

t-books – Merging Traditional Storybooks With Electronics

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ABSTRACT

In this paper, we describe the design process and a first pilot study of t-books, a toolkit consisting of an electronic platform, a book with slots on it and a set of picture cards that children place on the book to interact and explore the narrative. t-books was motivated by the wish to offer children an environment where they can play with the language elements, while engaging as story authors. In this process children can enlarge their vocabulary, experiment different storylines, simultaneously learning to create meaningful sequences that evolve to a narrative. At the same time children can build their own story world by choosing among a diversity of different characters, settings and actions according to their needs and preferences, thus generating a simulation environment within the story universe, where alternative scenarios, and what-if questions can be posed and tested. A first insight of children's interaction with t-books was very promising showing that children were highly motivated to create and share their own stories.

Categories and Subject Descriptors

H.5 Information interfaces and presentation H.5.2 User interfaces: User-Centred Design.

General Terms

Design, Experimentation, Human Factors.

Keywords

Children, Tangible Interfaces, Storytelling, Participatory Design.

INTRODUCTION

Stories play a major role in children's lives, by the age of 4-5 children are able to tell stories about themselves and the characters they invent, and even reflect over the language [4].

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Stories as well as fantasy role-play also enable children to explore and learn the world around them [3]. This is an experimental and exploratory activity, whereby children can experience how others behave and feel, identifying positive and negative aspects, while learning to express themselves and to communicate with others [1].

Very frequently children's first contact with stories happens through books, whether it is a book read by the parents just before going to sleep, or during the kindergarten daily routine, and later at school; most children grow up interacting with books. At the same time, technology has entered children's world, becoming an important part of it.

Our approach is to combine the traditional storybook with the new technological developments creating a new experience that expands both the way children interact with narratives as well as with technology [10]. The tangibility of the interface offers children a "playground" to experiment with story elements. By rearranging them until having meaningful sequences, children learn to create stories in a linear consequent manner gradually acquiring the discourse rules [1, 2].

t-books target pre-school children aged 5-6 years old as well as primary school children depending on the content of each book.

Our toolkit was motivated by the following goals:

- Support creative expression with technology as a medium;
- Bring together and expand the affordances of the traditional storybooks with the new possibilities provided by technology;
- Create a new experience by giving the tools that allow exploring and expanding the narrative, while providing children with a framework that guides them through the process of creating a narrative.

Additionally for educators, family or older users:

- Create authoring tools to custom and personalize their own materials;
- Empower non-technical users to implement high-tech ideas.

1. BACKGROUND

The t-books toolkit is part of a long-term project that aims to develop a toolkit of tangible interfaces where children and educators can develop their own learning activities mixing

digital and physical manipulation. It seeks the mix of traditional and electronics materials [7], enabling children's creation of narratives through drawings, sounds [8] and different forms of manipulation of digital content [5].

This project is largely motivated by a constructionist view of learning; an approach that stresses the importance of creating the conditions under which intellectual models can take root, empowering the learner to perform meaningful projects [6].

With t-books we combine the traditional storybook with an electronic platform. The educational goal behind this interface is to create a "playground" that allows children to explore a certain narrative and alternative storylines by manipulating the story elements, while simultaneously taking advantage of the traditional book which serves as a framework and a guide for the construction of the narrative. The approach creates a simulation environment within the story universe, where alternative scenarios, and what-if questions can be posed and tested. It allows for problem solving, where, for instance, to reach a certain desirable story outcome, the right elements need to be in place. An example is the story of the three little pigs, in order to escape the wolf, the pig should build his brick house, but ... what if the three little pigs join efforts, will they be able to beat the wolf?

In summary t-books aim to provide children with tools to shape their own creations, engaging them as story authors.

2. THE t-books TOOLKIT

2.1 Designing with Children

Our first approach to design t-book was to learn more about children's narrative skills. During two sessions we asked a total of 50 preschool children aged 5 to create and tell us a story. The children were divided in groups of three. Most stories that the children told were very simple reflecting children's daily routines, they were about their family and friends and took place in sceneries that were similar to the environment where the children lived. As a result from this first approach we felt inspired to develop an interface that would allow children to expand their narratives engaging them as story authors.

We started by developing three sets of picture cards: characters, places and actions (fig. 3). Instead of just confining the cards to the characters and the sceneries that the children had used, we included a vast set of characters, sceneries and objects, to provide new ideas as well as to increase the range of elements that children could use to develop their literacy.

2.2 First Tests

Our first electronic prototype was a platform with six slots for placing the cards; the platform was connected to a computer through USB. By placing the cards in the slots, different animations and audio were triggered and displayed on the computer screen, allowing children to create their own narratives.

This prototype was tested with 18 preschool children aged 5. We presented the prototype and asked the children to create a story using the cards. The children interacted with the interface in groups of three. They all were very enthusiastic about seeing the animations on the computer screen and hearing a voice, they tried out every single card and every possible combination of cards.

Reflecting over children's performance we noticed that the children were not interested in creating stories, what captured their attention was this new form of interacting with the computer by placing the cards on the platform.

We knew from previous contact with the children that a good storybook was capable of capturing their interest so we decided to combine a traditional storybook with the electronic platform. This would allow children to create their own narratives within a given framework.

2.3 Technical Development

Currently the system is composed by an electronic platform where a book can be placed (different books can be created according to the content and the age that they target), the platform connects to a computer through USB. The book has slots on it for placing the cards; the number of slots increases gradually to a total of 6 in the last page (Fig.1-2).

