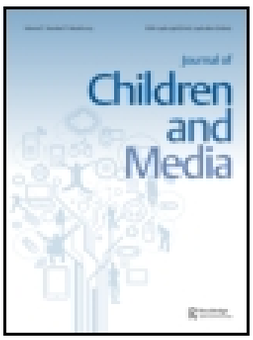

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Young children's thinking about touchscreens versus other media in the US

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ABSTRACT

Although children's use of touchscreen devices has rapidly expanded, how young children conceive of these devices is relatively unknown. Here, we examined young children's recognition, attribution of functions, and preference for using touchscreens as opposed to other devices. Forty-three preschoolers answered questions regarding six devices; for comparison, a group of 16 adults was also tested. Children recognized the devices as well as adults, but attributed fewer functions to touchscreen devices than did adults. However, compared to other media, children attributed more and different functions to touchscreens. Interestingly, children did not uniformly prefer touchscreen devices, but chose selectively for different tasks. The results show surprising differences from adult users as well as a developing understanding among young children regarding media tools.

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Media use; touchscreen devices; reasoning about media; learning; media preferences

Touchscreen use has exploded over the last decade. A recent survey found that 64% of American adults own a smartphone and 42% own a tablet (Pew Research Center, 2015). Children have also quite suddenly become major consumers of touchscreen devices. A 2013 Common Sense Media survey found that children's access to mobile devices had grown substantially since 2011 (Rideout, 2013). Tablet ownership for families increased from 8 to 40% across this period, and 75% of children in the surveyed families had access to a touchscreen device in 2013. Additionally, 17% of children used a mobile device on a daily basis, and on average, these children used mobile devices for over an hour a day. Nielsen (2011) ratings show similar levels of usage: In tablet-owning households with children under the age of 12, 70% of children use a tablet. The appeal of touchscreen devices is likely due to the expansive possibilities of mobile applications or "apps." More than 80% of the top-selling apps in the Education category of the App Store are aimed at children (Shuler, Levine, & Ree, 2012). In 2009, nearly half of the top 100-selling apps were created for preschool or elementary-aged children, and by 2012 that number had risen to approximately three-quarters. Additionally, 43% of children under 8 frequently use mobile devices to play educational games and 42% frequently play entertainment games on mobile devices (Rideout, 2013).

As these surveys show, children's use of touchscreen technology is sailing full speed ahead; meanwhile, research is struggling in its wake. One largely unanswered question is

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how children think about the ways a touchscreen can be used. Chiong and Shuler (2010) studied 4- to 7-year-olds' touchscreen use and found that of the children who reported having used an iPhone before, the majority (60%) said they used the iPhone to play games. Although parents agreed with this, parents also claimed their children used the iPhone for a variety of other activities, including taking pictures and listening to music. When asked their preferences for various media devices, children ranked the iPhone third, after the video game devices Nintendo DS and Nintendo Wii.

The present study takes a broader stroke by exploring how young children today think about the functionality of touchscreen devices compared to the functionality of traditional media like televisions and computers. One interesting issue is whether children distinguish between the functionality of tablets, smartphones, and computers. These three devices can all be used for the same tasks, including surfing the internet, watching videos, and playing games. Do children view these devices as similar in function, or as fundamentally different devices with different purposes? What is the developmental course of children's understanding, and to what extent does it depend on one's own use of each device?

In studying development, it is useful to consider the "end state"; here, this would be how adults think about these devices. Of course, cohort and developmental differences are always potentially confounded in such analyses, particularly when the object of interest is rapidly changing. This must be borne in mind when considering adult-child differences in thinking about touchscreen devices. Adults and children might differ because adults grew up in a different device ecology than exists for children today; this is a cohort difference. Alternatively, adults might view devices differently because they are more mature. Maturation-bound differences can be continuous differences, in which a child is viewed as a smaller version of an adult, or as qualitative differences, which we favor: They are fundamentally different from adults in their needs, interests, characteristics, and preferences. With these caveats about possible sources of difference in mind, we think it is useful and interesting to measure adults' views for comparison to those of children.

