

Touch, read and play: enhancing the reading experience of hybrid-enhanced children's picturebooks

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ABSTRACT

This paper summarizes the author's PhD research project on investigating the ways in which the reading of hybrid-enhanced picturebooks may impact children. It is also intended to expose the usage patterns and to inform the future design research of this kind of book.

The PhD research presented is part of the EngageBook project. The main goals of this research project are to develop hybrid-enhanced books for children, from six to nine years old; and explore new paths in its development, through the use of digital devices and electronics.

Categories and Subject Descriptors

H.5.2 [User Interfaces]

General Terms

Design, Experimentation, Human Factors, Languages.

Keywords

Picturebooks, e-picturebooks, enhanced books, gesture interaction, storytelling, HCI, TUI, Tangible, Augmented

1. Introduction

Reading books plays an essential role in the childhood. It allows the children to extend their lexicon and to develop their language skills [7; 8]; it contributes to the development of children's perceptual skills and it is central for their cognitive development [8].

Reading books sharpens both curiosity and imagination throughout the childhood; it allows children to contact with other perspectives, narratives and realities, improving the acquisition of new knowledge [7].

Children's picturebooks are one of the best media to introduce children to the combination of text and images, since both "the verbal and the visual aspects are essential for full communication" [24].

Before 16th-17th centuries picturebooks were created for an adult audience [19]. Maybe the children from upper classes had read them but they weren't their intended audience [19].

Children's book edition began in the 17th century. The first children's picture book, published in 1658 by John Comenius, is accepted to be *Orbis Pictus* and its main purpose was to teach [19] although it was also entertain.

Since then the picturebook, form and contents, evolved across time.

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Nowadays there are available contemporary picturebooks with distinct purposes and different kind of genres. They present several combinations between text and image and they may present multiple narratives, linear and non-linear. These picturebooks vary on format, size and media; and employ material elements that add to the playful dynamics [23].

The contemporary picturebook can be either a printed book or a digital book, inscribed in space and time. It can be also an enhanced book with printed illustrations, contextual sounds and animated characters on screen. Or an artifact that "lie in the borderline between books and toys" [23]. Beyond the reading, playing and interacting is part of the picturebook experience [19] and make the child a co-creator [23].

1.1 The experience of reading books

Reading books requires perceptual, cognitive and motor interactions [6; 8; 20; 21]. We read books in a multi-sensory manner [21] that is, perception, handling and cognition which inform us about the form, structure and book's contents. It is an experience that involves haptic perception, which in turns engages both the tactile and the kinaesthetic perceptions (haptic perception) [21].

So, switching from a printed bi-dimensional book to an enhanced book changes the dynamic between reader, words, and illustrations [12] since the technology frames the way we read [1; 21]. Different physical forms and interaction features unleash changes on interpretation and meaning [1]. The touch and the sight are ways of disclosing and playing with the elements of narrative.

1.2 Reading in the 21th century

Currently it is common to read text combined with pictures, videos and music in highly interactive digital environments [18]. People in 21th century can either read printed media or digital media with tablets screens, televisions, computers and smartphones.

Likewise, children read both printed books and digital media. They read the text and the illustration of the schoolbooks but they also read interactive graphics and texts from videogames.

Children, who have access to tablets, read enhanced digital books and use the same devices to read e-books and to play.

1.3 About enhanced printed books

The birth of enhanced printed picturebooks is deep-rooted in the history. Back to the 13th century Matthew Paris employed *volvelles* to determine ecclesiastical dates. Shortly thereafter Ramon Llull explained his theory of spirituality also using it [12]. Both authors are the first references we have from enhanced picturebooks.

Adults were the first audience of these books. The enhancement of printed children's picturebooks only began in 18th century.

A significant amount of techniques and material elements have been used, since then, to enhance printed children's picturebooks.

Movable elements, optical effects, tridimensional structures, digital contents and augmented reality are some of the techniques and technologies applied and combined with printed books to delight, surprise and instruct readers.

