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► **To cite this version:**

Fusai Claudia, Berthe Saudelli, Patrizia Marti, Françoise Decortis, Antonio Rizzo. Media composition and narrative performance at school. *Journal of Computer Assisted Learning*, 2003, 19 (2), pp.177-185. hal-04305614

HAL Id: hal-04305614

<https://hal.science/hal-04305614>

Submitted on 24 Nov 2023

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Media composition and narrative performance at school

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Abstract *POGO* is a distributed learning environment that allows children to create stories by connecting physical and virtual worlds. The environment is composed of several interactive tools that children use to compose, edit and perform stories. Together with teachers, five pedagogical objectives were defined as goals to be achieved in narrative. The pedagogical objectives drove the entire *POGO* design process and constituted a solid reference for the different evaluations undertaken during the project. This paper, after a brief introduction and a presentation of the *POGO* world, illustrates how the interaction with the *POGO* Tools supports the fulfilment of the pedagogical objectives.

Keywords: Audio, Video, Constructivist, Mediated, Distributed, Ethnographic, IT-use.

Introduction

The introduction of computing and interactive media into the classroom in the late 1980s promised to enrich the learning process. But the benefits that it brought had little to do with telling stories. While computers may help children with analytical skills as calculation, they seldom stimulate their imagination, helping them to be creative. The concept of storytelling is personal and creative as opposed to existing computer-book combinations which, simply tell, or allow the user to choose from pre-designed options. Kafai (1996) in her article 'Software by Kids for Kids' states that '*. . . much instructional software functions as enhanced page turning devices displaying information to be learned and monitoring students' progression. There are few opportunities for children to go beyond button-pushing and mouse-clicking in their interaction with technology.*' Similarly Bruckman *et al.* (1996) in her article 'Pianos Not Stereos' expresses this problem of existing software: '*By learning to play the piano, you can become a creator (not just a consumer) of music, expressing yourself musically in ever-more complex ways. In the field of technology there has been too much emphasis on the equivalent of stereos and CDs and not enough emphasis on computational pianos.*'

These statements demonstrate that although educational software and educational technologies have become very popular in the last decade, the impact that these tools have on learning is not obvious. First of all, educational information technologies mostly coincide with personal computer technology, where multimedia

Accepted 15 January 2003

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applications promise an easier and less demanding learning process. However, this promise is questionable. Secondly, the desktop computer metaphor can be a barrier for learning. Students are constrained to a screen, their movements are restricted to mouse clicks, and sensorial interaction is restricted to passive visual and auditory stimulation.

It is necessary to recognise that the development of educational technologies calls for new interaction design approaches that overcome the limitation of the current technologies. One of the first who stated the importance of new paradigms for designing educational technologies was Papert (1980). Programmable LEGOS (sold commercially as LEGO Mindstorms) are an early example of physical manipulation of computing concepts. Mindstorms have a very broad spectrum of use. Their ultimate objective is to provide scaffolding as a helping structure to guide the user to build novel applications and gain knowledge and ability. Notwithstanding the effort of introducing new interaction paradigms with the LEGO kits, the whole process of building new applications is still subjected to an initial phase of writing code on a PC and then transferring the scripts to the bricks via wired connection. It seems that this aspect of computer-based interaction of the Mindstorms could be improved by a fully distributed environment and manipulation of physical interactive objects.

This is one of the key issues which was addressed in designing *POGO*. Inspired by the idea of learning through knowledge construction while being engaged in active building, a fully distributed environment was planned where children could build stories, form new knowledge about the world, reflect upon and share with others. The challenge in designing this new system was to envision a new form of interaction that encouraged creativity and co-operation for children aged between four and eight. *POGO* is an open environment conceived as a learning 'space' designed to complement traditional learning practices and tools.

The experience of designing *POGO* to meet five pedagogical objectives that were defined as goals to be achieved in narrative is outlined. First, there is an explanation for the focus on story building by outlining the importance of narrative for learning which includes the theoretical framework that inspired the design of *POGO*. Then the tools which form the learning environment are described and finally, the experience of using *POGO* in two primary schools is presented.

The role of narratives in learning processes

Narrative is considered by Bruner (1990) as a primitive function of human psychology, lying at the heart of human thought. The representation of experience in narratives provides a frame, which enables humans to interpret their experiences and one another. Through storytelling children learn to express themselves and make sense of the external world. As Bruner (1990) points out, developing a narrative competence is for children the privileged and primary way to enter in the culture. For Bruner, narrative is also a fundamental aspect of meaning construction, which is a negotiation's activity that starts in early childhood and characterises the whole of human life.

