Elmo and 84% had nesting/stacking cups at home. As seen in Table 1, the proportion of visual attention of the toddlers in the treatment groups was very high \( (M = .86, SD \)
= .14 for Familiar Character; M = .81, SD = .14 for Unfamiliar Character; M = .93, SD = .10 for Adult Live) and did not significantly differ by condition. There was a wide range in language scores for toddlers in this sample (range: 3 – 99 words), with the overall mean at 44.63 words (SD = 23.22). Scores on the MacArthur CDI did not significantly differ by condition (see Table 1).

Correlational Analyses

Pearson product moment correlations indicated that owning stacking cups, sex, and percent visual attention were not significantly correlated with seriation scores. Therefore these variables were not included in subsequent analyses. Pearson product moment correlations did indicate a trend between MacArthur CDI language scores and seriation scores (r = .23, p = .06), but no significant correlation between MacArthur CDI language scores and nesting strategy used.

Analyses

Seriation score. Since MacArthur CDI language scores were positively related to toddlers’ seriation performance and because the demonstration of the seriation task involved language, a one-way Analysis of Covariance (ANCOVA) controlling for toddlers’ language scores was conducted with seriation scores as the dependent variable and condition as the independent variable. As seen in Figure 6, there was a significant main effect of condition, F (3, 59) = 3.53, p = .02, η² = .15. As predicted, post hoc ANCOVA analyses controlling for the language covariate revealed that toddlers in the Familiar Character condition (M = 10.63, SD = 2.96) performed significantly better on the seriation task than those in the Unfamiliar Character condition (M = 7.56, SD = 4.83), F (1,29) = 5.02, p = .03, η² = .15. As predicted, post hoc ANCOVA analyses controlling for the language covariate also revealed that toddlers in the Adult
Live condition \( (M = 9.25, SD = 4.12) \) and the Familiar Character condition \( (M = 10.63, SD = 2.96) \) had significantly higher seriation scores than those in the No Exposure Control condition \( (M = 6.31, SD = 3.96) \), \( F(1,29) = 4.22, p = .05, \eta^2 = .13 \), \( F(1,29) = 10.87, p < .01, \eta^2 = .27 \), respectively. Interestingly, the mean of the three children who were dropped from the Familiar Character condition because they did not know the character Elmo had a similar mean to those in the Unfamiliar Character condition \( (M = 8.00, SD = 5.29 \text{ vs. } M = 7.56, SD = 4.83, \) respectively).

Seriation strategy. Toddlers rarely imitated the model’s specific actions in seriating the cups. Only four toddlers who saw the demonstration attempted to imitate the act of lining up the cups at any point during the test. As seen in Table 2, the most frequent strategy used to nest the cups was the pot method \( (M = 48.13\%, SD = 22.43) \), which was not demonstrated in the treatment conditions. The pair method was also used frequently \( (M = 42.96\% , SD = 21.36) \). The more complex subassembly method, which was demonstrated in the treatment conditions, was rarely utilized \( (M = 8.91\%, SD = 12.03) \).

Paired-sample t-tests indicated that across all conditions, the pair and pot methods were used significantly more frequently than the subassembly method \( t(63) = 10.30, p < .01, t(63) = 10.83, p < .01 \), respectively.

Paired sample t-tests were conducted to determine if there were significant differences in method used within each condition. As seen in Table 2, toddlers in the Familiar Character condition used the pot method significantly more often than the pair \( (p < .01) \) or subassembly method \( (p = .01) \) and used the pair method significantly more often than the subassembly method \( (p < .01) \). Toddlers in the Unfamiliar Character, Adult Live, and No Exposure Control
conditions used the pair and pot methods significantly more often than the subassembly method ($p < .01$, $p < .01$, respectively).

A repeated-measures ANOVA with method (pair, pot, subassembly) as the within subjects variable and condition as the between subjects measure was conducted. Using the Greenhouse-Geisser correction, there was a significant effect of method, $F(1.46, 87.62) = 55.64$, $p < .01$, $\eta^2 = .48$, and condition by strategy interaction was approaching significance, $F(4.38, 87.62) = 2.20$, $p = .08$, $\eta^2 = .10$.

