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New active tools for supporting narrative structures

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Abstract

Constructing stories is a type of playing that involves mobilizing the storyteller's imagination and finding original ways to convey narrative intentions. When a child invents a story, there is a natural interaction with the local environment and the use of various means of expression. We adopted a user-centered approach to design POGO, a playful environment which utilizes the child's physical environment and sensory modalities. Pogo is a system of active tools that enable children to create stories by connecting physical and virtual environments. By providing children with the possibility of capturing and manipulating images and various media, and combining them in sequential form, Pogo triggered new strategies in the construction of narrative logic, time and space, in the construction of the episodes and in the visual narration.

Keywords: *narrative structures, active tools, ubiquitous games, invisible computing, user-centered approach.*

1. Introduction

Constructing stories is a type of playing that involves mobilizing the storyteller's imagination and finding original ways to convey narrative intentions. When a child invents a story, there is a natural interaction with the local environment. The activity involves implementing various means of expression. Whether in class or out, the object is to invent a story based on observations of the seasons, develop a comic situation involving two people or to touch an object collected during an outing. Through storytelling children learn to express themselves and make sense of the external world. As Bruner (1996) points out, developing narrative skills is for children the privileged and primary way to enter in the culture.

New technological tools are being marketed to help children invent stories. However, these tools impose structured interactions that limit both spontaneity and interaction with the environment. We used a user-centered approach to design a new environment. It is playful, educational, and utilizes the child's normal physical environment and sensory patterns (Rizzo et al., 2001; Saudelli et al., 2000). The first step in this approach consisted of investigating the use of existing storytelling aids for six-to-eight year old children and observing how these aids provided support for the children's imagination. The second step involved investigating how children used the physical media in their interactions, and finding the best way of using new and appropriate tools to support storytelling.

This was the basis for the design of an environment called POGO¹. The aim was to produce a virtual story environment and help children to utilize their many modes of

¹ The POGO Consortium: Philips Design (project coordinator (NL), University of Siena (I), Domus

expression. In the end, we evaluated the impact of this new environment on storytelling, and in particular on their narrative structures, taking into account the oral components of the story, the visual characteristics and their segmentation in terms of time, logic and space.

1.1. Information technology in storytelling

Computer mediated tools are increasingly present to support children narrative experience. However, few environments satisfy user expectations in the areas of spontaneity, stimulating imagination and interaction with the environment. In particular, these tools hobble narrative structures with rigid constraints in terms of characters and the flow of the story (Ryokai & Cassell, 1999).

We examined some of these environments, particularly CD-ROMs available on the market. We tried to understand the reasons for their very limited acceptance. Our first observation is that children rapidly lose interest in these types of systems, which sometimes lack the aspect of “playing a game“. Our second observation was that the children cannot really construct stories. In reference to the theoretical framework of Vygotsky (1998) concerning the laws of creativity and imagination in games and in narration, we observe that these systems significantly limit user creativity. They do not allow the child to use his prior experience. Choices are limited (characters, objects, scenery, etc.). The same is true of the animation possibilities (movements and actions of characters, etc.). There is no possibility of introducing new experiences into their predefined narrative environments. The child has the possibility of selecting and/or combining preestablished background modules, and is given a range of predefined behavior patterns for the characters. Sensory modes are also limited to the visual and auditory features built into each system. For example, the child can arrange parts of the background, and can add music or select a preestablished sound track (preprogrammed, coordinated sounds and movements, such as characters hitting each other, mocking one another, etc.). The result is a deeply entrenched channeling of the child’s imagination, which soon engenders frustration and aggravation with the stereotyped limitations of the characters. This type of experience does not stimulate the child’s imagination: the limited range of possible actions restricts the child to moving the character from one place to another (even with this feature, problems are encountered: a child who wants to make a phantom fly, places this character in the sky; since the top of the screen is not designed for this purpose, the display shifts and the phantom ends up down at the screen level where it started). These systems do not encourage children to use their own experience to develop new stories. In general, the only possible stories are those that exist in the program. There is no support for personal expression. For instance, the child cannot draw his own characters and use them as parts of the narrative. In addition, these systems are not designed so that groups of children can produce stories together, and therefore they do not engender social interactions between children. By confronting the child with a restricted space in front of a screen and by inhibiting social interactions, they make it impossible to produce collaborative and co-located story construction. Even the possibility of sharing the finished story with other is seriously limited. As shown by Mandryk & Inkpen (2001), this type of game eliminates the social features of traditional open-ended games. In

Academy (I), University of Liege (B), Ravensburger (D), Cryo (F).

short, this type of tool neither stimulates the imagination nor does it enable the child to develop the narrative skills that are essential at this age.