1.4 Two decades of enhanced printed books with digital and electronic devices

Over the last years have been designed a fistful of hybrid-enhanced books (printed books enhanced with paper, digital and electronic devices) 1999/2001 - *We The SIT* (Sound-Image-Text) (1st version) [3] / *Listen Reader* (2nd version) [2]; 2001/2007-*The magic book* [5] / *The Mixed Reality Book: A New Multimedia Reading Experience* [17]; 2009 - *The book that turns its own page #3* [11]; 2010 - *Electronic Popables* [28]; 2010 -*Marginalia* [4]; 2011 - *The Telescrapbooks* [16] / and *I/O Stickers*; 2012 - *Elektrobiblioteka (Electrolibrary)* [32]; *Leapreader™*, reading and writing system and *LeapReader™* Books; and *Wonderbook™*. Besides the last two (*Leapreader* and *Wonderbook*), both child-directed, these books had no impact beyond their research context.

2. RESEARCH DESIGN

2.1 Research objectives

My research interests are the design of children's picturebooks in particular enhanced children's picturebooks and hybrid-enhanced children's picturebooks (stands here for children's picturebooks enhanced with printed, digital and electronic devices).

The main PhD research goals are: to uncover the ways in which the reading of hybrid-enhanced books may impact and engage children; to expose the usage patterns of hybrid-enhanced children's picturebooks; and to inform the future design research of this sort of book.

2.2 Research questions

My core research question is:

Is it worth (and why) to push, even more, the design boundaries of the hybrid-enhanced children's picturebooks?

Dividing the main question into five research questions, to deal with:

1. Different books different reading experience. Is it worth comparing and why, hybrid-enhanced children's picturebooks with enhanced printed picturebooks?
2. How do children read and experience hybrid-enhanced children's picturebooks, which combine digital and tangible media? Is the reading of this kind of book an asset for children?
3. Is the crossing of printed media with digital devices a valuable path to follow on the design of hybrid-enhanced children's picturebooks? Why?
4. Does usage patterns will emerge from the interactions with both enhanced books?
5. Does this research will be able to inform the design of future enhanced books?

2.3 Research overview

Children are not adults or even short-adults in their needs, expectations, experiences and complexities[10]. With their own idiosyncrasies they may have distinct roles in the research of new technologies [10].

In order to address the research objectives and answer the research questions, a range of methods were and will be followed during the prototypes development and evaluation.

In our first project children assumed tester roles [10]. They have been asked to report their experience with Bridging book and we observed them playing with it. In our second project they will assume informant roles [10]. We are listening to children across the full design process.

2.3.1 Case study 1 - Bridging book

Prototype Description

Bridging book consists of a printed book merged with a tablet and was developed for children aged 7 to 9 years [13-15; 25; 26].



Figure 1 and 2 - Bridging book - Prototype 1 / Figure 3 and 4 - Bridging book - Prototype 2

The printed book and the tablet device are synchronized. Thumbing through the printed book pages changes the digital contents. The book's odd page consists of two parts: half digital (the tablet screen) and half printed; most graphics are divided. The digital counterpart adds expressive layers to the physical book, such as contextual sounds, music, animation and interactions.

Two prototypes have been developed. The first one (see figures 1 and 2) is a square cardboard book with embedded disk magnets built-in each page, including the cover.

The final prototype (see figure 3 and 4) has the same number of pages. The printed book instead of square becomes rectangle (250 mm width / 130 mm height), with approximately the same tablet width. The magnets location is also different. In order to decrease the attraction force between the pages, the magnets were placed alternately in two different positions: the detection remained unchanged and the book handling was smoothed.

Book of hours is the story of Bridging book. The narrative elements — illustrations, sounds, music and interactions – illustrate the course of a day, from dawn till dusk. The illustrations present different moments of the day, locations and events. Each even page has a text with the hour time, corresponding to the illustration.

