TOK - Developing a Tangible Platform for Storytelling

Cristina Sylla
engageLab, University of Minho, Portugal
sylla@engagelab.org

Clara Coutinho
Institute of Education, University of Minho, Portugal
ccoutinho@ie.uminho.pt

Pedro Branco
Dep. of Information Systems, University of Minho, Portugal
pbranco@dsi.uminho.pt

Eduarda Coquet
CESC, University of Minho, Portugal
coquet@engagelab.org

David Škaroupka
Institute of Machine Design, Brno University of Technology, Czech Republic
dadas@centrum.cz

Abstract: This paper describes a first study of a tangible interface, consisting of a platform and a set of picture cards that children can use to create stories. The handling of the picture cards has shown to be highly motivating and engaging, helping children to build a storyline creating logical relations among different characters and objects. The interface works like an experimental space where children can play with the language and simultaneously reflect over it, individually or in a collaborative process. We present the design of the first prototype and the data collected with two groups of five years old preschoolers and report our findings regarding the interaction design, as well as a reflection over future work.

Introduction

Stories have always been intricately linked to the world of childhood, children simply love to hear and tell stories, and it is precisely through storytelling and fantasy role play that they explore and learn to know the world around them (Bruner, 1996). Thus inventing, creating and telling stories is fundamental to the development of the child both as an individual as well as a social person (Healy, 1999, Cassell and Ryokai, 2001). Through an experimental and exploratory process the children experience how others behave and feel, trying out different roles, identifying positive and negative aspects, while learning to express themselves and to communicate with others. The competence of being able to express oneself and to communicate with others implies the gradual acquisition of the discourse rules (Ackermann, 2002) and that goes together with the need for experimental spaces where children can play and experiment with the language (Ananny, 2001, Ackermann, 2002). In recent years there has been a growing awareness in the development of technology that supports child-driven play and creativity and an interest in developing solutions that promote free expression, creativity and fantasy play engaging children as story authors (Ananny, 2001, Cassell and Ryokai, 2001, Decortis and Rizzo, 2002).

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. In this perspective, we consider that the prototype enhances motivation and the development of self-regulated learning, skills that are essential for school success and, furthermore, for lifelong learning (Zimmerman, 2000, Winters, Greene and Costich, 2008). In order to improve self-regulated learning it is important to create the conditions for the children to experiment and develop strategies, setting goals, learning

to concentrate in the proposed tasks and changing their approach if necessary; and most important of all, have the possibility to reflect over the learning process, and over their own effort to carry the task (Rosário, 2007). The tangibility of the interface supports children's creative expression making it easy for young children to interact with the content (Zuckerman, Arida and Resnick, 2005) transforming the creation of a story in a multitude of stimuli that range from: sensory, visual and auditory. Body motion and sensory perception such as touch, sight and hearing are crucial to children's development (Healy, 1999, Lowenfeld and Brittain, 1975) facilitating learning and content retention (Zuckerman, Arida and Resnick, 2005). Therefore, educational environments should support those physical activities.

A Tangible Interface for Storytelling

The interface presented here introduces a platform for preschool children to create their own stories. The current prototype consists of a platform and a set of picture cards. The platform has the format of a two pages book. The page on the left side is used for placing the cards; it takes three rows of five cards each. The page has 15 rectangular marks where the picture cards fit in. The page on the right side has the Portuguese version of the classmate PC (Magalhães) embedded.

Designing the Cards

The left side/page of the platform functions as the tangible work area, where the picture cards are placed, creating two levels of interaction: when the cards are placed on the left page of the platform they appear as an animation on the computer screen, which is embedded on the right page of the platform. Each card has audio associated according to the drawing represented on it (we will discuss this later). Every picture card has only one element represent on it. These elements are divided in three main groups: scenes (places/locations), actions and characters (objects). Each card is identifiable by the system and can be placed everywhere on the marks.

Following methodologies explored by previous authors (Scaife and Rogers 1997, Scaife and Rogers 1999, Malone, 1982, Druin, 2002) two groups of 25 preschool children each, all aged five, were from the beginning involved in the design of the platform: informing the design process, testing and using the cards and the prototype. The work conditions with the children are ideal, since the work is carried two days a week with the children, one day for each group, in children's room; while the teacher and the other children are involved in other activities, in the painting room. This way we can avoid possible interference/ influence from the teachers that might have a significant effect on the results. We normally work with three children at a time.

The first approach was to learn the kind of stories that children create. Where do they take place? What are the characters the children use? Which verbs/ actions do they use? To find this out we asked each child to tell us a story invented by her/ him. As a result we found out that at the age of five the stories that children tell are very simple, being often about their daily routines: going to the preschool, playing at the playground, playing with their friends and parents. According to that, the main verbs used describe the activities that the children carry along the day, such as: playing, eating or going to sleep.