The work done by various researchers in recent years Druin & Solomon (1996); Steiner & al. (1992) witnesses a growing interest in the possibility offered by new technologies to enrich story building activities. Several research projects are attempting to build technologies that encourage children's creativity in open-ended ways and peer collaboration.

The Kid story project aims to encourage spontaneous children collaboration. Technologies are based on single display groupware, which implies that several children interact with a single display using multiple input devices (Benford et al. 2000). Using Kidpad, a 2D drawing tool, children build stories by moving between different parts of a drawing, by creating links and zooming between pictures and scenes, therefore allowing the development of non-linear structured stories. A second tool called Klump based on an amorphous 3D object can be used by two or more children at the same time and is intended to be an improvisational tool to help generate ideas in the early stages of story development.

As Kid story, the Narrative toys project at the Interactive Institute in Malmö aims to develop toy concepts that support collaborative narrative. The aim of the project is to develop innovative toy concepts using physical objects augmented with digital media. The authors intend to develop a series of toy prototypes which view play as a space for "narrative processing". StoryMat (Cassell & Ryokai, 2001) is a tool to encourage collaborative storytelling through children fantasy play. It includes a soft play mat with appliqued objects such as houses and roads and provides a play space for children to tell their own stories. The story told by a child is recorded and then compared with other stories told by children previously. One of the past stories sharing a similar pattern with the present one can be recalled on the mat. The fragments of these previous stories can inspire children to pursue new stories in their own way. A previous story can be interrupted at any point and given a new ending. The philosophy of StoryMat is to capture children's everyday stories as a way of supporting children collaboration. The environment generates opportunities for children to listen and to interpret each others' stories even in the absence of other children. Children playing together on the mat have access to more stories from other absent children. According to their authors collaboration among peers is exploited to foster creative storytelling on StoryMat.

The POGO environment has similarities with those projects but differs from them as well. The POGO environment enables children to create stories by connecting the physical and virtual environments thus by interfacing the virtual story world to active tools. Children can use the active tools to create and manipulate the story elements in a physical way. The virtual story world integrates everyday objects with digital media. Therefore the environment relies on the child's physical environment and sensory modalities.

1.2. Developing narrative competences

Narration enables us to develop various capabilities, but it is also the opportunity to play a game that combines a number of sorts of expression. Our numerous observations on narration mechanisms of 6 to 8 year olds, inside and outside of school, have showed us that children use a wide variety of means for constructing stories (Decortis & al. 2001, Cioni & al. 2000, Decortis & al. 2002). While most narrative activities are centered on verbal production, the story is often enriched with other media, such as drawing, theatrical staging, but also sound, music and body expression. In school, the

acquisition of narrative skills provides children with the means to express themselves and successfully accomplish their storytelling intentions. One of the criteria for evaluating the acquisition of this skill is the capacity to use these various means of expression to structure story contents.

Narration can be envisaged in various ways. On one hand, we can focus on the process of story construction, on what we have called narrative activity (Decortis et al. 1999). Or we can focus on the product of this activity, i.e. the story as such, which is characterized by a story's structure. We thoroughly studied the design of the new POGO environment in terms of story construction by a group (Decortis et al. in press, Sanchiz, 1999), and in terms of using multiple means, both of expression and of modes of perception (Polazzi, 1999; Castelli & al. 2001).

However, we believe that it is also important to analyze the narrative product and the impact of such tools on the structural organization of a story that is made up of a variety of means of expression (e.g. text and pictures), and how these means are put together. In our point of view, a better understanding can be achieved by anchoring our analysis in two concepts: the way in which narration expresses logic, time and space (Bordwell, 1985) and the visual dimension of narration (McCloud, 1999).

