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Short and Project Papers

PLUG, Université Paris Nuit: A Design Reiteration of a Mobile Museum Edutainment Application

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Abstract

What is the potential of mobile edutainment applications introduced in the informal learning environment of the museum setting? This short paper proposes to shed light on this issue by presenting a design reiteration of a mobile edutainment application designed for a European Science Museum, by particularly insisting on the ways the design, implementation and evaluation of a first mobile serious game, informed the conception of a second game version. The latter has already been proposed to the museum public in four demonstration sessions that provided some first feedback on the acceptance and usability of the proposed mobile application.

Categories and Subject Descriptors (according to ACM CCS): H.5.1 [Information Interfaces and Presentation]: Multimedia Information Systems—Evaluation/ Methodology, J.5 [Computer Applications]: Arts And Humanities—Arts, Fine and Performing

1. Introduction

Cutting edge documentation and information systems, multimedia technologies and installations, digital audio guides, mobile multimedia guides and the use of social networks have nowadays reinforced the affinities between Cultural Heritage (CH) institutions and ICT and reshaped the expectations of the museum public. Within this context, the recent global spread in the use of mobile, pervasive and ubiquitous interactive applications and devices has come to renew this already prosperous scenery through the introduction of mobile technologies, devices and applications such as digital audio tours, podcasts and mobile multimedia museum guidance systems [EGKT08]. This evolution has lately also made possible the introduction of mobile, multimedia, interactive edutainment applications, specifically tailored for the museum environment that seem to lead to a re-conceptualization of the mission of the contemporary museum as an environment also dedicated to purposes of education and enjoyment.

2. Mobile museum edutainment applications

According to [WA05] if playing and growing are synonymous with life itself, then life-long playing can be seen as an important aspect of lifelong learning. Within the context of the museum setting, this conviction relating learning with play is expressed through the multitude of hands-on activities, workshops, demonstrations and paper and pencil quests addressed primarily Űbut not exclusively- to children and school-classes. Under this scope, the design and delivery of mobile edutainment applications can be seen as an interesting alternative to mobile multimedia tours delivered on handheld devices [Dam07]. Though mobile museum edutainment applications are still far from being common, already existing approaches have introduced observation games, reflection games or treasure-hunt games, played solitary or in teams, using one or multiple delivery platforms and at times proposing activities for linking with the pre- and/or post-visit phases [KCQS10]. However, the number of studies regarding the effectiveness and impact of mobile museum edutainment applications is largely inferior compared to the evaluation of mobile museum guidance systems and almost non-existing regarding a comparison with more traditional activities, like paper and pencil quests [TSBGH06].

3. The PLUG research project

Both of the games that will be presented were the result of the PLUG (PLay Ubiquitous Games and Play More) project regrouping museum professionals, sociologists, scenarists

and computer science engineers that set as a goal to explore the potential of mobile, ubiquitous and pervasive edutainment application to be deployed in the participating Musée des Arts et Métiers (Industrial Arts and Crafts Museum), in Paris, France.

3.1. The Musée des Arts et Métiers (MAM)

Science museums are not among the most easily accessi-ble in terms of content as the object labels and texts on the visitor's path are not always appropriate for the comprehen-sion and understanding of museum objects linked with the history of technology and science. This explains the MAM's interest in providing visitors with multiple interpretation resources and educational activities: tours are offered on a daily basis (general tours, thematic tours, demonstrations, children workshops), while a digital audio guide is offered in an adult and a family version. Workshops and demonstra-tion sessions are also proposed as well as many paper and pencil quests destined to young visitors. Many of them can be downloaded from the museum's website while an edu-tainment game allows junior visitors to browse the museum with their avatar and to explore the collection by answering riddles. Within the museum's exhibition-space, interactive kiosks enable visitors to surf at any time on the museum's website to find additional information while several interac-tive exhibits also exist. Finally the museum library and doc-umentation center is open and easily accessible not only to researchers but also to visitors. As the MAM had never been

Figure 1: *Snapshot of the PSM application interface*

experimenting with mobile multimedia museum guidance systems in the past, one of the goals of the project was to explore if the examined approach would eventually be able to stand alongside other interpretation policies and media so as to offer to the mu-seum visitors an autonomous, interac-tive, collaborative and self-motivating edutainment activity.