Based on those findings we draw three sets of picture cards: characters, places and actions. An important question was: what cards do the children need if they want to represent movement and actions? We choose to draw a set of actions for each figure, showing each figure in different situations. For instance, we found out that children like to tell stories about dogs, and that they associate the dogs with bones, balls and wooden stocks. In order to represent such actions we created five cards for the dog: the dog sleeping, the dog hiding a bone, the dog standing, the dog going, and finally the dog standing (Fig. 1- right). The same was done for the other characters.

After drawing the cards they were then tested with the children using a paper prototype of the platform that consisted of an A4 colored cardboard. This paper prototype was tested in two following days with four groups of three children each. The children were given the cardboard and the picture cards and asked to create and tell a story using the cards they wanted. The children understood immediately the drawings represented on the cards. Probably inspired by the drawings, the stories now created were very different from the ones they had told before without the cards. The children used different vocabulary and the stories were no longer about themselves, but about the characters on the cards. Although the three children set together around one table,

each one wanted to create her/ his own story; most of them asked to create more than one narrative.

Figure 1- Examples of cards (left). Sequence of cards with the dog (right)

All the interactions were videotaped and will be analyzed according to a set of categories drawn from literature on digital storytelling by, at least, three of the researchers, in order to guarantee the objectivity of the analysis (inter-rater/agreement validity, Moore, 1983). The obtained data will be considered for comparison in future interactions with the platform and the results will be presented in future work.

How Does the Platform Work?

The children can pick the cards, choosing the elements they like/need to create a story and place them on the left book page, each card over a mark. The working place comprises 15 marks, so that the children can use that amount of cards to create their story, but they do not have to use all the 15 cards, they are free to use less than that. The children can rearrange the story by changing the sequence of the cards, by adding new ones or by removing some of the ones they have used or they can simply begin a new story. When the cards are placed on the tangible left page they trigger the correspondent sound. As an example: when the card with a boy is placed the word "boy" is spoken by the system. All the sounds were recorded with the voice of a child. Simultaneously the cards that the children place appear on the computer screen embedded on the right page of the interface, showing the animated story that is being created with the cards. For instance if the children place a card showing a boy walking, on the computer screen they will see the boy moving along the screen (Fig. 2), or as another example if they place for instance the following sequence of cards: dog standing - bone -meadow - dog walking - dog with bone, on the computer screen they will see a dog running and then holding a bone (Fig. 3).

Figure 2: The platform with cards placed (left side) and the animation on the computer screen (right side).

When the children want to change the scene, the new one, appears on the screen, but s/he still has the previous scene on the platform, so that there is a continuous interaction between the cards and the screen.

Figure 3: Scene with the dog.

When the story is ready the children can press a button to hear it and a video comprising all the scenes is created. We are exploring scenarios where the stories can be then uploaded to a blog and shared with family and friends.

Related Work

In the last decade there has been a growing interest in developing tools for children that allow them to create stories in a more active and creative way promoting story authoring. Many of these tools are tangible interfaces allowing for an interaction that frees children from mouse and keyboard creating a more natural interaction (Ishii, and Ullmer, 1997, Cassell and Ryokai, 2001). In the following some interfaces that promote the development of such skills will be shortly described.

The Kid story consists of a single display with multiple input devices. The interface is composed by two tools: KidPad and Klump, KidPad is a 2D drawing tool that incorporates a zoom interface. The children can create links and zoom between the different drawing elements creating non linear structured stories. Klump is a deformable 3D amorphous object that can be used to help generating ideas during the early stages of the story (Benford, 2000).

The 1001stories is a project that involves the whole class in creating a multimedia presentation called "narrative". According to the authors one of the main advantages of this project is the inclusion of children with a lower school performance (Di Blas, 2010).

StoryMat is an interface developed to encourage storytelling through children's fantasy play. A soft play mat decorated with sewed objects provides a scenario for children to play using stuffed toys. The gestures and the story told by the child on the mat are recorded and then compared with stories from children that have previously played on StoryMat. The story with a similar pattern is than recalled and played, acting as inspiration for the creation of new stories (Cassell and Ryokai, 2001)

TellTale aims developing oral language skills and literacy through storytelling. The interface resembles a worm with the body consisting of five pieces and a colored head. Children can record audio into each part of the body and hear it by pressing a button. The pieces are independent of each other, can be randomly sorted and rearranged, or a new story can be created at any time (Fig. 4 left), (Ananny, 2001).