Children's thinking about touchscreen functions might adhere to one of three developmental models. First, children might think egocentrically about touchscreens and believe that a device's purpose aligns with their own primary use of the device. Since children often use touchscreen devices to play games (Chiong & Shuler, 2010; Rideout, 2013), they might see games as the primary function of these devices. Once children have determined a particular function (such as games) as the main function of touchscreens, they might be inhibited in their ability to recognize other legitimate but unfamiliar touchscreen functions. This type of functional fixedness occurs rapidly with novel artifacts (Defeyter & German, 2003), even by two years old (Casler & Kelemen, 2005), and might play a role in children's touchscreen comprehension. Egocentrism would also predict individual differences based on personal use. Although games were previously the most frequently reported function, some parents reported that their children used touchscreens for a greater variety of tasks (Chiong & Shuler, 2010; Rideout, 2013); individual differences in personal usage could drive different understandings about the uses of a touchscreen device.

Second, children might reason about touchscreen devices based on what is modeled for them, rather than how they use those devices themselves. Adults report using touchscreens for a wide range of activities, including taking pictures, using apps, and text messaging (Purcell, Entner, & Henderson, 2010). If children adopt adults' use as a model, they should endorse a multifunctional perspective. This perspective is what we expected from our adult sample, since they undertake and are exposed to a wide array of uses.

The third possibility is that children's views of device function are led by their preferences. Prior research with a ranking task showed children have a strong preference for touchscreen devices (Chiong & Shuler, 2010). This preference might supersede any specific goal, leading children to claim touchscreen devices are the best object for every purpose. However, from the age of 4, children are able to override certain cues and will pick the optimal tool to achieve a particular goal (DiYanni & Kelemen, 2008). Children may depend on this ability to selectively choose the most appropriate device for a task, regardless of whether the device is their favorite to use. In sum, we aimed to answer the following main questions with regard to young children, as well as how they compare with a sample of adults:

(1) Do children recognize touchscreen devices?
(2) Do children attribute the same functions to media devices, particularly touchscreen devices?
(3) Do children show a multifunctional understanding of touchscreen devices?
(4) Do children prefer to use touchscreen devices for goal-based tasks?

Method

Participants

Children

Forty-three children participated, including fourteen 4-year-olds ($M = 55.14$ months, SD = 3.37, range = 49–59; 8 female), fourteen 5-year-olds ($M = 66.50$ months, SD = 3.18, range = 60–71; 8 female), and fifteen 6-year-olds[1] ($M = 78$ months, SD = 4.39, range = 72–88; 8 female). Children were mostly white and middle class, reflecting the families who volunteer for research in the mid-Atlantic community in the US from which they were sampled. An additional seven children were tested but excluded from analysis due to inattention or inability to complete the experiment.

Adults

Sixteen undergraduate students (6 female) were recruited through a Psychology department participant pool. They participated for course credit.

Materials

Materials were six 10×15 cm color photographs showing a book, an iPad, a flat screen television (TV), an iPhone, a PC laptop computer, and a wireless home telephone. Apple touchscreen devices were chosen based on their use in prior studies (e.g., Chiong & Shuler, 2010), and the relative dominance in the US of Apple smartphones and tablets over those of other companies during the last five years (King, 2015).

Procedure

Recognition and function questions

Participants were presented with each photograph in the fixed order described above, which was devised to separate devices that are similar in form (iPhone and iPad) and function (iPhone and home telephone) to avoid confusion. Participants were asked to identify each

object individually. The iPad could be correctly labeled as an iPad or more generically as a tablet; likewise, the iPhone could be labeled as a smartphone. If participants identified an object incorrectly (e.g., called an iPad a phone) they were corrected (e.g., "This is actually an iPad."). Then participants were asked whether they had seen the object before and a series of function questions (e.g., "Is this something people use for work?") before proceeding to the next device. The Appendix includes the full list of questions. Although open-ended questions would be very interesting, here we used forced choice questions to restrain the variety of responses and allow for more experimental control.