Toddler behaviors. Consistent with the idea that children form parasocial relationships with familiar characters, all toddlers (100%) in the Familiar Character condition smiled and 94% said the name “Elmo” during the video demonstration. As expected, chi-square analyses indicated that significantly more toddlers in the Familiar Character condition smiled during the demonstration than toddlers in either the Unfamiliar Character, $\chi^2(1, N = 32) = 7.58, p < .01$ or the Adult Live conditions, $\chi^2(1, N = 32) = 10.11, p < .01$ (see Table 1). Not surprisingly, more toddlers in the Familiar Character condition also said the character’s name than toddlers in either the Unfamiliar Character condition, $\chi^2(1, N = 32) = 5.93, p < .05$ (see Table 1).

Discussion

The purpose of Study 2 was to examine whether toddlers can learn a cognitive seriation task from observing a video and whether or not a familiar character can improve their learning. As expected, toddlers learned to seriate plastic nesting cups after viewing a video, but only when the character was familiar to them did they outperform the scores of the no exposure control group. Moreover, toddlers learned the task equally well from the familiar character and the adult live demonstration, and those who saw the familiar character performed better than those who saw the unfamiliar character perform the same exact task. Taken together, these findings
demonstrate that even when faced with a cognitively challenging seriation task, toddlers can indeed learn from a video, thereby ameliorating the video deficit.

In contrast to earlier studies (e.g., Barr & Hayne, 1999), toddlers did not simply imitate the character’s behaviors exactly, but rather emulated the behaviors in order to reach the end goal. As in Greenfield and colleagues’ study (1972), the dominant strategy of the toddlers in our study was the pot method in which they started with a larger cup and placed smaller cups inside the bigger cup. This finding is important since the seriation task was demonstrated in all treatment conditions using the subassembly method in which cups were moved as a combined unit into a larger cup. Moreover, toddlers in our study emulated the behaviors to achieve the goal state of nesting the cups rather than directly imitating all the behaviors demonstrated, which involved lining up the cups by size before nesting the cups. These findings support prior research in which infants reproduce a person’s goals (Carpenter, Call, & Tomasello, 2002; Meltzoff, 1995). Put another way, the overarching goal in the current study was to nest the cups together, and toddlers worked to achieve this goal, rather than imitating the sub-goal, and unnecessary steps, of lining up the cups or copying the model’s exact behaviors. Thus, our findings indicate that toddlers can learn a task and can demonstrate logical reasoning from observing a video.

The finding that toddlers sequenced more cups correctly after viewing the video demonstration featuring a familiar rather than an unfamiliar character is important. Previous studies that found a video deficit used an unfamiliar adult on the screen to perform a demonstration (e.g., Barr & Hayne, 1999; Troseth, 2003b). Given the findings from the current study, the video deficit may have been ameliorated in previous studies if a familiar rather than an unfamiliar person or character had demonstrated the task on the video. Interestingly, the mean
seriation scores of the toddlers who were dropped from the Elmo condition because they were not familiar with him were similar to those of the toddlers who viewed DoDo, a Taiwanese character who was unfamiliar to US toddlers. This finding provides evidence that it is not just something about the Elmo character, but a function of familiarity with Elmo that helps learning.

We consider two possible, though not mutually exclusive, explanations for why toddlers learned more from a familiar than an unfamiliar character. One possibility is that the toddlers in the Familiar Character condition were more than just familiar with Elmo. These toddlers may have developed an emotionally tinged parasocial relationship with this character (Horton & Wohl, 1956), thereby improving their interest in and subsequent learning from him. Like adults, who demonstrated behavior changes as a result of parasocial relationships with media characters (Brown et al., 2003b), toddlers who develop a parasocial relationship with a media character may have increased trust in the character and be more motivated to model the behaviors that they see the character demonstrate.