2. Active tools to support narrative activity

It is a challenge to develop an environment composed of active tools capable of enriching the structural organization of a story. This is true from the early phases of analyzing user expectations, and on through the phases of designing the new tools.

2.1. Developing recommendations

To get around the limits described above, we compiled a list of the characteristics that teachers, adults and children expected from these new aids. Among these expectations is an essential feature of any new narrative aid: the children must be able to create the elements they use in their stories. Creativity cannot be limited to constructing a story out of components preselected and predefined by the aid. The new environment must be able to arouse the children's enthusiasm and increase their creative possibilities. It must also enable groups of children to introduce their own productions "into" the tool therefore enabling to use objects from the physical world into the virtual world (record a personal context, the children's own documents, drawings, photos, characters, music, and the tools functions should enable the children to associate these various components and use them in original ways), as well as being able to process them, handle them, modify them and even combine them with predefined components. The tools must be easy to use without any particular technical knowledge or skills, particularly in terms of editing and arranging story sequences. Another important aspect is that they have to help to structure the story, i.e. by enabling the user to visualize all of what has been done up to a given point, in order to evaluate the direction and development of the story in progress. In addition, the environment should not limit the size of the story. The child should be free to construct a story, with no restrictions on length. The child should also be free to create freely and spontaneously, with no rigid predispositions concerning the narrative components. These are the priorities that served as the basis for formulating a set of questions. The responses to these questions guided the design of the system's potential for oral and visual expression.

2.2. Narrative logic, time and space

Narration can create various types of structural organization (“syuzhet“ or storyline, i.e. the way events are organized) and formal organizations (the “style“ or the techniques used to construct a given syuzhet) for the same linear sequence of events (“fabula“). The relationship between these three systems is governed by the three organizational principles, namely logic, time and space (Bordwell, 1985; Eco, 1996). For example, the syuzhet organizes the events of the fabula in a certain order, assigning a duration to each event and presenting it a certain number of times. The logic of the story can also generate causal links between events, and the storyline can provide more or less precise clues to the space in which the event takes place. Bordwell posits that the style may vary when different media are used (e.g. through the framing or editing). An interpretation of the situation may be delayed or obscured by concealing a part of the set, or by postponing a fundamental sequence.







We asked ourselves if it were possible to develop new sorts of story organization using the POGO environment. Would POGO engender new ways of assembling a set of events, of perceiving these events in space and time? Would we witness stylistic changes? Our objective was then to analyze if and how POGO’s possibilities for combining different channels of expression would be reflected in the causal, spatial and chronological means used by the children to construct their stories.

2.3. Closures and visual dimensions of narratives

We thought that the new POGO environment, with its active tools and capabilities for breaking down, or segmenting, the visual representation of a story in a varied and comprehensible manner, would become an important aspect of the narrative.

By referring to the classification drawn up by McCloud (1999), we can see if POGO is capable of transforming this capacity for segmentation, and if so, on what type of closure? Are the majority of transitions made up of closure in terms of “action-to-action”, a common approach used, for instance, by authors of comic books? Does the tool favor this type of production, with its linear sequences of cause and effect, or does it favor larger leaps in time and space (“scene-to-scene”)? Can we observe the links of subject within a single situation (“subject-to-subject”), which necessarily implies weaker logical links between two scenes?

When children use POGO, do they produce links that are uncommon in Western narration, such as “moment-to-moment” or aspect-to-aspect”, that provide for juxtapositions of different points of view on the same scene, mood or idea?

	De Moment à moment L'enchaînement fait très peu appel à l'ellipse
	D'Action à action Un même personnage est représenté dans une progression
	De Sujet à sujet Un changement de focalisation à l'intérieur du même thème. Cela nécessite d'établir des rapports entre les cases pour que leur suite ait un sens.
	De Scène à scène Les cases ont des contenus très éloignés dans l'espace ou dans le temps.
	De point de vue à point de vue Evacue la notion de temps, et promène le regard sur différents aspects D'un endroit, d'une idée, d'une atmosphère.
	Solution de continuité Deux cases sont juxtaposées sans aucun rapport logique entre elles.

