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They can interact, but can they learn? Toddlers' transfer learning from touchscreens and television

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ABSTRACT

Despite the ubiquity of touchscreen applications and television programs for young children, developmental research suggests that learning in this context is degraded relative to face-to-face interactions. Most previous research has been limited to transfer of learning from videos, making it difficult to isolate the relative perceptual and social influences for transfer difficulty, and has not examined whether the transfer deficit persists across early childhood when task complexity increases. The current study examined whether the transfer deficit persists in older children using a complex puzzle imitation task constructed to investigate transfer from video demonstrations. The current test adapted this task to permit bidirectional transfer from touchscreens as well. To test for bidirectional transfer deficits, 2.5- and 3-year-olds were shown how to assemble a three-piece puzzle on either a three-dimensional magnetic board or a two-dimensional touchscreen (Experiment 1). Unidirectional transfer from video was also tested (Experiment 2). Results indicate that a bidirectional transfer deficit persists through 3 years, with younger children showing a greater transfer deficit; despite high perceptual similarities and social engagement, children learned less in transfer tasks, supporting the memory flexibility account of the transfer deficit. Implications of these findings for use of screen media (e.g., video, tablets) in early education are discussed.

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Introduction

Media sources are advertised as educational tools for young children (Common Sense Media, 2013; Fenstermacher et al., 2010), a perspective widely adopted by parents (Rideout, 2007; Zimmerman, Christakis, & Meltzoff, 2007), where information conveyed via the two-dimensional (2D) source (e.g., television, video, computer, touchscreens) is expected to transfer to contexts beyond the screen. In general, learned skills and knowledge are rarely tested in the same environment and under the same conditions in which learning takes place. More often, access to stored information must be transferred from one context to a novel context; this is termed *transfer learning* (Barnett & Ceci, 2002; Brown, 1990; DeLoache, Simcock, & Marzolf, 2004; Fisch, 2000). Barnett and Ceci's (2002) seminal review of the literature on transfer learning proposes that transfer distance mediates the cognitive resources required to complete the task. Transfer distance is defined as the degree to which context and content of to-be-transferred material match between learning and testing. A *near transfer* task is defined as small differences in context or content, and a more challenging *far transfer* task is defined as a large amount of change in either of these two aspects between learning and test.

Children are particularly sensitive to transfer tasks that involve 2D media because they appear to require more cognitive flexibility (Barr, 2010, 2013; Hayne, 2004) that children lack, making learning from media a far transfer task for young children. The *transfer deficit*, as it pertains to 2D media, is defined as young children consistently learning less from television, touchscreens, and books relative to face-to-face interactions and has been reported across multiple paradigms (for reviews, see Barr, 2010, 2013; Troseth, 2010). Much of the transfer deficit research to date has focused on describing the effect during early development. The transfer deficit emerges during late infancy at around 1 year, peaks at around 1.5 years, and becomes less pronounced in children between 2 and 2.5 years (for reviews, see Barr, 2010; Troseth, 2010). However, some studies have challenged this timeline, demonstrating that these transfer learning deficits may persist until at least 3 years or later for more complex tasks (see Dickerson, Gerhardstein, Zack, & Barr, 2013; Zelazo, Sommerville, & Nichols, 1999, for examples).

Despite being well documented, current explanations for the transfer deficit remain controversial. One explanation is that of *perceptual impoverishment;* degraded perceptual features (e.g., size of objects on screen compared with real-life counterparts, absent depth cues) characteristic of televisions and touchscreens make them a poor source of information (Anderson & Hanson, 2010; Barr & Hayne, 1999; Barr, Muentener, Garcia, Fujimoto, & Chavez, 2007). The perceptual impoverishment explanation is also a component of the poor *memory flexibility* account (Barr, 2013; Hayne, 2004); it is challenging for children to perceptually match features between encoding and retrieval when the features undergo changes in color, brightness, motion, and depth between the demonstration (e.g., 2D) and the test (e.g., three dimensional [3D]). In addition, with televised models there are also changes in social cues (Nielsen, Simcock, & Jenkins, 2008; Troseth, Saylor, & Archer, 2006). Other researchers suggest that the transfer deficit results from children's lack of, or developing understanding of, the dual nature of symbolic objects; two-dimensional images are physical objects that depict other objects, that is, *dual representation* (DeLoache, 2000; DeLoache et al., 2004). By this account, children must be adept at recognizing the relationship between symbolic objects (e.g., images on a tablet) and their real-world referents even though they differ in many attributes. Interestingly, there is mounting evidence of successful dual representation in 2.5- and 3-year-olds in scale model paradigms when perceptual cues between the model and testing room are similar (DeLoache, 2000; DeLoache et al., 2004). However, there is ongoing debate concerning the explanatory value of perceptual impoverishment versus memory flexibility in transfer tasks involving 2D media.

To date, many studies have been limited to the investigation of video demonstrations, which are confounded as to whether the transfer deficit arises from difficulty in mapping perceptual or social cues. There is a small but growing body of studies of learning from now ubiquitous touchscreen devices in which the image itself is the only thing that is 2D. In addition, the presence of a live model ensures the same high level of social engagement for the touchscreen or a live demonstration. Therefore, touchscreen technology functionally isolates perceptually based explanations of memory flexibility and perceptual impoverishment while maintaining the same level of social engagement