According to Bruner (1996) intersubjectivity, that he relates to interpretative activity, is the way humans come to know each other's minds. Analytical tools are not used to describe other's and our minds; mental activity is a 'mystery', not accessible to introspection. Through collaboration children can negotiate these inter-

pretations with others in order ‘*to achieve not unanimity but more consciousness*’.

The theoretical position of Vygotsky (1978) around the psychological processes of creativity and imagination is also taken into account. It is in this context that Vygotsky coped with the narrative phenomena. Vygotsky, 1998) opposes an evolutionist definition of creativity and imagination to the common sense definitions. The imagination is present in all — without any exception — aspects of cultural life, and it makes possible artistic, scientific, and technical creativity. Imagination is not psychologically opposed to reality but it is closely interrelated with it. Vygotsky argues that the creative activity of imagination directly depends on the richness and variety of previous experiences made by an individual, because fantasy’s constructions are composed of the material supplied by experience. Play, narrative, songs, theatre, pictures, and more in general art and science are expressions of the same phenomenon of combination of reality and fantasy.

The contribution of these authors, validated by teachers’ experience and knowledge, has led to the definition of five pedagogical objectives, which have all driven the *POGO* design process:

- expand as much as possible children’ sensorial experience;
- support children in developing emotional knowledge (e.g. empathy);
- allow them to embody and concretise the product of their imagination;
- support the child in building his fantasy and world model through discussion and co-operation (intersubjectivity);
- support co-operative mechanisms and reflection (metacognition).

The work done by various researchers in recent years (e.g. Steiner & Moher, 1992; Druin *et al.*, 1997) witnesses a growing interest in the possibility offered by new interactive technologies to enrich story building activities.

POGO aims at supporting the development of young children’ narrative competence by providing them with the opportunity to express themselves through different media channels. In accordance with the ‘invisible computing’ approach (Norman, 1998), the *POGO* consortium* designed a set of simple, distributed tools, that allows a seamless integration of the physical and virtual world through intuitive interaction modalities. The design challenge was to create novel interfaces for supporting narrative activities and interactive tools remarkable for their ease of use.

The *POGO* story world

The *POGO* environment has been thought as a virtual story world, accessible by a number of interactive distributed physical tools. The 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. *POGO* World comprises a series of tools:

The *Beamer* (Figs 1a, 1b, 1c) is a threshold tool, which connects the real and the virtual environment by allowing the passage of physical things into the virtual story

* The *POGO* Consortium: Philips Design (project coordinator-NL), University of Siena (I), Domus Academy (I), University of Liege (B), Ravensburger (D).

world. It captures story elements like real world objects (including children). It is a base unit integrating a video camera, a card reader and a touch screen. The *video camera*, located over the touch screen makes snapshots of any objects placed on it. The *touch screen* is the area where children deposit the objects that they want to import into the virtual story world. It can also be used with fingertips to draw freely or add drawing on the snapshot.

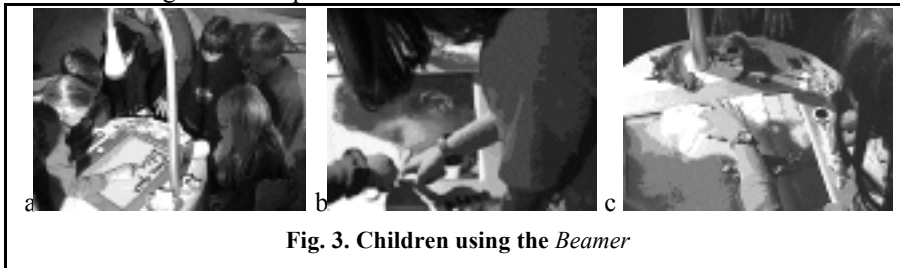


Fig. 3. Children using the *Beamer*

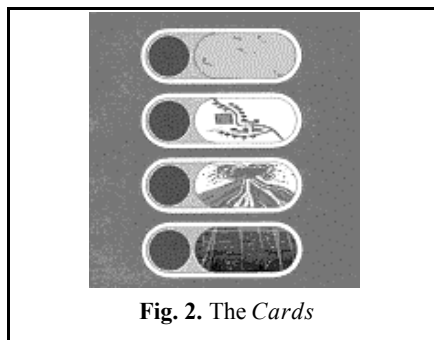


Fig. 2. The *Cards*

The *Cards* (Fig. 2 — shows some pre-registered background *Cards*: the desert, the village, the volcano, the deep blue) are based on tag technology and contain a unique ID tag. They allow storing and carrying story elements like pictures and sounds. Any physical objects can be defined and associated to virtual correspondences stored into the *Card*. The storage is performed on the *Beamer* while