Another possible explanation is that toddlers may have learned better from Elmo than from DoDo because they could allocate more working memory to learn the task when a familiar rather than an unfamiliar character demonstrated the behavior onscreen. Infants focus their attention on the faces of characters on a television screen (Frank et al., 2009), and they process familiar faces faster than unfamiliar faces (Moulson, Westerlund, Fox, Zeanah, & Nelson, 2009). According to Fisch’s Capacity Model (2000), children need to allocate working memory to process both the narrative and the educational content. In the current study, toddlers may be allocating working memory to both the processing of the character’s face and the cognitive task being demonstrated. When the toddler is familiar with the character, less working memory may be needed to process the face, and thus more working memory can be devoted to master the task.
Conversely, when a toddler is watching a demonstration performed by an unfamiliar character, their working memory may be directed at processing the novel face at the expense of learning the task. There were no overall differences in visual attention based on the familiarity of the character. Specific knowledge of where a toddler was looking on the screen is needed.

Although familiarity with a character was assessed through parental questionnaires and toddlers’ behavior toward the video character, a limitation of this study was that it was difficult to determine whether the toddlers in our sample truly had a parasocial relationship with Elmo. By randomly assigning toddlers to conditions, we were unable to place toddlers with a presumably strong parasocial relationship with Elmo, by parent report, in the familiar character condition. Preschool-aged children often look at videos before they begin to respond and interact with the characters on the screen (Crawley et al., 1999). Additionally, the Live Adult demonstration in this condition was performed by an unfamiliar adult and was presented significantly more quickly than the demonstration presented by the puppets in either the Familiar or Unfamiliar Character conditions. The demonstration was quicker because toddlers were close to the cup stimuli and often would reach out to get the cups prior to the completion of the demonstration. It is important to note that even with an unfamiliar adult and a quicker demonstration period, toddlers did learn to seriate the cups from the live demonstration.

In the current study, toddlers were only exposed to the video at one point in time and saw the task demonstrated only twice. Given that preschool children began to respond to the character after multiple exposures to programs like Blue’s Clues (Anderson et al., 2000), additional exposure to our video might have yielded increased levels of affective expressions. Future research should tease apart whether it is familiarity with the character having a parasocial relationship with Elmo that leads to improved learning from a video presentation. Eye-tracking
studies are also needed to determine where toddlers look on a screen when exposed to familiar or unfamiliar characters, thereby determining if facial processing is more prevalent when unfamiliar versus familiar people or characters demonstrate a task. Finally, it was necessary to control for language skills when unraveling the role of media in toddlers’ learning. Further examination of the role of language as well as other skills that very young children bring to media experiences could shed light on who can learn from media and why they can do so.

In conclusion, toddlers can learn important cognitive seriation skills after viewing a video in which a familiar character demonstrates the task. Overall, our results indicate that who presents the task plays an essential role in determining how much very young children will learn, and whether or not they will demonstrate a video deficit. At a policy level, our findings reveal that 21-month-old toddlers can learn important information from a video, a finding that is at odds with the recommendation made by the American Academy of Pediatrics (1999) of no screen exposure prior to age 2.
CHAPTER V. GENERAL CONCLUSION

Just over a decade ago the first video and television programs created and marketed specifically for infants began to emerge in United States (Anderson & Pempek, 2005) which led the AAP (1999) to recommend that children under age 2 should not be exposed to any screen media. Despite this recommendation, the number of videos, television programs, and computer/video games, created for very young audiences has increased dramatically (Garrison & Christakis, 2005), and the number of children watching videos at very young ages has increased (Rideout, Vandewater, & Wartella, 2003; Rideout & Hamel, 2006). As of 2006, nearly 80% of children under 2 had watched television and 43% watch television every day (Rideout & Hamel, 2006). As a result, this dissertation examined whether children can learn cognitively meaningful information from video presentations and, if so, what factors may be necessary for very young children to learn from media presentations.