To explore participants' understanding of the multifunctional nature of media tools, we added together the functions that each participant attributed to a particular device to determine a multifunctional score for that device. Multifunctional scores could range from 0, if a participant claimed a device could accomplish none of the functions presented, to 7, if a participant claimed a device could accomplish all of the functions presented.

Preference task

For the preference task, we presented four different scenarios that included a goal and asked participants which device would be best to use. By separating preference into different categories based on type of task, we hoped to clarify whether participants understood the functional purposes of different media depending on context. For this section, the experimenter laid the six photographs before the participant in a random order and asked which object would be best to use for four different tasks: learning about dogs, seeing a map, hearing Spanish, and talking to a friend. For example, participants were asked, "If you wanted to learn about dogs, which one of these would be best to use?"

Parent media survey

For child participants, parents filled out a media survey asking whether the five technological devices (tablet, smartphone, computer, television, home telephone) were present in their home and to what extent their child used each device. Books were not included in the survey but children's use of books was uniformly high in a media survey administered in a similar study (Eisen & Lillard, 2016), and other surveys show that the majority of children are read to on a daily (60%) or weekly (25%) basis (Rideout, 2013). Children who used a device rarely (either did not use a device or used it less than once a week) were coded as infrequent users, children who used a device once a week or several times a week were coded as weekly users, and children who used a device once a day or several times a day were coded as daily users.

Results

First, we present the results of our parent media survey of the extent to which children use each of the technological devices. Next, we present participants' ability to recognize each device and their description of the functionality of each device. Lastly, we present participants' preferences for particular devices in goal-based tasks.

Parent media survey

Parents reported how frequently their child uses each technological device; results are shown in Figure 1. More than half of the children used tablets and smartphones on a weekly basis,

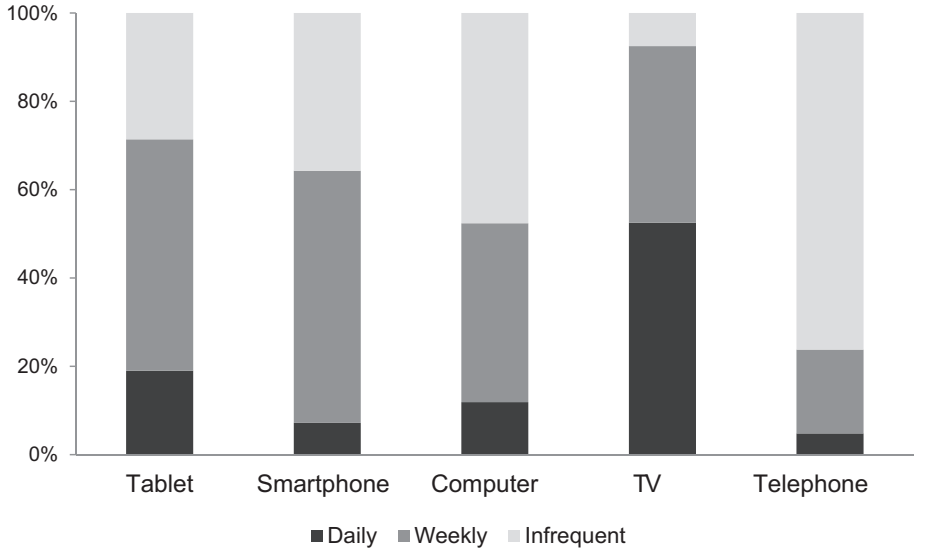

Figure 1. Percentages of children reported to be in each category of use for each device.

while about a third used touchscreens less than once a week or not at all. Although 19% of children used tablets daily, only 7% used smartphones as often. For computers, 47.6% of children were infrequent users, 40.5% were weekly users and almost 12% were daily users. Over half of children watched TV daily and 40% watched it weekly. Nearly 5% of children used a telephone daily, 19% used one weekly, and most children (76%) use a home telephone only rarely. These patterns are consistent with other surveys involving middle-class American children (Rideout, 2013).

