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Media as Social Partners: The Social Nature of Young Children's Learning From Screen Media

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Television has become a nearly ubiquitous feature in children's cultural landscape. A review of the research into young children's learning from television indicates that the likelihood that children will learn from screen media is influenced by their developing social relationships with on-screen characters, as much as by their developing perception of the screen and their symbolic understanding and comprehension of information presented on screen. Considering the circumstances in which children under 6 years learn from screen media can inform teachers, parents, and researchers about the important nature of social interaction in early learning and development. The findings reviewed in this article suggest the social nature of learning, even learning from screen media.

Since the advent and rise of television in the 1950s and its colonization of American's leisure time over the subsequent decades, television has become a dominant activity of childhood (Wartella & Robb, 2008). Recent polls have shown that a large portion of children's time is spent with some form of screen media (e.g., television, videos). Preschool-aged children not in child care spend an average of 2.4 hr a day, and children under 2 years not in child care spend about 1.6 hr a day watching television (Christakis & Garrison, 2010). These numbers continue to rise despite the recommendations of the American Academy of Pediatrics (2007) that children under 2 years not be exposed to television at all, and children over 2 years be exposed to no more than 2 hr daily. Given the amount of time young children spend with screen media, the nature of children's learning in this environment has important implications for raising healthy children. The relevance of this topic for parents is reflected in current controversy surrounding the efficacy of Baby Einstein videos. Recent research has suggested that children younger than 2 years do not learn words from a Baby Einstein video (Richert, Robb, Fender, & Wartella, 2010), and the Walt Disney Company has offered refunds for parents who bought Baby Einstein videos and DVDs with the expectation their children would learn from these DVDs and feel they were misinformed (Lewin, 2009).

In this article, we review various lines of research into children's learning from screen media between birth and 6 years of age. The goal of this review is to provide a broader interpretation of past research, and to highlight implications for understanding the impact of screen media in raising healthy children. We consider the circumstances in which children *do not* learn from screen media and what these findings tell us about the importance of social interaction in healthy cognitive development and learning. We also consider the circumstances in which children *do* learn from screen media to provide parents, policy makers, and programmers with information about what makes educational programming effective. On the one hand, given that learning in general is profoundly social in nature, we would expect limits to what children can learn from media. On the other hand, a sociocultural approach suggests that we cannot consider children's development apart from the social and cultural context in which this development occurs (Gauvain, 2001; Vygotsky, 1978). Within this framework, social partners typically are viewed as parents, teachers, siblings, or peers within the child's immediate environment. However, the growing prevalence of screen media in young children's lives suggests technology itself may function as a more advanced partner scaffolding children's developing abilities and facilitating learning.

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The following review is separated into two segments, the first 3 years and the preschool years. This division reflects how research has been conducted into children's learning from screen media. Researchers have traditionally focused either on children younger than 3 or children older than 3 years. As will be outlined in more detail next, this division reflects specific hypotheses about the factors related to children's developing interpretation of and learning from screen media.

The First 3 Years: Learning About Screen Media

Although some estimates of scholarly publication have suggested a lack of research into mediated transactions relative to research into person-to-person interactions in development (Durkin & Blades, 2009), there has been a surge of research in the past decade comparing infants' and toddlers' interactions with and learning from live and screen models. As outlined next, research examining infants' and toddlers' learning from screen media has typically focused on studies of visual and auditory perception, symbolic understanding, imitation, and word learning. This body of research has revealed a pattern of results, termed the *video deficit effect* (Anderson & Pempek, 2005), in which children under 2½ to 3 years of age are less likely to learn from people on a television screen than from a live person. Hypotheses have suggested the deficit results from perceptual differences between live and screen models (e.g., Barr & Hayne, 1999; Schmitt & Anderson 2002) or from children's poor understanding of the symbolic relation between the screen and the real world (e.g., Troseth & DeLoache, 1998). While both explanations provide a means of accounting for the development of children's abilities to learn from screen media, neither fully accounts for all the current findings (Barr, 2008). We propose that the video deficit also reflects the fact that very young children are learning about the social significance of screen media.

Perception

Visual perception. One explanation for toddlers' difficulties in learning from screen models has focused on the perceptual limitations of a televised image (Barr & Hayne, 1999; Schmitt & Anderson, 2002; Suddendorf, 2003). According to this explanation, the three-dimensional (3D) space represented in a two-dimensional (2D) image on television is degraded in such a way that the cues typically used to perceive the world, such as motion parallax, depth perception, and texture and shadow gradients, are not sufficient for children to encode and use information on the screen (Barr, Muentener, Garcia, Fujimoto, & Chavez, 2007; Schmitt & Anderson, 2002). Processing this perceptually impoverished, degraded image consumes cognitive resources that otherwise could be used to understand and transfer information from screen media. In contrast, live people and demonstrations provide rich perceptual information in 3D space, placing less cognitive load on young children's processing. At least one study supports this view, demonstrating with event-related potentials (ERPs) that 18-month-old children do not process 2D images as quickly as 3D images (Carver, Meltzoff, & Dawson, 2006).