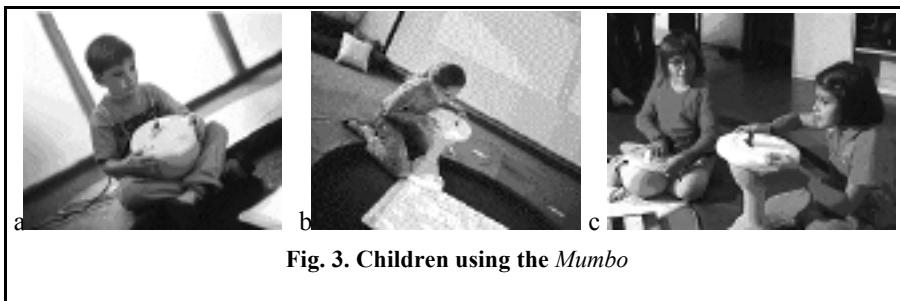


Fig. 3. Children using the *Mumbo*

the *Card* reading is activated due to other tools (*Beamer*, *FlexiScreen* or *Mumbos*) that display the corresponding image or play the relative sound hold by the cards.

The *Mumbos* (Figs. 3a, 3b, 3c) are tools that 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 foreground of the story. *The Mumbos* can have different shapes and controls, and children can even

define some aspect of the shape and of the controls.

The *Camera Tool* (Figs. 4a, 4b) allows to bring live video in the story composition (displayed on the

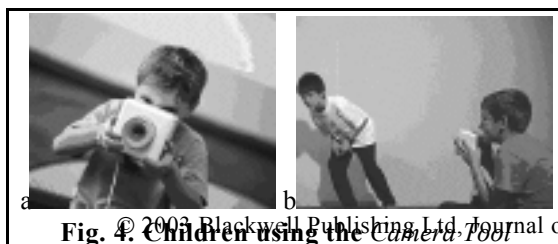


Fig. 4. Children using the *Camera Tool*

screen). A controller allows stirring the image, adjusting its size on the screen and taking snapshots, which are automatically presented in background.

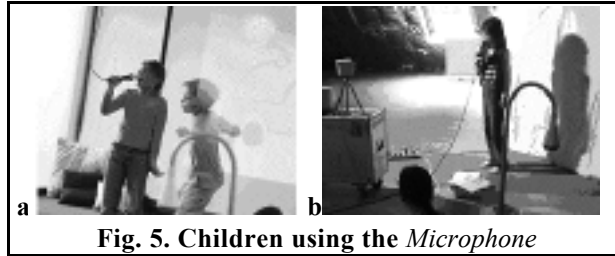


Fig. 5. Children using the *Microphone*

The *Microphone* (Figs 5a, 5b) allows users to add voices into the story.

The *FlexiScreen* (Figs 6a, 6b) is a mat designed with three pockets (allowing a multilayers

composition) that reads and allows the full screen projection (as background) of images hold in cards. The mat can be placed every-where in the physical environment, either laid on the ground or hanged up on the wall faced by a projector.

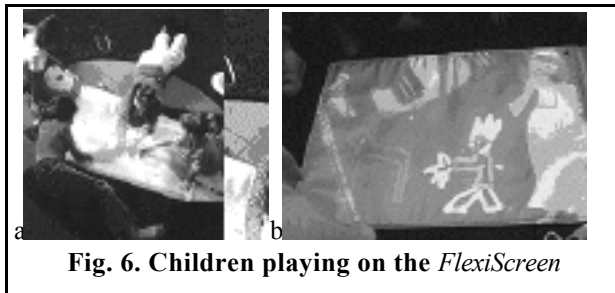


Fig. 6. Children playing on the *FlexiScreen*

The *Sound Carpet* (Figs 7a, 7b) is a mat with one slot and nine musical pads. The slot reads a sound card that produces in loop a thematic (e.g. the Card 'city' plays traffic noises) background sound. The pads pressure activates nine different foreground sounds related to the card theme (for the Card 'city', the foreground sound might be klaxon, car crash, people shouting, etc.).



Fig. 8. Children using the *Recorder/Reviewer* tool

The *Recorder/Reviewer* (Figs 8a, 8b, 8c) is a tool that allows the recording and display of a little video clip created when children combine and manipulate the story elements together. The introduction of a slide (large pill-like tool) into the *Recorder* side activates the automatic recording function of the system. When the slide is inserted in the *Reader* side the video clip is played.