Les ellipses définies par Scott McCloud

3. THE POGO environment

3.1. Active tools description

The POGO environment has been conceived of as a virtual story world, accessible through a number of interactive physical tools distributed in the environment (Rizzo et al., 2002). The active tools are the main interface to the narrative process. The functionality of the tools span over many areas, gestural (live performances), visual (manipulation of images and drawings), aural (sounds and atmospheres), manipulative (physical feedback) and material (physical objects). Although the system is computer-based, the standard computer interface of keyboard, screen and mouse has been replaced with a far more intuitive one. The interaction is very simple so that children can begin to play with no need for instruction.



Fig. 1. The Pogo tools (from left to right, the beamer, the cards, two mumbos, the settings, the voice tool, the recorder/reader, the camera tool, the background composer, the colour tool and finally a picture of the entire environment with children playing around.

The POGO environment has been developed to support fluid ways of building narratives. It includes: The Settings, a silver mat surrounded by leather cushions and various tools. The mat is a tissue screen to project images. However, it is possible to project images everywhere in the physical environment, including the children's body. The Beamer, a threshold tool which connects the real and the virtual environment by allowing the passage of physical things into the virtual story world. The Beamer captures new story elements like real world objects (including the children) or live video. It is a base unit integrating a video camera, a Card reader, and a composition area. In the composition area drawings can be positioned, objects can be placed and collage can be created. The camera can be used both to capture these elements as a simple, live video mode where the images are directly projected on the walls. Indeed raw materials (produced or found by children) and affective objects (a puppet or a flower found in the school's garden) can be imported into the virtual story world, becoming an element of the story. The child can scan even his own image and become a character of the story. The Beamer is designed as a table with a screen built into it. When the child touches the screen, it makes different noises. When the child puts an object on the screen and presses the button on the side it is possible to take a picture of whatever is on the screen. The picture then appears on the table and the child can add to it by drawing with fingertips in different colors. Using the table and the screen, it is possible to make as many pictures and characters for the story as wanted.

The Cards, easy to use interfaces to the digital world based on tag technology. Common objects can be defined and associated to virtual correspondences by storing the image or sound of an object into the Card. The Cards are media to exchange physical carrier of story elements like sounds, pictures and video clips. They are a "memory" of story elements that can be associated to real-world objects by physically attaching the card on drawings, clay models or toys. Cards contain a unique ID tag and are used as physical pointers to Virtual Story World elements. Whenever the card is activated (inserted in the silver mat) it displays the corresponding image or sound. When the children pop a story card in the slot on the table and press the record button, the pictures are stored on the card. If a child places a card in one of the pockets on the side of the silver mat, the pictures on the card are displayed as a background. If a child puts the story card into one of the mumbos, whatever's on the card is shown on the mat in front of the backgrounds.

The Mumbos, are tools to control foreground elements on the screen. Through the mumbos images can be animated (moved) and modified. If the mumbos are rolled, the image stored in the card contained in the mumbo moves in the direction of the roll. This is a way to change and animate the background of the story. The Sound Twister allows to activate sounds by inserting a sound card into the mat.

The Voice tool allows users to insert their voices into the story. A controller allow to record and modify these voices. Children can speak in strange voices and can add echoes and noises. The Recorder/Reader allows to record and display story scenes. When introducing a card in one of the Recorder/Reader side, the scene is recorded in real time, when inserting the card in the opposite side of the Recorder/Reader the recorded scene is displayed.

The Camera Tool allows to record live video which can be stored in cards and displayed together with the other elements and characters. A controller allows to adjust the image size on the screen and to take photos which can be inserted in the background. The Background Composer is inserted in the mat and allows to insert up to three cards to create a hierarchic background. Dropping Cards into the Background Composer activates background images and/or related sounds in mixed media

combinations. Background images can be created by children (drawings, collages, composition of elements picked from the real world) or maybe selected from a database. The Background Composer provides a continuous output, so even if there is no Card in it, a live video image is shown as background. In a sense, the live image allows children to “perform” a story in the real world on a virtual background. The Color Tool comprises four buttons to change the color of the background of the screen. POGO active tools have been tested in classroom in order to identify their actual impact on narrative activities and to evaluate the environment’s conformity to the user requirements.

