Interactive Storytelling in Pre-School A Case-Study

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ABSTRACT
This paper presents a successful case-study of introduction of an authoring tool for multimedia storytelling in a class of 27 pre-school children. Unlike more sophisticated and demanding approaches, the tool requires basic technology and is very easy to use: in spite of this simplicity, the results are highly rewarding in terms of creativity, media literacy and "traditional" educational benefits (above all the ability to narrate). We deem this extreme simplicity a pre-requisite for large-scale deployment of computational systems for kids in standard, low-tech environments.

Categories and Subject Descriptors
K.3.0 [**Computers and Education**]: General. K.3.m [**Computers and Education**]: Miscellaneous – *computer literacy*.

General Terms
Design, Experimentation, Human Factors.

Keywords
Children, Digital Storytelling, Educational applications, eLearning.

1. INTRODUCTION
Empowering very young children to tell stories has been a non-huge but still constant trend of the last decade, both in the commercial and academic arena. All the attempts made so far have gained valuable insights, first and foremost on the importance of having children as *informants* rather than passive listeners to stories [2, 5, 9, 15]. The project we present in this paper, the 1001stories authoring tool for multimedia narratives, exemplifies the very essence of this lesson. If compared to existing digital storytelling systems, 1001stories can be defined, in a word, as "minimal": minimal in technological requirements (it requires a standard PC with an audio recorder and an Internet connection), minimal in "look & feel" (as we shall explain below, it was originally conceived for professional use and then transferred to schools as it was with no additional "make up"), minimal also in terms of budget (it is offered to schools as a free web service, by means of user name and password). Unlike more demanding and sophisticated approaches, 1001stories is also very easy to use: the average learning time is 20 minutes in junior and high schools and 30 minutes in elementary schools. Almost any teacher can easily manage an educational activity based on it. Still, in spite of this extreme simplicity, 1001stories *works*. It has been used so far by more than 4,000 students of all school grades (from pre-school to higher education) to produce beautiful, sometimes moving applications on cultural topics. A careful monitoring of the educational benefits gained by using 1001stories shows substantial results in terms of knowledge acquisition (around the subject dealt with: history, art, a school subject…), skills (about technology, communication, group work) and attitudes (towards technology, school's activities etc. [6, 11, 12]). This paper tries to investigate the reasons behind this apparent paradox by means of the most paradoxical case-study we had at hand: the use of 1001stories by a class of 27 pre-school Italian kids aged five. After introducing the related works on digital storytelling and the background on the 1001stories toolkit and its deployment in Italian schools, we move to the case-study description, trying to elicit the reasons behind its successful results. In the conclusions we summarize the general lessons gained in the experience.

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2. RELATED WORKS
Storytelling tools are subject of various academic studies as well as commercial developments. For the sake of the present work, we will consider only those tools that empower kids "to express, create and co-create […] in open ended ways" [9] rather than those that see children as passive listeners to tales. MIT's StoryMat is a wonderful example of a system that supports storytelling with children as authors: StoryMat records and recalls children's voices as they play with stuffed animals on a colorful story-evoking quilt [9]. Other approaches, like SAGE [5] and PET [14], integrate tangible elements (like stuffed animals) into the technology-enhanced storytelling process. StoryRoom also adopts a "physical" approach by providing kids with room-sized interactive storytelling spaces where they share a "theatrical" experience taking active part in the story [1]. Fostering the children's active role is also the goal of the PUPPET project [26]: PUPPET is an autonomous agent populated virtual environment

where children play multiple roles in creating narratives: by playing the (1) audience, (2) actor, (3) scriptwriter and (4) editor they learn the basics about drama.