Interaction and pedagogical objectives

Ideas inspiring *POGO*, as well as the final prototype, were submitted to a continuous evaluation process. Rather than performing formative and summative evaluation sessions, it was decided to constantly assess the outputs of the design process with teachers, children and colleagues. Formal evaluations were renounced in favour of a long lasting and qualitative assessment of the project outcomes. For example, high level concepts with teachers using storyboards, interaction aspects with children using cardboard mock-ups, and full-scale narrative scenarios with teachers and children using prototypes were assessed. The objective of this variegated evaluation activity was the iterative testing of *POGO* design from various perspectives, inter-actions, contents, fulfilment of pedagogical objectives and properties of enabling technologies. The testing of the final prototype aimed to understand if and how the technology fulfilled the pedagogical goals and how the transition from current pedagogical praxis was embodied into the praxis of the *POGO* design solution.

It is essential to consider *POGO* as a whole environment and the reference to the single tools is just an exemplification of the potentialities offered by the environment, but each tool can exploit its effectiveness only if used with the others. The discussion is grounded on the results of the narrative activity observations made in schools with the final prototype. The system was installed in two primary schools in Siena and Bruxelles. Intermediate prototypes and the final system were tried out for a total of four weeks in the design cycle of the system. However, all design concept and mock-up were continuously submitted to assessment by teachers and children.

Expand sensorial experience

The creative activity of imagination depends directly on the richness and variety of previous experiences. With this in mind, it is important to expand not only children's direct experience, but also their socially mediated interactions with the world.

Children can bring into *POGO* personal objects, intimate memories, photographs, etc. to be shared with others, and evolve them into elements of the narration. Especially through the use of the *Cards* and the *Beamer*, the environment supports the transition from everyday life experiences to the fantastic world of narration. Such opportunity affords the collection of different media like physical objects, sound and noises and transforms them in virtual objects creating a rich repository of elements useful for the story. In particular the *Beamer* stimulates children to store an experience represented by the object itself. Indeed *POGO* has a special feature of being smoothly 'compatible' with any traditional and consolidated educational technology available in the classroom.

Emotional knowledge

When teachers plan activities to develop and expand children emotional language, they often meet difficulties in finding the instruments that let children express their sensations, feelings and emotions. If children have different audio/visual instruments, which allow them to express themselves in a richer manner, they will be offered more chances to externalise their emotions. It is through the expression and the reflection on the externalised product, that they have a better knowledge of

themselves, their inner feelings and emotions.

Through the *Cards* and the *Beamer* *POGO* offers the possibility of having a large lexicon of sounds and images. This particular feature can constitute the alphabet through which children can build and then externalise their personal emotional language. Many instruments of the *POGO* world support the creation of expressive scenes and therefore let arise children's emotions. For instance, the effects given by some tokens connected to the *Beamer* trigger the creation of more expressive scenes realised with various techniques, or the peculiar interaction of the *Mumbos* allows a better identification with the characters or the object they manage. Indeed often, during the building of the story, the tool has 'disappeared' from the kids' hands and became an integral part of their body, allowing an identification process and therefore a way to express their feelings.

Moreover by the use of the *Camera Tool* children can effectively enter themselves in the story in a dynamic way: through an image or through a movie. Indeed to enter the scene, children preferred the *Camera* rather than the *Beamer*. When they used the *Camera*, they felt like actors of the story. Moreover the presence of the *Camera* stimulated kids to express their emotions not only through voice but also with their body, supporting them in the development of different expressive modalities (verbal and nonverbal language). Together with the *Camera* children often used the *Microphone*, through which they made some attempts to communicate the feelings of the character they were embodying by modulating their voice.

Externalise imagination

The *POGO* environment sustains children in the externalisation of imagination in the real world. The *FlexiScreen* is one of the most sharable places in *POGO*, where children can externalise the products of their creative imagination. As all children can see the projection on the *FlexiScreen*, individual productions can be shared with the entire class and enriched in real time by other classmates' contributions. Moreover the contemporary use of the *Sound Carpet* constitutes a clear means for the externalisation of character's feeling or to transmit the scene's atmosphere.

Intersubjectivity

The narrative form allows children to express their own theories of the world, to represent others' and to negotiate them. The strong involvement in the narrative plot and the characters' embodiment, made possible by the *Mumbos*, the *Microphone* and the *Camera*, develop children's capacity to enter into other minds and to broaden their points of view. Indeed to embody a character means to think its feelings, mood and thoughts, so developing their intersubjectivity skills.

