

TinkRBook: Shared Reading Interfaces for Storytelling

Angela Chang and Cynthia Breazeal

MIT Media Lab

20 Ames St.

Cambridge, MA 02142

1 (617) 452-5674

{anjchang, cynthiab}@media.mit.edu}

ABSTRACT

Today, the way children learn to read is very different from the way they learn from playing with toys. Books present static images and text on the page, whereas toys allow for manipulation and interactive exploration of cause-effect relations. What if books were "tinkerable"? What if children could actively explore and modify a story, through voice and touch, to dynamically explore meaning as conveyed by the relationship of text to illustrated concept? How might this change how books are experienced, explored, and shared between parent and child? How might interactivity support and enhance existing shared reading practices?

We report the development of interaction design techniques for encouraging storytelling behavior during shared book reading. The design of our storytelling platform, the TinkRBook, encourages active exploration when parents read to very young children (ages 2-5 years old). Our approach uses findings from *in-situ* parent-child ethnographies and advice from 24 participatory design interviews with researchers, designers and professionals from relevant domains. We believe that our approach addresses the environmental conditions in which interactive storytelling with preschoolers is most likely to be adopted, and is compatible with current shared reading practices.

Categories and Subject Descriptors

K [Computing Milieux]: K.3 Computers and Education; K.3.1. Computer Uses in Education: Collaborative Learning; K.3.2 Computer and Information Science Education: Literacy

General Terms

Design, Human Factors, Theory

Keywords

Interaction design, interviews, storytelling, emergent literacy, shared reading interface, young children, multisensory learning, participatory design, building block metaphor, TinkRBook.

1. INTRODUCING TINKRBOOK

As interaction designers, we ask: How might we combine a basic primer book with interactivity to support parent-child reading interactions? Furthermore, how might interactivity help parents

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

IDC 2011, June 20-23, 2011, Ann Arbor, USA.

Copyright 2011 ACM 978-1-4503-0751-2...\$10.00.

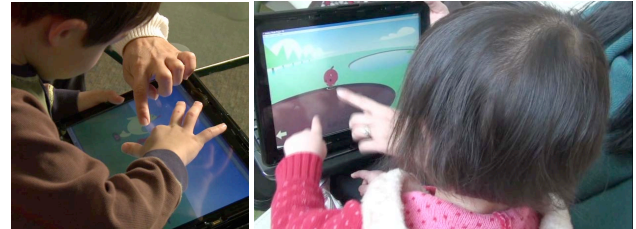


Figure 1. TinkRBook affords shared reading behaviors

engage in more positive emergent literacy behaviors? We see a real opportunity to create new primer technology that fosters richer parent-child reading moments.

The TinkRBook storytelling system investigates how interactivity can encourage storytelling behaviors. A touchscreen device opens up a wealth of interaction possibilities for shared book reading. Similar in weight and size to a physical book, the parent can easily hold the child while visually sharing the TinkRBook. Both parent and children can gesture on the surface (as in figure 1). The form factor also allows both parties to grab and manipulate the device easily, and there are no wires to entangle readers.

2. SHARED STORYTELLING IN PARENT CHILD READING

The shared picture book reading activity is a key element of emergent literacy [11]. "Reading at home is a big part of a child's success with language and (in school)" [7]. Concentration, social collaboration, and language development come together during reading. A child's eagerness for reading results in a life-long development of intellect and social skills [2].

Our research method begins with understanding the socio-cultural experience of shared book reading in context. We asked five parents (who work at our institution) to allow us to study them reading to their child (aged 2-5) using their personal books at home. Afterwards, parents answered questions about their reading practices, such as frequency, duration, and book preferences. Observing the shared reading activity in the real world context provided us with a baseline of interactions.

Physical books enable **physical proximity**. The child is usually touching the parent (usually in the adult's lap). The book was visually accessible to both people (often in front, although positions shifted dynamically). All parents made **expressive sounds** and **gestures** to draw attention to the content, using **finger pointing** to words and graphics, making noises, and moving the book to **visible range**. Some children would similarly make noises, point and gesture. To **navigate the book**, both parties might turn the pages or book in either orientation or direction.

