Toddlers, touchscreens, and tablet technologies: Learning "concepts beyond print"

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Toddlers and Touchscreens: Learning "Concepts Beyond Print" with Tablet Technologies

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Abstract:
Three-fourths of U.S. families with young children have mobile devices (e.g., smartphones, tablets). These accessible digital tools are equipped with touchscreens that respond instantly to a fingertip swipe and are just the right size for preschoolers to handle, carry, and operate. However, the icon-based interface of touchscreens organizes space and image very differently than book-based Concepts About Print (Clay, 1993). Analysis of online videos of toddlers operating touchscreens identifies *Concepts Beyond Print* and reveals how very young children are learning to read multimodally: recognizing icons, expecting a finger action to produce a screen change, or knowing where to tap to make an invisible icon visible.

Introduction

"Is there an app for that?" Apps--software applications for mobile devices such as smart phones and tablets (e.g., iPads)—are proliferating, for every purpose, everywhere, and anytime. Apps on mobile devices operate through touchscreens, that is, touch-sensitive glass display panels that respond to pressure from a user's fingertips. As mobile devices become more accessible and touchscreens provide a more user-friendly experience, more and younger children are playing, viewing, reading, and interacting with apps. Three-fourths of U.S. families with young children own mobile devices such as smartphones or touchscreen tablets, according to a sampling of 1,463 parents in a survey of U.S. families with children eight years of age and younger (Rideout, 2013). An increasing number of parents report that their children have access to some kind of mobile device:

> The past two years have seen an explosion in the use of mobile media platforms and applications ("apps") among young children. To begin with, access has expanded dramatically among families with 0- to 8-year-olds: in 2011, 8% had an iPad or similar tablet device; today, 40% do. In fact, almost as many children now have their own tablets (7%) as parents did two years ago (8%). Also, smartphone ownership has expanded significantly from 41% of families to 63%. Two years ago, a total of half (52%) of all children ages 8 and under lived in a home where they had access to any type of new mobile media device such as a smartphone or tablet; today, three-quarters (75%) do. (Rideout, 2013, p.20)

What are the early literacy implications of young children's widespread access to digital tools that respond instantly to a fingertip swipe and are just the right size for preschoolers to handle, carry, and operate? In this chapter, viral videos of toddlers handling tablets and smartphones illustrate how our conception of early literacy must expand to encompass new digital reading practices and multimodal conventions for touchscreen technologies. Reading on a tablet engages interactive text in ways that require more complex handling than a periodic page turn. The haptic- and icon-based interface of a touchscreen uses conventions that organize space and image very differently than books or even computers. For example, text in books is organized into horizontal lines of print and sequential pages, supplemented by illustrating images. Marie Clay's (1993) *Concepts About Print* identified emergent understandings of book conventions, including awareness that letters make up words, identification of punctuation, and directionality that progresses front to back, top to bottom, and left to right[1]. By contrast, the home screen on touchscreen is organized by a grid of squarish images: icons that represent software applications with no fixed position. An icon opens an application at the touch of a finger and navigation within apps is also guided by tapping various icons (e.g., arrows, "x", checkmark, trashcan, pencil, plus sign), which are not arranged in orderly sequence but are visible—or sometimes invisible—at the top, bottom, or corners of the touchscreen. Touchscreen technologies operate with an expanded set of conventions for interactive modes including touch, image, and speech, or as I suggest here, *Concepts Beyond Print,* that illuminate how very young children are learning multimodal,

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[1] Assuming English language and conventions

interactive, and flexible orientations to digital reading: recognizing icons as activators or portals, expecting a finger action to produce a screen change, and persisting when nothing happens, knowing that an area of the screen might contain an invisible icon that may appear when pressed.

