Chapter 9
Media Characters, Parasocial Relationships, and the Social Aspects of Children's Learning Across Media Platforms

Melissa N. Richards and Sandra L. Calvert

Amid today's electronically saturated world, childhood is a period of development that is crucial for learning both social and academic skills. Indeed, the foundational cognitive skills learned during the infant and toddler years may have a large impact on future scholastic success (Bryant, MacLean, Bradley, & Crossland, 1990; Wagner et al., 1997). Media characters and the affective bonds that children form with them while interacting with programs and apps on various media devices (e.g., televisions, touchscreen tablets, computers, robots, intelligent agents) hold unfilled promise as they influence the ways that children are learning in the digital age (Brunick, Putnam, McGarry, Richards, & Calvert, 2016).

Many parents, educators, and researchers recognize that the pathways for children's learning are changing. Early childhood is now filled with opportunities for informal learning in a twenty-first century world in which technologies permeate daily existence, with children under the age of 8 spending approximately 2 h with screens each day (Common Sense Media, 2013). Although there are vast opportunities for children and parents to learn from onscreen educational content, limitations in how well children learn from screen presentations compared to live presentations (i.e., the video deficit; Anderson & Pempek, 2005; Barr, 2013) have created challenges in this area. The solution to these problems may be rooted, in part, in the social presence that the technology is able to afford through media characters.

The following chapter examines the issues surrounding how children learn from media, with a specific focus on language and STEM (Science, Technology, Engineering, and Mathematics) subject areas. We will first describe the components

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M.N. Richards
Eunice Kennedy Shriver National Institute of Child Health
and Human Development, Washington, DC, USA
e-mail: melissa.richards@nih.gov

... Georgetown University, Washington, DC, USA

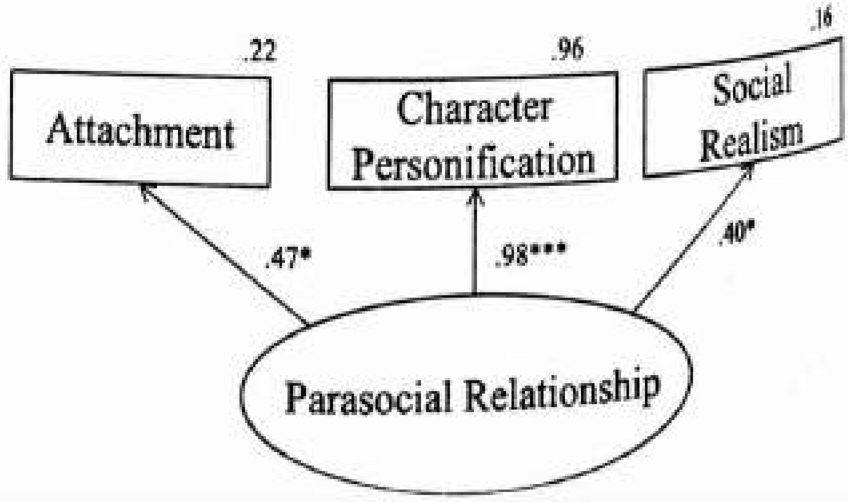
that define *parasocial relationships*, i.e., the one-sided connections viewers form with media characters (Horton & Wohl, 1956). We then discuss theories and studies that emphasize the importance of social factors in learning of academic content. We turn particularly to the importance of parasocial interactions and parasocial relationships in these social foundations of learning, looking first at current common technologies in children's homes and then looking forward to future research directions as robotics and intelligent agents become more common in children's lives. Characters, we argue, are a key element of the transmedia spectrum that stay constant, and thus, are the hub of the wheel in children's media landscape and subsequent learning. In other words, the parasocial relationships that children form with characters can potentially unite a large number of media platforms, such as television, video, computers, iPads, robots, and intelligent agents.

9.1 What Is a Parasocial Relationship?

One of the first studies to thoroughly investigate the components of children's parasocial relationships was conducted by Bond and Calvert (2014), who surveyed parents about their children's favorite media characters. Researchers sent an online survey to parents with children between 6 months to 8 years old and asked them to describe their child's favorite media character and the child's feelings and behaviors toward the character. As seen in Fig. 9.1, factor analyses revealed that parents viewed certain characteristics as important in the development of parasocial relationships. Twelve survey questions comprised three factors with eigenvalues greater than 1.0. These were as follows: (1) *character personification* (six questions), e.g., does the favorite character have thoughts and emotions? (2) *attachment* (three questions), e.g., does the favorite character makes the child feel safe? and (3) *social realism* (three questions), e.g., does the child believe the favorite character is real? These three factors were used to conceptualize and operationalize the multidimensional nature of children's parasocial relationships with media characters.

Bond and Calvert (2014) also created a descriptive model of this parasocial relationship development among very young children that includes parasocial interac-

Fig. 9.1 Components of parasocial relationships (Bond & Calvert, 2014, used with permission of the *Journal of Children and Media*)