Collaborative storytelling has also been explored by researchers: MOOSE crossing for example allow kids to design and build objects and virtual characters in a shared virtual space [7]. The FaTe project is another interesting example of collaborative storytelling system for young kids (aged 5 to 8), who virtually meet in 3D web environments [18]. Also CBC4Kids's StoryBuilder exploits collaboration over the internet: using StoryBuilder, "children can create multimedia comix-style stories", based on the typical mechanism of "add-a-sentence-to-a-story". Children can then save their stories in an online personal space and also publish them and share them with friends, via e-mail [2]. Digital drawing, especially if collaborative, has also been considered a form of storytelling, like in the KidPad project [4, 31]: the KidPad project makes use of a "magic carpet", an interface that uses pressure mats and video tracked and barcoaded physical props to navigate a story. Commercial products for children to create their own stories are often CD-rom based and *de facto* impose limitations to their creativity and almost never allow cooperation or sharing of the stories with other peers [2].

All the above projects have provided valuable insights into the ways in which technology can be used to empower kids to tell their own stories; still, probably in that oftentimes very demanding in terms of competences and technologies required, few have resulted in wide adoption (StoryBuilder being an exception). In the next paragraphs we shall introduce 1001stories, a toolkit for authoring multimedia (and also multi-channel) applications that *in spite* of its extreme simplicity, allows kids to produce highly creative "narratives" and that *due* to its extreme simplicity, can see (and is actually seeing) a large-scale deployment in any kind of school environment.

3. 1001STORIES TOOLKIT FOR MULTIMEDIA AUTHORING

1001stories is a toolkit for authoring multimedia "narratives"; it is an example of Instant Multimedia approach, a recent trend in digital communication born in the cultural heritage field: MEDINA [16] and Pachyderm [3, 24, 29] are other examples of this approach. "Instant Multimedia" means answering in quick time to a communication "need" (like for example an exhibition), with a low effort in terms of man-power and budget but still with a highly qualitative result. The toolkits empowering this approach must therefore be effective and simple, cutting short all the technical/design issues and dealing straightforwardly with the core issue, that is, the *message* (what the communication is about). Actually, 1001stories was first developed so as to allow a staff of non-technical people to develop in quick time an application for an exhibition that was due to take place in a month [10]. 1001stories was developed jointly by HOC-LAB (Politecnico di Milano, Italy) and TEC-LAB (University of Lugano, Switzerland) in winter 2005. It has been used so far to produce more than 30 professional applications of various kinds (ranging from business to cultural heritage communication [10, 13]) and also hundreds of user-produced applications in school environments of all grades (from pre-school, as we shall see in the next paragraphs, to higher education [6, 11]). 1001stories produces "narratives" in the sense that content is always meant as a "tale" about a theme with the aim of engaging the user and raise her/his curiosity, never as a systematic knowledge organization; in addition, content is "listened to" rather than read, a typical storytelling consumption style. The toolkit is composed by a format (a fixed design schema with pre-defined interaction possibilities), a precise workflow of activities and an engine. As regards the *format*, we may note that every application built using 1001stories is composed by a set of topics and subtopics, organized as shown in figure 1.

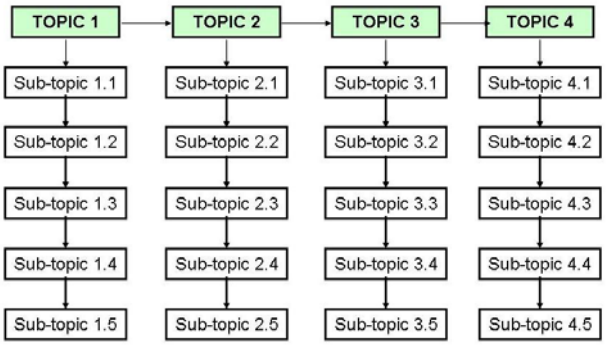

Figure 1. Design structure of the applications generated with 1001stories. The number of topics/sub-topics is variable according to the designer's choice (usually ranging between 3 and 8).

Each content item (be it a topic or a sub-topic) consists of visual communication (typically a slideshow of images; videos and flash animations are also possible), an audio (lasting one minute approximately) and its transcript, available on demand (fig. 2).

Figure 2. Screenshot from an application for the Archeological Museum of Milan (www.poliarcheo.it). In the middle, a slideshow of images; on the left, the list of the sub-topics and the audio control buttons. On the right, the text of the audio (available on demand).

