

New Channels, Creativity, EUD for creating Engaging Experiences of Cultural Heritage

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Abstract – The goal of our research in Cultural Heritage is to create applications on advanced devices, in order to provide engaging experiences that can foster people interest in Cultural Heritage. In this paper, we highlight some features of the developed applications to show how creativity, new communication channels and End-User Development (EUD) are used to reach our research goal.

Keywords – *Interdisciplinary design team, meta-design, educational games, soundscape.*

I. INTRODUCTION AND MOTIVATION

Since many years we have worked with professional people in different application domains, such as medical doctors, mechanical engineers, etc., [1-3], and we have always involved such experts in participatory design team, as well as Human Factor experts, very much convinced that the former possess fundamental knowledge of the domain, and the latter have the expertise for creating usable applications that satisfy people's needs. Today, it is widely acknowledged that design processes "require more comprehensive knowledge than any single expert can possess", as stated in the Call for Papers of this workshop. Indeed, our approach goes beyond participatory design since we empower all the different stakeholders in our interdisciplinary team, and even end users, to actively contribute to the design by providing them with design environments through which they bring their own creativity to the product under development [4; 5].

In the last years, we have been involved in projects related to Cultural Heritage (CH), with the goal of kindling people interest in knowing more about history through guided analyses of the remains of ancient settlements, as CH is ultimately about constructing identities [6]. Human-Computer Interaction (HCI) can contribute to foster a wider appreciation of archaeology by offering tools and products able to inspire the general public and to increase awareness of the importance of CH. This is a highly complex challenge, which requires attention on a wide variety of factors: who is going to use the products, how they will be used, where they will be used, etc. To face this challenge,

experts from different disciplines have to share their knowledge, skills, practices and tools. In the case of CH, the interdisciplinary team includes experts in cultural domain – e.g. archaeologists, historians, artists – and experts in technology and science – e.g. software designers, HCI experts, cognitive psychologists, architects, etc., as well as end users.

Capitalizing on interdisciplinary teams, we created educational games for supporting school pupils learning about ancient history through their active involvement during visits to CH sites or follow-up activities at school [7; 8]. Some of the developed games, beside multimedia feature provided through the visual channel, also exploit the auditory channel to further increase the immersion of the players in the atmosphere of the ancient site they are visiting. Studies have shown that such games are able to motivate children, to stimulate their imagination and creativity and to learn through socialization and collaboration among themselves [7].

Such games have been developed with the active involvement of domain experts. In fact, the traditional design practices, in which only professional designers create software artifacts, not only are very resource demanding (cost of developers, time to get new releases, etc.), but they do not capitalize on the expertise and creativity that domain experts, and even end users, can bring in the design of the new products. Today, end users are not only passive consumers of software, but they are becoming software producers. The End-User Development (EUD) approach goes beyond the traditional participatory design by providing end users with tools to let them create or modify software [5; 9]. Thus, end users become co-designers of the tools they will use, participating to the overall software life cycle since they are involved in design, development, use and evolution of software system. This implies a change in the design paradigm: professional developers become meta-designers, since they have to first design the environments (meta-design phase) that are used by the other stakeholders (end

users included) to contribute to the design of the final applications (design phase) [3]; [10]. In some cases, professional developers also create application templates, i.e. patterns for producing other similar things, which require the intervention of other stakeholders to provide proper content.

As indicated in the abstract, this paper briefly reports some features of the educational games we have developed to create engaging experiences and to stimulate the interest of school children in CH.

II. THE SOUNDSCAPE IN EXPLORE!

Explore! is a system that implements the excursion-game, an educational game which allows children, during visit to archaeological parks, to better interpret the archaeological ruins and envision what life was like in ancient times [7]. The excursion-game is similar to a treasure hunt: groups of 3-4 children have to explore the environment to identify meaningful places, which are the targets of the missions they have to solve. This requires a detailed analysis of ruins and promotes a better understanding of their ancient function and appearance.

The interdisciplinary design team, beside human-computer interaction and software engineering experts, was composed of: history-teaching experts; archaeologists; members of *Historia Ludens*, a cultural association in Bari, which has developed the original paper-based version of the game; the director and staff representatives of the Egnathia Archaeological Park in Southern Italy; students and teachers from a local middle school "Michelangelo" in Bari. All these people brought their expertise to the design and the development of Explore!. They participated in different ways. For example, history-teaching experts suggested which concepts and how should be transferred through the game; archaeologists and staff of the park provided details on the specific archaeological park; teachers and students were observed during their performance of the game in the traditional version and participated in formative and summative evaluations of the Explore! prototypes.

Explore! was first evaluated in a field study that has reported in [7]. Based on this field study, a second version of Explore! was implemented in order to generate a more engaging experience. During an interdisciplinary team meeting, it was conceived the idea of a virtual soundscape, whose aim is to increase visitors' immersion in the atmosphere of the ancient time and to help them to better understand the degraded physical environment of the archaeological site [11]. Indeed, sounds have the potential to enrich physical environments. There are a few systems that use contextual sounds to improve the perception of environments (e.g. [12-15]).