4. Methodology

Our methodological approach aims at understanding the way that narrative activities are carried out by children age six to eight, to derive recommendations to the design of the Pogo tools and to evaluate the changes brought about by tools.

Our prime objective was to understand how narratives are produced by children in the classroom in two schools in Belgium and Italy. This iterative cycle of analysis of design and testing was filtered through analytical and design criteria derived from observation in the classroom.

A set of thirty pedagogical sequence was observed. Each pedagogical sequence lasted an average of two hours. Each of these pedagogical sequence was filmed in video. The observation and capture of video data was carried out by two observers. Two stationary digital cameras and one mobile digital camera were used. The stationary cameras were placed on tripods on either side of the Pogo instruments, to provide uninterrupted filming of the activity . The observer used the mobile camera to film selected dialogues, interactions between children or particular uses of tools. Choices were made on whether or not to film a particular aspect of the pedagogical sequence, to focus on the activity of a number of children, or on the interactions between one or more children and the teacher. The researchers did not intervene during the pedagogical sequence, except when a problem arose with tool use, and then only to provide additional information on its use. The observers’ presence in the experimental space does not seem to have disturbed the children, who rapidly ignored their presence.

When the narrative activities were finished, a meeting was held with the children and with the teachers. This enabled us to gather their impressions, comments and criticism concerning the prototypes, their use and their impact on the activity, and particularly on the changes introduced by the tools in terms of group dynamics, and structural parameters.

Each observation was transcribed. The data transcribed describes the child’s narrative production, the verbal interactions between children, the behavior and movements of the children, individual and group activities. The data also illustrates the types of tools used at different stages of the activity. An example of narrative will be given below. In the “Castle invaded by witches”, everything began in class with the creation of a scene on a sheet of A4 paper and cardboard silhouettes, cut out and attached to straws. These elements became 2-dimensional marionettes. The children took a little while to understand how to have their character play roles on the beamer, and to improvise dialogues to make up their story. At the end of the story, it was already time to recount it to the half of the class that did not participate in the Pogo activity.

5. Impact of the POGO environment on narrative structures

The evaluating phase foregrounded several interesting emerging properties of the stories produced by children with the Pogo tools and in this paper we focus on the analysis of the narrative structures as a dimension for the evaluation: in which way the use of the Pogo tools mediates the structuring of the story content.

As we observed at school, children have traditional tools used typically to represent the story events and their relationships by using verbal language (oral and written) and, sometimes, by drawing illustrations. Stories produced by children using conventional procedures mainly consist of a brief written text occasionally combined with a drawing. This product represents a more or less descriptive episode of the story, the characters or may be a more or less abstract and decorative illustration. It is uncommon for 6-year old children to be able to construct a complete story, in Labov's sense of the term. According to the teachers, narrative production in this age group consists of the "beginning of the story, describing the situation, characters and action". Then the child gradually learns to better organize the narrative. In higher classes he/she will learn to build more structured narratives and "properly formed stories, with a beginning, middle and end".

During the evaluation, the POGO tools have been used to support different narrative activities involving small groups of children aged from 6 to 8 years (Fig. 2).



Fig. 2 Two moments of the testing: children, grouped around the beamer create a scene and observe its projected image.

From the analysis of the stories produced we identified a number of emergent stylistic strategies triggered by the Pogo tools. In the following paragraphs we describe them by focusing on the positive impact of the tools and on the opportunities for further improvement.

5.1. Logic, time and space

In all the stories narration is segmented in separate units that we called scenes. A scene is composed by an image comprehending background and foreground elements associated with a brief oral text, and represents an episode of the story



1a I am gonna tell you the story of a castle invaded by witches and ghosts....