Changing the Way We Read, One Fingertip at a Time

From infancy, young children are immersed in a world of screens where the dominant modes for making meaning are sound, image, and animation rather than just print (Jewitt & Kress, 2003). Now with the rise of touchscreens and mobile devices, touch has gained prominence in reading (Simpson, Walsh, & Rowsell, 2013). This innovation makes mobile technologies uniquely suited for the youngest literacy users (Shuler, 2009). Touchscreens, glass screens that respond instantly to the pressure and conductivity of a fingertip touch, provide an icon-based interface that enables children to independently manipulate apps while the hand-held size of phones and tablets makes them easy for children to handle, carry, and operate.

Educational researchers have known for quite some time that very young children rely on touch and handling as a way to know the world. As babies handle and mouth objects, they learn about the textures, contours, and properties of things in the physical environment (Rochat & Senders, 1991). Through handling and repetitive motor play, toddlers develop symbolic and physical knowledge of the world (Piaget, 1962). In literacy, children enrich their understandings of story through opportunities to play and handle materials in interactive board books that invite touch such as the classic Pat the Bunny (Kunhardt, 1940), "touchy-feely books with fluffy animals' fur, or little holes in peekaboo books … Children who are given the opportunity to manipulate objects and experience their textures can often demonstrate implicit knowledge which they may not be able to yet verbalise" (Kurcikova, 2014). Multimodal research on haptic modes and design (Rowsell, 2013) opens new ways to consider how touch operates in interactive cardboard books as well as on digital touchscreens. By stroking furry, scratchy, or smooth textures in baby board books, children coordinate gaze, touch, and speech to associate feels and language with various textures, that is, they are learning *about* touch and to discriminate the feel of various physical objects. By contrast when tapping on touchscreens, the feel (or haptic experience) of the screen never changes: the touch is hard, smooth, glossy. Instead, touch monitors user actions to regulate the pressure used (e.g., to determine thickness of a brush stroke in paint programs (Rowe, Miller, & Pacheco, in press; Matthews & Seow, 2007) or to adjust the speed and duration or abruptness of contact that discriminates between a drag and a swipe or an exploratory hover and a confirming tap (Neumann & Neumann, 2013; Simpson, Walsh, & Rowsell, 2013).

Through touches and taps on glass screens, children are learning new reading practices with the digital devices in their homes. As toddlers handle tablets, they learn that finger taps, pinches, and stretches on touchscreens activate icons that symbolize literate actions (e.g., opening or turning pages). This early literacy learning is evident in the viral YouTube video with about 4 and a half million hits. In the opening scene of the parent-produced film "A Magazine is an iPad That Does Not Work", a toddler uses her fingers to press, tap, and swipe icons on the glass screen on an iPad to open various apps. But in the next scene, when she tries using the same finger on glossy fashion magazine

pages, nothing happens. Puzzled, she pauses to test her finger by pressing it on her own knee. Satisfied that her finger still works, she returns to pressing spots on the magazine but with no reaction from the inert images on the page. In the final scene, she returns to the iPad and happily presses app icons that respond instantly to her finger touches.

Here we see a toddler's emerging understanding that reading operates differently with non-interactive paper texts than it does on an electronic tablet. She experiences a rupture in her expectations for reading as she tries to engage a magazine that does not "do" anything. Her expectation is that reading is interactive, apparently based on prior experiences with similarly glossy but digital pages. In her concept of text, one engages in reading or "browsing" by pressing images with an index finger and waiting for perhaps a second for the tablet to respond. On a touchscreen display, pressing an icon or swiping across the screen launches an app or loads a new page while pinching and spreading a thumb and forefinger resizes an image on a page. These mediated actions make up key digital reading practices, which as this baby discovered, simply does not work with static print on a magazine page.

Reading as a Nexus of Practice

How does a viral video of a toddler's finger tapping an iPad, a magazine, and her own knee trouble our commonplace assumptions about early reading and signal a major global shift in reading practices? What captures our attention here is not only her charming puzzlement over the lack of response from a paper text, but also what it shows us about our own normally-tacit expectations for reading.