Several recent studies suggest perceptual limitations cannot fully account for the deficit between learning from an on-screen demonstration and a live demonstration (Schmidt, Crawley-Davis, & Anderson, 2007; Zack, Barr, Gerhardstein, Dickerson, & Meltzoff, 2009). In one study, 2-year-old children successfully used a 2D video display as a source of information about where a sticker was hidden on a 2D felt board (Schmidt et al., 2007, Experiment 1), indicating the participants were not limited in their processing of the 2D image. In another study, 15-month-olds were tested on their ability to transfer information from a 2D touch screen or a 3D object to either the same-dimension object (i.e., transferring from 3D to 3D) or a cross-dimension object (i.e., transferring from 3D to 2D and vice versa; Zack et al., 2009). Infants who watched an action demonstrated on a 2D touch screen were successful at demonstrating that action on the same touch screen, just as infants who watched an action demonstrated on a 3D object were able to recreate the action on that object. Again, these results indicate that the 2D image was not so impoverished that children could not use information from it. Performance only deteriorated when children tried to transfer from the 2D display to a 3D object or vice versa (Zack et al., 2009). Thus, although infants' visual perception of a screen may play an important role in whether they learn from 2D screen images, other factors are likely also relevant in how and when children learn from screen models.

Auditory perception. Research into young children's auditory perceptions of screen media builds on findings that suggest young children have an innate capacity to discriminate between the phonemes used in all languages (Eimas, Siqueland,

Jusczyk, & Vigorito, 1971). By 12 months, infants' ability to make these distinctions in non-native languages diminishes greatly (Kuhl et al., 2006; Zhang, Kuhl, Imada, Kotani, & Tohkura, 2005). However, exposure to foreign languages can prevent the decline in phonetic discrimination (Kuhl, Tsao, & Liu, 2003). One experiment tested exposure to a high-quality foreign language DVD in twelve 25-min sessions over 4 weeks could prevent declines in foreign language speech perception either through viewing and listening, or listening alone (Kuhl et al., 2003). Although the DVD emulated a book-reading session by showing a person reading a book from an infant's perspective, there was no social interaction with the infants. Nine-month-olds did not maintain their phonetic discriminatory abilities after exposure to the DVD book reading, despite the fact that children of the same age continued discriminating after interaction with a live book reader. The implication is that simple auditory exposure to foreign phonemes is not sufficient for preventing declines in infants' phonetic discrimination; social interaction is critical in this process. Televised models could not replace live interaction, even when the learning appeared to be simply related to auditory input.

In summary, research on children's auditory and visual perception of the images, sounds, and people portrayed on screen has indicated that children's developing perceptual abilities play an important role in their developing ability to learn from a screen. However, as outlined before, perceptual development alone cannot account for the situations in which children *do not* use information on a television screen. Learning from television may also be related to other aspects of cognitive development, such as children's understanding of the symbolic nature of the screen.

Symbolic Representation

Symbolic representation is important for communication and social interaction (Huttenlocher & Higgins, 1978). As children learn about symbols, they not only need to learn about what each symbol represents but also about how people use particular symbols to communicate. As part of this process, children learn about screen media as a form of symbolic communication within their cultural environment. Apart from general repetition of McLuhan's (1964) claim that the medium is the message, suggesting that each medium has unique properties that influence users' reception of content in specific and constrained ways, few researchers have explicitly outlined what it means to consider the screen as a symbolic form. This is likely because screen media are best conceptualized as tools that use multiple symbol systems simultaneously (e.g., pictures, language, music, visual cues, auditory cues) rather than as symbol systems in their own right (Salomon, 1979). For children to learn from information provided on screen, they need to view the screen as a symbolic source of information about present reality (Schmidt et al., 2007; Troseth & DeLoache, 1998).

Modeled on past research into children's ability to use symbols as sources of information, this line of research often uses object retrieval tasks in which children are asked to find a hidden toy after watching a hiding event live or on a television screen (e.g., Troseth & DeLoache, 1998). Success on these tasks is thought to indicate understanding that screen media can be used to symbolically communicate information (Troseth & DeLoache, 1998). In the object-retrieval paradigm, 3-year-old children who watch an adult hide a small toy in a 3D-scaled model of a room and are then asked to find it in a real room find the toy with few problems, but 2½-year-old children do not (DeLoache, 1987). Using the scale model of a room as a source of information about an actual room requires dual representation, or the understanding that an object can be an object in and of itself and that it can stand for something else. In this task, dual representation enables children to conceive the scale model as a symbol meant to communicate where the toy is hidden in the real room (DeLoache, 1987). Salience seems to play a significant role in this ability (DeLoache, 1987). Because the model was very salient, both visually and physically, 2½-year-old children had a harder time overlooking the fact that it was meant to be a symbol and instead focused on it as the object itself. However, 2½-year-old children will use 2D video and pictures as a source of information about the location of a toy, suggesting that video and pictures are less salient than scale models and thus easier to use as symbols (DeLoache, 1991; Troseth & DeLoache, 1998).