1b "Hi !" – "Are you coming for the castle ?" – "yes !" – "–,Let's go I'll show you the way"



1c – "Which message brings you to me today ?" – "A very important message" – "What is it about?," – "About the castle, it is invaded by the prince, princess, king, queen, horses, all their stuffs....," – "we have to prevent them, it is our castle..."



1d – "Ah ! looks at the nice castle". . . – "Let's go and visit it"



1e In the cave of the witch. . . – "People have invaded our castle !" – "We have to impede them" – "Let's cast a spell on them..."



1f "I have an idea" – "What ?" – "We should cut off their head"... – "oh ! no - ", I suggest to give them a bewitched treasure..." – "Good idea !"



1g The little princess with her bodyguard is getting near the treasure, touches it and faints



1h "I can get you rid of the witches and ghosts which are haunting your castle" – "But what can we do ?" – "You need to push on the witch in a lake..." – "OK !" – "With all these damned ghosts !"



1i Here is the fate which comes to deliver them She tells them that there is only one cure : to push on the witch into the lake, like that she will disappear with all the ghosts



1k This was the story of the castle invaded by the witches. . .

Narrative 1. The castle invaded by the witches.

The use of the scenes as narrative units distinguishes Pogo stories from traditional ones in two main respects:

Visual language: With respect to the activities carried out without the tools, the use of the Beamer created an affordance to the visual organization of the story content. Building a scene required children to think about how to arrange the story elements (background, characters, objects, etc) in order to create a coherent representation of the event.

In addition, the possibilities offered by the tools enables the users to assemble pictures from various sources. These include drawings (in narrative 2a-2b-2l-2m, a red heart is superimposed on an imaginary love story involving the founder of the school), photos (e.g. old photos of the school, which were used as support for the invention of an imaginary history of the school), scenes of narrative content acted out by the children (using the camera – fig. 3a), and voices (with the narrator recounting the main stages of the story – fig. 3b).

By triggering a reflection on the composition of the scene, the Pogo environment supports the visual organization of the narrative content.

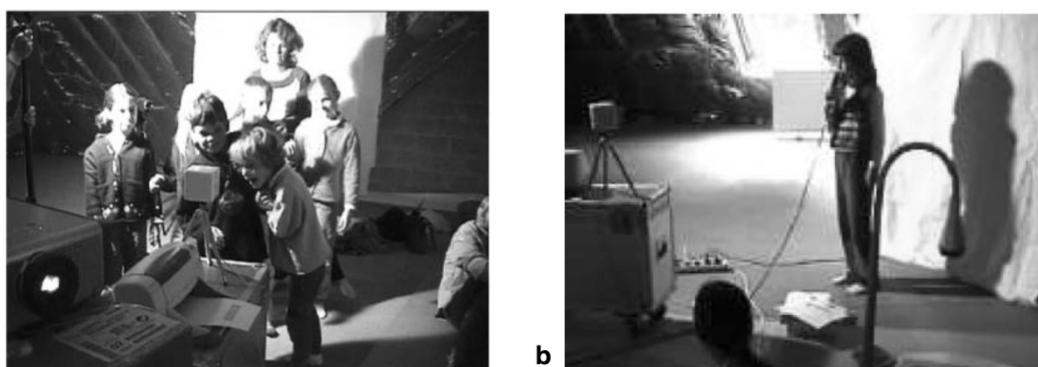


Fig. 3. Scenes acted out using the camera (a) and narrator (b) recounting some parts of the story.

Content structuring: according to the teachers, the use of the cards facilitates children in structuring the story content. Recording the scene require in fact to segment the story-line, identify a pertinent narrative unit and connecting it with the previous and following ones. In this respect Pogo is a support for the development of children' ability to organize story material in a narrative structure.

5.1.1. Temporality

The use of the Pogo tools supports children in the temporal organization of the story and trigger creative solutions to manipulate the events' chronological order.

Sequentiality. By affording the scene to scene segmentation of the stories, POGO supports the chronological patterning of the narrative content: in all children' productions the order of the scenes reflects the chronological order of the events.