Three main interaction possibilities are offered: automatic short navigation: the user is automatically led through the set of topics (without their sub-topics), to get a general overview of the subject; automatic long navigation: all the topics and sub-topics are offered in a sequence; manual navigation: the user freely selects what s/he is interested in. A further option is the loop mode (for both short and long navigations), very useful in commercial fairs or exhibitions. The toolkit goes with a workflow, meant to speed up the process: the workflow is

composed by ten steps, going from the gathering of the raw material to the final version (for a detailed description see [10]).

The last ingredient of the 1001stories instant multimedia package is the engine: the 1001stories engine is a Web service (no installation is required), offered by the HOC-LAB of Politecnico di Milano, which allows the creation and generation of multi-channel applications (web, CD-ROM, Ipod, iPhone).

Figure 3. The 1001stories engine allows generating multi-channel applications.

The authoring process requires only basic technological skills: creating text, (MP3) audio files and jpeg pictures, uploading files. In essence, the functionality offered by the 1001Stories tool can be summarized in three main features: Data Entry, Preview and Generator. The *Data Entry* is a simple control panel enabling the user to edit the editorial plan of the story, to enter content for each element (i.e. title, text, images with captions and audio file), and to perform all needed changes (fig. 4).

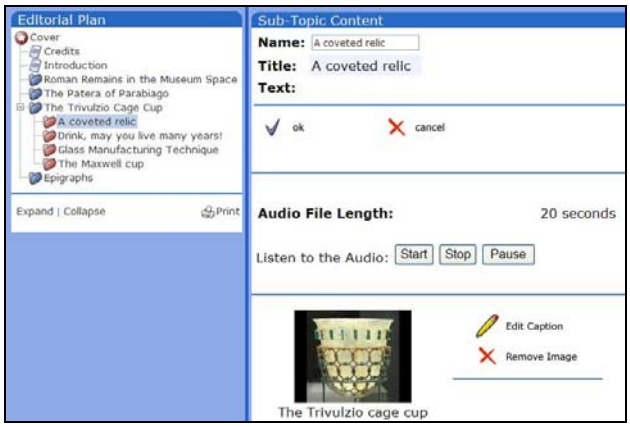

Figure 4. The data entry interface of the 1001stories engine. On the left, the tree-structured editorial plan allows navigating topics and subtopics. On the right, contents can be added, edited, repositioned, or deleted.

The *Preview* allows to visualize at any moment of the process the preliminary resulting story (as it will appear to the user) of what has been entered that far. In this way, the developer can immediately check the quality of the story (e.g. the impact of the content, of the graphics) and make the wished improvements. The *Generator* produces and publishes the final applications (for the different delivery channels), once every element of the story has been set.

4. 1001STORIES IN SCHOOLS: THE "POLICULTURA" COMPETITION

PoliCultura is a national competition for Italian students; it was first launched in year 2006-07, aimed at high schools only. Since a parallel pilot project in an elementary school had demonstrated that the tool could successfully be used even with very young children [17], the next year (2007-08) the competition was opened to all school grades (table 1). At the time of writing, the third edition of PoliCultura is under way, involving also pre-schools (as we shall explain below).

	PoliCultura 2006-07	PoliCultura 2007-08
Enrolled classes	106 (high schools)	339 (primary schools, junior high schools, high schools)
Works delivered	56	135
Students involved	+1100	+3600
Teachers involved	+56	+173

Table 1. The number of (Italian) participants to the PoliCultura competition (school years 2006-07 and 2007-08); the third edition is currently underway (March 2009): subscriptions are more than 400.

Students are invited to collaborate to create a multimedia narrative on topics of their own choice, but related in some way or another to school curricula or activities, using 1001Stories. Participants are provided with a set of instructions (approximately 10 pages) on how to create a narrative and on how to use the engine, to which they are given access by means of username and password. An online tutoring service is offered.

The typical workflow in school consists of five steps:

1) *Overall theme selection*. The teacher and the students decide what theme to deal with: local culture (art, history, folklore…), a school subject, an activity (like a cultural outing) etc.