Media Presentations and Learning

For the past century, there have been concerns regarding the impact that each new form of media will have on children (Wartella & Robb, 2008). With the invention of film, comic books, radio, and television, parents and policy makers have expressed concerns that the new entertainment medium will negatively impact children. In recent years, parents and pediatricians alike have expressed concern that screen media experiences at very young ages may be detrimental to the well-being and development of children (AAP, 1999). However, the findings from this dissertation suggest that programs created for children under the age of 2 can, in fact, be educational and effective teaching tools when created appropriately. While this is just one study in a slowly growing field of research that demonstrates that under certain conditions the video deficit can be ameliorated even for very young children (Barr et al., 2007; Lauricella et al.,
2010; Troseth, 2003b; Troseth et al., 2006), it does offer a first step in making the considerable amount of time that infants and toddlers spend in front of a television screen as beneficial as possible.

Here we demonstrate that not only can infants and toddlers imitate material they view on a video screen, but they can learn a complex cognitive seriation task which is a skill that is associated with later mathematical reasoning (Arlin, 1981; Clements, 1984; Piaget, 1952). This provides evidence that infants, like preschoolers, may be able to use video as an additional tool to help them develop school readiness skills. A recent study supports this premise, by demonstrating that infants and toddlers can successfully learn new vocabulary words, such as “crescent” from commercially available videos created for infants and toddlers, further supporting the idea that videos created for infants and toddlers can be designed to teach educational content (Vandewater et al., in press).

While there is preliminary evidence that educational video programs can be created for very young audiences, it is important to note that these findings only occur under certain conditions. Specifically, Study 2 found that toddlers only learned the seriation task from video when the task was demonstrated by a familiar character. When an unfamiliar character demonstrated the identical seriation task, toddlers failed to learn. Similarly, infants and toddlers who learned from a commercially available video watched it repeatedly in their homes (Vandewater et al, in press). These very specific conditions that are necessary for young children to learn from video presentations indicate that these might be something about the relationships that children form with media characters that play an influential role in their ability to learn.

*The Power of Parasocial Relationships*
Research has demonstrated that adults form parasocial relationships with media characters, and these relationships can influence their behavior around hot topic issues (Brown & Basil, 1995) and even purchasing behavior (Stephens et al., 1996). While less is known about the parasocial relationships that very young children form with media characters, we do know that familiar characters, specifically Elmo, can strongly influence preschool-aged children’s food choice, simply by adding an Elmo sticker to the packaging of a food item (Kotler et al., under review). Further, Study 2 demonstrates that the use of a familiar character on a video presentation can result in learning from a video at very young ages.

While no scientific study has directly assessed parasocial relationships that very young children form with media characters, parental reports, product sales, and children’s excited vocalizations when they see Elmo provide preliminary support that Elmo has a very special place in the hearts of many US children. Parents’ blogs report that children are “obsessed” with Elmo (Jordan, 2007). Another parent adds, “My 2nd daughter is head over heals with Elmo. In the toy store, we tried offering other stuffed Sesame Street characters, but she just slapped them aside and hugged Elmo even tighter. Elmo is her first true love” (Jordan, 2007). Parents post videos titled “Elmo Obsession” that show their toddlers running through the house to find their Elmo toys, dancing with their Elmo toys, and saying Elmo’s name repeatedly (MySpace, 2006). On the reality television show John & Kate Plus Eight, their eight children go to the set of Elmo’s World and the kids call out, “Elmo!”, “It’s my buddy!” , “Hug and kiss Elmo!” , “Hi Elmo!” (TCL, 2009). From just these parental descriptions, it is evident that many very young children love and trust Elmo and have developed some sort of emotional connection to him.

The findings from Study 2 suggest that Elmo plays a positive role in toddlers’ learning from video presentations. This study did not study parasocial relationships directly. However,
given the anecdotal evidence about toddlers’ emotional connections and love for Elmo, there is reason to assume that many of the toddlers that participated in the study may have had a parasocial relationship with him. It is possible that the relationships that children form with media characters may be felt strongly, just as they feel strongly about their parents, caregivers, and teachers. For very young children, Elmo may not be just a television character, he may be a friend and comfort item that very young children are deeply connected to, which in turn, can help them learn from video presentations.