This interpretation is supported by a study in which 9-month-old children treated objects moving across a video screen in the same way they treated actual objects, by hitting at or grasping at the objects on the screen (Pierroutsakos & Troseth, 2003). This kind of reaction to on-screen objects decreases by 15 months, suggesting that 9-month-old children did not view the on-screen objects symbolically. In contrast, the 15-month-olds recognized the on-screen objects as symbolic representations rather

than as real objects (Pierroutsakos & Troseth, 2003). Given that children as young as 15 months may understand the symbolic nature of a 2D screen image, it is important to consider circumstances under which children can use information presented on-screen, and should be interpreted within the context of experiments examining children's abilities to successfully use a 3D scale model.

When children believe that what they are seeing is actually reality, the need for dual representation of a scale model disappears and children are able to find the toy in hiding tasks (DeLoache, Miller, & Rosengren, 1997). For example, leading 2½-year-old children to believe that a scale model of a room was actually *the room itself*, by telling children that it had been shrunk by a ''shrinking machine,'' removed the need for children to dually represent the scale model (DeLoache et al., 1997). Similarly, researchers have attempted to remove the need to symbolically represent a television screen by obscuring the casing of a television and making it seem as if children were actually watching a person hiding a toy through a window (Deocampo & Hudson, 2005; Troseth & DeLoache, 1998). The 2-year-olds who view the television through the window have been more successful at finding the hidden object than those who viewed the hiding event on video directly, though still not as successful as children who watched the hiding event live through a window. Thus, removing the need to symbolically represent the screen is one successful pathway to increasing children's use of the on-screen information (Troseth & DeLoache, 1998).

However, children's natural experience with screen media requires they learn the symbolic relation between screen images and the real world. Research has suggested it is quite difficult to accomplish this with children under 2½ years, even if the relation between the real world and the screen is made explicit by allowing children to have experience with, or interact with, live-feed video. In one study, a group of 2-year-old children watched an assistant hide a toy concurrently on a television monitor and through an open doorway while an experimenter noted the relation between the screen and the room (Troseth, 2003a). After it was hidden, children retrieved the toy. Children who then viewed a toy being hidden only via television found the toy less than 50% of the time (Troseth, 2003a). An additional group of 2-year-olds watched an experimenter hide two toys on a television screen. Children watched on screen as the experimenter retrieved one toy and returned to ask the child to retrieve the other toy. Both forms of training involved orienting children to live-feed video, but neither form of training was sufficient to facilitate children's use of the information from the screen during the testing trials (Troseth, 2003a).

Other findings have suggested that the nature and duration of the live-feed interaction may be relevant. Children as young as 2 years will use information on screen when they have had experience seeing themselves on television (Troseth, 2003b). Two-year-old children who had 2 weeks' experience watching themselves on television through a live-feed were more likely to find an object after watching it hidden by an experimenter on a television screen than children without live-feed experience (Troseth, 2003b). Importantly, the 2-year-old children who had viewed themselves through live-feed were also more likely than children without this experience to use pictures as a source of information about where an object was hidden (Troseth, 2003b), a task past research has suggested is difficult for children under 2½ years (e.g., Troseth & DeLoache, 1998). Thus, children's experience with live-feed video transferred into using another 2D symbol as a source of information, indicating children had learned something about the utility of 2D symbols for communicating information about reality. This suggests that children's experiences with seeing themselves on television can play a significant role in strengthening their understanding of symbol-referent relations.

In addition, 2-year-old children will use information from a person on screen after an extended, socially contingent, screen-mediated interaction with that person. In one study, 2-year-olds had 5½ min of interaction with live-feed television (Troseth, Saylor, & Archer, 2006). Half of the children participated directly with an experimenter who interacted with them in a socially contingent manner (e.g., playing games, responding to questions). The other half of the children watched a prerecorded video of an experimenter interacting with another child, limiting the amount of socially relevant information (e.g., the experimenter referred to the child by an incorrect name). The children who interacted live with the experimenter through the video-feed prior to the video search-and-retrieval task were more successful than the children who were shown the prerecorded video prior to the search task (Troseth et al., 2006). This socially contingent experience may have given young children feedback that the on-screen events provided useful information. Without this experience, 2-year-old children are less likely to use information from a person on screen, even if the person simply tells

the child where a toy is hidden (Schmidt et al., 2007).

In summary, young children demonstrate the ability to use information from a symbolic screen before they have fully developed their dual representational understanding of 3D symbols. Specifically, 2-year-old children demonstrate learning from information presented on a television screen either after removing the need to represent the symbolic nature of the screen by having the children watch the screen through a window (Troseth & DeLoache, 1998), after having a socially contingent interaction with an on-screen person (Troseth et al., 2006), and after seeing themselves or others through live-feed (Troseth, 2003b). Although symbolic understanding plays an important role in how children process what is happening on a screen, symbolic understanding alone does not account for how children learn about the relation between the 2D televised image and the 3D world. Related to children's increased use of information after socially contingent, live-feed interactions, one factor in children's use of on-screen information may involve viewing the on-screen character as a social partner, a hypothesis supported by research into children's imitation of on-screen models.