2) *Editorial plan definition.* The list of topics and sub-topics is defined: students are usually divided into groups, each in charge of a topic.

3) *Content creation* (texts and images). Each group of students creates the content for its topic (plus the sub-topics); local experts are contacted and interviewed, books and internet resources are browsed. Eventually, the set of texts and images to illustrate the topic is prepared.

4) *Recording of the audio commentary files*. The texts are recorded by the "best voice" of the team. Sometimes music is added to make listening more pleasurable and add pathos to the narratives.

5) *Inserting contents into the engine*. In the end, students introduce their content into the engine, check how the application looks by means of the preview function, make the needed adjustments and produce the final version.

On the whole, schools are engaged for approximately 1-2 months in the activity. The result is a simple, but polished multimedia hypertext, which is submitted for the competition and then transformed into a Website, a CD-Rom and podcasts.

We monitored the educational benefits acquisition by means of online surveys and focus groups: the reader can find detailed reporting elsewhere [6, 11]. In extreme synthesis, for the sake of this work, we can note that: (1) the overall experience is engaging

for students who feel actively involved in it; (2) the experience brings substantial educational benefits to students in terms of knowledge (increased critical understanding of the subject matter), skills (technological skills) and attitude (towards the subject matter but also towards technology, which gets conceived as an effective *tool for communication*).

5. 1001STORIES GOES TO PRE-SCHOOL

In spite of the fact that in school year 2007-08 the PoliCultura competition was not aimed at pre-school classes, still a group of teachers from a pre-school of Padua decided to take part, pushed by the desire of experimenting digital storytelling. They had had an art-lab with a class of 27 kids aged 5 about creative uses of stones and had gathered a lot of visual materials about it (pictures but also the kids' own "artistic" productions). Teachers thought 1001stories would be a wonderful opportunity to organize and present the material about the art-lab.

In the following paragraphs, we explain the production workflow as it was interpreted in this peculiar environment, the benefits achieved and the pedagogical principles that stand behind the experience. This material is based on an interview with two of the four teachers involved, Elena Scordo and Martina Borgato: their words are reported in italics.

Figure 5. Kids had undergone an art-lab in which they learnt how to make creative usages of stone (in this case "a paper-holder for daddy"). The art-lab became the subject of their digital storytelling with 1001stories.

5.1 Workflow

In this paragraph we explain how the standard workflow for producing a narrative with 1001stories was adapted to the peculiar needs of the pre-school class. First of all, the teachers selected the topic (an art lab about the artistic use of pebbles and stones), and sketched the editorial plan, consisting of four topics: (1) Galzignano Terme (the little town where the school is), (2) Discovering stones, (3) Let's make experiments! and (4) Our works of art. The overall narrative revolved around the story of the "Pebble Elf", who introduced kids to artistic usages of stones (fig. 6).

Figure 6. The "Pebble Elf", protagonist of the kids' storytelling, peeps out of his "house".

The visual communication definition was one of the most important steps of the whole work: images are fundamental for very young children who cannot read nor write. Children were asked to browse through more than 600 pictures portraying the lab activities and their own artifacts to select the ones they liked most. Teachers thought it was crucial for the kids to select those images that were most relevant to them. Narratives were made with the "live" comments by the kids; in this case, there are no transcripts: the texts are short comments by the teachers.

Figure 7. The audio recording of the kids' comments.

Teachers gathered small groups of 5/6 kids: after some trials (fig. 7), they decided to use two computers at a time, one to show the images and the other for the recording program. In this way, kids would at the same time control the recording process (green light: recording on; red light: recording off) and stick to commenting the image at stake. As teachers report, many trials – even up to three for each image – were needed to obtain a satisfactory result (in terms of length, appropriateness, relevance, etc.). The teachers

then put all the pieces together, amended minor flaws and eventually generated the final version.

5.2 Impact

The impact of the experience (as gathered through the words of the teachers) was multifaceted, ranging from engagement to educational benefits' achievement and involvement of the social community at large.