We note that shared reading is by definition NOT a solitary activity. A physical book serves as a shared visual reference and shared mental representation between people. It encourages

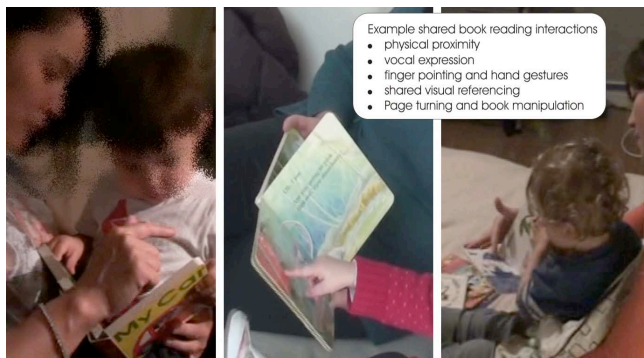


Figure 2. Shared reading interactions observed

parents to explain, play, and demonstrate to their children. Figure 2 depicts some interactions between parent, child and physical book. These observations confirmed reports in academic research on positive emergent literacy behaviors [4,7].

We then realized the role of picture books as storytelling prompts; and that positive reading behaviors were storytelling behaviors [6]. Storytelling describes face-to-face performance during which a story is acted out. The parent is not merely a passive reader, but an active performer of the story. How might a dynamic interface encourage the parent to become a better storyteller? How might we encourage the child to participate as an actor, too? We strive to encourage the following storytelling behaviors:

2.1 Encouraging Vocal Expression

Much parent-child reading research focuses on the dialogue between parent and child [10]. Mothers use expressive intonation called motherese with their infants [4]. Encouraging sound making is seen as a good feature to have [3]. Novelty in dialogic interaction stimulates new readers to learn expressive and receptive vocabulary [9].

2.2 Supporting Storyteller Creativity

The ability to reconfigure story elements is a creative and playful method of social and linguistic inquiry[8]. As they get older, this play takes the form of question and answer during reading [10]. Childhood wonderings about the mutability of narratives are common in research literature [12]. Perhaps the interface could provoke users to play with story elements.

Four sample interactivity vignettes were implemented in Flash software [1] to provoke these behaviors. These samples demonstrated potential interaction designs for a new type of storybook. One feature employed the microphone to control animations. Other features semantically highlighted the images relating to text, allowed object dragging, and provided menu for text changes.

3. SOLICITING EXPERT CRITIQUE

We interviewed 24 people (12 females, 12 males, 16 parents, ages 24-66) with relevant storytelling, digital media, and early reading education expertise. We selected these experts based on their publications, research, or products. The one-on-one interviews occurred in informal settings, e.g. offices or coffee shops. During the interview, they made comments in response to questions about their storytelling techniques and approaches. They also assessed the fun and educational value of the sample vignettes after 5-10 minutes of interaction with each vignette. We asked them to suggest improvements and brainstorm new ideas.

3.1 Novel Design Recommendations

During the interviews, people proposed a range of traditional interaction ideas, such as menus and pre-configuration options. Much discussion centered on how storytelling choices should preserve the flow of storytelling experience. Selecting or changing words too often might interrupt the storyline. Making choices implicitly through grabbing and manipulating on-screen objects was preferred over word menus. Another important idea was that every gestural action on words or graphics should result in a visible reaction from the stage.

We share our most novel design recommendations below:

Vocally Responsive Narrative Text: When asked about how audio interaction might correspond to the text, writers expressed a desire to generate semantically interesting narrative text effects to describe affect, arousal, and repetition. The printed text should change to represent the vocal energy in a semantically relevant way. With repetition, if the finger is over an utterance, such as “moo” in figure 3, the text changes to “again and again,” corresponding to the repetition of that word. Storytellers also suggested populating the scene with rhythmic noises to encourage parents to use onomatopoeia, rhyme, and sing.

Multisensory Contextual Selections: A reader can change story elements using a combination of touch and speech. First, the reader touches the word or element he wishes to change. That element will visibly respond if it is indeed alterable as shown in figure 4.

The reader then speaks the new option aloud. Assuming the spoken word is accepted as a valid replacement, both text and illustration change to suit. Figure 5 demonstrates how audio and touch could combine to change the weather. The reader can touch either the word “sunny” or the sun itself, and say “rainy” to cause clouds to roll in and rain to start falling. This scheme limits voice-recognition errors, as the touch greatly constrains the list of possible spoken words, making disambiguation simpler.