Imitation

Research on imitation can be informative about children's ability to learn from television because imitation is one of the key processes involved in cultural learning (Tomasello, 2000) and is ''a robust mechanism by which infants learn in the real world'' (Barr & Hayne, 2003, p. 16). Studies of children's imitation of screen models reveal the extent to which children treat people on screen as social partners. Of particular interest is the development of deferred imitation, or imitation after a delay, which is often used to gauge how and when young children learn through the observation of others. Infants as young as 9 months have demonstrated memory for and reproduction of live event sequences up to 1 month after initial exposure (e.g., Barr & Hayne, 2000; Lukowski et al., 2005).

In research into children's imitation from screen media, it is typical to compare children's imitation of a single or multistep process after they have viewed a demonstration by either a live person or via a televised display of the same person (e.g., Barr & Hayne, 1999; Hayne, Herbert, & Simcock, 2003; Meltzoff, 1988). As will be outlined next, children either watch a prerecorded videotape of a person performing an action sequence or a presentation of the action sequence through live-feed. In both cases, it is common for parents and experimenters to direct children's attention to the television. This is important not only because it orients children to the screen but also because adults are indicating that the television has special relevance as an object worth attending to, and by extension, learning from. This is one way parents can scaffold their children's behavior, mediating how children process television by directing their attention (Barr, Zack, Garcia, & Muentener, 2008).

One early study of deferred imitation from a live-feed, televised interaction indicated 14- and 24-month-old children were able to reproduce a simple action such as pulling apart a novel dumbbell toy up to 24 hr after seeing an adult perform the action (Meltzoff, 1988). Participants viewed an experimenter who demonstrated how to manipulate a novel object through a live-feed camera. Parents and the on-screen experimenter directed children's attention to the television, and the demonstration did not begin until the infant fixated on the television screen. Nearly all the participants imitated the action immediately after the demonstration, and approximately half of the 14-month-olds imitated the televised display after a delay (Meltzoff, 1988). Similar to situations in which 2-year-old use the information from a screen to find a hidden toy, these findings suggest that when a person on screen mimics some aspects of a socially contingent interaction, 14-month-old children will imitate the on-screen model.

Other researchers have found that children in this age range were more likely to imitate live people than previously recorded videos of people in the reproduction of multistep action sequences (e.g., Barr & Hayne, 1999; Hayne et al., 2003). Using a methodology similar to the one outlined before, 12-, 15-, and 18-month-olds were more likely to imitate a three-step action after viewing a live demonstration compared with a previously videotaped demonstration (Barr & Hayne, 1999). These results were consistent for children who were tested immediately after viewing and children who were tested after a 24-hr delay. This discrepancy in imitation persists until 30 months of age (Hayne et al., 2003). Similarly, 24-month-old children are more likely to imitate the actions of a televised person through live-feed than a noninteractive, videotaped model (Nielsen, Simcock, & Jenkins, 2008).

These findings suggest that even without a socially contingent model, young children can imitate on-screen models before they have achieved dual representation (for a detailed explanation,

see Deocampo & Hudson, 2005). Interestingly, 6-month-old children are equally likely to imitate a live person and a previously recorded video of that person, but 12- to 18-month-old children are more likely to imitate the live person (Barr, Muentener, & Garcia, 2007). The authors speculated the 6-month-olds may not have mentally separated the representation of the televised and real-world objects and as a result were able to transfer an action from the screen to the real world with less difficulty than older infants. In other words, the video deficit did not occur because symbolic representation did not occur (Barr, Muentener, & Garcia, 2007). Another interpretation of this finding is that the 12-month-olds have become more sensitive to the lack of social contingency from the previously recorded videotaped models (Troseth et al., 2006). Regardless, the findings on imitation suggest the importance of considering children's interactions with people on screen when interpreting the situations in which children learn from on-screen models.

Recent research has focused on the conditions that facilitate the ability of children under 2 years to imitate a video model. Two-year-old children who have trouble imitating a noncontingent, videotaped person need as many as six repetitions of a procedure before imitating televised demonstrations (Barr & Wyss, 2008). This finding has been replicated with 12-, 15-, 18-, and 21-month-old children (Barr, Muentener, Garcia, Fujimoto, et al., 2007). Participants who were shown a live demonstration three times or a video demonstration six times imitated the process at equivalent rates, and both were higher than the baseline children who did not participate in a demonstration session and only in the test session. In other words, children need twice as much exposure from a nonsocially contingent person on television to imitate a procedure as children who watch a live person.

One recent study has suggested that the duration of modeling, as opposed to the number of repetitions, can account for the boost in children's deferred imitation (Strouse & Troseth, 2008). In this study, 2-year-old children viewed a multistep action either live or on video three times over about 2.5 min. Children in the live and video conditions were equally as likely to imitate the actions. However, when the duration of the videos was shortened to include only one repetition lasting about 1 min, children in the live group outperformed those in the video group. In addition, 2-year-old children were less likely to imitate if they viewed either demonstration on television in their homes rather than in the lab setting (Strouse & Troseth, 2008). One explanation for this finding is that children's experiences with television in their homes may have contributed to an expectation that television does not provide useful information because regular programming is not responsive and lacks markers to link televised images to children's own experiences. This stands in contrast to experience with live-feed television (Troseth, 2003b), which does reflect a child's environment and real-world actions.