Non-linearity. At the same time the Pogo tools support non-linear representations of time within the scenes. Children exploit the functionalities of the camera and mumbos to manipulate the narrative sequence: to build flash-backs and flashforwards they superpose to the scenes representing the current situation small scale images of previous or following events. The same example illustrates also a manipulation of the narrative frequency : through flash-backs and flash-forwards the same event is presented several times.

Time localisation. The possibility to combine different medias allows to situate the story in different periods of time, starting one hundred years earlier (in the below narrative 2, children start their story by presenting their protagonist a long time away

in the past). Children play a scene to record the events that took place according to their imagination and add a drawing (“she finds in the forest a beautiful house...in ruins”) to reinforce the dream character of the scene. A combination of both the old photo and the drawings is also created by children when they superimpose an old photo of their protagonist (Amélie Hamaïde) into a drawing representing the school in ruins.

Once upon a time, there was our school. Amélie Hamaïde has been very unhappy at school and when she became adult, she was still unable to write and read properly. She reads the newspaper’s classifieds and finds a place as cooker in Dr Decroly house. Miss Hamaïde cooks for Dr Decroly. She is happy and Dr Decroly thinks she is nice.

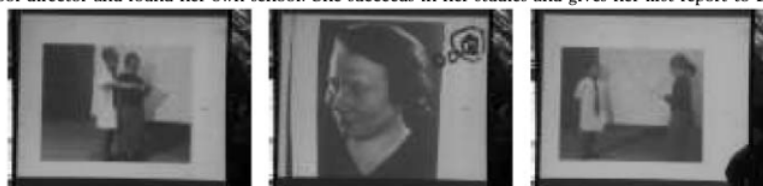
«I, Dr Decroly, asked to Amélie to come cooking in my school. I think it will be better than pocket lunches »
In a first time she doesn’t accept because of the bad memories of her childhood at school but finally she accepts.



There, she discovers a very special school where children do modelling, music, painting, where children observe nature and animals, do theatre and basketry.



Amélie wants to start studying again and Dr Decroly wants to help her. Amélie makes a dream. Guess which dream? She wants to become a school director and found her own school. She succeeds in her studies and gives her first report to Dr Decroly



And what had to happen happenedSome years later they have about ten children ; it’s normal , cause they love children . She doesn’t forget her dream and wants to found a school next to the Dr. Decroly school.



She finds in the forest a big beautiful house, which is unfortunately in ruins.
Firstly she does babysitting to make some money. She finds some good workers



Thanks to their help the new Hamaïde school became a real paradise that will welcome a lot of children.



Narrative 2 : Amélie’s dream (a story invented by children about their school founder : Amélie Hamaïde)

5.1.2. *Spatiality*

By supporting the visual construction of the story, Pogo enhance children's opportunities to represent the space where the events take place. Building a scene requires children to imagine and design a story space, to position characters and objects and to create relationships among the story elements.

5.1.3. *Causality*

Classic narrative structure. The Pogo tools facilitate children in building causal links among the events. In the stories they produced the action is segmented according to a classic patterning : transitions from scene to scene articulate the progression of characters' action or scan spatio-temporal shifts. According to the teachers creating a visual representation of the events and recording it in a card, facilitate children's memorization of the storyline and improve their ability to build a coherent causal chain.

5.2. *Visual narration: linking scenes*

The types of links found in the children's stories are predominantly "action-to-action". That includes all links in the story "the jungle" and three out of nine in The Castle Invaded by Witches. "Scene-to-scene" links occur in the first story (e.g. 1b-1c; 1c-1d; 1d-1e; 1g-1h). Other links are uncommon: "subject-to-subject" links and "moment-to-moment" (in one narrative the awakening of a witch is portrayed by two images of the character, one with eyes shut, the other with eyes open). There are no "aspect-to-aspect" or "non sequitur" links.

It is interesting to point out that the first story has a number of cases where pictures indicate an "action-to-action" transition, while the text suggests a change of venue, and consequently a "scene-to-scene" transition (3e-3f; 3h-3i;). This ambiguity resides in the use of the same scenery for different locations, or more precisely, for different areas of the same location. In this story, the characters cross a jungle where there is no change of scenery.