Recognition

Participants were first asked to identify each object and state whether they had seen the object before. Adult participants identified all objects correctly and claimed to have seen all objects before. Children were near ceiling at identifying objects and almost all had seen all of the objects before. Thirty-five of the 43 children (81%) identified the iPad correctly when it was first presented and 41 children (95%) said they had seen an iPad before. Forty children (93%) correctly identified the iPhone and 42 children (97.7%) said they had seen an iPhone before. Chi-square tests of independence indicated that children and adults did not significantly differ in their identification or recognition of any object.

Function

Figure 2 shows the extent to which children are less likely than adults to claim particular functions for each device. When asked about books, children showed an adult level of understanding for the functions of talking to others, taking pictures, playing games, watching shows and movies (all no), and for learning and reading (both yes). However, children did not understand that books are used for work, rendering them significantly different from adults on this question, χ^2 (1, N = 59) = 6.47, p = .011.

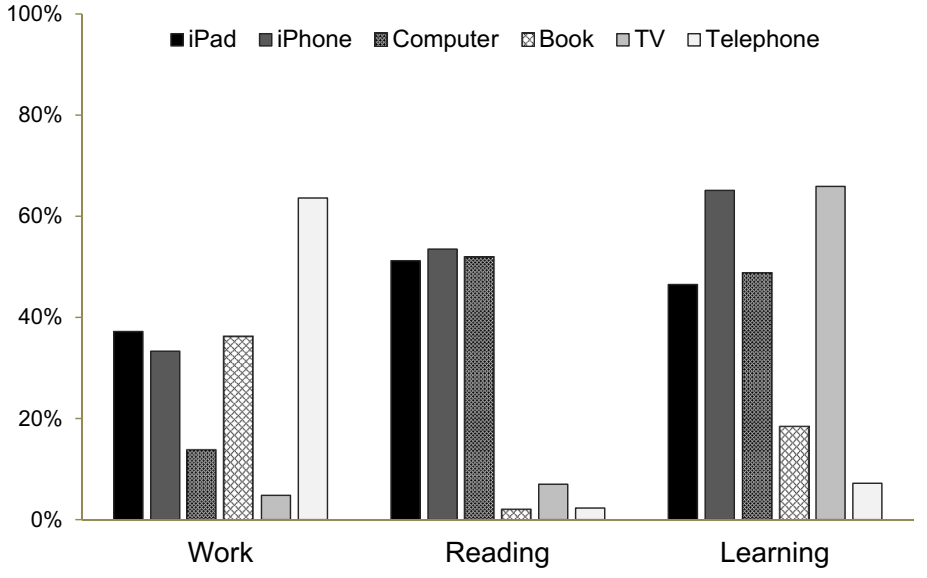

Figure 2. Extent to which children are less likely than adults to claim each device performs a function.
Note: Higher percentages represent larger discrepancies between children and adults.

Regarding iPads, children understood that they can be used for taking pictures, playing games, and watching shows and movies. Children differed from adults in being less apt to realize that iPads are used for work, χ^2 (1, $N = 59$) = 8.17, $p = .004$, for talking to others, χ^2 (1, $N = 59$) = 16.14, $p < .001$, for learning, χ^2 (1, $N = 59$) = 11.26, $p = .001$, and for reading, χ^2 (1, $N = 59$) = 13.50, $p < .001$. Only about 63% of children understood an iPad might be used for work, and 41% understood that it might be used to talk to someone. Perhaps more surprising, only half of children realized that an iPad can be used for reading and learning.

For TVs, children showed an adult level of understanding for the functions of working, talking to others, taking pictures, playing games, reading, and watching shows and movies. Significantly, fewer children than adults claimed a TV can be used to learn, χ^2 (1, $N = 59$) = 20.37, $p < .001$. Fewer than 30% of children thought TVs could have an educational function, whereas 94% of adults saw TVs as useful for learning.