Reading practices, whether online or with books, materialize cultural expectations for how texts should be read as well as for what readers should do. This embodied and naturalized set of practices, expectations, and identities form the nexus of practice, the familiar combinations of everyday ways of interacting that members of a cultural group expect from one another (Scollon, 2001). Reading nexus are learned in daily living activities in families, schools, and communities during early childhood, gradually becoming engrained and absorbed as familiar, embodied, automatic, and largely unremarkable patterns of daily life. A toddler's actions with the iPad --gazing at its glass screen, pressing down on an icon to open an app, pinching and spreading thumb and fingers to size a page--fit an expected pattern of tablet handling that we recognize as a digital reading practice. Her surprise at the immobility of print and image on a paper page creates a rupture in her existing reading nexus…and an opportunity to grow her repertoire of reading practices.

Re-Reading Nexus of Early Reading Practices

Concepts About Print: A Book-Reading Nexus of Practice

To understand how young readers learn expectations for books, magazines, and reading practices, pioneering literacy researchers analyzed reading from a novices' perspective in order to identify usually-backgrounded and tacit reading knowledges, identities, and practices. Marie Clay (1966) documented young children's approach to text and developed a book-reading task to uncover the set of understandings that children bring to their reading: *Concepts About Print*.

> Some of the concepts it explores are whether the child knows the front of the book, that print and not pictures tells the story, what a letter is, what a word is, where the first letter in a word is to be found, pairs of upper and lower case letters, and some of the punctuation marks. (Clay, 1989, p. 268)

Specifically, the concepts about print that children demonstrate when interacting with books include:

> 1. *Concepts about book orientation.* Items related to these concepts provide insights into whether children know how to open books and know when a book, pictures and print are right-side up or upside down.
> 2. *Concepts about whether print or pictures carry the text message.* These are observed by asking the child to point to where the observer is reading as the observer reads aloud to the child.
> 3. *Concepts about directionality of lines of print, page sequences and directionality of words.* These are evaluated by asking the child to follow along with a finger and point as the teacher is reading and also by asking a child to say what's wrong with a page that has lines of print, letters or words out of order.
> 4. *Concepts about the relationship between written and oral language.* The child is asked to follow along with a finger as the observer reads. This provides insights into the child's awareness of what is being read and its relationship to specific text items.
> 5. Concepts of words, letters, capitals, space and punctuation. These are obtained by asking the child what the conventions are or to point to such items. (Goodman, 1981, p. 446)

Clay's CAP shares features with bookhandling assessments created by Yetta Goodman (1985) to elicit children's abilities in navigating through the pages of a book. Children display bookhandling abilities when holding a book right-side up, tracking print top to bottom, or pretending to read the print on the page by labeling or narrating the illustrations (Owocki & Goodman, 2002).

Through these active engagements, children develop theories about how books work in general as well as about specific meanings of an emerging text as

> the child works at analysing print in such a way that the cues from various sources agree. In that analysis the child pays close attention, tries new responses, notices new features, puzzles over these, thinks s/he understands. The child may change this new theory within a day or so as new encounters uncover previously unseen features. Thus the route to awareness lies within the learner and the actions taken by the learner. (Clay, 1989, p. 275)

Clearly, children's reading practices and concepts are constructed flexibly as readers move through processes of prediction and confirmation, adjusting as predictions are disconfirmed. Furthermore, children adjust their expectations and reading practices to fit the particular genres and forms that they encounter in everyday contexts. Digital reading practices are similarly constructed through repeated explorations and uses of

technologies. However, the multimodal and dynamic nature of conventions of digital texts produces additional complexities.

Concepts Beyond Print: Interactive Modes in a Digital Reading Nexus

As children use keypads and touchscreens on a broad range of technological devices, they are learning new ways to browse, view, interpret, navigate, interact, and produce original texts (Burnett & Merchant, 2013), creating a need to update and better understand the concepts involved in learning to interact with digital texts, not only ebooks. Research on early childhood literacies with technologies (Marsh, 2004; Merchant, 2005; Wohlwend & Kargin, 2013) has recently expanded "bookhandling" and CAP to accommodate mouse-handling and a new set of computer literacy concepts and relationships specific to interacting with screens (e.g., keyboard strokes, understanding the mouse–cursor relationship, screen navigation in Table 1).