3a The story is happening in the jungle. In the jungle, a monkey and a leopard walked around



3b They quarrel because they want the same prey



3c The leopard bite the monkey's tail the monkey loose his tail



3d The leopard feels guilty and tells the monkey that he has to go and look for the magic flower



3e The monkey goes to look after the magic flower



3f The monkey has to eat the flower' petal which fits his tail colour



3g The monkey recovers his tail



3h The monkey thanks the leopard. They celebrate and the leopard shares his prey.

Narrative 3. 'The jungle'.

6. Concluding remarks

In this research our design challenge and scientific concern was to create interfaces and active tools to fit the narrative activity in a transparent and natural way and to create a concept of situated or ubiquitous editing. Our objective was to anticipate the impact and major changes of distributed tools on children narrative experience and structuring of stories. Through the evaluation of the Pogo active tools we have seen that there are many patterns for structuring activity when distributed instruments are introduced including group dynamics and the structuring of the narrative (Decortis et al. 2001). The children's experience has been enriched in both quality and quantity with the possibility to record and use sound and movement in their narrative creations. In terms of the group, the narrative has been improved by diversifying the tools used

to create content. The introduction of a number of new instruments for simultaneously capturing, manipulating and combining pictures and sounds increase the participation of all children in the construction of story content. Simultaneous use of tools also permit the introduction of a more personal dimension into the narrative: each child can simultaneously take part in the group creation and make his/her personal contribution, as desired. In terms of structuring the narrative, the system seems to support and even improve the organization of the story. We esteem that developing tools in the sense of more open patterns of use to enrich the children's potential for expression was required. In practical terms, factors which contributed to this line of development were: (a) a mobile camera with zoom, with the possibility to zoom in for close-ups on parts of the scene, and a mobile camera that could take photos from different viewpoints. These improvements offer the children the opportunity to develop visually richer and more varied narrations. For instance, they focus on a character's face or change the camera angle so it corresponds to the viewpoint of a character, etc. (b) the introduction of sound into narratives enhance the potential expression achieved with Pogo : the children's characters could have voices, dialogues could be improvised, soundscapes reproduced, etc.

Our results also indicate that use of these instruments appears not to interfere with the activity, and that they integrate into existing instruments. The Beamer, for example, becomes a workbench. We also found the spatial distribution of these instruments interesting. The use of cards and slides goes in the direction of possible incorporation of mnemonic units into physical objects, and using them in a spatial dimension (possibility to transport them and reuse them in another spacetime frame). Information handling is enlarged in spatial terms and is consequently no longer limited to a central processing unit. The instruments seem to us to be headed in the same direction of distributed creation, the creation and recording space being integrated into the context of handling and constructing natural objects from the children's physical world. These points seemingly indicate a movement towards invisible technology, where any central processing unit stays out of sight and out of mind for its users.

As shown by the testing' results, the use of Pogo triggered new strategies in the construction of narrative logic, time and space, especially at the visual level. By providing children with the opportunity of building and manipulating narrative scenes and to organize them in a sequence, the system seems to support the development of their ability to create stories through different media.

Finally the Pogo active tools thanks to their functions, potentialities and forms encourage the collective creation. We have seen that the tools encourage exploration, inspiration, production and sharing of stories (Decortis et al. 2002).

For instance as with traditional activities, children are encouraged to rethink the original experience, to list its constituent parts and to express them verbally or graphically. Pogo offers new instruments to encourage thought and choice : - the possibility to combine and recombine elements on the Beamer table, and to display the result on the screen in real time, - to facilitates experimentation and comparison of different solutions; - screen displays have an amplifying effect that facilitates perception and information sharing (Scott et al. 2002). The tools support also both personal reflection and intersubjective comparison. The children's production ideas, the monitoring of their own production and the productions of other children become a support for their discussion and group decisions. The tools help the children to think and analyze their own experience and to construct the narrative in a coherent and well-structured manner, to amplify and enhance the moment when narrative products are combined. Therefore the creative process is shared by the class, which becomes a

fundamental part of the process. For instance we have seen that the children insisted on “redoing” the story for themselves, and also wanted to present the story to children who had not participated in the production.

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