In summary, interaction plays an important role in whether very young children imitate people on a television screen. Children under 2 years are more likely to imitate when a person on screen is socially contingent. Without contingent interaction, young children need more repetitions of or longer exposure to an event sequence before they will imitate an on-screen person. One possibility that has not yet been tested with children of this age, and is only starting to be evaluated in preschool-aged children, is the role of familiarity with and emotional connection to the people on screen. If the duration of exposure is more important than the number of repetitions (Strouse & Troseth, 2008), there are likely factors related to the longer exposure that increase the likelihood of imitation. While repetition and duration of exposure are important aspects of young children's learning in general, repetitive viewing also promotes familiarity and interaction with characters in the preschool years (Anderson et al., 2000). The confounded relation between repetition of an action and a child's relationship with the on-screen character has yet to be accounted for.

Word Learning

Another approach used to examine whether children at this age view television as a source of socially relevant information is to examine their learning of words from screen models. In a longitudinal study of learning from baby DVDs, children between 12 and 15 months were randomly assigned to view a DVD highlighting words around the house over the course of 6 weeks or to follow their normal routines without watching the DVD (Robb, Richert, & Wartella, 2009). Over 2-week segments, children in the experimental condition viewed the DVD five times and were assessed on expressive and receptive communication measures. Children who viewed the DVD did not learn more of the words in the DVD than children in the no-DVD group, even after 15 exposures. Further research has suggested no evidence of learning DVD-highlighted words in this scenario by 2 years of age; however,

in a joint-viewing session, if parents drew children's attention to the screen and also labeled the words, some children did learn words from the DVD (Richert et al., 2010).

Research specifically comparing very young children's learning from live and videotaped models suggests live interaction is necessary for helping toddlers see the relation between an object labeled on screen and the referent of the label. In one study, children heard a label for a novel object in four different conditions (Krcmar, Grela, & Lin, 2007). In two video conditions, children either (a) watched a previously recorded scenario of an adult playing with and labeling the object or (b) watched segments of a children's program with a voice-over labeling a periscope when it appeared on the screen. In two live conditions, children heard the object labeled (a) by a live adult who had established joint reference with the child or (b) by a live adult who labeled the object after the child had been distracted. All children were most likely to learn the words in the live joint-reference condition, and least likely to learn the words when they heard the label as a voice-over during the children's program. Children were also more likely to learn the word from the adult on video than from the voice-over in the children's program (Krcmar et al., 2007). These findings suggest not only that before the age of 2, a televised model cannot replace live interaction in children's language learning but also that children may be more likely to learn a label from an on-screen adult than from a children's program.

Other findings suggest that by the age of 30 months, children may begin to learn differently from different screen models. One study found negative correlations at 30 months between viewing the infant show *Teletubbies* and infants' vocabularies, but positive correlations between viewing *Clifford*, *Arthur*, *Dragon Tales*, *Blue's Clues*, and *Dora the Explorer* and toddlers' vocabularies (Linebarger & Walker, 2005). The negative correlation between watching *Teletubbies* and language at 30 months suggests children are capable of discriminating between shows. Children may be receptive to the developmental appropriateness (or lack thereof) of *Teletubbies,* a show targeted for much younger children, especially compared with the other shows studied. The characters on *Teletubbies* speak in an infantile language, in a way that may be similar to infant viewers, but does not emulate the speech of older English-language speakers. Thus, children may be more likely to learn from on-screen sources who appear to know more than the children themselves know, even if those sources are on a television screen.

Other studies have shown that children over 2 years can learn novel words from a screen when exposed to object labels through video in a lab setting (Roseberry, Hirsh-Pasek, Parish-Morris, & Golinkof, 2009; Scofield, Williams, & Behrend, 2007). One study has suggested the importance of live interaction in helping toddlers learn words from a video (Roseberry et al., 2009). When 30- to 42-month-old children were taught action words either by a video alone or through a combination of video and live interaction with an adult about the video, children learned the verbs in the social interaction condition, but only children older than 36 months learned verbs from the video alone (Roseberry et al., 2009). Another study has suggested children can transfer a novel label for a 2D representation of an object to another 2D representation of an object (Scofield et al., 2007). In this scenario, 2- to 3-year-old children viewed a picture of an object displayed on a computer screen while hearing a voice-over label the objects. On the same screen, children were then shown pictures of the target object and three distracter objects; and children in this age range could point to the object after hearing the label. These findings should be interpreted in light of children's success in transferring symbolic information from 2D to 2D displays (Zack et al., 2009). The findings do not speak to whether children would also use the words to refer to 3D exemplars.

Taken together, the research on children's learning words from on-screen models in the first years of life suggests that screen media do not function in the same way as live social partners in learning. Indeed, children under 2 years of age rarely demonstrate learning from screen models independent of an adult noting the importance of the words labeled on screen. What remains unclear is whether a screen model who engaged in a socially contingent interaction through live-feed would be successful in teaching these young children words. Based on our review of the circumstances in which children at this age imitate on-screen models and use the information presented to them on screen, we would hypothesize an increase in learning words from socially contingent on-screen models.