For iPhones, children attributed the functions of talking to others, taking pictures, and playing games at similar rates as adults. However, they differed from adults regarding whether iPhones are used for work, χ^2 (1, $N = 59$) = 6.09, $p = .014$, for learning, χ^2 (1, $N = 59$) = 19.83, $p < .001$, for reading, χ^2 (1, $N = 59$) = 14.03, $p < .001$, and for watching shows and movies, χ^2 (1, $N = 59$) = 12.13, $p < .001$. Children attributed these functions to iPhones at a much lower rate than adults. For example, just 35% of children thought one could learn something with an iPhone.

For computers, children understood that they serve work purposes. Children were significantly less likely than adults to claim that computers are also used for talking to others, χ^2 (1, $N = 59$) = 24.31, $p < .001$, for learning, χ^2 (1, $N = 59$) = 12.13, $p < .001$, for taking pictures, χ^2 (1, $N = 59$) = 24.19, $p < .001$, for playing games, χ^2 (1, $N = 59$) = 6.83, $p = .009$, for reading, χ^2 (1, $N = 59$) = 12.74, $p < .001$, and for watching shows and movies, χ^2 (1, $N = 59$) = 10.43, $p = .001$. Only half of children thought computers were for learning, 42% thought they could be used for reading, and fewer than 30% knew they could be used for talking with others.

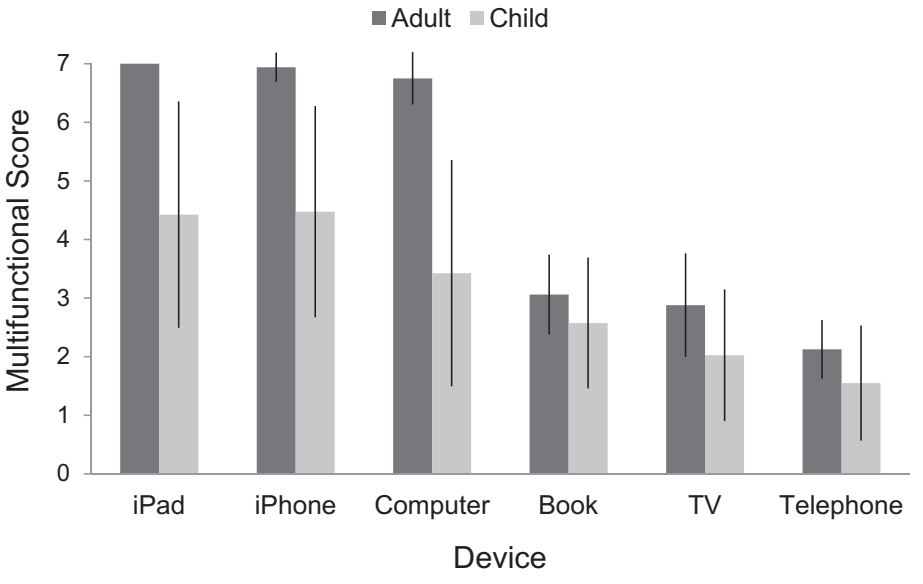

Figure 3. Multifunctional scores given by children and adults for each device.
Note: Lines show standard errors.

For home telephones, children understood at adult levels the functions of talking to others (yes), learning, taking pictures, playing games, reading, and watching shows and movies (all no). However, children were significantly less likely to understand that home telephones are sometimes used for work, χ^2 (1, N = 59) = 18.87, p < .001.

Multi-functionality

Figure 3 shows multifunctional scores for each device, allowing a comparison of child and adult understanding. Overall, children attributed fewer functions than adults did to each device, particularly for the touchscreens and computer. Children attributed significantly fewer functions to the iPad (M = 4.53, SD = 1.93) than did adults (M = 7.00, SD = 0), t(57) = 5.08, p < .001. Children also attributed significantly fewer functions to the iPhone (M = 4.56, SD = 1.80, vs. M = 6.94, SD = .25), t(57) = 5.23, p < .001, and the computer (M = 3.44, SD = 1.93, vs. M = 6.75, SD = .45), t(57) = 6.75, p < .001.