The findings that toddlers learn better from Elmo than from an unfamiliar character, DoDo, are important and can positively influence the way in which future educational media content is made for very young children, but this finding also sparks many interesting questions: How and why do infants and toddlers form relationships with media characters? What types of characters do toddlers connect with? How strong must the familiarity or relationship with the character be in order for learning to occur?

Implications

Even before children are 2 years old, they are watching and interacting with screen media regularly (Rideout & Hamel, 2006). From the current studies, we now know that there is potential for screen media experiences to be educational, even for the youngest audiences. Clearly, the requirements for media to be educational for infants and toddlers are different than those for older children and even preschoolers. The findings from this study provide an initial glimpse into ways in which early media experiences can be created to have a positive influence on young children by uncovering the powerful role that familiar characters, and likely emotional connections to characters, play in infants’ and toddlers’ learning from media characters.
The current studies provide new factors that can aid infants’ and toddlers’ learning from video presentations, but considerable research is needed to fully understand how program-length videos and media products can be created so that they are effective teaching tools for very young children. Additionally, it is important that program developers and policy-makers recognize the vast challenges that infants and toddlers face when learning from media presentations.

**Future research.** The results provide evidence that young children can learn cognitively meaningful information from video before the age of 2. However, additional research is needed to fully understand what factors help infants and toddlers learn from video presentations and how specifically these factors influence learning.

There is reason to believe that toddlers process television differently if they are familiar with the television character than if they are unfamiliar with the character. To understand whether toddlers’ process videos differently as a function of the familiarity of the character, we are working with Dr. Daniel Anderson and Dr. Heather Kirkorian at the University of Massachusetts to replicate Study 2. Eye-tracking software will be used to examine where toddlers are looking when they watch these two videos that feature either Elmo or DoDo. By assessing exactly where toddlers are looking on a screen, we can determine if they are focusing their attention more on the faces or the objects used in the demonstration task, and whether there is a difference in eye-gaze location as a function of the familiarity of the character on the screen. Furthermore, using eye-tracking data, we can more clearly examine the relations between where the toddler is looking on the screen and their success at the seriation task.

The results from Study 2 also indicate that children who viewed the video of a familiar Elmo character performed significantly better than those who saw unfamiliar DoDo character video. To assess if increased familiarity with a television character is resulting in toddler’s
successful learning from television, we are conducting a follow-up study that increases toddlers’ familiarity with DoDo, our unfamiliar Taiwanese character. In this study, we are providing 18-month-old toddlers with a DoDo puppet, DoDo’s backpack, a 12 minute DoDo video with multiple vignettes, DoDo coloring books, and DoDo stickers. Toddlers keep all of these toys and videos in their home for 3 months and parents are asked to show the video at least twice a week. When the toddlers are 21 months old, we are returning to their homes and replicating the procedure used in the Study 2. That is, toddlers watch the video of DoDo seriating the nesting cups and then are given the identical cups from the video to seriate. If it is in fact familiarity that is driving successful learning from video, the children that had three months of exposure to DoDo in their home will perform better than toddlers for whom DoDo is unfamiliar.

Finally, future research should work to develop assessment measures that examine young children’s parasocial relationships with media characters. It is important to determine if children feel an emotional connection and trust for certain television characters over others and whether this develops as a function of familiarity with the character or as a result of something more powerful. Similarly, it would be interesting to examine whether toddlers who have a parasocial relationship with Elmo perform differently on the seriation task than children who are just familiar with Elmo.

Public policy. The current recommendation from the AAP (1999) is that children under age 2 should not be exposed to screen media. While this recommendation does not directly discuss any scientific evidence for why the recommendation was made, the article discusses the vast amount of brain development that occurs during the first two years of life and suggests that media exposure may take away from parent-interaction which may negatively impact brain development. While the information provided in this dissertation does not directly address the
impact of media exposure prior to age 2, it does provide evidence that there are ways in which children can learn from media presentations prior to age 2 and that video has the potential to be an educational tool even for very young children. Given that the majority of parents are allowing their infants and toddlers to watch videos and television programs (Rideout & Hamel, 2006), perhaps the policy of the American Academy of Pediatrics was premature and in need of more nuances.