Summary

Research with children in the first 3 years suggests toddlers view the people and characters on the television screen differently than they view

people in live interactions. Although this claim may seem to be common sense, it has important implications for debates about what factors are important in children's learning from screen models. In particular, mere exposure to information is not sufficient for learning, and screen models do not replace live models as social partners who can scaffold learning at these young ages. Past research has suggested that televised voices cannot substitute for live interaction (Kuhl et al., 2003), and children need televised information to be repeated more often and for longer durations to be equivalent to a single live interaction or a socially contingent, mediated interaction (Barr & Wyss, 2008; Strouse & Troseth, 2008).

On-screen models do not, on their own, effectively scaffold very young children's learning. However, adults may facilitate children's learning through screen-related behaviors. A recent study examined how 12- to 18-month-old children learn about television from their parents (Barr et al., 2008). Children whose parents treated the on-screen images as something with relevant information (e.g., asking on-topic questions or labeling) were more likely to interact with the video (Barr et al., 2008). In addition, 12- to 24-month-old children demonstrated some evidence of word learning from a DVD when parents directed the children's attention to the DVD and repeated words from the DVD (Richert et al., 2010).

The findings also suggest the importance of considering the social nature of children's learning from screen media in addition to perceptual or symbolic understanding accounts for why children tend to demonstrate the video deficit effect in this age range. The studies can be interpreted as indicating the importance of contingent feedback for learning, mirroring past research on effective scaffolding techniques (Wood & Middleton, 1975). In much of the research reviewed before, children learned from on-screen models when those models provided a contingent interaction with the children.

There are a number of factors to consider when interpreting the research to date. First, the experimental conditions in which very young children have demonstrated learning do not represent children's traditional exposure to television in which there is little to no contingency between televised models and the child's environment. Second, theorists have argued that young children initially view the television as a window to the real world, assuming what they see on television reflects something that is currently happening in reality (Strasburger, Wilson, & Jordan, 2009; Wright, Huston, Reitz, & Piemyat, 1994). Contrary to this assumption, the findings about word learning suggest that before 3 years of age, it takes substantial training and assistance from an adult present during the interaction or from an on-screen model for young children to see the relation between information presented on television and the real world. In the remainder of this review, we consider how preschool children understand and learn from screen media as further evidence for the social-cognitive nature of young children's interactions with screen media.

The Preschool Years: Learning From Screen Media

Hypotheses about learning from screen media in the preschool years have focused on program comprehensibility, children's understanding of formal features and the importance of repetition for children's comprehension of and attention to screen content (Calvert, 1999, 2004; Huston, Bickham, Lee, & Wright 2007; Schmidt & Anderson, 2007). Although these explanations can account for the relation between the development of certain cognitive skills (e.g., perception, attention, comprehension) and learning from screen media, they do not account for social-cognitive factors in how preschool children learn from media. As we have noted before, by the time they reach the preschool years, children begin to react to screen media with social ideas and expectations (Reeves & Nass, 1996; Strommen, 2003). Recognizing the social factors in preschool children's learning from screen media can provide information about whether and in what circumstances screen media can promote learning.

One important factor in children's learning from screen media is related to the fact that children must rely on others for various kinds of information that children cannot verify for themselves through direct observation (Gelman, 2009; Harris & Richert, 2008). Similarly, children must learn who or what in their environment provides reliable information (Harris, 2007). By preschool, children have begun to discriminate between people who provide reliable information and people who do not (Harris, 2007), a discrimination that is likely extended to television shows and characters. Given their abilities to choose who to rely on for information, we may expect preschool children to understand that certain television shows or characters provide relevant information about the outside world whereas others do not, and preschool children may be more likely to learn from some shows than others.

Another factor in whether a child will attend to and learn from a person on screen is whether he or she identifies with the character (Bandura, 1989). When a character more closely resembles a viewer, emotional investment with a program increases, and the likelihood that viewers will learn educational content also increases (Fisch, 2004a). By the age of 7 years, children are more likely to demonstrate wishful identification and form parasocial relationships with same-sex characters (Hoffner, 1996). Parasocial relationships describe the interactions between media users and the people or characters on screen, in which users respond to on-screen figures as though they were in a typical social relationship (e.g., via empathic responses, feelings of companionship), even though there is no socially contingent interaction (Giles, 2002). Research into preschool children's development of parasocial relationships has been rare (Giles, 2002).

Judging the reliability of on-screen characters and identifying with on-screen characters are both aspects of the social nature of children's interactions with screen media. Because of the lack of research directly comparing preschool children's learning from live and screen models or between various kinds of screen models, we review research into children's general learning from and preferences for on screen models. In particular, we summarize research into children's reality-status judgments about program content, children's learning from different programs, and how learning may be facilitated by children's development of parasocial relationships with on-screen characters.

Before examining whether preschool children learn differently from different kinds of programs, it is important to establish how children judge the reality status of program content. Around 3 years of age, about half of children will claim that all on-screen characters are pretending, even when doing ''real'' things (Rosen, Schwebel, & Singer, 1997). Children reliably differentiate pretend from real actions on screen by the age of 5 years, and about half of 5-year-olds understand the pretend intentions of on-screen characters when the characters are pretending (Rosen et al., 1997). Five-year-old children also will acknowledge that fictional programs may contain content that cannot happen in the real world, but children at this age will claim that programs containing educational content, such as *Sesame Street*, can occur outside the television (Wright et al., 1994). In addition, increased viewing of particular characters, whether cartoon or real, is related to increased judgments that those characters exist outside the television (Wright et al., 1994).