Table 1: Some Concepts about Screens

Desktop Computers	Multimodal Action	Onscreen Reading Practice
Mouse-handling	Double-clicking	Open an application or select options
	Clicking	Open or confirm options
	Hovering	View a drop-down menu
Keyboarding	Tapping (e.g., key, spacebar, arrow keys)	Type a letter or space Start a new line Move cursor
	Toggling (e.g., between keys on numeric pad, arrow keys)	Move cursor or avatar various in-game moves

Now, touchscreens on mobile devices advance the need to refresh CAP again and add interactive *Concepts Beyond Print* that include an awareness of app conventions and the organization of space and image on touchscreens, icon recognition, and expectations for interaction, that is, expectations that screens will respond to the slightest one-finger touch or where an icon *should* be and knowing where to tap on a screen to make an invisible icon visible.

Table 2. Some Concepts Beyond Print

Tablet Features	Multimodal Action	Onscreen Reading Practice
Touchscreen	Tapping	Select and open or turn a page Select, highlight, copy, and paste text Play or animate
	Swiping	Scroll through screens Turn a page Select and highlight text

	Pinching	Resize an object, image, or screen to make smaller
	Stretching	Resize an object, image, or screen to make larger
	Dragging	Add, delete, move or reposition objects Draw using a paint program
Buttons	Pressing	Power on/off Return to home menu of apps Capture screenshot Enable voice-over or other read-aloud options Adjust volume
Voice Recording and Recognition	Speaking	Locate information, or initiate a browser search Open a digital text or app Record narration and dialogue (e.g., for video) Interact with/through online avatar

Toddlers with Touchscreens in Viral Videos

Touchscreens provide icon-based navigation and instantaneous feedback that makes the results of a finger swipe or tap immediately apparent. This combination of affordances enables rapid learning of digital literacy practices (Matthews & Seouw, 2007), making tablets appear "intuitive" and contributes to the erroneous impression that young children are "digital natives" (Prensky, 2001) who are organically adept at new techno-literacies with little adult help. This is the stuff of "Amazing iPhone Baby" viral videos with millions of hits on YouTube. However, digital literacy practices are learned on parent's laps through active observation and participation in daily living. The "amazing" digital literacy practices are built from tiny multimodal actions—gazing, clicking, tapping, swiping on a glass screen—that combine to make up a dramatically new reading nexus. Here is a sampling of digital reading practices visible in viral videos with infants and toddlers with their constitutive multimodal actions:

Navigating Among and Within Apps:
- Tapping arrow icons or lightly touching areas of screens where arrow icons are not visible but expected in order to open a new screen
- Swiping scroll bars to load more options
- Tapping icons/words to launch an app
- Swiping the screen to turn a page, return to a screen, or load the next photo
- Pressing a button to go to the home screen with app menu to change apps
- Tapping an icon (e.g., checkmark, "x") to confirm and proceed or cancel an action or to close a page or application

Listening to e-Books
- Tapping an icon to open ebook
- Pressing a toggle button to increase volume on e-book ("turn up, turn up")
- Tapping arrows to turn page
- Tapping words to activate highlighting and read aloud features

Talking to Interact:
- Talking to character, image, avatar with expectation of response (e.g., onscreen movement, action, verbal response including repetition of copied voice.)
- Talking to other people on phones
- Talking to voice-recognition program (e.g., Siri) to ask a question ("*1 Year Old Nephew Talking with Siri*" http://ireport.cnn.com/docs/DOC-883996)

Playing Music
- Tapping images to play musical notes

Drawing and Painting
- Tapping icons to choose brush, brush width, color, paper color
- Tapping and dragging icons to select and paste clip art
- Dragging finger as brush to paint

The value that both families and viewers place on these practices is indicated by the number of videos posted as well as the number of views for videos with children who are apparently independent and experienced technoliteracy users. What is only occasionally visible is the nexus, the submerged teaching and everyday scaffolding of digital literacy practices in daily use by families that led to the dispositions and engrained practices buried in young children's online performances.