We also examined the development of device multi-functionality understanding within the child sample. A one-way ANOVA with age group (4–6) as the between subject variable revealed no significant effect of children's age on multifunctional scores for the book, TV, iPhone, or home telephone. An age effect was observed for the computer, F(2, 40) = 5.18, p = .01, and the iPad, F(2, 40) = 4.37, p = .02. In both cases the significant result was between 6-year-olds and 4-year-olds. Post-hoc Tukey's HSD tests showed that 6-year-olds assigned significantly more functions than did 4-year-olds to both the computer (M = 4.47, SD = 1.69 vs. M = 2.36, SD = 1.90, p = .007) and the iPad (M = 5.53, SD = 1.64 vs. M = 3.57, SD = 2.21, p = .015).

In addition to looking at age differences, we examined multi-functionality differences between devices. Focusing on the three devices that are the most multifunctional (iPad,

iPhone, and computer), pair-wise comparisons with Bonferroni correction showed that children attributed significantly more functions to the iPad ($M = 4.53$, SD = 1.93) than to the computer ($M = 3.44$, SD = 1.93), $t(42) = 4.99$, $p < .001$. Similarly, children attributed significantly more functions to the iPhone ($M = 4.56$, SD = 1.80) than to the computer ($M = 3.44$, SD = 1.93), $t(42) = 4.32$, $p < .001$. By way of comparison, adults did not show a significant difference in multifunctional scores between the iPad ($M = 7.00$, SD = 0), iPhone ($M = 6.94$, SD = .25), and computer ($M = 6.75$, SD = .45), $p = .19$.

Children may attribute more functions to a device when they have more experience using it. Therefore, we conducted a one-way ANOVA with use level as the between subjects variable and multifunctional scores as the dependent variable. Level of use did not significantly affect multifunctional scores for the iPad, the iPhone, or the computer. We also conducted a two-way ANOVA to explore the effect of both use level and age on multifunctional scores, but found no significant interaction between use level and age for the three devices. Finally, we conducted a one-way ANOVA with age group as the between subjects variable and use level as the dependent variable; this showed that age did not affect level of use for touchscreens or computers.

Preferences

To determine whether participants prefer touchscreens to other forms of media, we asked which object would be best to use for four separate tasks: learning about dogs, seeing a map, hearing Spanish, and talking to a friend. Chi-square Goodness-of-Fit tests were performed to determine whether the six objects were equally preferred. To learn about dogs, children showed a significant preference for books, χ^2 (5, $N = 43$) = 53.57, $p < .001$, whereas adults preferred a computer for learning, χ^2 (5, $N = 16$) = 60.41, $p < .001$. To hear Spanish, children showed no significant preference, whereas adults preferred a computer, χ^2 (5, $N = 16$) = 19.72, $p = .0014$. Interestingly, to talk to a friend, children showed a significant preference for using a home telephone, χ^2 (5, $N = 41$) = 68.17, $p < .001$, whereas adults preferred to use an iPhone, χ^2 (5, $N = 16$) = 81.91, $p < .001$. Finally, to see a map, children showed a significant preference for using a computer, χ^2 (5, $N = 41$) = 20.52, $p = .001$, consistent with adults, χ^2 (5, $N = 16$) = 33.54, $p < .001$.

Discussion

Although touchscreen devices are ubiquitous in children's lives, we know little about what children make of them. This study attempts to break new ground by asking young children about the functionality of various media tools. We had four primary questions. First, do children recognize touchscreen devices? They did, and as well as adults, even by age 4. In fact, young children are fairly frequent users of touchscreens, with over 50% using them on a weekly basis. Children are more likely to use tablets on a daily basis than smartphones, possibly because the larger screen of a tablet allows for easier use. The results of our media survey support existing research on the recent and rapid increase of preschoolers' touchscreen use (Nielsen, 2011; Rideout, 2013).