3.2. PLUG v1: The secrets of the museum

The 1st version of the game "Plug, Secrets of the Mu-seum" (PSM) proposes the playful discovery of 16 carefully se-lected exhibits of the museum's permanent exhibition. The game is delivered on RFID-enabled mobile phones with

which the visitors are equipped and is much alike a card-exchange game. The 16 selected museum objects are divided in 4 families. At the beginning of each session the visitors see on the screen four different cards, belonging to differ-ent families while they are attributed a specific family of cards/objects to collect, marked by a colour (Fig.1). Within the museum exhibition, the 16 objects are signposted by a dedicated stand, containing a "virtual" RFID tag with stored data that refers to the "real" museum object. When the game begins the cards of the session are mixed. The goal is to as-semble all four cards of the same family, complete as many families as possible, answer to textual quizzes and riddles and/or obtain the greatest score. Via the use of the NFC-enabled mobile phones the cards hidden in the RFID tags can be read, moved from one tag to another, or exchanged between two players. An elaborate point-system was also put to place enabling visitors to gain points almost by every action performed and thus allowing the development of dif-ferent strategies. The architecture of the application is de-scribed in [Sim09].

The game was introduced to the public in November 2008 with 150 participating players. 118 of them, aged 8 to 60 years, filled in a questionnaire that was distributed at the end of the game session. 116 of them appreciated this innova-tive and original exploration of the museum. Through the evaluation process, that made an extensive use of logs, ques-tionnaires, observations and interviews it was also found out that for the large majority of the participating new visitors, the game proved to be an excellent teaser, making them want to come back in order to visit the museum in a more "con-ventional" way [AA09]. For several adult visitors a comment often heard was that the game allowed them to appropriate themselves with the museum environment and visit differ-ently the museum. At the same time, a certain nonfullfille-ment was related with the fast pace of the game, connected with the well-predefined duration of the game sessions and the point-system. Some of the adult visitors mentioned that they felt they did not have adequate time to delve into the his-tory of the selected objects themselves. At the same time, the excitement often aroused by the game among the youngest visitors was also to be correlated with the feedback obtained by other museum professionals that praised the game for its potential to familiarise young publics with the museum envi-ronment but assessed that the educational aspect of the game was not enough reinforced.

3.3. Towards a new game version

Following the large acceptance of the 1st game version, that has up till today been played by more than 500 visitors, the decision taken was to create a new game that would allow a more in-depth discovery and appropriation of the museum objects and the permanent museum exhibition. The educa-tional aspect of the game was to be reexamined, by giving a central place to the objects while pointing to the notion and the particularities of the museum space and the museum

collection. A second point to take under consideration was the fact that the new version of the game should make a maximum use of already existing in-terpretation media and incite visitors to consult different types of resources related with the museum objects to be included in the game, ranging from object labels, interactive kioks and exhibits, the museum's web site, library resources, videos, documentaries, multimedia animations, audio guide commentaries or information available in the museum website.

4. The 2nd iteration of the game: PLUG, Université Paris Nuit (UPN)

However these resolutions came in contrast with the material configuration of the game. More in particular and with regards to the new design guidelines the configuration of the 1st version of the game, suffered by a small interac-tion surface, while the type of multimedia content embarked consisted only by audio, text and images. For this reason, a second delivery platform was to be included in the game design and architecture, and more in particular I-Phones, that could thus allow to deliver richer multimedia content or even consult external (e.g. web pages) resources. The point-system was also to be abandoned so as to decrease the competitiveness of the game and reinforce a slower pace in the discovery of the selected museum objects. At its place an adaptability mechanism would be implemented so as to tailor the delivered content and quests according to three different visitor profiles.

4.1. Game design

The new game design had to put the accent on the reinforcement of the educational aspect of the game by proposing activities that would encourage an object-oriented learning. Eventually and after many discussions the idea adopted was to take as a starting point two museum objects, called Target Objects (TO), make the visitors observe them and then prompt them to discover other museum objects on display (or Intermediate Objects-IO) that can be considered as predecessors of several technical aspects and innovations of the two main TOs. These prerequisites greatly established the game structure that resembles a treasure-hunt game. Each team is attributed a TO. Each TO is associated to four IOs. A maximum of 4 teams can participate at each game session. The game is over when the TO is located and all quests regarding the IOs are completed.

For each TO and IO, the players have to follow three steps. First, they have to use specific hints in order to dis-cover the museum exhibition section in which each object is to be found. Once they have correctly validated the relevant museum section, using the NFC-enabled mobile phones, some new hints appear that help in the discovery of the TO or the IO. The objects as well as the museum sections concerned are signposted with discrete square markers with the logo of the game (measuring 8cm*8cm) integrating an RFID tag. Once the object to be found is located the visitors have to

answer to different types of quizzes and activities in order to validate their "comprehension" of the technical and historical context from which each object is issued. For this reason they are provided with a list of resources residing not only on the I-Phone, but equally in the museum exhibition, in external web sites available through the use of the device or even in documents that can be found in the museum documentation center. When the riddles are solved, the visitors can go on looking for the next associated object. At the end of each game session, the visitors are invited to explain the links between the objects in a special ceremony. At this point it is also important to explain, that as in contrast with the first version of the game, PSM, which is a stand-alone mobile edutainment application, the second version of the game had foreseen the integration of a narrative universe greatly inspired by role-playing games. The players are immersed in a narrative universe that wants them to assist in a police investigation but then find themselves participating at a competitive entrance examination to integrate a secret night University. Upon completion of the quests the players are received by the University director that will decide for their entrance at this secret scientific institution based on their answers regarding the interrelations among the TO and the IOs.