In summary, preschool children tend to assume that the information on television is not real. This has important implications for leaning from television, given that preschool children are less likely to use a problem-solving strategy learned in the context of a fantasy story than in the context of a realistic story (Richert, Shawber, Hoffman, & Taylor, 2009). If children treat fantasy as ''not-real'' and thus do not apply information from fantasy stories to real-world stories, it seems plausible that children would also have a more difficult time applying information from television programs that they consider ''not real.'' Indeed, 5-year-old children are more likely than 3-year-old children to imitate a complex action sequence from television, even in a realistic display (Flynn & Whiten, 2008). Importantly, not readily applying information from fantasy stories can be viewed as a sophisticated strategy, given that children should not always assume something they learn about in a fantasy story (e.g., flying) would work in the real world (Richert et al., 2009). One by-product of this assumption about information on screen may be that young children may also not see the connection between the kinds of information parents do want children to apply (e.g., moral lessons) and the world outside television.

Some studies have suggested that preschool children may have difficulty in understanding the abstract messages embedded into children's programming. Research into children's comprehension of the moral lessons in television shows would suggest that preschool- and kindergarten-aged children generally do not learn the complicated, thematic elements that program designers embed into their stories (Mares, 2006; Mares & Acosta, 2008). In one study, 5- and 6-year-old children learned a moral from watching *Clifford the Big Red Dog* but did not transfer the moral outside the boundaries of the story (Mares & Acosta, 2008). In another study, 3- to 5-year-old children were more likely to learn a moral lesson that could be demonstrated concretely (i.e., cooperation) rather than abstractly (i.e., honesty; Fisch, Brown, & Cohen, 2001). These findings may not be surprising given children's increasing abilities to recall narrative and correctly sequence stories across these ages (Fisch et al., 2001). However, at least one study noted the effectiveness of highlighting the programmers' intentions for children in helping the children learn from a program (Mares, in press). In this case, stopping a cartoon program with nonhuman protagonists and having an adult male voice tell children the message (i.e., ''The people who made this show want you to

know that the same thing is true for humans'') can increase 4- to 6-year-old children's comprehension of the prosocial message in the program (Mares, in press).

Given the emphasis on early children's television programs in teaching children language skills, a large body of research has been conducted on the effectiveness of these programs, specifically, on *Sesame Street* (see summaries in Calvert, 1999; Comstock & Scharrer, 2007). Rather than review these studies in their entirety, which generally suggest viewing *Sesame Street* can teach children language and result in long-term positive outcomes for children's academic achievement, we highlight several studies examining the situations in which preschool children demonstrate learning specifically from the television screen. In one study, 3- to 5-year-old children were able to learn novel words from a 15-min television program in a controlled viewing situation (Rice & Woodsmall, 1988). In this case, new words were embedded into stories about a bug and a mole. An on-screen character did not draw children's attention to the specific words; rather, children had to learn the words in the context of a story narrative. Although all children in the experimental condition benefited from the story, the 5-year-old children learned more new words than 3-year-olds (Rice & Woodsmall, 1988). When considered within the context of previous research demonstrating that children under the age of 2 years were learning less from a television program than a live adult (Krcmar et al., 2007), these findings suggest children continue to develop in their ability to learn from on-screen models throughout the preschool years and should be interpreted in light of other research about the factors involved in children's learning from *Sesame Street* (e.g., Rice, Huston, Truglio, & Wright, 1990).

Viewing *Sesame Street* in the home between 3 and 3½ years old is a significant predictor of vocabulary scores at 5 years of age, independent of many potentially confounding variables including gender, parental education, parental attitudes toward television, and family size (Rice et al., 1990). This relation was not found for viewing other noneducational children's programs and suggests children view *Sesame Street* differently from other programs. Additionally, children who view *Sesame Street* more have shown greater gains than those who watch fewer hours (Rice et al., 1990). This relation exists for child viewers who watch alone, without coviewing parents who might provide additional linguistic support. One possible explanation for children's learning from *Sesame Street* specifically is that in addition to having a highly structured educational curriculum, *Sesame Street* utilizes quasi-social interactions by having characters talk or sing directly to the audience, mimicking social conventions like establishing eye contact or waiting for responses. *Sesame Street*, like many children's programs, uses features like humor to elicit positive emotion, which has been shown to result in higher levels of visual attention (Miron, Bryant, & Zillmann, 2001). The elicitation of a positive emotional response is one of the reasons children attend to, and thus encode, content presented on television (Fisch, 2004b).