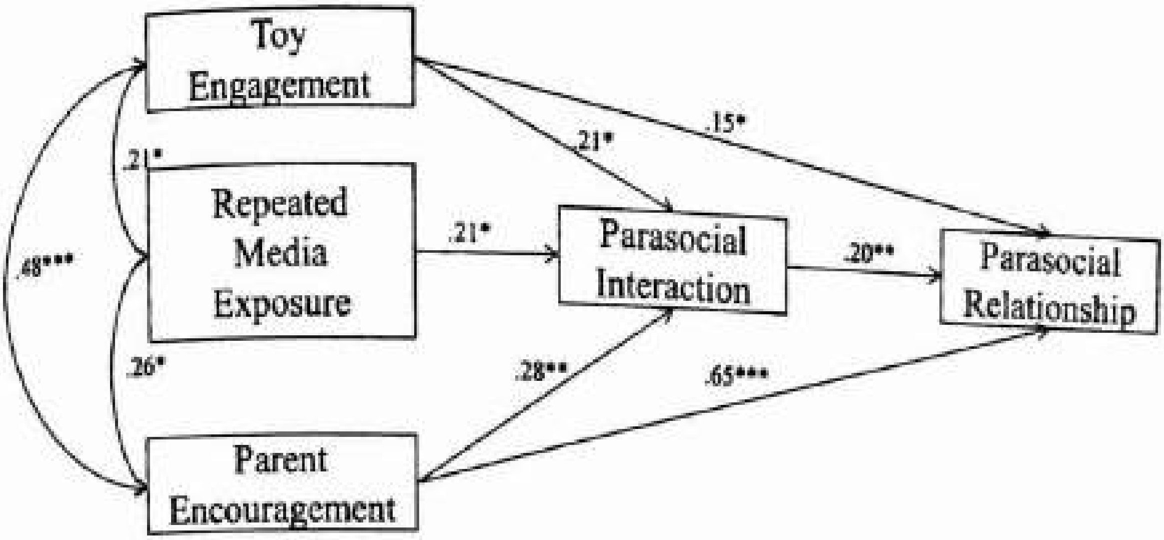


Fig. 9.2 Parasocial relationship development model (Bond & Calvert, 2014, used with permission of the *Journal of Children and Media*)

tions, media use, toy play, and parent scaffolding. *Parasocial interaction* behaviors included questions such as "how often does the child act out toward the screen, like waving or pointing?" *Parent encouragement* was measured with questions such as "I encourage my child to think that the [favorite character] has thoughts and emotions." Parents were asked about *repeated media exposure*, that is, how often children had been exposed to their favorite media character on a variety of media platforms over time. Finally, *toy engagement* was measured, that is, how often the child played with a toy version of their favorite media character and treated the toy as having humanlike needs, such as engaging in pretend caretaking behaviors.

The results from this study suggest that there are strong associations between parasocial relationships and parent encouragement, toy play, repeated media exposure across platforms, and parasocial interaction. Path analyses revealed that toy engagement and parent scaffolding were related directly to the formation of parasocial relationships (see Fig. 9.2). In fact, the strongest predictor in their model of parasocial relationship development was between parent scaffolding and the formation of the child's parasocial relationships. Toy engagement, repeated transmedia exposure, and parent scaffolding predicted parasocial interaction with the characters onscreen, with parasocial interaction then predicting parasocial relationships. Therefore, children's play with toys, repeated media exposure, and parent scaffolding leads to children's parasocial interactions, which in turn, is another pathway that is associated with the formation of children's parasocial relationships (Bond & Calvert, 2014). Two alternate models for the development of the parasocial relationship were also tested, with the current model depicted here remaining the best fit with the data (Bond & Calvert, 2014). Nevertheless, causality still cannot be determined given that data was collected at only one time point. Future research using longitudinal methods should be conducted to further explicate the directional nature of these pathways.

Although not tested in this model, a different potential pathway for the development of parasocial relationships is through watching characters' interactions with each other side by side (Calvert, 2015; Calvert & Richards, 2014), as takes place in social cognitive theory when children view social models onscreen (Bandura, 1977). This kind of interaction occurs when viewers watch two or more characters talk to each other and engage in behaviors with one another. Various studies have suggested that seeing characters talk to each other aids learning. For example, children were able to learn novel words just as well from watching two people interact with, hand over, and talk about an object onscreen as they did in person (O'Doherty et al., 2011). Therefore, children watching their favorite characters interact with other characters onscreen may be another pathway for the development of parasocial relationships and subsequent learning of new skills and facts.

Richards and Calvert (2014) adapted the parental survey of Bond and Calvert (2014) to be administered to children. Their factor analyses revealed similar conceptual categories of children's parasocial relationships with their favorite characters (i.e., *attachment and friendship, social realism*) from child report and earlier parent report data, with child and parent report accounting for approximately the same percentage of variance. However, children reported *humanlike needs* as a component of parasocial relationships. The authors speculated that this difference in the third factor was due to the concrete nature of children's reasoning given the strong link between findings in this child self-report study and behavioral findings of parasocial relationships in which children fed characters and tucked them in for a nap in prior behavioral research (Calvert, Richards, & Kent, 2014; Gola, Richards, Lauricella, & Calvert, 2013). Young children also strongly preferred characters that were the same gender as them, as has been found in prior research with older children (Calvert, Kotler, Zehnder, & Shockey, 2003).

In a follow-up study (Richards & Calvert, 2016), the child survey reports of children's parasocial relationships were compared to assessments made by their own parents. *Social realism, attachment, and character personification* (parents) or *attachment and friendship* (for their children), and *humanlike needs* emerged as factors among both parent and child reporters. Like their children, parents were overwhelmingly more likely to report their child's favorite character as the same gender as their child. Parent–child pairs, however, identified the same favorite character only 30 % of the time (Richards & Calvert, 2016).

In Hoffner's (1996) interviews of 7–12-year-old children about their relationships with their favorite media characters, children described how attractive, strong, humorous, prosocial/antisocial, and intelligent they found their favorite character to be. Children also answered questions about their relationship with the character, such as "[character] makes me feel comfortable" or "I feel sorry for [character] when he/she makes a mistake." Results revealed that a majority of boys and girls reported that their favorite character was the same gender as them. Intelligence was the most appealing trait the character had for boys, while attractiveness was the most important one for girls. Other researchers have also found that physical attractiveness was most important to girls when choosing a favorite character, yet physical strength was most important for boys (Reeves & Greenberg, 1977). Children also rated physically attractive characters as nicer than unattractive ones, especially at younger ages (e.g., 3–5-year-olds) (Hoffner & Cantor, 1985). Finally, 5–12-year-old children had stronger parasocial relationships with characters that they regarded as real (Rosaen & Dibble, 2008). Therefore, parasocial relationships among older children are also multidimensional and may be based on attractiveness, gender, social realism, intelligence, and strength, qualities that are somewhat different than those found for younger children.