Scaffolding Digital Reading Nexus through Family Literacies

In addition to probable immersive experiences with phones and tablets in everyday activities, some videos depict family members more actively supporting children in shared literacy practices that encourage them to use tablets while teaching the ways these digital tools work.

Adult's scaffolding of children's touchscreen handling can be intensely verbal (e.g., "*Baby Works iPad Perfectly. Amazing Must Watch!*" 1,303,473 views; "*iPhone Used by 1 Year Old Baby*" 311,835 views) involving questions, directives, explanations, and shared wonderings between parents and young children (Davidson, 2012). However, research in preschool settings shows that touchscreen tablets enable additional modes (e.g., gesture, touch) in adults' scaffolding of early literacy.

> Along with using gesture as a means to invite participation and scaffold the steps in technical procedures, adults used embodied demonstrations as a means to model the hand movements necessary for successful iPad navigation. Adults demonstrated how pressing screen icons, such as the "New Project" icon in *Drawing Pad* and the "New Page" icon in *Book Creator*, accomplished specific tasks necessary for eBook composition. Adults also used embodied demonstrations to model how hand movements like swiping, dragging, or pinching, could be used as mediational means for composing. Pinching with thumb and forefinger to resize images, for example, was demonstrated by adults in 35% of the eBook events analyzed. (Rowe, Miller, & Pacheco, in press, p. 297).

Additional online videos, of infants and toddlers snuggled on parents' laps, illustrate the multimodal scaffolding that adults provide. Babies as young as two months gurgle and brush the keys on piano and xylophone apps as parents hold the tablet screen within arm's reach (*"iPad Baby Two Months Old"*45,119 views*)*. This is the social construction of intentionality (Rowe, 2008b) as parents prop up babies and iPads, encourage and reposition tiny fingers, framing these touches as intentional "playing" of a virtual instrument on a tablet. Through scaffolded experiences like this, infants and toddlers learn to expect interactivity from a tablet, similar to other social contracts for the physical properties of texts that are implicitly taught to children as they learn to draw and write words (Rowe, 2008a).

The viral video "*Apple's iOS 7 Brings Jack to Tears*"(3,106,081 views) illustrates the need to support children in developing a flexible problem-solving orientation that allows them to adjust to changes that result from continual updates.

> …updates to composing apps... created changes in the visual layout of the composing screen. Adults' explanations helped children manage digital writing environments that were constantly in flux in ways that print-based literacy materials were not. (Rowe, Miller, & Pacheco, in press, p. 293).

In addition to periodic updates that alter visual displays, icon functions on touchscreens shift from app to app. Although the surface is the same, the placement, appearance, and functions of icons can differ from app to app:

> Tapping on the right corner of the iPad may link children to the next level of a game. In another app, tapping the same place may give them a pre-recorded voice-over for their favourite book character. In another e-book, it may activate the 'buy more' button for purchasing new clothes for their book avatars. Children thus need to distinguish between some complex combinations of touch-manipulable possibilities embedded in the digital books / apps that they can operate. (Kucirkova, 2014)

While virtual objects like icons do not offer the stability of reactions in physical objects, they offer opportunities for children to develop flexible and persistent orientation to problem-solving, useful in a changing digital environment. Children using touchscreens persist when they meet obstacles or encounter "glitches associated with learning this new technology…without becoming frustrated" (Couse & Chen, 2010, p. 96). Problem-solving dispositions are evident in the viral videos when toddlers use trial and error to learn the boundaries within an app, tapping not only icons but also locations where apps might be hiding. With this framing, we can revisit the baby with a broken magazine video and newly appreciate her determination to locate and activate an interactive icon that she might believe is hidden within an image or under a perfume packet in the magazine. With this orientation to digital reading, children can flexibly adjust their literacy practices and expectations within apps, as well as generalizing literacy practices across programs. Such dispositions are internalized over time and experiences, becoming engrained and embodied in a child's reading nexus.

