TOK – a Tangible Interface for Storytelling

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 the 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
Telling stories and fantasy role play is children’s way to explore and learn to know the world around them [3]. This is an experimental and exploratory process whereby children learn to express themselves and to communicate with others, gradually acquiring the discourse rules [1]. In recent years there has been an increasing development of technology that supports child-driven play and creativity engaging children as story authors [2, 4, 5, 8, 9]. 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 [7], making it easy for young children to interact with the content. Simultaneously the cards act as generators of ideas, fostering imagination and creativity [7].

A Tangible Interface for Storytelling
TOK is a platform for preschool children to create their own stories. The prototype consists of a platform with 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 screen (fig.1).

The Design Process
Following methodologies explored by previous authors [10, 6] two groups of 25 preschool children each, all aged five, were involved from the beginning in the development of the prototype, informing the design process, testing and using the cards and the prototype.

Testing a Paper Prototype
We drew three sets of picture cards: characters, places and actions (fig.2). The cards were tested with the children in two following days with four groups of three children each, using a paper prototype of the platform that consisted of a simple A4 colored cardboard (fig. 3-7). The children sat around a table (fig.3), each one was given a cardboard, the picture cards were scattered in front of them (fig.2-7) 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. 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 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. 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.

**Insights for the Design of the Interface**

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 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 - e.g. 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 - the system must identify two things: the content of each card as well as its location. Also the system reads the cards following the order they have entered it. 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. Each card that is placed on a slot activates audio 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.

**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 StoryMat [4], TellTale [2], Pogo [5], Jabberstamp [9], Make a Riddle or TeleStory [8]. Building on the same principles TOK targets preschool children, though its use can be as well extended to primary school. 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 is 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 input for the creation of stories helping children to generate ideas. 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 of a storyline. 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.

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 more ambitious 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.

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References