TOK – a Tangible Interface for Storytelling

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Abstract

We present the design of the first prototype of TOK - a tangible interface for children to create their own stories. Based on data collected with two groups of five years old preschoolers we present our findings regarding the interaction design of the system. The picture cards have shown to generate ideas, acting as input for the creation of stories, promoting creativity while proposing a framework that supports and guides the construction of logical structures. This is a first step in an effort to build a toolkit of tangible interfaces allowing children and teachers to build their own digital enhanced learning activities.

Keywords

Tangible Interfaces, Paper based Interfaces, Storytelling, Interaction Design, Children.

ACM Classification Keywords

H.5.2 [Information Interfaces and Presentation (e.g., HCI)]: User Interfaces, user centered design. K.3.0 [Computers and Education]: General.

General Terms

Design, Experimentation, Human Factors

Introduction

We probably can say that all children around the world simply love to hear and tell stories. Telling stories and fantasy role play is also children's way to explore and learn to know the world around them [6]. This is an experimental and exploratory process whereby children experience how others behave and feel, try out different roles, and identify positive and negative aspects, while learning to express themselves and to communicate with others. Along this process children gradually acquire the discourse rules [1]. In recent years there has been an increasing development of technology that supports child-driven play and creativity and new solutions have been developed that promote creativity and fantasy play engaging children as story authors [2, 3, 6, 7, 8, 12, 13, 14, 13]. TOK, the prototype presented here is a tangible platform where children can create their own stories by placing picture cards on a platform, rearranging them until creating meaningful sequences and stories. As the cards give oral and visual feedback after being placed on the platform, they help children to reflect over their narratives, whereby they can learn how to build logical sequences, enhancing their vocabulary and literacy. The tangibility of the cards invites and supports spatial interaction supporting performative behavior [11] and embodied interaction [3] making it easy for young children to interact with the content [17]. Simultaneously the cards act as generators of ideas, fostering imagination and creativity [11].

A Tangible Interface for Storytelling

TOK is a platform for preschool children to create their own stories. The prototype consists of a platform, which has the format of a two-page book and a set of picture cards drawn on paper. The page on the left side is used for placing the cards, comprising 15 rectangular slots where the picture cards fit in. The page on the right side has a classmate PC embedded. When the picture cards are placed on the slots, an animation is triggered on the computer, e.g. if a card that represents a boy walking is placed on the platform, the animation of a boy walking along the computer screen will appear on the screen (fig. 1).

Figure 1: Conceptual rendering of the platform with cards placed on the slots and the animation on the computer screen.

The Design Process

Following methodologies explored by previous authors [9, 10, 16] two groups of 25 preschool children each, all aged five, were involved from the beginning in the design of the platform: informing the design process, testing and using the cards and the prototype. We worked with three children at a time (fig. 3). The first approach was to learn the kind of stories that children create. During two sessions we asked each child to invent and tell us a story. Most stories were about children's daily routines, their family and friends. The characters and scenarios that the children used are presented on table 1.

Figure 2-The cards scattered over the table during one of the sessions.

Figure 3 – Children creating their stories.

Figure 4 – A story beginning on the top left side of the paper prototype.

SCENERY:
Kindergarten, playground, football place, home, kitchen, room, living room, bed, doghouse, garden, picnic, meadow, woods.

CHARACTERS:
Men , girl, boy, mother, father, brother , daughter, girlfriend, cousin, granny, grandpa, doctor, dog, bees, wolf, cat, bird, rabbit, piggy

NATURE:
Flower, tree, apples.

Table 1- Scenery and characters referred by the children

Drawing the Cards
Based on the stories that children had created, we drew three sets of picture cards: characters, places and actions (fig. 2). Every picture card has only one element represent on it. Instead of just confining the cards to the characters and the scenery that the children 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 have to develop their literacy. At this point we are exploring rectangular shape cards, other shapes, eventually supporting other affordances could be explored in future.

Testing the Paper Prototype
The cards were tested with the same children in following sessions, using a paper prototype of the platform that consisted of a simple A4 colored cardboard (fig. 3-7). This paper prototype was tested in two following days with four groups of three children each. The children sat around a table (fig. 3), each one was given a cardboard, the picture cards were scattered in front of them and the children were asked to create and tell a story using the cards they wanted. All the children placed the cards on the platform; most of them wanted to tell more than one story, in the total

they created 30 stories, which were quite different from the ones created before. Having the cards as an input the scenarios, the characters and the actions were much more diverse not just confined to children's daily routines. The content of the cards was in general very clear for the children. Some of the children grabbed all the cards they liked without really thinking about the story that they wanted to create and began to place them on the platform; others took their time to reflect about what they wanted to tell, and looked for very specific cards. Most children began to place the cards on the platform aligning them horizontally on the top or bottom of the platform (fig. 3-7); three of the children used the platform like a drawing: placing the sun and a flying bird on the top and the characters on the bottom. Almost all filled the A4 cardboard, using as many cards as possible (fig. 5). Most children felt the need to align the cards, arranging them in straight lines while creating the story (fig. 6). Very often and before beginning to tell the story the children removed some cards from the platform replacing them with others, adjusting them to the narrative. The children that began to place the cards on the top left side also began to tell the story from there (14 stories) similarly the children that had placed the cards on the bottom right/left side began to tell the story from there. In 16 of the stories the children told the story following the order of the cards, in 8 of the stories they did not follow the cards and in 7 of the stories the narrative jumped back and forth between the cards (table 2).

stories created	Begin 1st card top of page		Begin Left to right		Follows the cards		
	yes	no	yes	no	yes	no	s t
30	14	17	20	10	16	8	7

Table 2 – Spatial position of the cards on the paper prototype.