9.2 Social Aspects of Learning

Learning is often grounded in social relationships and social interactions. Theorists such as Bandura proposed that children learn new behaviors through observing others as a model, and later use this information as a guide for how to act in future situations (Bandura, 1977). Similarly, Vygotsky believed that children learned new facts "only when the child is interacting with people in his environment and in cooperation with his peers" (Vygotsky, 1978, p. 35) in what he described as a *zone of proximal development*. This zone is the difference between the child's current skill level and the skill level that they are capable of reaching when they receive guidance from adults or highly capable peers. In Vygotsky's (1978) view, moving to the next knowledge level is not possible unless children have a social influence to aid their learning. Through a process called *scaffolding*, parents act similarly to tutors, helping their children solve problems gradually through the introduction of increasingly difficult steps (Wood, Bruner, & Ross, 1976). Thus, scaffolding by parents and caregivers is a crucial part of learning and moving forward to the next phase of knowledge acquisition.

Very young children often focus on interpersonal interaction and the nonverbal cues of adults (Baldwin, 2000). For instance, toddlers (18–20 months) who only heard an audio input of the name of an object had lower comprehension of the object name than toddlers who were accompanied by an adult who labeled and gazed at the object with the child (Baldwin et al., 1996). When focusing on STEM skills specifically, children also learn math and science better with help from adults. One study, for example, reported that fifth graders had higher math skills when they had parents with better scaffolding techniques than children who did not (Pratt, Green, MacVicar, & Bountrogianni, 1992). Thus, learning is a social process aided by skilled others.

Some researchers posit that learning from a screen has an essential social component (e.g., Richert, Robb, & Smith, 2011), and uses the same kinds of elements, such as observational learning, social interaction, and social meaningfulness, as is the case in face-to-face encounters. For instance, Reeves and Nass (1996) suggest that "individuals' interactions with computers, television, and new media are *fundamentally social and natural*, just like interactions in real life" (Reeves & Nass, 1996; p. 5). Consistent with this idea, the lack of social cues present in onscreen presentations may serve as one of the reasons why children are not able to learn as well from videos as they can from live presentations (Troseth, Saylor, & Archer, 2006). That is, video may not be able to provide social cues that are present in real life such as eye gaze, contingent responses, and pointing. Some have theorized that this lack of social information leads children to discount information that has been presented on screens, and hence they do not learn as well from them as they would from an active social partner (see Troseth, 2010).

We turn now to the role of social and parasocial relationships in the current technological environments where children live and learn. Then we examine the implications of future learning as robots and intelligent agents join the rapidly emerging plethora of technologies that are embedded in children's homes, schools, and everyday worlds. Children's parasocial relationships with media characters, we believe, have great possibilities for unifying their learning across media platforms.

9.3 Learning from Current Technologies in Children's Homes and Lives

Common Sense Media (2013) paints a very comprehensive picture of 0–8-year-old U.S. children's current media environments. In their national survey of contemporary U.S. children, parents reported that 96 % of their children had access to a television set (78 % with a DVD player and 28 % with a DVR), 76 % to a computer (with 69 % of those children having high speed Internet), 63 % to a smart phone, and 40 % to a tablet. Although mobile media access was particularly on the rise, viewing television programs, DVDs, and videos was the most common experience of young children. We link those technologies to our emerging knowledge of social learning from screens, including the literature on parasocial relationships.

9.3.1 Traditional Observational Media

The importance of incorporating social elements into traditional media has been demonstrated in experiments that directly manipulate the presence of social cues in video-based demonstrations. In one study, 2-year-old children saw a video of a person onscreen who provided directions for where to find a hidden object in the other room. Other children saw a live person in the room explain where to find the hidden object. As expected, children performed significantly better when the live person told them where the object was than when a person onscreen told them where it was (Troseth et al., 2006).

In a follow-up experiment using closed circuit television, some children saw the experimenter onscreen act in a responsive manner by, for instance, calling the child by name and talking about that child's siblings, pets, and favorite songs. Another group of toddlers saw a noncontingent, pretaped video where the experimenter called the toddler by the wrong name and talked about unfamiliar siblings and pets. Because the video demonstration was not perfectly contingent with the child's actions, those onscreen experimenters also did not respond immediately to the child's prompts. Children received the same instructions for where the toy was hidden through these two video presentations. Toddlers who saw the socially relevant interaction did significantly better in finding the toy than children who did not have the socially relevant interaction. In fact, children in the socially relevant video condition performed just as well as the children who interacted with a live person (Troseth et al., 2006).

Krcmar (2010) built on this concept, separating Troseth's idea of social relevancy into two parts—*social contingency* and *social meaningfulness*. Social meaningfulness is when children are familiar with and have experience with the objects and events on the screen (Krcmar, 2010), an idea consistent with the concept of parasocial relationships (Calvert & Richards, 2014). By contrast, social contingency is when these media characters and onscreen figures appear to reply to what the child says through the use of questions, program pauses, and comments, which is consistent with the idea of parasocial interaction (e.g., when *Dora the Explorer* asks viewers to respond aloud to her questions; Lauricella, Gola, & Calvert, 2011).

In order to investigate social meaningfulness and social contingency, Krcmar (2010) had either a mother or an unfamiliar experimenter demonstrate a series of actions. Some children saw the demonstrations in person, and others saw them onscreen. Krcmar found that between 13 and 20 months of age, children have difficulty imitating actions and learning words from a video compared to a live demonstration, as would be expected from the transfer deficit. Further analyses revealed that having the socially meaningful parent onscreen rather than a stranger onscreen helped these toddlers overcome the transfer deficit (Krcmar, 2010). Therefore, the *social meaningfulness* that was provided by a mother may help young children grasp onscreen information.

9.3.1.1 Social Contingency

Contingency is extremely important for child engagement. For example, Johnson, Slaughter, and Carey (1998) found that 12-month-olds were more likely to look at humans if they spoke and waved at the child. Additionally, children were more likely to look at objects if they contingently interacted toward them, that is, if they beeped and flashed lights (Johnson et al., 1998). In the world of media, beeping and flashing lights are perceptually salient production features that can facilitate contingency by creating orienting responses that get nonlooking children to attend to specific content (Calvert, 1988).