Second, do children have an adult-like understanding about the functions of media devices? One area in which they are vastly underdeveloped is understanding how these devices function for work. They know computers are used for work, but many do not realize

that iPads and iPhones can be used for work. Nor do children understand that books and home telephones are sometimes used for work. This could be due to an underdeveloped concept of work, except with regards to computers; we suspect that children are often told that adults are working when they are on the computer.

In general, children's understanding that touchscreen devices can be used for learning and for reading were also very reduced relative to adults'. Nor did children understand that computers and TVs can be used for learning. Hence, children appear to approach these devices with an entertainment bias. And consistent with their views of computers as work-devices, children do not tend to see them as devices for communicating with others, watching shows and movies, and taking photographs.

Our third question was whether children understand that touchscreen devices are inherently multifunctional. There is considerable development in this understanding, as children were less apt to ascribe multiple functions to the touchscreen devices than were adults. However, 6-year-olds were more apt to ascribe them than 4-year-olds. Consistent with the results just described, the computer was the device for which children were slowest to recognize multi-functionality. We had expected that children who used devices more frequently might be most likely to appreciate multi-functionality, based on the assumption that frequent use would involve using for more functions. This is a questionable assumption that should be examined in further research, as our expectation was not confirmed.

Finally, we asked which media tools children prefer to accomplish different goals. For three goals involving acquiring information, adults chose the computer, whereas children chose the computer for just one of these – viewing a map. This is interesting given children's tendency to categorize the computer as a work device, and given the prevalence of smartphone-based navigation. However, unlike adults, children preferred a book for learning about dogs. In an era when adults will often search the web to learn information about seemingly everything, it is interesting that young children view books as the best sources. For speaking Spanish, children (unlike adults) had no preferred device. When it came to talking on the phone, adults showed a preference for the iPhone, whereas children preferred the home phone. This might speak to the functional fixedness point raised earlier. While home phones typically have only one function, children recognize at least some of the myriad of different functions of an iPhone, which might lead to this preference. However, a simpler explanation could be that children are generally not allowed to use their parents' smartphones to make calls.

We introduced three potential outcomes for children's comprehension of functionality. First, egocentrism could lead to functional fixedness, in which children view touchscreens primarily as entertainment devices. Second, they might derive their understandings from what is modeled. Since adults and other children (Chiong & Shuler, 2010; Rideout, 2013) use touchscreen devices for many functions, children might recognize early on that touchscreens have a wide range of uses. Third, they might base their views of function solely on preferences; others have found that children prefer touchscreen devices (Chiong & Shuler, 2010).

We did not find evidence for the preference-based account; children selected devices according to what seemed to make sense for each device. However, we found evidence for both egocentric and modeled responses. The strongest evidence for children deciding the functions of devices based on modeling came from computers. Children appear to equate computers with work and fail to understand the many other things they can do. Yet in support of egocentrism, children also fail to appreciate the many uses of touchscreen devices that

extend beyond entertainment. Most interesting, we think, is young children's failure to perceive that touchscreen devices can be very useful to learn.

Children tended to attribute a few main functions to each device and their multifunctional scores were lower overall than those of adults. However, we see rapid development in their understanding that devices can have multiple functions, with 6-year-olds understanding this significantly better than do 4-year-olds. This was not due to children's own level of use but it could have been due to the type of experience children have – something we did not ask about in our parent survey. Further research should examine this and could also extend this investigation with open-ended questions about what children think devices are for.