2.3.2 Bridging Book evaluation

Our methodology approach was user-centered design (UCD).

Initially, it was done an overview of the design of some significant hybrid-enhanced books, collecting its full characteristics and identifying their developmental limitations. It was also considered the children and their idiosyncrasies; the role of the book in the childhood [29]; the characteristics and affordances of both digital and printed media; and the dissemination and use of the digital media, by children [9; 30; 33].

2.3.2.1 Mixing media

Both the paper and the digital media have unique advantages [31]. Digital media can include dynamic contents, such as audio-visual interactive resources. Digital data can be easily searched, archived and shared. Paper renders information tangible and both hands can get tactile and kinaesthetic feedback "freeing up the brain to think" [27]. Besides, thumbing through a book we can realize the full information organization.

To merge common forms with new ones has advantages in the design for children: it maintains their link with known objects and gradually integrates new forms of interaction and use.

Therefore, crossing printed and digital media presented itself as a valuable path to design hybrid-enhanced children's picturebooks.

2.3.2.2 Design Guidelines and observations

After, some design guidelines to the book's design were outlined: to use the printed book as the core artefact; to expand the contents – image and text – of the traditional printed picturebook; to use audio-visual interactive resources; to create an handy hybrid-enhanced children's picturebook, for increased readability.

Across the design process, [22] the user's feedback was emphasized allowing us to evaluate and redesign the prototype iteratively.

For the evaluations, observations (direct and indirect through video recording), children's interviews and surveys were the choice.

Across the two (2) evaluation sessions (see figures 5 and 6) it was evaluated the prototype affordances, the children's relationship with the narrative and the experience engagement. For the first evaluation session children ages 7-8 years, to whom the prototype is addressed (see figures 5 and 6), were selected randomly from a class children. The second session happened in the public library. Children's parents signed on the session announced by the library (children in the same age group than the previous session).

Participants were grouped in pairs and a Bridging Book was assigned to each group. It was explained to them the basic affordances of the book and it was told them to explore the book freely. Our help was offered, in case they needed it, during the session. After 12/15 minutes of the book exploration the children were gathered in a group talk to report their experience. At the end of the session each children filled out a survey about their use habits of digital media.



Figure 5 - Session 1- Prototype 1 / **Figure 6** - Session 2 - Prototype 2

Summary of findings

The observation methods were effective to gather data of both prototype affordances and experience.

Summarizing, in the first session some issues were detected such as: trouble keeping the distance between the printed book and the tablet; some difficulties on thumbing through the book. These issues were solved within the new prototype design.

In both sessions, considering the affordances, some children interacted with the app with more gestures beyond programmed; almost every child interacted with the expressive contents of printed book; the artefact allows group's reading and playing.

Considering the user engagement, the children have explored the playful dimension of the device and expressed enjoyment and fun.

The observation sessions and the group talks were not very effective to research the full reading experience. A longitudinal study with a slightly different approach is being considered to gather more data on it.

2.3.3 Case study 2 - Tangible / digital book

Brief Description

Taking as the starting point a well-known story, *The tortoise and the hare*, we are developing the concept of the new hybrid-enhanced picturebook, using tablets and tokens.

Stage 1 - Paper prototype

To sketch the book's concept we developed a paper prototype. The children interacted with paper cut out characters, comic balloons, texts and paper scenery, to staging the story of the picturebook.

We wanted to know how children interacted with paper interface to create the story in the scenery; how they performed the narrative, while using the characters and the objects; and if they both understood and used the code of comics balloons.

The first two sessions with children using the paper prototype occurred last month (April 2014) and the following developmental steps will occur within the three next months.

These sessions are impacting the second hybrid-enhanced picturebook development.

3. UPCOMING RESEARCH

The first book development – Bridging book [13; 14] – was already concluded. More research is needed to explore the reading experience and the engagement.

The second prototype is currently being developed and the first sessions occurred already. Next session will occur in July.

The PhD research will continue until 2015.

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