Another interface that targets the narrative domain is Jabberstamp allowing children to add sounds and voices to their drawings. Using a small trumpet the children can hear the stories they have created (Fig. 4 right), (Raffle, 2007).
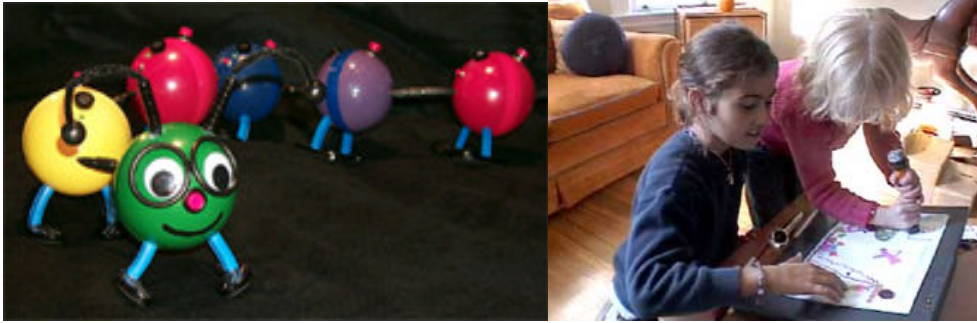
Figure 4: Left: the TellTale prototype, right: children creating a story with Jabberstamp.

POGO allows children to create stories by connecting physical and virtual environments. A set of different tools provides for simultaneously capturing, manipulating and combining pictures, drawings or collages, as well as sounds (Fig. 5), (Decortis and Rizzo, 2002)

Figure 5: Children using POGO.

More recent projects are Talking Paper, which brings together conventional paper based elements such as drawings, pictures and multimedia like videos, sounds and animations creating playful interactive spaces for storytelling.
A project that explores the use of the language is SPRITE enabling children to create a spoken document, or *talkument* by assembling bits of spoken language that can be edited, indexed and scanned (Rosenberger Shankar, 2005).
Singing Fingers brings together drawings and sound for creating stories (Rosenbaum and Silver, 2010).
Taking advantage of children's increasing use of mobile devices, Mobile Stories, is a system that enables collaborative reading and creating of stories embracing mobility and collaboration (Fails 2010).
As the interfaces shortly presented, our prototype, pretends to enhance children's creativity, however it has some different characteristics: first of all, it targets a very young public, it can be used with preschool children, but its use can be extended to primary school; it is conceived to be used in the classroom as a pedagogical interface for storytelling, allowing for free expression and personal creativity while proposing a framework that supports and guides the construction of logical structures, thus promoting self-regulated learning.

Discussion

Following this line of development the prototype presented here pretends to be an experimental space, where children can explore the language, in a game like manner. The major contributions of this interface are the

simplicity of the set up ant its low cost, since the platform uses computers that are being distributed to students, and the technology used to build the cards is low-cost, which would make it easy to implement at preschool or at school, as well as being a tangible space for playful exploration bringing together visual, auditory and sensory stimuli. A space where children can find out and learn about logical relations and sequences, enhancing their creativity and ability to create stories by working individually or collaborating with each other, enhancing autonomy and self-regulated learning.

Instead of telling children a story and work that story with them, this interface, in turn, aims to promote children's potential in imagining, creating and sharing their own stories. At the same time the interface can be used by the teachers to propose a series of educational activities. The picture cards work as an input for the creation of the stories helping children to generate ideas; the tangibility of the interface allows younger children to easily interact with it. At the age of five it is still not easy to build logical relations, since the cards give auditory feedback the system might foster a better understanding of a storyline; working at the same time as an experimental space to reflect about the language helping children to build logical relations and to develop their literacy. As we found out such a challenge has revealed very motivating for the children, who engaged from the beginning in creating a story. The recorded stories, which can be uploaded to a blog allow seeing children's progression over the time and at the same time allow for sharing 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 showed that the physical handling of the pictures was very motivating and engaged children from the beginning in creating their own stories. The interface has shown to function as an experimental space where children can play with the language and at the same time reflect over it. In future work we plan to develop different sets of cards that focus on different skills. As a future version we plan to use the platform to teach/learn foreign languages, therefore the sounds attached to the cards would only need to be recorded in a different language; since Portuguese children begin to learn English at preschool we plan to develop an English version. Additionally we plan to embed light and sensors on the cards so that it is possible to extend the kind of exercises and activities supported by the interface. Further we hope to contribute with our research to the discussion on the cognitive benefits related to the physical manipulation of materials (Marshall, 2007, Marshall, Cheng and Luckin, 2010).

References

Ackermann, E. (2002). Language Games, Digital Writing, Emerging Literacies: Enhancing kids' natural gifts as narrators and notators: *Information and Communication Technologies in Education. 3rd Hellenic Conference with International Participation* (pp.31 – 38).

Ananny, M. (2001). Telling Tales: A new toy for encouraging written literacy through oral storytelling. *Society for Research in Child Development*, 2001, Minneapolis, MN.