More broadly, the Children’s Television Act (1990) was enacted to increase the quality of content that is provided on broadcast networks for children. Two decades have passed since the creation of this legislation and the media world that children are living in has changed dramatically. Infant and toddler exposure to television and video content was not a concern of parents or pediatricians two decades ago. As times have changed, legislation created to protect and provide quality media programs for our young children must be updated. The Children’s Television Act (1990) could be updated to provide the best media experience for our young children given the new technologies and media advances that have occurred over the past 20 years. Finally, since many infants and toddlers are watching store-bought videos that are frequently marketing with implicit and explicit educational claims (Garrison & Christakis, 2005), legislation could be implemented to restrict companies from making educational claims without scientific support.

*Industry.* Regardless of federal legislation, those individuals and companies that create educational media products for very young children have a responsibility to delivery quality content to their audience members. As the scientific literature continues to discover factors that help infants and toddlers learn from media presentations, the media industry could rely on factors
like familiar characters and repetition that have been found to enhance infants’, toddlers’, and preschoolers’ learning from media presentations.

**Conclusion**

In conclusion, the research presented here provides evidence that children under age 2 can learn from video presentations when the toddler is familiar with the onscreen character. Not only are infants and toddlers able to imitate the actions they see demonstrated on a video screen, they can learn cognitively challenging skills that are associated with later mathematical-reasoning and school readiness. Toddlers may well need to form a relationship with the onscreen character in order for parasocial interaction techniques to be effective in teaching via video. Indeed the power of relationships to excite and enhance learning may cross the great divide between life on the screen and life in everyday face-to-face encounters.
Table 1. Descriptive statistics by condition.

<table>
<thead>
<tr>
<th></th>
<th>Familiar</th>
<th>Unfamiliar</th>
<th>Live</th>
<th>No Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of children who own cups</td>
<td>14</td>
<td>15</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Mean MacArthur CDI Score (SD)(^a)</td>
<td>49.88</td>
<td>49.00</td>
<td>37.50</td>
<td>42.14</td>
</tr>
<tr>
<td>Mean Percent Visual Attention (SD)</td>
<td>86 (.14)</td>
<td>.91 (.14)</td>
<td>.93 (.10)</td>
<td>N/A</td>
</tr>
<tr>
<td>Number of Children who Smile during Video</td>
<td>16</td>
<td>11</td>
<td>10</td>
<td>N/A</td>
</tr>
<tr>
<td>Number of Children who Say Character Name during Video</td>
<td>15</td>
<td>1</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

\(^a\)Mean CDI scores were substituted for missing CDI data (N=2)
Table 2. Percentage of total moves (SD) performed by toddlers in each condition that were pair, pot, or subassembly moves.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Pair Method</th>
<th>Pot Method</th>
<th>Subassembly Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Familiar</td>
<td>34.01 (15.24)</td>
<td>59.37 (15.90)</td>
<td>6.62 (12.03)</td>
</tr>
<tr>
<td>Unfamiliar</td>
<td>45.04 (24.72)</td>
<td>47.89 (23.38)</td>
<td>7.07 (9.53)</td>
</tr>
<tr>
<td>Live</td>
<td>40.19 (21.29)</td>
<td>44.68 (22.44)</td>
<td>15.13 (17.50)</td>
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<tr>
<td>No Exposure</td>
<td>52.59 (20.60)</td>
<td>40.59 (24.55)</td>
<td>6.82 (9.45)</td>
</tr>
<tr>
<td>Total</td>
<td>42.96 (21.36)</td>
<td>48.13 (22.43)</td>
<td>8.91 (12.03)</td>
</tr>
</tbody>
</table>
Figure 1.
Figure 2.

Parasocial Video

Non-Parasocial Video
Figure 3.
Figure 4.

Familiar Character
Elmo

Unfamiliar Character
DoDo

Live

No Exposure
Figure 5.
Figure 6.
References