Parents and educators were interested in how the actual content of the storybook could change to suit the age of the child. Younger children may focus on local changes such as modifying or replacing objects. Figure 6 demonstrates how the system can present color, size, and type of animal options to a child focused on the rhinoceros. For older children, the ability to change motives and alter settings and moods might be more enjoyable and developmentally appropriate. For instance, the rhinoceros could be hungry, angry, or sleepy. Such a decision would have a broader effect on the story plot that an older child might appreciate.

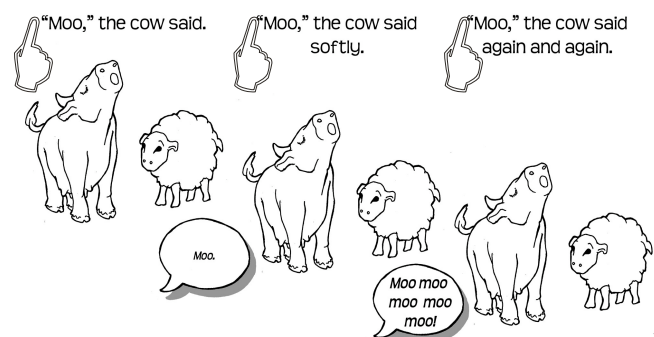


Figure 3. How text changes in response to volume and repetition

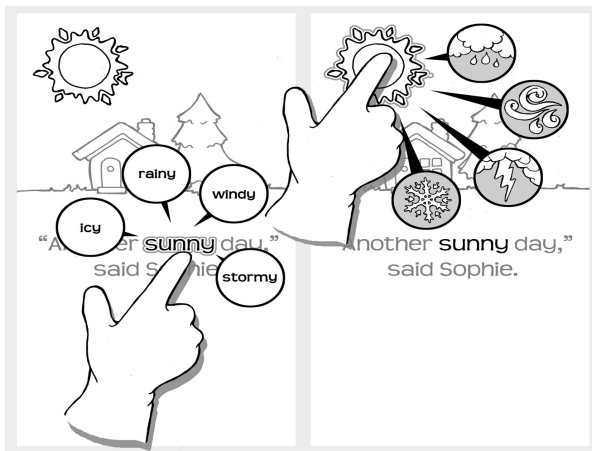


Figure 4. Contextually defined story options. Touching an image reveals a graphic menu, and touching a word reveals similar choices as text.

4. Building Block Metaphor: Tinkerable Story Elements

In essence, a TinkRBook story flexes to accommodate the changes made, but remains consistent. The story is not rebuilt from scratch, but maintains the basic heart of narrative while elements are altered within it. Like a traditional static storybook, it must be consistent enough that children can recognize recurring aspects and begin to establish their own internal rules for understanding stories. Within bounds, though, it can vary enough to encourage exploration of story structure, drive curiosity and enthusiasm about reading.

We have developed a building blocks metaphor for the TinkRBook story elements to guide our thinking. Like with building blocks, the parent and child can test how story elements (characters, settings, and contexts) contribute to a larger narrative structure. We believe this new learning paradigm provides the following benefits for early emergent literacy:

- By making the relationship between written words and images testable, we move the abstract relationship into a realm of learning more familiar to young children. Children can immediately see the changes made by switching a word or graphic. The immediate feedback based on their interaction allows them a way to observe the effect of different words within the context of the story. Whereas the text-graphic relationship in traditional storybooks is static, children can now explore the effect of different story elements within the context of a narrative.
- The use of interactivity to make story elements alterable encourages readers to play with the words for the story. By manipulating words, children can more easily understand the power of words and graphics as controls for representation.
- Shared visual referencing (both parties can see and point to the interface and each other) enables either party to take the lead in the storytelling. Anyone can touch the screen or make noises to cause the animations and text to change.
- Multisensory interaction techniques support the different modalities involved in learning. Educators suggest that allowing for variety in interacting with the story elements can engage children predisposed to different “multiple intelligences” (e.g. visual-spatial, body-kinesthetic, and verbal-linguistic intelligences).