Benford S., Bederson B., Akesson K., Bayon V., Druin A., Hansson P., Hourcade J.P., Ingram R., Neale H., O'Malley C., Simsarian K.T., Stanton D., Sundblad Y. & Taxen G. (2000). Designing storytelling technologies

to encourage collaboration between young children: *Proceedings of the CHI 2000 Conference on Human Factors in Computing Systems* (pp.556 – 563). ACM Press.

Bruner J.S. (1996). *The culture of education*. Cambridge, MA: Harvard University Press.

Cassell, J., & Ryokai, K. (2001). Making Space for Voice: Technologies to Support Children's Fantasy and Storytelling. *Personal Ubiquitous Computing 5*, (3), (pp. 169-190).

Decortis F., Rizzo A. (2002). New active tools for supporting narrative structures. *Personal and Ubiquitous Computing 6*, (5-6), (pp. 416-429).

Di Blas, N., Paolini, P., Sabiescu, A. (2010). Collective digital storytelling at school as a whole-class interaction: *Proceedings of IDC Interaction Design and Children 2010* (pp. 11-19). ACM Press.

Druin, A., Stewart, J., Proft, D., Bederson, B. & Hollan, J. (1997). KidPad: design collaboration between children, technologists, and educators: *Proceedings of the SIGCHI 1997 Conference on Human Factors in Computing Systems* (pp. 463–470). ACM Press.

Druin, A. (1999). Cooperative inquiry: Developing new technologies for children with children: *Proceedings of the CHI 1999 Conference on Human Factors in Computing Systems* (pp. 592-599). ACM Press.

Druin, A. (2002). The role of children in the design of new technology. *Behaviour and Information Technology, 21* (1) (pp. 1-25).

Healy, J. M. (1999). *Failure to connect: how computers affect our children's minds-and what we can do about it*. NY: Touchstone.

Inkpen, K.M., Ho-Ching, W., Kuederle, O., Scott, S.D. & Shoemaker, G.B.D. (1999). "This is fun! We're all best friends and we're all playing": Supporting children's synchronous collaboration. *Computer Support for Collaborative Learning* (pp. 252-259). ACM Press.

Ishii, H. & Ullmer, B. (1997). Tangible bits: Towards seamless interfaces between people, bits and atoms: *Proceedings of the CHI 1997 Conference on Human Factors in Computing Systems* (pp. 234-241). ACM Press.

Lowenfeld, V. & Brittain, W. (1975). *Creative and Mental Growth*, NY: Macmillan, 6th Ed.

Malone, T. W. (1982). Heuristics for designing enjoyable user interfaces. *Conference on Human Factors in Computing Systems* (pp. 63-68).

Marshall, P., C-H. Cheng, P. & Luckin, R. (2010). Tangibles in the Balance: a Discovery Learning Task with Physical or Graphical Materials: *Proceedings of the Fourth International Conference on Tangible Embedded Interaction* (pp. 153-160). ACM Press.

Marshall, P. (2007). Do tangible interfaces enhance learning? *Proceedings of the First International Conference on Tangible Embedded Interaction* (pp. 163-170).

Raffle, H., Vaucelle, C., Wang, R. & Ishii, H. Jabberstamp (2007). Embedding sound and voice in traditional drawings: *Proccedings of IDC Interaction Design and Children 2007* (pp. 137-144). ACM Press.

Rosenbaum, E. & Silver, J. (2010). Singing Fingers: Finger paint with sound: *Proccedings of IDC Interaction Design and Children 2010* (pp. 308-310). ACM Press**.**

Rosenberger Shankar, T. (2005). *Speaking on the Record.* PhD Thesis, MIT Media Laboratory, Cambridge, MA.

Scaife, M., Rogers, Y., Aldrich, F. & Davies, M. (1997). Designing for or designing with? Informant design for interactive learning environments*: Proceedings of the CHI 1997 Conference on Human Factors in Computing Systems* (pp. 343-350).

Scaife, M. & Rogers, Y. (1999). Kids as informants: Telling us what we didn't know or confirming what we knew already? In A. Druin (Ed.), *The Design of Children's Technology* (pp. 27-50). San Francisco, CA: Morgan Kauffman Publishers.

Topping, K. (1992). Cooperative learning and peer tutoring: An overview. *The Psychologist, 5*, (4) (pp. 151-157).

Zuckerman, O., Arida, S. & Resnick M. (2005). Extending Tangible Interfaces for Education: Digital Montessori - Inspired Manipulatives: *Proceedings of the CHI 2005 Conference on Human Factors in Computing Systems* (pp. 859-868). ACM Press.

Wood, D., & O'Malley, C. (1996). Collaborative learning between peers: An overview. *Educational Psychology in Practice, 11*, (4) (pp. 4-9).