An example of social contingency that children may witness onscreen is a pseudo face-to-face interaction, as when the characters on the screen directly address children (Calvert & Richards, 2014). Often, a short pause is incorporated into the programming where the character will not say anything, as if waiting to respond to the child (Lauricella et al., 2011). Although there is not technically an interaction occurring, children may perceive that there is one taking place. This method cannot provide perfectly contingent feedback, yet it aids children's learning from the screen. For example, Calvert and colleagues found that children who were more active in their physical and verbal participation, such as pointing at the screen and replying to the character's queries, had higher comprehension of the program content (Calvert, Strong, Jacobs, & Conger, 2007). Therefore, children readily and actively engage in socially contingent interactions with onscreen media characters, and this may aid their learning.

Parasocial interaction may affect language learning as well. Kuhl, Tsao, and Liu (2003) examined different instructional methods for teaching 9-month-old infants Mandarin Chinese. Over the course of 4 weeks, children went to twelve, 25-min long sessions. One group of children watched a DVD of a native Mandarin speaker playing with a toy or reading a book, and another group played games or read books with the native speaker in person. Children in the video condition did not learn as well as children in the live condition (Kuhl et al., 2003). The authors argued that much of this difference was due to the lack of social cues and immediate contingency available to children who watched the DVD versus those who interacted with the speaker in person. This interpretation of the findings is bolstered by the fact that even seeing two people onscreen talk to one another onscreen in a contingent, reciprocal manner may be enough interaction to help children who are viewing the conversation onscreen learn novel words from their exchange (O'Doherty et al., 2011). Therefore, social contingency and parasocial interaction may be important for children's language development, perhaps by increasing their engagement with the onscreen person in some way.

9.3.1.2 Social Meaningfulness

Numerous studies have illustrated the importance of socially meaningful parasocial relationships in adulthood. For example, Eyal and Rubin (2003) found that college students who behave aggressively have higher wishful identification scores with aggressive characters (i.e., they want to be like that character), which is, in turn, moderated by the strength of the emotional parasocial relationship the person has formed with the characters. Kassing and Sanderson (2009) also found that adults had formed strong parasocial relationships with the professional cyclist Floyd Landis, even though they had probably never met him (Kassing & Sanderson, 2009).

Just like adults, children also form meaningful relationships with onscreen figures (Gleason, Sebanc, & Harp, 2000). These parasocial relationships and affective bonds children form with media characters are important to study during early childhood because they may have a large influence on children's behaviors and personal identity in the digital age (Hoffner, 2008; Meyer, 1973) and may have an enduring impact on children over time. For example, children who were "TV focused" and spent more time watching violent television at age 5 exhibited higher levels of aggression once they reached adolescence (Anderson, Huston, Schmitt, Linebarger, & Wright, 2001). Parasocial relationships are of crucial importance because there is a strong link between learning and the parasocial relationships that children form with the media characters who present the onscreen content (Calvert et al., 2014; Gola et al., 2013).

Children under the age of 2 are able to learn from the characters that they frequently watch onscreen. In one study, 21-month-olds saw a demonstration of the popular Elmo character from *Sesame Street* perform a seriation cup-nesting task (an early STEM skill) onscreen. Another group of children viewed the exact same demonstration, but instead of seeing Elmo, they saw a character unfamiliar to them named DoDo (a popular media character in Taiwan but unknown to U.S. children) perform the same seriation task. Both of the characters in these demonstrations were dubbed so that they spoke with the friendly, high-pitched childlike voice of Elmo. When children were given their own set of nesting cups to play with, children who watched Elmo were able to nest their own set of cups significantly better than children who saw DoDo nest the cups, and better than a control group who did not view a seriation demonstration. However, toddlers who saw DoDo perform the task did not perform any better than the no-exposure control group. The authors posited that children's meaningful relationship with the Elmo character facilitated their learning from his onscreen presentation (Lauricella et al., 2011).

A follow-up study was designed to build a parasocial relationship between the child and an unfamiliar media character. One group of children was introduced to a stuffed, plush toy version of the Taiwanese character DoDo at 18 months of age, and they played with him over the course of 3 months. In addition to the plush toy, children played with DoDo stickers, coloring books, a backpack, and were able to watch a short 10-min DVD featuring DoDo as he did familiar activities like jump in a puddle and enjoy his birthday party. The experimenters visited the child's home when he or she was 21 months old to show a new video of DoDo, this time performing the cup stacking seriation task. At age 21 months, another group of children, who were unfamiliar with DoDo, also saw the video demonstration, and a third group did not view a demonstration at all. All children then completed the cup-nesting task. The results indicated that children who had played with the DoDo character over the course of 3 months performed significantly better than the group who did not view a demonstration, while the group that was unfamiliar with the character did not perform significantly differently from the other two groups. Within the treatment condition that was exposed to DoDo for 3 months, toddlers who exhibited parasocial, nurturing behaviors with the DoDo plush toy during playtime, which are indicative of the *human needs* parasocial relationship factor discovered by child and parent reports (Richards & Calvert, 2014, 2016), had higher seriation scores than those who did not nurture the toy version of the character. The results suggested that parasocial relationships, even one that has been built over the course of only 3 months, are influential in helping very young children learn STEM skills from onscreen presentations (Gola et al., 2013).

A later study manipulated the toddlers' familiarization with personalized or non-personalized interactive toys over the course of 3 months (Calvert et al., 2014). All children in the treatment conditions received a plush puppy that was interactive and responded to the child when he or she pressed its paws. At 18 months of age, one group of children received a puppy that was personalized to the toddler: i.e., the toy called the child by name, was the same gender as the child, and was programmed to have the same favorite food, song, and color as the child. Another group of children received a puppy that was not personalized to them, i.e., the toy called the child by the nongeneric name "pal," was the opposite gender of the child, and had a different favorite food, song, and color as them (nonpersonalized condition). Each group played with their respective interactive toy for 3 months.