5.2.1 Engagement

Kids found the activity very pleasurable: when teachers arrived at school, they would ask "teacher, do you have the laptop in the bag?" in the hope of working at the narrative. They even created the "PoliCultura game" pretending to record their stories with a fake microphone, thus moving the activity form the digital to the "physical" world [30].

5.2.2 Ability to narrate

According to the teachers, the main educational benefit gained by the kids was the ability to narrate. Actually, thanks to this experience, kids seem to have learned three out of four (the fourth being "be truthful", a pre-requisite of the whole activity) of Grice's maxims of discourse [19].

Maxim of quantity: "Make your contribution as informative as is required". As we explained above, the 1001stories format requires each chunk of content to be approximately one minute long. By trials and errors, kids learnt to produce audio files of the right length: "*probably the most difficult task for them was to be concise: kids that age just like talking and talking… at first we had to tell them to stop, but then they would look at us as if to say 'is it ok? Should I stop?'. It was wonderful – we learnt to understand each other without words*".

Maxim of relevance: "be relevant, that is, say things related to the current topic of the conversation". Teachers say: "*kids tended to stray from the main topic, therefore we started using two screens: on one, there was the image the kid was supposed to comment, on the other, the recording program: in this way, kids learnt to stick to the topic without following their free train of thoughts*".

Maxim of manner: "be clear". Before beginning the experience, teachers thought it was crucial to adequately motivate the kids. They explained that they were about to author a "multimedia book" that other people, including their parents, would read and that therefore they had to be as clear as possible ("*otherwise what will people think… they will wonder 'what are these people doing with all these stones?'…*"). Kids had a very precise commitment that they took very seriously.

5.2.3 Media literacy

Media literacy is defined as the ability to "effectively create, use and communicate information" (US National Commission on Library and Information Science, 2003). In spite of the fact that most of the interaction was managed by teachers, still using 1001stories increased the kids' media literacy, by making them acquainted with the characteristics and constraints of computer mediated communication: they selected images, recorded audio files and experimented the hypertext nature of the application by producing in first person the various pieces of content. They were immersed in an overall "interactive environment" during the whole process.

5.2.4 Group work

Kids were organized in small groups of 5/6; they worked together selecting the images and then recording the audios in a sequence, one kid at a time, thus enacting a simplified version of the "add-a-sentence-to-a-story" narrative scheme [2]. Teachers report that they mutually helped each other (for example, if the comment was too long they would tell their mate to stop), a remarkable result for kids that young.

5.2.5 Sense of (individual) responsibility

At the same time kids developed a sense of individual responsibility with respect to the final result that for example helped them to endure the nuisance of the many trials in recording the comments: "*at first they would complain about recording again a comment, but then, after they understood how the work had to be done, they would willingly say: ok, let's do it again*".

5.2.6 Involvement of disabled kids

In the class there were two kids with mental disability (tutored by a specially-dedicated teacher); teachers report that to their surprise they volunteered to participate and spontaneously recorded their own comments.

5.2.7 Involvement of parents and of the community at large

Kids were so enthusiastic that they told home what they were doing at school, therefore parents would often ask the teachers about the activity and were pleased about it. When the work was finished, they auto-financed the burning of the CDs (since the school could not afford it). At the end of the school year, the narrative was shown in the town's theater to the school's principal, the parents and also the town's mayor. Local newspapers mentioned the initiative.

5.3 Pedagogical principles

A number of pedagogical approaches stand behind the way 1001stories was deployed in this context.

5.3.1 Learning through external representation of knowledge

One of the most strongly supported pedagogical principles is that people learn from opportunities to construct external representations of their own knowledge [21, 23, 25]. The teachers' aim in undergoing this project was exactly "*to help kids to recollect their experience [of the art-lab]*"; as they pointed out, "*it is very difficult for kids that young to organize the experience, to recollect what came before and after and tell things in the right order*". By means of 1001stories, they were able to select the most relevant elements of their experience, put them in the right order, re-elaborate them by freely commenting on them and properly tell them to their "audience".

Figure 8. "First of all we washed the stones…". 1001stories helped children to recollect and re-organize their experience.