Another limitation of this research is our use of a homogenous convenience sample. Initial research on the "digital divide" – the gap between those who can afford technological access and those who cannot–suggested that low-income and minority families are less likely to own mobile devices than more affluent families (Rideout, 2013). Yet other studies have revealed that low-income families are frequent users of mobile technology (Kabali et al., 2015) and that minority youth between the ages of eight and eighteen spend more time consuming media on mobile devices than white youth (Rideout, Lauricella, & Wartella, 2011). Low-income families show higher use of educational mobile media than high-income families, although this may be because low-income parents are more likely to rate media titles as educational (Rideout, 2014). The prevalence of mobile technology has begun to close the gap between high- and low-income families in terms of device ownership, but a digital divide still remains, with low-income families less able to pay for better quality devices and apps and less comfortable with mediating their children's media use (Livingstone, Mascheroni, Dreier, Chaudron, & Lagae, 2015). Future research should include children from a wider variety of income and ethnic backgrounds to get a comprehensive view of children's understanding of these devices.

Implications

One touchscreen function in particular that children discounted was learning. Only half of the children understood that iPads could be used for learning and only a third understood that iPhones could be for learning. Instead, children in our study favored books as learning resources. This may be due to how learning is framed by parents and teachers. Perhaps children are generally led to believe that learning involves books and this guided their responses in our study. Do children think knowledge gleaned from books is more valuable than that from a touchscreen device? And do parents encourage these beliefs in the ways they discuss learning with their children? It is possible that this explanation is particular to middle and upper class families, who could be more likely to emphasize the utility of books for learning.

Parents and educators may believe that children are learning from educational apps, but if children do not think of touchscreens as learning tools, this could impact their transfer of learned concepts to the real world. They may even invest less mental effort into their interactions with touchscreens than with books, as has been theorized about children's interactions with television (Salomon, 1981, 1984), which could lead them to learn less. Alternatively, if parents do not view touchscreens as positively as they do books and are not framing time with touchscreens as educational, this may affect how children perceive touchscreen devices. Parents are divided in their beliefs about the educational merits of mobile devices. For

example, Wartella, Rideout, Lauricella, and Connell (2013) found that 37% of parents felt mobile devices positively influenced their child's reading skills, but 21% felt there was a negative influence and 40% felt the influence was neutral. Since parent attitudes toward screen media are a significant predictor of how much time children spend using screen media (Cingel & Krcmar, 2013; Lauricella, Wartella, & Rideout, 2015; Vandewater et al., 2007), this ambivalence toward the educational value of touchscreens may directly affect how children view these tools. Parents' views are understandable: The "app" universe could stand significant improvements to aid children's learning (Hirsh-Pasek et al., 2015). Parents also report social interactions and books as the most valuable methods of learning for their children, and only 10% of parents claim digital media as an important source of learning (Rideout, 2014; Wartella et al., 2013). It is likely that parental attitudes about the educational value of screen media will predict children's use and perception of educational media. Further research on children's beliefs about touchscreen learning is needed, as this work would have important implications for educational touchscreen media.

Conclusion

This study shows that children as young as age four can reliably recognize an array of media devices, including tablets and smartphones. It also reveals that children grasp the multi-functional nature of touchscreen devices but are still developing this understanding. They do not fully recognize the capabilities of touchscreens and tend to attribute certain functions, such as playing games and watching shows, over other functions like learning. Finally, we showed that children do not have an overall preference for using newer forms of technology to accomplish a variety of tasks, whereas adults consistently prefer to use computers and smartphones for these same tasks. This research serves as an initial step towards a deeper understanding of how young children think about the functions of touchscreen devices, at a time when these devices are rapidly becoming a ubiquitous feature of their lives.

Note

1. One child was 7. This child did not significantly differ from the 6-year-olds and analyses that excluded this child produced the same pattern of results.

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Sierra Eisen is a doctoral student in the Department of Psychology at the University of Virginia. Her research focuses on how children think about and learn from interactive technology and educational apps.

Angeline S. Lillard is a professor of psychology at the University of Virginia. Her research interests include pretend play, Montessori education, theory of mind, executive function, and children's media interactions.

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Appendix

Recognition and function questions

What is this?
Have you seen this before?
Is this something people use for work?
Is this something people use for talking to other people?
Is this something people use for learning about things?
Is this something people use for taking pictures?
Is this something people use for playing games?
Is this something people use for reading?
Is this something people use for watching TV shows and movies?

Note: Repeated for each device.