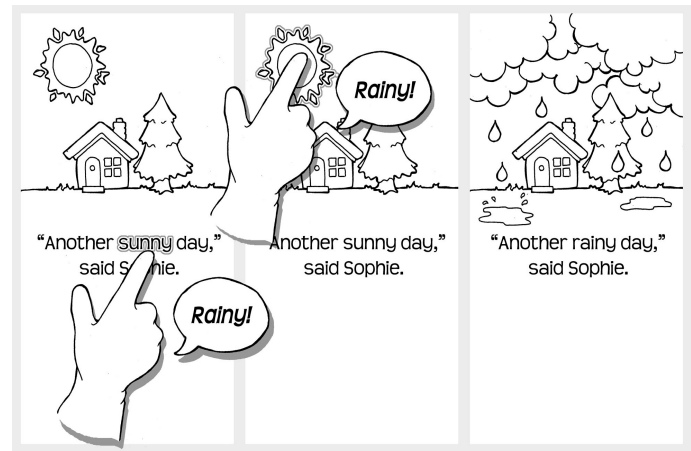


Figure 5. Speech and touch combine to change the weather. The hand chooses the element to be changed, and the voice specifies the replacement.

- Altering the text visibly modifies the corresponding imagery. Altering images visibly modifies corresponding text. The end result is a stronger conceptual bond that text and graphics are symbolically linked.
- Furthermore, as elements are changed within the story, children can see the propagation of their changes throughout the storyline. This ability to see the influence of small changes having an effect on a larger system encourages system level thinking.

5. CONCLUSIONS

Within the context of shared reading, we have identified novel interaction designs co-created by a panel of experts from various storytelling and educational disciplines. We have proposed a series of interaction techniques for selecting and navigating through numerous causal relationships between text and imagery. We also suggest a building block metaphor for creating interactive story elements. As we begin to observe users with the interface, it will be clear that certain interactions are better suited for active narrative exploration. Although the TinkRBook is still in the development phase, we present two key ideas in our design process:

Focus on the socio-cultural experience: We focused on first understanding the interactive sharing experience. Our study led us to observe the activity of the home environment. This led us to realize that picture books are storytelling prompts for encouraging expression between parents and their children. Sixteen of our reviewers happened to be parents. Parents really appreciate traditional storybooks as visual and mental interfaces shared with their children. All the parents involved (including the reading dyads) were encouraged by the TinkRBook’s support of the shared social dynamics of this important activity. These characteristics can support sibling and peer interactions as well.

Consulting Domain Experts: Studying very young children is a challenge for interaction designers [5]. Parents had to allow us into their homes to observe personal family rituals. Although these ethnographic observations were useful, preschoolers usually cannot answer questionnaires with detail, making participatory design with them difficult. The experts shared their best practices and disciplinary insights, such as developmental appropriateness.

By seeking iterative participatory design feedback from cooperative designers, researchers and developers, we have found

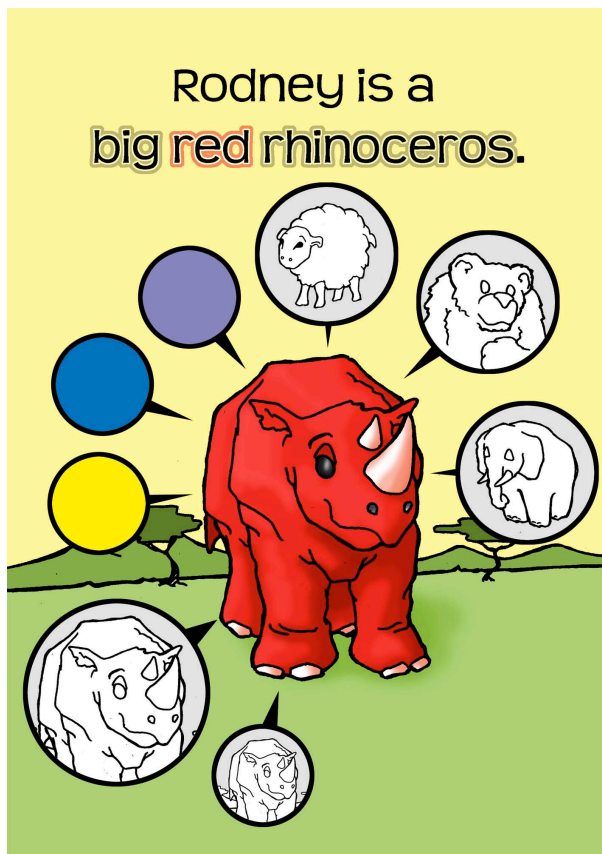


Figure 6. Alterable story elements representing different categories of story content.