Table 9.1 Studies examining STEM learning from familiarized characters

	Study 1 (Lauricella et al., 2011)	Study 2 (Gola et al., 2013)	Study 3 (Calvert et al., 2014)
Pretreatment	None	One condition was familiarized with novel character DoDo puppet for 3 months before testing session	One condition was familiarized with novel personalized interactive character for 3 months before testing session
			One condition was familiarized with non-personalized novel interactive character for 3 months before testing session
Characters demonstrating STEM task onscreen	Elmo	DoDo	Personalized interactive character
	DoDo		Nonpersonalized interactive character
Results	Enhanced learning from meaningful Elmo character	Enhanced learning from DoDo puppet after familiarization with him when compared to a no exposure control group; child nurturing of character improves seriation scores	Enhanced learning from personalized interactive character when compared to no exposure control group; child nurturing of interactive personalized character improves seriation scores

At age 21 months, children saw a video of their respective character performing the cup stacking seriation task. Children in the personalized condition performed significantly better than the control group that did not view a demonstration, while the children in the nonpersonalized condition did not perform significantly differently from the other two groups. Within the personalized condition, children who demonstrated an increase in nurturing behaviors (an indicator of an emotionally tinged, parasocial relationship with the character) over time scored higher on the seriation task. The authors suggested that stronger parasocial relationships are fostered with characters who interact with children in ways that are consistent with children's interests, which subsequently leads to enhanced learning when the character presents content onscreen (Calvert et al., 2014). Table 9.1 depicts this line of studies.

Taken together, these studies documented the role of the emotionally engaging aspects of parasocial relationships for children's learning. Alternately, children may learn better from characters with whom they have parasocial relationships because children have a limited amount of cognitive processing power which is allocated to understanding who the character is, rather than to understanding the educational content (Lauricella et al., 2011). For instance, working memory is devoted not only to processing the narrative content of an onscreen presentation but also to processing the educational content (Fisch, 2000). When the child is familiar with a character onscreen and subsequently does not have to process who it is, additional working memory resources may also be freed up, allowing the child to understand the educational messages on the screen (Lauricella et al., 2011). By contrast, when the child does not know the character, precious resources may be spent trying to determine the identity of that character rather than processing the educational task. This problem may be particularly potent during the early years of life when attachment issues, such as fear of strangers, are prevalent.

9.3.2 Computers

The advent of computers has led to a plethora of online games that are interactive and that can respond contingently to children's actions, an important aspect of human interaction (Calvert, Strong, & Gallagher, 2005). Computers and other new technologies that allow children to be active learners may help children pick up information more readily than if they are observing information from a screen (Lauricella, Pempek, Barr, & Calvert, 2010). Computer games are also unique in that they are customizable and can feature characters that are seen on other media outlets such as television, thus providing another space in the transmedia spectrum in which children can access and play with the character in an interactive environment.

Lauricella et al. (2010) tested the effectiveness of the contingency that computers provide when children played with characters from *Nick Jr.'s Curious Buddies*. The experimenters worked with 30- and 36-month-old children and assigned them to one of three conditions. In one condition, the children saw stuffed versions of the Curious Buddies characters hiding in an adjacent playroom through a one-way mirror only once. Children in another condition saw the characters hiding on a screen in a representation of the playroom in a prerecorded video, which was repeated six times. Children in the third condition played the Curious Buddies game in an onscreen representation of the playroom in which children pressed a spacebar to make the characters pop out of their hiding places. Children watched the experimenter demonstrate the game once and then played with the interactive computer game themselves five times.

After children were exposed to the three respective demonstrations, all children then went in the adjacent playroom and searched for the characters that they had seen hidden on the screen or through the window. Children who played with the interactive video game or observed the characters hiding through a window were more likely to find the stuffed characters in the playroom than children who simply viewed the characters onscreen via a prerecorded video. In addition, attention to the observational video condition was lower than in the other groups. Therefore, interactivity of computers and increased engagement, as indexed by looking time, helped children grasp information that was presented to them onscreen by characters (Lauricella et al., 2010).

One component of interactivity is control (Rafaeli, 1988). Calvert et al. (2005) manipulated the amount of control that 4-year-old children had while playing a computer program. Specifically, children played with an online storybook that would display an audio or visual embellishment if the user rolled the mouse over an image (e.g., rolling the mouse over the image of a bird would make the bird move and chirping noises occurred). Children either watched the online storybook as an adult experimenter controlled the game with the mouse, they took turns with the adult experimenter in controlling the mouse, or the child completely controlled the mouse. Participants played the game four times over the course of two sessions. Children were much less attentive over time in the conditions where the adult controlled all or part of the game. The findings suggest that children become most immersed in online games when they can control the onscreen content.

9.3.3 *Touchscreen Tablet Devices*

Touchscreen tablets may provide cutting-edge learning opportunities for very young children. Tablets are highly interactive and are easy for children to manipulate with their limited motor skills (Chiong & Shuler, 2010). Mobile touchscreen devices also can be used at any time in any place, allowing children to connect with the characters that they see on these applications in a variety of settings (Shuler, 2009).

Applications (i.e., apps) that feature media characters that are available through other media outlets (e.g., television) have been effective in teaching children new skills. In one study, 3–7-year-olds showed enhanced vocabulary skills after playing *Martha Speaks: Dog Party App* for 2 weeks. This particular app taught children new vocabulary by playing mini-games and then having them take a quiz (Chiong & Shuler, 2010). Similarly, children who played with the literacy learning app *Super Why* for 2 weeks had significant gains in their generalized literacy skills such as rhyming and sentence completion (Chiong & Shuler, 2010). Therefore, well-designed apps featuring popular characters may act as efficacious teachers for very young children.

One thing that may contribute to these findings is the interactive nature of these iPad apps. In basic research without the use of screens, Bedford and colleagues found that 2-year-olds were able to learn the name of a word for a novel object through a live presentation if they were given contingent feedback on their correct and incorrect answers (Bedford et al., 2013). For example, the person may say "'Yes, this is the modi. What a nice modi!" Or "No, this is the modi. What a nice modi." Similarly, Moreno and Mayer (2005) found that feedback that gives an explanation for why a fact is correct aids in user learning from technology.