5.3.2 Constructivism

The re-organization of something learnt before is exactly what constructivism calls for: development of different cognitive structures (such as schema and mental models) based upon learners' previous knowledge and interests [28]. In addition, if re-construction takes place in a collaborative way, in Vygotsky's opinion this transforms the users in "responsible knowledge generators" [32].

5.3.3 Constructionism

Kids were highly committed to the task of telling a story to others, first and foremost to their parents: as constructionism says, faced with an authentic and personally relevant activity to complete or problem to solve, learners are pushed to investigate and represent knowledge in a proper way. This pedagogical principle is strongly supported by the work of scholars such as Papert and Kafai and Resnick [22]. Papert calls this principle "constructionism" [20, 27].

5.3.4 "Aha" experience

The creation of their own collaborative narrative produced in the end what in psychology is know as an "aha" experience, that is, an insight that manifests itself suddenly (the term was coined by the psychologist-linguist Karl Bhüler [8]). When the teachers put all the pieces together, generated the final narrative and showed it to the kids, they were simply astonished: "*before the end of the work, kids had not been really able to grasp the overall plan; but when they saw it all, they were simply wowed by the result; they started asking: is that me? Is that really my voice? ... and then they wanted to show their work to everybody*".

6. CONCLUSIONS

1001stories was *not* designed in view of very young children; even when it was proposed to schools, it was *not* adapted in any way: it was offered as it was. *No strategy* was used to make it more appealing for kids, like for example introducing cartoon characters, stuffed animals or puppets, well-known story patterns or similar: it was the for-professionals version that worked so well for kids aged five. In this respect, 1001stories can be assimilated to other tools like Power Point or even Google presenter; what differentiates it is the balance between being a 'neutral' tool (like… a pencil) and its power of engagement. As we said above, kids were deeply engaged: they loved the activity (they spurred their own teachers to work), they re-enacted the activity in their games (mimicking the audio-recording with a fake microphone) and even mentally disable kids volunteered to take part. Kids' enthusiasm crossed the school's borders to involve parents and relatives and in the end the social community at large. In addition, they gained substantial educational benefits, like the ability to narrate and to work as a group, a sense of self-responsibility and meta-cognition on their own performance, a friendly acquaintance with basic technological skills like image editing and audio-recording. We can summarize the above by saying that 1001stories empowers a kind of multimedia authoring that is at the same time educationally sound and as playful as a game. How to develop this kind of tools, in view of these achievements, is certainly a challenging research question to investigate.

In spite of the fact that we are dealing with a single case-study, we venture to draw some lessons from our experience.

- The path goal-requirements-design solution is not always consequential: in our case, we discovered almost by chance that a "for-other-users-intended tool" worked fine with a totally different audience.
- It is fundamental to involve kids in an overall learning *experience* [15] in which technology is just one of the ingredients. Kids can thus integrate the technology-based activity with more confidence into their world: their school's activities (in this case, the art-lab), their games and even their family.
- The possibility of actively telling their story was another crucial point, as it has widely been pointed out in literature [9]. Kids love to act as informants rather than passive audience of tales, introducing themselves and telling "how things went" their own way.
- Simplicity is a keyword for smooth introduction of the activity into a real school setting. In our experience, simplicity does not dampen creativity; on the contrary, it triggers creative solutions.
- Last, but not least, the low-technological profile of tools like 1001stories is not a limitation but rather a strong point, making them suitable for large-scale deployment in all school environments (not only in privileged ones). To this end, they must not require specific technical tutoring nor assistance, in order to be easily manageable by the teacher in the class.

The case of the Padua pre-school pushed us to officially include pre-schools in the PoliCultura competition; this year's enrollment is currently underway, but already we have received on the whole more than 400 applications, of which **44 from pre-schools:** this means that **more than 800 kids aged four-five will be using 1001stories** to create their multimedia narratives this spring. An extensive monitoring and evaluation is planned (including online surveys and focus groups with the teachers) in order to better understand 1001stories' impact in this challenging environment.

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