many thoughtful solutions and considerations. The breadth of knowledge represented from their advice helped us consider the many dimensions for understanding how to merge interactive storytelling and shared book reading in an enjoyable and educational way

5.1 Limitations of the Current Design

Despite the novel interactions afforded by the TinkRBook, several limitations still exist. Although reading is a conceptual process, the physical form of traditional storybooks provides tactile interaction that is easily accessible for young children. A touchscreen interface is not the same as a physical storybook, and the tactile manipulations of a physical storybook are missed. Rather than try to imitate all the physical affordances of a storybook, we have adapted some of the tactile manipulation techniques such as page navigation and underlining. It is our hope that the conceptual benefits of the TinkRBook will mitigate these tactile losses, although a more tactile TinkRBook would be an interesting design problem.

Another challenge to the current work is that we have yet to test extensively with children. We asked the five dyads to use the TinkRBook at home. Initial video observations suggest that the parent-child pairs spend lengthier amounts of time reading scenes from the TinkRBook, compared to reading a static page. Explicit demonstration of semantic highlighting and alterable story elements allowed them to talk about the story elements even

more. These experiential features facilitated playful communication and personal bonding between parent and child.

Preliminary results from this ongoing fieldwork suggest that children love to explore a scene exhaustively and enjoy multisensory interaction techniques. One surprising observation is how much they enjoy the multisensory ability to control animations, exhibiting random touching and pointing behaviors to try to make things happen. All of the children have asked to repeat the playthrough multiple times, particularly in scenes with vocal interactions. This behavior is reportedly analogous to existing requests to re-read favorite books.

6. ACKNOWLEDGMENTS

Our thanks to the many domain experts who contributed their advice to this project. In particular, we thank Fardad Faridi, Jeff Orkin, Sylvia Feinburg, Elisabeth Sylvan, Edith Ackerman, Keith Peters, Nicolette Heavey, Erik Blankinship, Kevin Brooks, Clara Fernandez-Vara, and many education and HCI researchers from Boston College, Tufts University and Northeastern University.

7. REFERENCES

- [1] Adobe Flash CS5 <http://www.adobe.com/products/flash>
- [2] Beauchat, K. A, Blamey, K. L., and Walpole, S. 2009. Building Preschool Children's Language and Literacy One Storybook at a Time. *The Reading Teacher*. 63.1 (2009): 26.
- [3] Cassell, J. and Ryokai, K. 2001. Making Space for Voice: Technologies to Support Children's Fantasy and Storytelling. *Personal Ubiquitous Computing* 5, 3 (Jan.2001),169-190.
- [4] DeLoache, J. S. 1984. What's This? Maternal Questions in Joint Picture Book Reading with Toddlers.
- [5] Druin, A., & Solomon, C. 1996. *Designing multimedia environments for children*. New York: J. Wiley.
- [6] Dwyer, J. & Neuman, S.B. 2008. Selecting Books for Children Birth Through Four: A Developmental Approach, *Early Childhood Ed. Journal*, 35, 489-494. Retrieved from ERIC database. (EJ796441)
- [7] Honig, A. S, and Brophy-Herb, H.E. 1996. *Talking with Your Baby: Family As the First School*. Syracuse, NY: Syracuse University Press, 1996. p.45.
- [8] Paley, V. G. 2004. *A Child's Work: The Importance of Fantasy Play*. Chicago: Univ. of Chicago Press, 2004.
- [9] Senechal, M. 1997. The Differential Effect of Storybook Reading on Preschoolers' Acquisition of Expressive and Receptive Vocabulary. *Journal of Child Language*. 24.1 (1997): 123-38.
- [10] Vander Woude, J., van Kleek, A., & Vander Veen, E. 2009. Book Sharing and the Development of Meaning In P. Rhyner, (Ed.) *Emergent Literacy and Language Development: Promoting Learning in Early Childhood* (pp36-75). New York. Guilford Press.
- [11] Whitehurst, G.J, and Lonigan, C.J. 1998. Child Development and Emergent Literacy. *Child Development*. 69.3 (1998): 848-72.
- [12] Winner, E. 1982. *Invented worlds: The psychology of the arts*. Cambridge, Mass: Harvard University Press.