Although the research on touchscreens is just emerging, it appears that iPads hold strong promise in promoting children's learning from screens, due in large part to children's abilities to determine who is a credible source of information, even at very young ages. In a series of three experiments by Richards and Calvert (2015), 24- and 32-month-old children judged the credibility of information about familiar and afterward, novel fruit names presented on a touchscreen tablet by a meaningful (Elmo) and nonmeaningful (DoDo) media character. Depending on the condition, either the meaningful or nonmeaningful character accurately labeled the familiar fruits. Regardless of age, prior familiarity with the meaningful character, or corrective feedback provided by the tablet, children trusted the previously accurate character when they had to select the names of the novel fruits. The results suggest that knowledge conveyed by popular characters, with whom children are likely to form parasocial relationships, is discounted when the characters are incorrect. It also lends support to the thesis that children look at their relationship with these onscreen characters as horizontal—that is, viewing these characters as their friends—rather than as authoritative information sources that they find in vertical relationship with adults who are their teachers (Calvert, 2015; Richards & Calvert, 2015).

9.4 The Future of Parasocial Relationships: Robotics and Intelligent Agents

The literature on children's parasocial relationships with media characters is only beginning to emerge. What does the future hold as technologies continue to develop and enter the lives of young children? What will happen, for instance, when the perception of interaction with these characters is much more realistic and contingent on what children say and do through new developments in robotics and intelligent agents? What are the characteristics of these highly interactive platforms that make them lifelike to users and that may foster parasocial relationships? Will parasocial relationships matter, and if so, should popular media characters now begin to take on those new forms? Will children's perceptions of, and the impact of, parasocial relationships change as there is a shift from a one-way to an increasingly two-way contingent interaction? These are the questions that we address in the final section of this paper, as we look forward to an emerging world of interactive robots and intelligent agents that can respond (or who appear to respond) contingently to users. We will include studies of adults as well as children in this discussion for two reasons: (1) many of the studies focus on adults; and (2) adults appear to treat robots and intelligent agents in much the same way that children do (i.e., as humanlike with emotions and needs).

9.4.1 Robots

Just as children create relationships with media characters, so too may they create parasocial relationships with humanoid *robots*. Early developmental theorists such as Piaget noted that children personify nonhuman objects to make them more human and lifelike, a phenomenon known as animism (Piaget, 1929/2007). Animism is consistent with parasocial relationships in that children breathe life into previously nonresponsive objects (Calvert & Richards, 2014).

As robotic technologies develop and become more commonplace, children of the future may engage in more animism because their toys appear to be autonomous. For instance, children aged 34–50 months of age and 58–74 months of age were more likely to attribute lifelike qualities to an autonomous, robotic dog than a conventional stuffed dog (Kahn, Friedman, Perez-Granados, & Freier, 2006). In this study, children played with either a robotic dog or a stuffed dog, both of which were roughly the same size and color. The children attributed more autonomy to the robotic dog than to the stuffed dog; that is, they believed that the dog would do something (rather than just sit in place) if the experimenter hid the dog toy. Children who played with the electronic dog were more likely to be apprehensive around him (e.g., startled when he stood up, leading the child to back away), as well as expect reciprocity (e.g., children anticipated that the dog would respond when he or she put the toy ball in front of the dog). This type of expectation of contingent responding is similar to a component of social realism that parents identified when responding to the survey item: "When [character] acts out a behavior on screen (like dancing, singing, or playing a game), [child] believes that [character] is performing the behavior in real life" (Bond & Calvert, 2014; Richards & Calvert, 2016). Thus, belief that the robot can act out behaviors, and is doing it in real life in front of the child's eyes, may enhance children's scores in beliefs that the character portrayed in a robotic form is real.

By contrast, children who played with the stuffed dog were more likely to mistreat the toy (e.g., throw the dog across the room) as well as animate it (e.g., child makes dog hop over to pick up the toy ball) (Kahn et al., 2006). Overall, then, children with the stuffed toy engaged in more pretend play, but they were also less likely to treat the toy in a way that they would treat a real dog, as demonstrated with their rough behavior with the stuffed dog.

Some research has also examined how children and adolescents respond to a robotic dog compared to a real dog (Melson et al., 2009). The 7–15-year-olds in this experiment were more likely to have social speech (e.g., greeting the dog) and ask questions to the real dog than the robot dog. Nonetheless, large majorities of children still believed that the robotic dog had the ability to be a social companion and could be his or her friend (70 %), also a major component of parasocial relationship development (see Richards & Calvert, 2016), as well as believe that the dog was subject to moral standing and should *not* be thrown in the garbage (76 %). The study suggests that although there is a difference between real and robotic dogs, most children still attributed humanlike qualities to the robotic dog, which fits well with our findings of character personification as a property of parasocial relationships (Bond & Calvert, 2014; Richards & Calvert, 2016).

An additional study expanded on this basic moral reasoning research and examined the rights and privileges children believe robots should have (Kahn et al., 2012). Nine-, 12-, and 15-year-olds interacted with the humanoid robot named Robovie, which could talk to the child, act contingently, and appear to move around the room autonomously (although he was still controlled by an experimenter in the other room). The authors found that for the most part, children interacted with the robot in social ways, namely, by shaking his hand, following his commands, and hugging him, the latter being a component of attachment in our research (see Bond & Calvert, 2014). Over 80 % of children believed that the robot was acting autonomously. At the end of the experiment, the researcher forced the robot into a closet, despite the robot's pleas to not put him there because he was afraid. In an interview afterward, most children believed that Robovie had mental states; for example, they believed that he could be sad, which we found to be a property of character personification in parasocial relationships (Bond & Calvert, 2014). Most children also looked to Robovie as a social other, e.g., they said they would spend time with Robovie if they were lonely (a component of the attachment dimension), and they believed that he could be a friend (a component of character personification) (see Bond & Calvert, 2014). Although 54 % of children believed that it was not appropriate to put Robovie in the closet, 100 % of them thought it was okay to put a broom in a closet (Kahn et al., 2012). Overall, then, many children considered an autonomous, humanoid robot to be humanlike.