Figure 5 – A completed story.

Figure 6- Child rearranging the cards.

Figure 7 – Story created using the bottom of the paper prototype.

The children showed much interest in listening to the stories created by the other children and they followed the narrative looking at the cards that had been placed on the platform. Frequently the two children that were listening to the child telling the story asked for the drawings when the picture placed did not matched the narrative.

Insights on the Design of the Interface

As already mentioned, inspired by the classical book we developed a prototype that resembles a two-page book. The observation that the children placed the cards in rows on the paper platform as well as noticing that many of them were concerned with the alignment of the cards - they often asked us to help them with that - made us think of a solution that would facilitate this task and lead us to design the left side of the interface with a square grid comprising 15 slots to place the cards. The children can use 15 cards to create their story but they are free to use less than that. Given the fact that the children used the space differently - as for example some began to tell the story from the top left side, others from the bottom right side, others placed the cards in the middle of the platform, and some used the space as a drawing - the system must identify two things: the content of each card as well as its location. This way, each card can be placed anywhere on the slots, since the system supports connections between cards, or groupings of cards, thus giving the children the possibility of beginning the story where they want. The children told their story following the spatial position that they had chosen for placing their cards. To support this, the system reads the cards following the order they have entered it, this means that the children can place a card on the bottom of the platform and then continue placing the next card on the middle of

the platform, jumping back and forth as they create their story. The interface creates two levels of interaction: each card that is placed on a slot activates audio (all the sounds were recorded with the voice of a seven year child) and a computer animation. This means that each card contains an audio identification according to the picture that it represents, e.g. when a card with clouds and rain is placed on a slot the words "it is raining" are spoken by the system; at the same time the clouds and the rain appear as an animation on the computer screen, which is embedded on the right side of the platform. When the story is ready the children can press a button to hear it and a video comprising the audio and the animation is created. Currently we are working on the syntax, defining a system of rules for the different cards that enables the system to build coherent sentences. Further we consider inserting text under each card that is placed, as seeing the words written while handling the pictures may as well raise children's curiosity and motivation to learn how to write. Additionally we are exploring scenarios where the stories can be then uploaded to a blog and shared with family and friends.

Building on previous work

In the last decade there has been a growing interest in developing tools for children that promote story authoring. Some examples of such interfaces are Kid story [5], StoryMat [7], TellTale [2], Pogo [8], Jabberstamp [13], SPRITE [15] Singing Fingers [14], Make a Riddle or TeleStory [12]. Building on the same principles TOK targets preschool children, though its use can be extended to primary school. It is being conceived to be used in the classroom as a pedagogical interface for storytelling, with an effective educational value. Therefore it is being designed from the start with

the intervention of both children and educators. One of the aspects we are paying particular attention is its feasibility to be integrated within the classroom, and its affordability for schools and students. Rather than having a complex setup, TOK is being built based on an existing computer (the classmate pc) that is being distributed in Portuguese schools to children, and it incorporates low cost materials for the card detection technology. It has the advantage of being very simple and handy – like a book that can be carried by the children and taken everywhere. Differently from the TUIs referred above, the interface makes available a multitude of characters, scenes and objects that children can combine almost endlessly, allowing them to be the authors of their own stories, promoting creativity while proposing a framework that supports and guides the construction of logical structures. Additionally, instead of giving just audio feedback it provides visual feedback as well.

Discussion

The prototype presented here pretends to be an experimental space, where children can explore the language in a game like manner. The picture cards work as an input for the creation of stories helping children to generate ideas; it was noticeable that the cards bring the story forward; when the children saw some specific cards that they liked, they choose them and built the narrative according to the drawings represented on them. The stories created with the paper platform where much more complex than the ones created before just verbally. Since the cards give audio feedback children can find out and learn about logical relations and sequences and the system might foster a better understanding helping the construction of a storyline. The fact that the content is attached to

the cards may help children to think of how a story is built as well as about logical sequences, a process that can be guided by the teachers, who can work on the construction of the narratives with the children. Additionally the interface can be used by the teachers to propose a series of educational activities. The tangibility of the interface allows younger children to easily interact with it [17]; looking for specific cards, going through the cards, handling them on their hands, gives children time to think about the content and about what they are going to tell, creating a link between the movements and the process of thinking [4]. The recorded stories, which can be uploaded to a blog, allow seeing children's progression over the time and can be shared with family and friends.

Conclusions and future work

We have reported on the design and first testing of a tangible interface for children to create stories. Our observations carried with a paper prototype were fundamental for the design process and have been incorporated in the prototype. This is an initial stage of a plan to develop a toolbox of tangible interfaces, consisting of low cost materials commonly used at preschool, such as paper and cardboard, so that children and educators can use the materials to build their own interactive interfaces, thus exploring, simulating, and creating knowledge in an active way. We will proceed exploring the cards and plan to develop different sets that focus on different skills and activities.

Acknowledgements

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