Metacognition

POGO allows children to become more aware and conscious of the way they learn, think and organise experience and negotiate meaning by narrative. Several times teachers pointed out the necessity of having a sort of activity 'final product' to give children the chance of seeing the result of their work immediately and also to show it to others (classmates, teachers, parents, etc.). Due to the Recording/Reviewing System, children can instantaneously see and hear what they are producing and verify if it is exactly what they intended. The possibility of recording/replaying

children's productions, is a sort of living memory that reinforces the group spirit and supports the metacognition of the whole process. Indeed children, while seeing the scenes they produced, are supported in reconstructing the process that led to the overall story.

Conclusions

POGO's challenge was to design innovative technologies for children that should be attractive, fun, long lasting and yet offer sound pedagogical learning opportunities to be seamlessly integrated into the current context of European schools. So far, the results have been very encouraging. The *POGO* world does not replace any of the current tools that the teachers successfully use in their teaching practices, instead it empowers those tools and integrates them offering new opportunities. But the most important achievement of this research was the development of a system that supports pedagogical objectives in line with theoretical perspectives on narrative.

Indeed the *POGO* tools allow a rich sensorial interaction where physical and affective elements of children's reality can be explored, analysed, decomposed and recombined in new ways. The existing objects or the new one produced working with the different *POGO* tools can be captured by children and edited in real time. What a child builds or brings as a part of personal experience can be combined with the products of other children in a continuous negotiation process. In such a context the evolution of objects' transformations is recorded and the going back and forward along this process of meaning construction can be used as a way to understand other's point of view. Moreover the physical objects that are produced in an iterative and combinatory activity remain alive features of the process and can be used as the physical entity for the articulated production of future creative activities.

The *POGO* project advocated a design that was focused on children's and teachers' needs and grounded in thorough research into those needs. Its purpose was to provide a sustainable solution that could help children create and enjoy intellectually interesting activities. The project broadened the understanding of a design process founded on social and cultural values. Much was learned about ways of enhancing people's everyday experiences with technology built to meet human requirements, and insight into the social behaviours involved in the creation and sharing of information and stories was significantly increased. *POGO* presents a new 'type' of system, an open system. It is a kind of 'personality', capable of intelligent responses. Depending on how the system is used, *POGO* is a camera, a video recorder, a microphone, a display screen. *POGO* reacts to the user and adjusts its behaviour accordingly. It is open to change. While at the moment it supports children in building stories together, *POGO* offers many avenues of exploration. It proposes new ways of looking at interaction design and of enhancing electronic learning for children of all ages. Two issues, which emerged during the use of *POGO* in the schools, should be further explored.

The first issue concerns the production of new contents. Over three years of observation on narrative educational practices, it had been noticed that the media (drawings, objects, sounds, movies, etc.) play a role of affordance in content production. During storytelling children imagination is stimulated by the external elements they have in the environment. Indeed the materials and objects made available in the *POGO* stimulate children in proposing contents. The cotton becomes snow, the dry leaves are considered to represent summer and grass for

spring. Every single object being recordable becomes a potential story element. But *POGO* also introduces new modalities of content production. Children do not only propose content because of the available objects and material, but also because of the tool functionality. In the following example the manipulative functions of *POGO* allowed a child to propose an idea that concerns the behaviour of a character in the story.

Teacher: Did you position correctly the cow?

Child: The cow flies!! Then I fly too.

Teacher: Darling, let's go! Turn this cow.

Child: The cow is flying!

Moreover the use of *POGO* seems to be characterised by the iteration of the narrative construction. Each iteration is an object of a narrative complexification, because of modification, adjustment, re-iteration of the initial proposal. Often teachers used *POGO* to work again on something previously made in classroom; this re-elaboration of such products produced new and more complex contents.

The second issue concerns lifelong learning. '*The notion of lifelong learning captures the idea that economic and social development depends on human beings ability to learn new things beyond school — at work and in life in general*' (NGF, 1999).

Children learn in any environment — at home, at school and in the play area. Some environments support informal learning, while others encourage the acquisition of competencies through more formal approaches. Although learning occurs in a multitude of places, school is still seen as the primary environment for learning. Because of this supremacy, the interaction and integration between potential learning environments are often low. Therefore it is necessary to rethink traditional boundaries between the home, the school, the workplace and the recreation area. School should not be considered the only recognised learning environment. Children's learning takes place in so many places and so many ways that it is essential not only to recognise the importance of all learning environments, but also to integrate them in innovative ways. *POGO* supports the natural fusion between the different learning environments as children can bring at school any kind of personal or collective experience. Through the use of the *Beamer*, they can capture any object, sound, image taken from any kind of places in or out the school, to be shared with classmates and being naturally acquired and elaborated in the learning process.

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