



Full length article

## Reading with hotspots: Young children's responses to touchscreen stories



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### ABSTRACT

Worldwide estimates indicate that toddlers and preschoolers are introduced to mobile technology at an early age, with many now using touchscreens on a daily basis. One of the appeals of touchscreen technology is that it seems to be intuitive to very young children and, at least from anecdotal evidence, they seem to enjoy it. Even the simplest forms of children's touchscreen media often contain hotspots, which are interactive elements of a screen that allow children to touch a picture and obtain an immediate visual and/or auditory response. Despite the fact that children seem to engage haptically with these technological features, little is known about how they use them and how these features may influence their attention to and comprehension of the media content. A detailed understanding of children's verbal and haptic responses, as well as their visual attention and comprehension, is key to gaining a more complete understanding of children's use of this medium. Using an experimental design, in this pilot study, we examine Dutch preschoolers' (age 2–5,  $n = 78$ ) haptic use (how much and when they use hotspots), verbal responding (i.e., narrative relevant and irrelevant comments), attention, and story comprehension when hotspots are either activated or turned off. Implications for the use of touchscreen media in early childhood, as well as the design of such media, are offered.

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As the debate continues about how, and whether, digital technologies fit in the lives of young children, adoption of these technologies, including smart phones, tablet computers, and game consoles, continues at a rapid pace (Common Sense Media, 2013). In 2006, Rideout and Hamel (2006) found that 91% of American children aged 2 to 3 consumed screen media at least several times per week, with the frequency and duration of use increasing throughout the preschool years. By 2011, children under 2 had an average of 53 min daily of screen time (Common Sense Media, 2011), and by 2013, this number had increased to 58 min for children under 2 and 1:58 for children 2–4 (Common Sense Media, 2013). These increasing numbers are due, in part, to the increased presence of mobile technology in young children's lives. In 2011, for example, 52% of parents reported that their young children use one of the newer forms of mobile media such as a smartphone, a video iPod, or a tablet device (Common Sense Media, 2011), a number that has increased to 75% in the most recent report (Common Sense Media, 2013). Indeed, more recent data with non-representative

American samples suggests that children's access to mobile technology may be approaching saturation (i.e., 96.6% of children under 4 reportedly have used mobile devices at home; Kabali et al., 2015). Importantly, these patterns are not exclusive to American children. Estimates from other industrialized countries similarly indicate that toddlers and preschoolers are introduced to mobile technology at an early age, with many now using touchscreens on a daily basis (Holloway, Green, & Livingstone, 2013).

One of the appeals of touchscreen technology, of course, is that it seems to be intuitive to very young children and, at least from anecdotal evidence, they seem to enjoy it. Even the simplest forms of children's touchscreen media, such as e-books, often contain hotspots, which are interactive elements of a screen that allow children to touch a picture and obtain an immediate visual and/or auditory response. Touching a picture of a cow, for example, may result in a mooing sound and some movement in the cow. Despite the fact that children seem to engage haptically with these technological features, little is known about how they use them, and importantly, how these features may influence their attention to and comprehension of the content. Although there does exist some previous work with children's touchscreen use (e.g., Krčmar &

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Cingel, 2014), these researchers examined parent-child reading from touchscreens, looking only at situations in which parents read the story and importantly, focusing solely on stories which mirrored a traditional book in every way except the format (i.e., no hotspots). Yet, many tablet-based children's books include hotspots and, despite this wide availability, little research has looked at how children respond to stories presented on a tablet computer when hotspots are present. In order to better understand the larger issues regarding children's use of various tablet-based content, it is important to obtain a descriptive understanding of how young children interact with tablet-based applications.

To address this gap, in this pilot study we ask how children behave and respond to a story read to them by a tablet computer when that story either contains or does not contain hotspots. Past research has shown that both verbal interaction and haptic responses are key elements in how well children attend to and learn from media including tablet computers (e.g., Krcmar & Cingel, 2014) and television (e.g., Anderson et al., 2000). Thus, a detailed understanding of children's verbal and haptic responses, as well as their visual attention and story comprehension, is key to gaining a more complete understanding of children's use of this new medium. Using an experimental design, we examine preschoolers' (age 2–5) haptic use (how much and when they use hotspots), verbal responding (i.e., narrative relevant and irrelevant comments), attention, and story comprehension when hotspots are either activated or turned off. We utilize the capacity model as a general framework for understanding children's initial processing of touchscreen technology.