Robots often elicit the same emotions that adults would feel for a real human being. For example, Rosenthal-von der Putten, Kramer, Hoffmann, Sobieraj, and Eimler (2013) showed adult participants a video of either a robot being tortured, which made the robot cry and protest, or a video of the same robot getting treated nicely by getting stroked and fed. Participants who saw the video of the robot getting tortured had significantly higher physiological arousal (measured through skin conductance response) and had more negative affect, more pity for the robot, and anger toward the person in the video who was torturing the robot. They also viewed the robot as less happy than those who saw the video of the "happy" robot. Furthermore, some participants interacted with the robot before seeing the videos for 10 min by being able to play with him and feed him (again, behaviors that can lead to the formation of a meaningful, parasocial relationship; i.e., Gola et al., 2013). These familiarized subjects found the video less entertaining than those who were previously unfamiliar with the robot and did not get a chance to play with him. Thus, very strong emotions can be felt for robots if they appear lifelike and engage in humanlike behaviors, especially if humans have the opportunity to interact with the robot beforehand (Rosenthal-von der Putten et al., 2013).

Taken together, the results from these studies suggest that humans (starting in childhood and continuing into adulthood) hold animistic beliefs about robots when the robot acts in a lifelike emotional manner that is similar to the experiences of live people. Furthermore, the feelings and actions that humans project onto robots parallel the components of parasocial relationships, as ascertained through parent and child survey, in the realms of social realism, attachment, humanlike needs, and character personification (Bond & Calvert, 2014; Richards & Calvert, 2014, 2016). Emotional expressions by the robots were central to this lifelike assessment.

It is important that the robot exhibits some physical humanlike qualities in order for individuals to look at robots as realistic, live beings. For instance, Broadbent et al. (2013) introduced adults to one of three robots—one that had a humanoid face, one that had a silver face with blank holes where the eyes would usually be, and one that did not have a face. A majority of participants preferred the humanoid face, which was also rated as the most humanlike. Participants also viewed the humanoid display as more amiable than the other two displays. Participants who rated the face as being humanlike also perceived the robot as being alive and having agency (Broadbent et al., 2013).

Some research has examined how children react to robots with completely nonhuman characteristics. Meltzoff (1995) discovered that 18-month-old toddlers who viewed an adult attempt to complete a target action but fail (e.g., the adult would try to pull apart a dumbbell, but the experimenter's hands accidentally slid off the end of the dumbbell), were still able to complete this target action. However, when the toddler saw machine pinchers engage in this action, he or she did not perform the target action. These pinchers, though robotic, were not anthropomorphic, which may explain why young children had difficulty interpreting their actions. Consistent with these findings, 3- and 4-year-old children judged whether or not an object should be called by a name by whether or not the object had a face (Jipson & Gelman, 2007). The latter studies, then, highlight the importance of a robot looking like a living being before humanlike qualities are attributed to it, and being embodied is one quality that we have argued is essential for parasocial relationships to occur (see Calvert & Richards, 2014).

9.4.2 Intelligent Agents

Intelligent agents refer to computer-generated characters that are able to mimic many of the social patterns of real human interaction with a user. Intelligent agents can provide joint attention and gaze, can deliver verbal and subtle nonverbal feedback, and can demonstrate in real time how to complete a particular task (Johnson, Rickel, & Lester, 2000). All of these uniquely social features of intelligent agents distinctively contribute to an agent's ability to teach new information and skills effectively to users. At present, little research exists on the use of intelligent agents with very young children under the age of 5, but there is some research with adults and older children on this topic.

The *Ethopoeia Concept*, originally coined by Nass and Moon (2000), suggests that if there are social cues present in human computer interaction, the human will act in a pseudo-social way toward the computer. Taking these social cues into account, many scholars studying human–computer interaction have been able to quantify the specific features that allow users to look at intelligent agents as social companions, and friendship is an aspect of character personification in parasocial relationships (Bond & Calvert, 2014).

Some theorize that greetings and humanlike interaction between computers and users lead the person to believe that the computers are more reliable, capable, and subsequently more trustworthy (Cassell & Bickmore, 2000). Embodied agents that engage in humanlike behaviors such as small talk are also more likely to elicit trust than those who do not engage in small talk (Bickmore & Cassell, 2001), and trust is a component of parasocial relationships, specifically an aspect of character personification (Bond & Calvert, 2014). Similar results have also been discovered with children. Bickmore and Picard (2004), for instance, found that if an intelligent agent was programmed to have a relationship with the child user, that is, if the intelligent agent engaged in social dialog and exhibited humor and empathy toward the child, then the users liked her significantly more than children who had an agent who did not engage in these social behaviors. Characters that have emotions represent aspects of the character personification factor of parasocial relationships (see Bond & Calvert, 2014).

Intelligent agents and the increased social presence afforded by them have promise to be efficacious teaching tools to both adults and children. For instance, Moreno, Mayer, Spires, and Lester (2001) gave seventh graders an educational biology game to play. The game featured an animated agent named Herman, a bug with an engaging voice. Children in one condition received their information from Herman, while another group received all of their information via text box on the screen (they did not see, hear, or interact with Herman). Students with Herman received significantly higher transfer scores when asked to solve a brand new problem than those who just received text-based instruction. Those with the pedagogical agent also had higher interest in learning the material than those who did not have Herman (Moreno et al., 2001).

Similar results were found with younger children. Ryokai, Vaucelle, and Cassell (2003) found that intelligent agents could provide scaffolds that improved 5-year-old children's language skills. In this study, children played with an intelligent tutor during a storytelling game. During the playtime with the agent, the children actually increased in their spatial expression skills (describing exactly where an event took place) and quoted speech (describing what the character in their story said), which the intelligent agent had previously modeled, compared to children who played alone or with another child. Therefore, intelligent agents can serve as social models that can aid children's learning.