The slots are arranged in a way that allows the cards to have direct contact with the electronic platform, which is placed under the book. When this happens a microcontroller collects the data from the cards and sends the information to the computer, thus depending on the cards that the children chose different animations and audio are triggered and displayed on the computer screen.

The books can be conceived with a different number of slots in each page and its arrangement can be set up accordingly to the content of the book.

Each card has an electronic tag on its backside that allows the system its detection and identification. There are plenty of technologies that could be used to accomplish this task, from the simplest ones such as electronic physical contacts, to more complex ones ranging from infrareds, RFID, or even a Wi-Fi sensing technology.



Figure 1. The book placed on the electronic platform, opened on the first page.



Figure 2. The book placed on the electronic platform, opened on the last page.

However, considering the robustness and cost of the system, which is intended to be the lowest possible, but also reliable, the

technology used is proximity capacitive sensing. Thus both the slots and the cards have electronic pads that once a card is placed in the slots allow its identification. The actual version of the implemented system can read up to about 250 different cards, taking into account that it already has error prevention, which is done through a checksum that avoids wrong detections caused by misplaced cards, or by touching the sensors with fingers.

The entire system is being developed to have “wide walls” [9] keeping its flexibility in mind to support many different types of projects. This means that it can be easily updated with new contents, it is not restricted to a subject and the content can range from creating stories to scientific experiences or even solving mathematical problems. The system can be used with or without the book, the second option allowing for a more open exploration and experimentation.

2.3.1 An Authoring Tool

An additional goal of our approach is to provide educators, parents or older users with authoring tools that allow the creation of their own personalized content. More experienced users can easily create and craft their own cards as well as their own rules. The pads on the back of the cards that allow for its detection and identification can be painted using conductive ink or conductive sticky tape such as aluminium or copper. Teachers and children can enrol together in creating and custom their own stories and their own cards, developing activities with both a “low floor” (easy to get started) and a “high ceiling” (opportunities to create sophisticated projects) [6].

3. PILOT STUDY

3.1 Objectives

The goal of our pilot study was to find out if the children would be interested in creating a story following the narrative of the book, whether they would create different storylines, or if they would prefer a more open use of the cards. Additionally we wanted to test the robustness of the system.

3.2 Study Design

The current prototype was tested with a small group of 8 children aged 5. They interacted with t-books in pairs of two. A facilitator read the story and the children were invited to follow the narrative by choosing the cards they liked and place them on the slots according to the unfolding narrative.



Figure 3. The book with some cards.

The book was entitled “Oshy’s adventures” (fig. 3) and was about one main character and its friends; it comprised two slots on the first page and its number increased by one till the last page to a total of 6 slots (fig. 1, 2). The set of picture cards that children could use included diverse settings, a total of three characters and a set of different actions. The written narrative in the book was about Oshy and his friends; by using different cards the children

were able to place the story in different sceneries, as well as use different characters that were performing different actions.

3.3 Results of the Pilot Study

The children immediately understood the functioning of the system; they could easily place and replace the cards in the slots (fig. 4 -7).



Figure 4 -7. Children interacting with the platform

All were very enthusiastic about the book, especially about the communication between the cards and the computer. They were all successful in following the unfolding narrative of the book and creating their own story version with the cards they chose. An interesting observation was that when they reached the last page, the one without text and just with the six slots, instead of creating a new story version rearranging the completed story by changing

the cards on that page, the great majority would close the book and start a new story from the first page. Every child was so engaged that s/he would create several different stories.

The pilot study revealed also a spontaneous collaboration among the children, thus the children that had interacted with the system were eager to show its functioning to the new ones that were coming in the room to interact with the prototype. The tangibility of the interface showed to promote this collaboration [10].

The system proved to be very robust and did not undergo any change or damage after children's manipulation. Some children were very curious and interested in the technical functioning of the platform, they investigated and asked questions about it and some even wanted to create their own cards.

4. FUTURE DEVELOPMENT

Currently each book is placed on the electronic platform, but since the whole device is very thin it can as well be inserted in a book's back cover. The communication between the platform and the computer occurs through USB, but other alternatives are being considered to reduce the dependency of a computer, such as a connection with the iPad, also a wireless interface between the book and the host would be an interesting approach, though it has not yet been implemented due to difficulties with power supply.

Additionally we consider attaching text to the cards, as seeing the words written on the screen while handling the pictures may as well raise children's curiosity and motivation to learn how to write. Moreover we are exploring scenarios where the stories can be then uploaded to a blog and shared with family and friends.

Further and following this first pilot study and together with the children and the teachers we will proceed with a thorough evaluation of the learning benefits promoted by the use of t-books.

5. CONCLUSIONS

We designed the t-books toolkit hoping to promote children's creativity as story authors. From previous tests we noticed that it was important to give children guidance and a framework for their stories. Instead of proposing them to create a story we divided the structure of the narrative into smaller steps, making it more "communicable, more assimilable, more simply constructible", thus simplifying the task and making it easier to accomplish [6].

The children in our pilot study became immediately familiar with the interface, enthusiastically engaging in playing with the elements of the narrative and creating different storylines. They preferred to generate their stories "page by page" using the book, which gave them an important guidance throughout the construction of the narrative, acting as a framework for the creation of the stories.

We envision T-books as a tool to help children develop their literacy, as well as their models of the world. As it has been shown, learning is by far more effective when it is self-motivated and when learners become deeply involved with the learning materials. We are convinced that by giving children the power to "dive into" the story [6], engaging them as story authors may lead to a better and more effective learning.

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