The virtual soundscape is generated according to a specific model, whose details are described in [16]. During the game, Explore! produces multiple sounds which depend on the position in the site of the player holding the cell phone, acquired by the GPS. Such contextual sounds are originated from virtual sources located at the main places accessible to visitors and their intensity changes dynamically according to the players' physical position. The sounds are related to important events and situations that occurred in ancient time at such places. In the case of the archaeological park of Egnathia, one of these places is Foro Boario, which was an animal market at Roman time. Thus, the virtual source located at the center of the Foro Boario produces sounds like people shouting, people arguing, cows lawing, goats bleating.

To produce a very realistic effect, the algorithm that generates the soundscape is quite sophisticated. It mixes sounds produced by all virtual sources and determines sound attenuation based on the distance from the sources and on the sound type (distinguishing between stronger and weaker sounds). The details of the algorithm are omitted here.

The new version of Explore! was tested in a successive field study. With respect to the virtual soundscape, the study results highlighted that contextual sounds were found useful and helped children identify the target places and enter more into the spirit of the times, bringing the park ruins to life and relating them to the real world and their own experience [16]. Our take-home message is that designers have to consider how to effectively use new channels, which have a great potential to increase user experience.

The virtual soundscape was defined as a joint work of archaeologists, historians, and park curators, in order to identify meaningful sounds for important places in the site where virtual sources should be located.

More recently, in order to facilitate the definition of the contextual sounds, we have implemented an application on a handheld device that stores all the sound tracks that have been identified by the interdisciplinary team to define the virtual soundscape. The definition of the soundscape is done experimentally in the field, by involving a small group of stakeholders (about 3 people) in the team. This group of stakeholders, carrying the device, gets to the position in the site where a sound source should be virtually located. Through the application, users acquire the source's GPS coordinates, and input and visually manipulate the sound parameters to create the final soundscape. Since users are on the field, they adjust the parameters in order to get the soundscape that they considered the best.

III. META-DESIGN OF GAMES IN CH

Our on-going work aims at empowering domain experts, and even end users, to tailor applications that support different types of visitors in CH site. Thus, we are not considering educational games for children but other types of applications, which use various multimedia resources (e.g. pictures, animations, videos, contextual sounds, etc.) in order to provide historical information during an amusing and engaging visit. These resources are created with a considerable effort. It is convenient to reuse them for producing tailored guides suited to different types of visitors, e.g. adults for whom the developed games would not be engaging.

Our approach for allowing people to perform EUD activities prescribes to provide the stakeholders in the interdisciplinary team with software environments, customized to their needs, culture and skills, through which they collaborate with the other members in the team in all phases of the software life-cycle of the final applications. We have developed a design framework whose central element is the concept of *workshop*, intended as a virtual laboratory in which users shape software artifacts (this is in accordance Software Shaping Workshop model [1; 3]). Workshops are the result of the meta-design activities carried out by professional developers, who do not directly design and develop the final application anymore, but they design the environments for allowing the other stakeholders to create the final application.

The workshop provides *application templates*, which are the skeleton of the applications to be developed. These templates guide the user in providing the proper contents and in adapting them not only to the specific target of visitors, but also to the particular device that users will be used for visiting the CH site.

Beyond the template, the workshop provides the *building blocks* that are the components to be added to the templates providing specific content and various user interface functionalities (e.g. showing content, inputting data, searching, zooming).

Other important elements, which are essential in the development of the final application, and available in the workshop, are *multimedia resources*. Indeed, certain types of building blocks require particular resources in order to satisfy the constraints associated with the used template. In other words, the same resource can be used in two different contexts: for example a 3D reconstruction of an important place of an archaeological site could be employed in an interactive guide for adults as well as in a game for children. All multimedia resources are stored into a central repository that stakeholders can access through their workshops.

Application templates, building blocks and multimedia resources are classified according to

different visitors' profiles and devices on which application will be deployed.

As an example to show how the framework is used, let us suppose that a primary teacher wants to create a game that her students could play at an archaeological site they will visit during a school trip. Her workshop provides templates for creating application adequate to her user profile, e.g. template for creating an excursion-game, a puzzle game, or a guided visit. Among them, teacher chooses the puzzle game, which proposes a set of puzzles depicting important places of an ancient site. As shown in [17], this type of game requires different multimedia contents, such as a short video showing the 3D reconstruction of the place, sounds associated to the place; photos of the place, etc.

The teacher workshop shows the building block associated to the puzzle game template. The teacher selects the desired building block and guided by the template completes the definition of the application. The workshop automatically generates a folder containing a collection of XML documents and multimedia resources, adapted to different devices that can deploy the application. Such folder is then transferred on the target device equipped with a tiny client able to show the final application. More details of this software environment can be found in [17; 18].

IV. CONCLUSIONS

In this paper, we have reported our participatory and meta-design approaches for creating applications that can foster people interest and appreciation of Cultural Heritage. We have shown how the use of new communication channels, e.g. the auditory channel, can contribute to increase the user experience.

An important aspect to be considered during the development of applications in the CH domain is the creativity of all stakeholders involved in design, development and use of the applications. The design framework we have defined allows the stakeholders to perform EUD activities in order to actively contribute to shape the final applications.

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