The reasons that people may be able to learn from these agents could be because they appear to exhibit social intelligence. For example, researchers used an intelligent agent to teach college students chemistry. Students who received a polite tutor (e.g., used responses such as 'Shall we calculate the result now?' versus 'The tutor wants you to calculate the result now') had higher learning scores than those who did not. The authors proposed that the polite conversation allowed the students to look at the machine as a social conversational partner, encouraging them to understand the message (McLaren, DeLeeuw, & Mayer, 2011). Similarly, Wang et al. (2008) also found that college students who received a polite intelligent agent learned more than those who had a nonpolite tutor.

The type of voice that the agent uses may affect learning. College students, for instance, had higher problem-solving scores after instruction from an intelligent agent that used a humanlike voice than from one with a voice that was synthesized by a machine. Once again, students who perceived intelligent agents on a screen as more humanlike learned more from them (Atkinson, Mayer, & Merrill, 2005). Overall, then, when users view intelligent agents as having qualities that are consistent with the parasocial relationship factor *character personification* (e.g., viewing the character as a friend, trustworthiness; Bond & Calvert, 2014), they learn better from the intelligent agent, suggesting the importance of parasocial relationships in the study of learning from intelligent agents.

Intelligent agents that can act in ways that are contingent to another person's actions and that are emotionally responsive to users through the use of physiological sensors may, then, be robust teaching agents for young children (Woolf et al., 2009). One study used an intelligent agent that acted contingently to school-aged children's emotions (Woolf et al., 2009). The intelligent agent was able to measure the child's emotions through a camera that determined the child's feelings through facial recognition. The intelligent agent was also able to read physiological signals such as posture through seat cushion sensors, pressure on the computer mouse through sensors, and a bracelet that could measure arousal through skin conductance. Using the input from these devices, the intelligent agent on the screen would directly respond to the student's feelings and could effectively mirror the child's emotions (e.g., showing confusion, boredom, frustration) in order to display empathy for the student, adding a layer of social realism which is an important element of parasocial relationships (Bond & Calvert, 2014; Richards & Calvert, 2014, 2016). Students who were more engaged with this contingent, emotionally responsive tutor had higher posttest mathematics scores (Woolf et al., 2009).

Gender differences may exist in human interaction with intelligent agents. Burleson and Picard (2007) conducted research on an affect sensitive computer game with 11–13-year-olds. In their project, they measured skin conductance, facial expressions, pressure put on the mouse, and posture in order to sense the user's emotions. The agent on the screen would provide affective feedback by mirroring the user's feelings. Students also received task-related help from the agent, e.g., "if you move this disk out of the way, one may be able to move this disk over to the goal position." The boys in the sample responded more when they received the task-related help and hints than when they received the affective feedback; by contrast, girls performed best when they received more affective feedback than task-related assistance. These findings suggest that character personification, in the form of emotional expressions (Bond & Calvert, 2014), may be more important for girls' than for boys' learning.

Although intelligent agents hold immense potential for acting as dynamic teachers in the twenty-first century for very young children under the age of 5, little research has directly investigated this age group. The promise of using intelligent agents as learning tools lies in the perfect contingency and customizable nature of the characters that could foster strong parasocial relationships so important to onscreen learning (Brunick et al., 2016). Yet, there are challenges in using this kind of technological interface with young children. Intelligent agents are expensive to produce, largely prototypical, and have limited mobility (i.e., equipment needed to create intelligent agents is currently bulky), and there is concern that very young children will become socially isolated if their favorite social partner is an intelligent agent (Brunick et al., 2016). The fundamental nature of parasocial relationships may also change as parasocial interactions become increasingly realistic, thereby making the one-way nature of parasocial relationships even blurrier for those who interact with robots and intelligent characters who are capable of contingent replies. Nevertheless, future research on intelligent agents, particularly in the form of intelligent media characters, is an important next step, as it capitalizes on children's parasocial relationships with their favorite media characters to engage children and to enhance their learning (see Brunick et al., 2016).

9.5 Conclusion

Children today grow up in an increasingly sophisticated digital world surrounded by an array of onscreen messages, which are often delivered by media characters. Although there is considerable evidence that very young children have difficulty learning from screens, much of this difficulty may stem from the fact that media presentations lack social meaningfulness or social interaction. To address this limitation, media presentations can simulate interactivity and enhance meaningfulness by incorporating social relevancy into their design.

Research should be conducted that further investigates the social nature of learning from content presented via onscreen characters. More specifically, future studies should investigate the benefits of using touchscreen technology and the unique features of mobile apps that include children's favorite media characters. Parasocial relationships have historically been a one-way experience from child to character. Future technological developments in the field of robotics and intelligent agents will further blur the lines of what a one-way and a two-way interaction is, as well as what a relationship is.

To address this rapidly changing technological environment, studies should look at intelligent agents and robots that children can bond with and these agents' ability to detect social cues from users that can enhance children's learning. Future research can also link the literature on parasocial relationships and intelligent agents by creating intelligent characters, as children's favorite media characters can easily transcend media platforms (Brunick et al., 2016). By more fully understanding the parasocial relationships that children have with onscreen figures as well as the parasocial interactions that they engage in with these characters, we will have a richer understanding of how children can effectively learn from screens.

As citizens of the twenty-first century, we need to begin to consider the new types of social relationships and interactions that exist for the digital natives who are growing up today. The fundamentals of friendships and relationships are taking on new meaning with advancements in interactive technology. We should question what a relationship 'is' for children, and who (and what) can provide scaffolds for children's learning. Technological innovations hold promise in teaching children skills that are foundational for their future success. Understanding the social nature of onscreen learning will provide new methods to harness that potential. In today's increasingly technological world, we need to find ways to make these characters who come to life in television programs, computers, apps, and as robots and intelligent characters become responsive guides of children's lives in order to make children in the digital age happy, healthy, and educated citizens of the future.

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