## 1. The capacity model and children's responses to media

Although several theories have been posited to explain children's processing of media, one of the more frequently cited theories is the capacity model. Designed specifically to explain how children extract educational content from television, the capacity model is based on an information processing approach to cognition. The model posits that children have limited cognitive capacity available to process and comprehend information (Fisch, 2000). The capacity of working memory dictates these limits and children, with their necessarily smaller working memory capacity, may easily be overtaxed. Fisch (2000) argues that demands on children's cognitive capacity arise from three areas: the processing of *narrative* or story content, the processing of the *educational* content embedded within the program, and the degree to which the educational content is necessary for or integral to the processing of the narrative. Narrative content is argued to take precedence over educational content such that the amount of resources available for educational content is dependent on the amount of resources not *already* committed to the narrative. Accordingly, Fisch argues that television content can be educational only if the memory system is not overloaded (Fisch, 2004). When the system is overloaded, insufficient processing resources are allocated to the educational material and learning suffers. Thus, according to the capacity model, learning occurs only when the system is not overburdened.

Fisch (2004) argues that the structure of media content can either reduce the amount of processing resources necessary for comprehension, or conversely, increase the amount of resources necessary and potentially overload the cognitive system. For example, research has shown that the inclusion of participation cues in children's television increases the processing complexity of the media content and, on their own, results in weaker comprehension of the educational content (Piotrowski, 2014) while other work has shown that other structural features, such as cuts, zooms or complex formal features, may similarly stress the cognitive system (Krcmar & Cingel, 2014). Although initially developed for

educational television, researchers now argue that the capacity model can also be reasonably applied to children's interactive media, including touchscreen stories (Kirkorian & Anderson, 2009). As with educational television, it is expected that children have limited working memory to devote to processing digital story content, and when overloaded, processing (and subsequent comprehension) is expected to suffer. Moreover, as with educational television, it is reasonable to argue that there are structural features which may influence children's responses to touchscreen stories.

## 2. Structural features and responses to touchscreen stories

Structurally, one of the most relevant features to consider when investigating children's responses to touchscreen stories is the hotspot. Indeed, the very nature of touchscreen technology, and being able to touch or tap pictures and icons in order to experience some immediate outcome, is not only one of the key features that differentiates these screens from other, older technologies but is a feature that makes the screens so intuitively appealing to very young children. These interactive hotspots, designed to elicit immediate visual or auditory responses from the child, are a core feature of many touchscreen stories for children. Yet, their impact on *young* children's responses to the screen remains unknown. To address this gap, in the present study, we examine children's haptic responding, verbal responding, attention, and story comprehension. First, we ask how the inclusion of hotspots may influence frequency and timing of hotspot haptic interaction since such descriptive patterns can provide relevant information as to how young children engage with these features:

**RQ1.** *For children reading a touchscreen book with active hotspots, what is the frequency and timing of hotspot haptic interaction?*

Following this, we investigate whether the inclusion of hotspots in touchscreen stories may influence verbal responses, attention, and story comprehension.

### 2.1. Verbal responses

In terms of verbal responses, there is some precedent to suggest that the inclusion of hotspots in touchscreen stories may influence the type of verbal comments (i.e., narrative-relevant comments; narrative irrelevant comments) that occur during reading. Whereas narrative-relevant comments are seen as potential aids for processing stories, narrative irrelevant are more likely to distract processing (Haden, Reese, & Fivush, 1996; van Kleeck, 2003). Thus, while narrative-relevant comments are typically seen as helpful to children's processing of the narrative, narrative irrelevant comments are often seen as more problematic. In previous research, Krcmar and Cingel (2014) found that, when reading a tablet book, parent-child conversations focused less on the narrative content and more on book format and environment. Conversely, when reading a traditional book, parent-child verbal interactions focused more on the narrative of the book. Krcmar and Cingel (2014) argued that the additional cognitive load required by the tablet computer may have influenced parent-child dialogue, particularly decreasing the child's ability to focus upon the narrative content. Similarly, in the present study, it is possible that the inclusion of hotspots may tax children's cognitive load and subsequently results in fewer comments associated with the narrative of the story and instead an increase in narrative-irrelevant comments.

**H1.** *Children reading a touchscreen story with active hotspots will have fewer narrative-relevant verbal comments than children reading the same story with deactivated hotspots.*

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