Although a positive emotional response on its own does not indicate a purely social response to the characters on screen, a series of studies has suggested preschool children are more likely to learn educational content when they have developed a relationship with an on-screen character. One study examined 3- to 5-year-old children's learning and transfer from a *Blue's Clues* episode (Crawley, Anderson, Wilder, Williams, & Santomero, 1999). Comprehension of both educational and entertainment material in a *Blue's Clues* episode increased with additional exposure for 3-, 4-, and 5-year-olds. Although these findings have been explained via the relation between increased exposure and increased comprehension, a review of research into learning from *Blue's Clues* indicated that preschool children who more frequently watched *Blue's Clues* were more likely to interact with both the characters in *Blue's Clues* as well as on-screen characters in other programs (Anderson et al., 2000). Thus, it is unclear whether, in the presence of a parasocial relationship, repetition alone can account for increased learning. In a study of preschool children's learning from *Dora the Explorer*, children who interacted more with Dora while Dora was on screen were more likely to understand the central content of the story (Calvert, Strong, Jacobs, & Conger, 2007). In addition, children who perceived themselves as more similar to Dora were more likely to learn a problem-solving strategy. These findings suggest children are most likely to learn from on-screen characters when they treat those characters as social partners or when they identify with them.

Summary

During the preschool years, many children assume that what happens on screen is pretend (Rosen et al., 1997). This stance may interfere with preschool children's learning of the information

provided to them by on-screen characters. The educational programming from which preschool children do learn likely succeeds because the programs establish mock social interaction (as in *Blue's Clues* or *Dora the Explorer*; Calvert et al., 2007) or have been established as a source of reliable information (e.g., through explicit connections to the real world; Mares, in press).

From this perspective, it is interesting to consider the mechanisms through which increased viewing may facilitate preschool children's learning. Although increased viewing likely increases children's comprehension of the message (Crawley et al., 1999) and children's more sophisticated search for information within a program (Calvert, 1999), it is also associated with increased interactions with the characters and belief that the characters exist outside the television (Wright et al., 1994). Thus, there is a greater likelihood that children will form a relationship with the on-screen characters in a way that increases their belief that those characters may be reliable sources of information. Importantly, once they have come to understand that screen models *can* be socially relevant, children still have to learn which screen models are reliable and provide useful information about the real world, and which do not.

Raising Healthy Children: Implications for Policy and Practice

We conclude with two key implications these findings have for parents, teachers, programmers, policy makers, and researchers. We also note suggested directions for future research.

First, children under 2 years of age primarily learn from screen media under specific conditions in which the social relevance of the on-screen models has been made apparent (e.g., through live-feed, socially contingent interactions). Thus, screen models do not function in the same way as live social interaction in early learning and development. In addition, the conditions under which very young children demonstrate learning from screen models are qualitatively different from the kinds of exposure children at this age typically have to screen media. Parents, educators, and programmers should be aware of the limitations on children's learning from screen media at these young ages. In terms of policy, media producers must be cautious in how they advertise media intended for children under 2 years of age, being careful not to imply educational value where none has been demonstrated. Some efforts have been made in this direction already. As noted before, the Walt Disney Company announced refunds for all Baby Einstein videos and DVDs (Lewin, 2009).

Research should continue to examine how children learn about media and mediated models in the early years. One important means by which children learn about the information on television is through parents and siblings, and how parents treat media likely plays a role in how and whether children learn from television. In this sense, coviewing may be seen as a time for additional parent–child interaction, but also a time when parents teach their children healthy ways of approaching their media interactions. However, parents should also note that new research has suggested both the quantity and quality of parent–child interactions is lower when television is on the background (Christakis et al., 2009; Kirkorian, Pempek, Murphy, Schmidt, & Anderson, 2009). Thus, parents should not mistake being in the room with children while the television is on as equating to high-quality coviewing.

Second, preschool children's learning from screen media is likely influenced by their parasocial relationships with on-screen characters and their belief that events on screen are not real. To the first point, children's social relationships with on-screen characters likely influence their learning from those characters (e.g., Calvert et al., 2007). If parents and programmers want to increase the likelihood that children will learn from educational programming, they should consider parasocial relationships to be an aid to learning (Hoffner, 2008). Research should examine the influence of having socially contingent on-screen models. In practice, several preschool television shows, such as *Blue's Clues, Dora the Explorer,* and *Mr. Rogers' Neighborhood*, have tried to utilize a socially interactive approach by having characters create faux eye contact, talk directly to the screen, and establish parasocial relationships with child viewers. These factors are expected to engage child viewers and increase the likelihood of learning (Lauricella, Barr, & Calvert, 2008). Researchers should examine the effectiveness of these techniques as they are used by programmers in educational media.

To the second point, adults should not assume that young children are aware of which on-screen characters are reliable and have useful information about the real world and which do not. Many young children begin their preschool years assuming that on-screen characters are pretending (Rosen et al., 1997). If parents and educators want to

increase the likelihood that children will learn educational content from programs, parents and educators could explicitly draw connections between what is presented on screen and what does (or does not) happen in the real world. If programmers want to increase children's learning from different characters, they should establish the authority of characters from which children should be learning. Programmers also should make the messages explicit rather than implied (Mares, in press). Researchers should continue to study how children apply information from screen media to the real world and how children evaluate the different messages they receive from media sources. Although preschool children have demonstrated the ability to learn some kinds of information from animated and other fantastical characters in children's programming (e.g., both the Muppet characters and adults on *Sesame Street*), it is important to consider how children view and learn from fantastical and realistic characters (Richert et al., 2009). Future research should examine children's expectations about different characters' knowledge and expertise and how those expectations influence children's learning from on-screen characters.

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