Implications

This chapter situates children's literacy nexus with touchscreens within family literacies, the practices they learn from perches in car seats and shopping carts as they watch and participate in parents' everyday digital practices.

> This is the techno-territory of family life in the twenty-first century and unless early years educators acknowledge the rapid changes which are taking place, the curriculum offered to many of these 'toddler-netizens' (Luke, 1999) will continue to offer outmoded and irrelevant reflections of their lived realities... (Marsh, 2006, p. 23)

Knowing that the apparently intuitive skills of technotoddlers are actually scaffolded and learned nexus of practice, how should early literacy instruction expand to help young children handle new and changing literacies? How does our understanding of early reading need to grow to accommodate devices where reading means instantaneously recognizing icons and possible pathways through sound, image, animation, and touch? Our response should not be to withhold or simplify programs until children are "ready" but to appreciate their multi-linear problem-solving (Simpson, Walsh, & Rowsell, 2013) as a useful new literacy disposition. In this, children are supported by app developers who are deeply concerned with users' experiences (Rowsell, 2013) and design from children's perspectives.

> Well-designed visual displays offer the child the opportunity to bypass linear description and see, if not at a glance, then very readily, quite complex total systems. This is why computer games are so successful with the young. These allow holistic engagement with complex systems because of clarity of visual and dynamic display. When we introduced children to simple programming devices, we found the same held true. The design of these visual and dynamic environments allowed the child to manipulate several streams of cause and effect simultaneously. More research is of course required to ascertain how deep, lasting and transferable is this new kind of knowledge. (Matthews & Seow, 2007, p. 260)

In these viral videos, we see the range of children's engagements with tablets. Reading that is most similar to book-reading nexus-- moving sequentially through an electronic picturebook-- makes up a only small fraction of children's digital literacies with touchscreens.

> Reading is the least-common activity on multipurpose tablets or small devices among all the options children have. They are more likely to have used a smartphone, iPod Touch, or tablet to watch video, play games, and use apps than they are to have read books on them. (Rideout, 2013, p.28)

Enriching and expanded uses of multimodal literacies are emerging as more early childhood teachers are recognizing children's strengths as technology users and meaningfully integrating touchscreen technologies into literacy curriculum (Flewitt,

Messer, Kucirkova, 2014). Teacher support and research is critical to this endeavor, knowing "the vast majority of preschool teachers need and typically welcome systematic, on-going opportunities to explore new digital technologies" (Paciga, Lisy, & Teale, 2013, p. 98).

With the spread of technoliteracies, early access and enriching experiences with touchscreen technologies becomes an issue of social justice tightly tied to income disparity. Digital technologies with touchscreens are expensive and out of reach for many families and access to tablet technologies continues to break along what Rideout (2011) terms an "app gap" where children in affluent families have high-quality apps on the latest devices connected to robust 24-7 internet networks while children in low-income neighborhoods depend on public libraries for internet access and "may not know what an app is."

> Access to mobile, Internet-enabled devices also varies significantly by income from 61% of lower-income families to 91% of higher-income ones. The largest gap is in ownership of tablet devices such as an iPad, Microsoft Surface, Kindle Fire, Galaxy Tab, or similar product: 20% of lower-income families have one of these compared to 63% of higher-income ones. The gap in smartphone access between higher- and lower-income families is 25 percentage points, while the gap in tablet access is 43 percentage points. (Rideout, 2013, p. 29)

A financial divide separates not only have and have-not households but also early education centers--doubly discouraging as schools are important sites for ensuring equitable and regular access to new literacies for all children.

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