4.2. Game sessions

The goal during the first public demonstrations was to validate the game design, to fine-tune the narrative and storytelling universe that supplemented it and to obtain feedback on the suitability of the edutainment activities proposed, especially concerning the cognitive impact. In the time-span of four months, 4 demonstration sessions were organized in the MAM, in which 45 players participated, aged between 9 and 60 years old, among which 3 families as well as representatives from other local museums. The overall duration of the game sessions was approximately two hours and a half, including the introductory and final scene session (and about one hour and a half without the role-playing introductory and final scene session). The visitors were observed throughout the entire game session, while whenever it was possible, they were also questioned regarding their experience. Questionnaires regarding the cognitive impact of the new version of the game were also distributed in two of the four demonstration sessions.

4.3. First feedback and lessons learned

One of the main research questions for these first demonstrations was to validate the application content in terms of pedagogy. This encompasses both the suitability and acceptance of the game structure and the game design, as well as the content included and the proposed activities. It was observed that the pace of the game was slower as compared with the first game version, as the riddles and quizzes to be solved demanded from the visitors to stay near the objects, observe and contemplate them, as well as consult the proposed resources in order to further advance in the game. At

Figure 2: *Quest-solving using a museum map and the two delivery platforms used for the game UPN*

the same time valuable feedback was collected concerning aspects of the interface and interaction design, both of which underwent several changes in between the first and the fourth demonstration sessions. For example, it was found out that the interface design did not convey for all visitors the fact that all of the objects to be discovered were related with one main TO. Another preoccupation was to see whether the participating visitors would manage to work collaboratively as well as whether they would be able to appropriately use both of the necessary mobile devices (the NFC-enabled mobile phone for reading the content of the RFID tags and the I-Phone for receiving the hints related with the TO and the IOs, Fig. 2). For the majority of the players, the rules seemed to be explicit enough while the game design provided a fast learning curve.

4.4. Juxtaposing the two game versions

The underlying motivations for the design and implementation of the second iteration of the game as well as the four demonstration sessions allowed the project stakeholders to further delve into the effects from the changes in the game design, implementation and delivery and naturally brought to the surface a comparison between the two game versions. The 1st version of the game received some critique not so much for its entertaining and educational value, but for not encouraging the visitors to go far enough in their comprehension and appropriation of the included museum objects. Up to a point it also seems that the point-system used in the first application rather favored a fast pace for playing and visiting. The 2nd version of the game, on the other hand, made use of a more complex game design, introduced a new delivery platform, which made possible the use of rich media, and embellished the game with an inspired narrative so as to further immerse the visitors in their quest. The pace indeed slowed down, with the participating visitors passing more time in front of the museum objects. The visitors were also very apt to collaborate between them not only for the manipulation of the equipment but also for solving the riddles included in the game. However, the new game design

resulted to a more complex system-architecture as well as to new requirements regarding the necessary infrastructure both in terms of material as well as in terms of human resources in order to set-up and run a session. Additionally, it became very soon clear, that the card-exchange game was much easier to play by young children, aged between 5-14 years old, as in contrast with the new game version, destined to visitors aged between 15 and 35 years old.

5. Conclusions and Directions for Future Work

Though mobile museum edutainment applications have started to make their appearance in the museum environment, there is still a certain lack in evaluating their real impact and effectiveness. This paper presented how the lessons learned during the evaluation of a first mobile "serious game", nourished the reflections for designing a new edutainment application that put the accent on a more elaborated mechanism, both for appreciating and comprehending the museum exhibition as well as for appreciating the selected museum objects. Though the intention of the project team was for the very beginning to maintain and run sessions for both game versions, it was only through practice that the advantages and drawbacks of both proposed games came to surface. These include but are not limited to the robustness of the two applications, the game design, the overall duration of the game sessions but also to the inherent difficulty for completing the quests set by each version of the game. Nevertheless, the most important outcome of this design reiteration is that the research question for all project stakeholders but most importantly the museum switched from whether a mobile edutainment application can supplement existing museum interpretation media to how to design more effectively for self-motivated learning through play in the museum environment using mobile devices and applications. New demonstration sessions are under way that will allow to further focus on the visitors' experience through more structured evaluation sessions that have foreseen to collect and analyze both quantitative and qualitative data.

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